THE DICTIONARY OF HUMAN GEOGRAPHY

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B

real units of organic history were populations, not types or species. The change from one species to another was simply the by-product of the process of a population becoming increasingly adapted to its particular environment. Here, then, was an account of population change that accounted in naturalistic terms for differential reproductive success among organic groups.

The network of Darwinian commitments, of course, had repercussions beyond biology and biogeography. Disciplines from anthropology to zoology registered at least some of the currents of the Darwinian vision. In addition, Darwinism had a considerable cultural impact, although interpreting the significance of this 'revolution' has proved to be an infernally stubborn problem (Bowler, 1988). Some have seen its significance as the triumph of science over religion, the substitution of natural law for natural theology, or the shift from a creationist to an epistemology of POSITIVISM. Others, such as R. M. Young, stress the ideological continuity between religion and science, regarding both as the socially sanctioned IDEOLOGIES (see discussions in Gillespie, 1979; Moore 1982; Young, 1985; Brooke, 1991).

Given the ambiguities over the term 'Darwinism' and the fact that it cannot be reduced *just* to an acceptance of the natural selection mechanism, it is understandable that the percolation of Darwinian themes into geography did not take place in any systematic way. Notions such as change through time, interrelationships between organism and environment, organic analogies, and selection and struggle, certainly became commonplace in the geographical literature (Stoddart, 1966, 1981). But these, as often as not, were derived from the LAMARCKIAN version of evolution which emphasized that organisms could consciously adapt themselves to their surrounding and pass on acquired characteristics to offspring. Still, whatever the sources, aspects of the evolutionary PARADIGM found expression in almost every subdisciplinary specialism of geography. Davis's cycle of erosion expressed his interpretation of LANDSCAPE evolution; Clements's plant geography displayed his fascination with organic modes of thought; Ratzel's ANTHROPOGEOGRAPHY disclosed his organismic conception of the STATE and provided a human geographical articulation of Moritz Wagner's Lamarckian-based MIGRATION theory; Whittlesey's scheme of SEQUENT OCCUPANCE and Fleure's geographical anthropology were also evidently imbued with evolutionary thinking. Besides these individuals, a variety of key issues within the geographical tradition drew heavily on evolutionary *motifs*. Statements of ENVIRONMENTAL DETERMINISM by figures such as Semple, Huntington and Taylor were invariably couched in evolutionary categories (Livingstone, 1987); debates about acclimatization were similarly connected up to questions about heredity and adaptation (Livingstone, 1992a); and early theoretical statements about REGIONAL GEOGRAPHY, such as those of Herbertson and Geddes, were supported by appeals to the need for elucidating evolutionary mechanisms in specific contexts (Livingstone, 1992b).

DNL

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data analysis See CATEGORICAL DATA ANALYSIS; CONFIRMATORY DATA ANALYSIS; EXPLORATORY DATA ANALYSIS; LONGITUDINAL DATA ANALYSIS; SECONDARY DATA ANALYSIS.

databases Collections of information records in digital form. A database will probably contain more than one type of record, with information on the linkages or relationships between different types, since the term 'file' implies a simpler collection of only one type of record. To qualify as a database, there is often some degree of 'transparency', a term implying that access to the records does not require detailed knowledge of how they are stored. Transparency is provided by a Database Management System (DBMS), which contains the necessary information on formats and coding schemes, and handles requests expressed by the user in convenient terms. Many DBMS have adopted the standardized query language SQL (Structured Query Language) which allows the user to formulate queries in a simple English-like syntax. Some widely known DBMS include Oracle, INGRES, INFO, DBase and SIR. The database approach is being used increasingly to handle, distribute and access the large collections of social and economic data maintained by national census and other agencies.

MG

decentralization A process of spatial change produced by centrifugal forces (see CENTRIFUGAL AND CENTRIPETAL FORCES). Within urban areas, demands for space and the desire to escape the congestion, pollution and high land values of the CENTRAL BUSINESS DISTRICT are increasingly encouraging businesses (both commercial and industrial) to move their premises to the SUBURBS and beyond, where custom-built, accessible industrial estates, office parks and shopping complexes are increasingly common. At a larger scale, the negative EXTERNALITIES of vast cities encourage movement to smaller settlements (a process also known as deconcentration – see also COUNTER-URBANIZATION).

RJJ

decision-making The process whereby alternative courses of action are evaluated and a decision taken. The decision-making perspective attracted

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exit, voice and loyalty A theory of consumer influence on the quality of PUBLIC GOODS: it was developed by Hirschman (1970), who contends that in a monopoly situation the quality of such goods is likely to be lower than when consumers have a range of potential suppliers. In the latter situation, consumers can react to an inefficient/ineffective service by taking one of the following options: (1) *exit*, which involves transferring their custom to an alternative supplier; (2) *voice*, complaining about the quality of provision and threatening exit if it is not improved; and (3) *loyalty*, remaining with the current supplier without either voicing complaints or threatening exit. The higher the exit costs (i.e. of switching suppliers) the lower the likely impact of voice, because the supplier can assume loyalty. If exit is impossible, because of a monopoly, then loyalty is virtually guaranteed and voice will have little impact.

Several consequences have been deduced from this argument, and some were put into effect by New Right governments during the 1980s. One is that to obtain efficient and effective service-delivery public-sector monopolies should be dismantled, either by their PRIVATIZATION in a way that will create competitive situations or by the creation of a quasi-market system within the sector (as with the British National Health Service from 1990 on: see also TIEBOUT MODEL). Another is that although individual voice may be ineffective, collective protest may not, since powerful pressure groups may be able to mobilize effective collective voice and/or exit: against this, it is argued that those with least political POWER to organize are least likely to have effective exit options open to them (e.g. transferring their consumption of such items as education and health care from the public to the private sector). RJJ

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expert systems Software packages that attempt to mimic the behaviour of an expert in a given field. The notion that a computer could emulate an expert is attractive, since it implies that such expert systems could be used to standardize many DECISION-MAKING processes, reduce errors and improve the performance of regulatory agencies. An expert system consists of a rule base, containing a digital representation of the known decision rules, and a processor to evaluate the rules in a given instance and reach an appropriate decision. The builder of an expert system will commonly make use of a set of generic tools known as a 'shell', which takes care of the storage of the rule base, and the processing functions. Expert systems have often been coupled with GEOGRAPHICAL INFORMATION SYSTEMS (GIS), which provide many of the inputs and may also display and manage the outputs, in supporting decision-making in forestry, RESOURCE MANAGEMENT, hydrology, and URBAN AND REGIONAL PLANNING. The success of expert system approaches depends on the degree to which all relevant rules can be expressed in the highly constrained forms required of a rule base, and on the credibility of an expert system's output to its users. Rules are often imprecise or 'fuzzy', and expert systems based on fuzzy reasoning have become popular in many geographical applications. Finally, an expert system can provide a useful formal structure for studying decision-making processes. MG

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exploration While it is generally taken to refer to the growth of knowledge of the globe that resulted from various voyages of discovery and scientific expeditions, the label 'exploration' disconcerts. Its controverted character arises from the clash over the appropriate vocabulary in which to speak of this essentially contested concept. The very terms *discovery* and *exploration*, according to revisionists, should be replaced by *invasion, conquest* or *occupation*, for the simple reason that these unmask the pretended innocence and moral neutrality that the standard scientific-sounding idioms convey.

Whatever the allocation of moral accountability, there can be no doubting the significance of 'exploration' on the scientific enterprise in general and the discourse and discipline of geography in particular. Traditional chroniclers of these exploits have thus tended towards a progressivist interpretation of scientific knowledge, cartographic history and global awareness (Baker, 1931). The vast maritime expeditions of Chêng Ho in the early decades of the fifteenth century (1405–1433), for example, have been commended for their contributions to Chinese marine CARTOGRAPHY and descriptive geography; although, in contrast to later voyages, the purpose of the mission was neither the garnering of 'scientific' information nor commercial conquest (Needham, 1959; Chang, 1971). In similar vein, the writings of the Muslim traveller Ibn Battuta during the late Middle Ages are typically interpreted as an encyclopaedic conspectus of Islamic life and culture in different climatic regimes (Boorstin, 1983; James, 1972).

It is, however, with the European voyages of Reconnaissance during the fifteenth and sixteenth centuries that putative connections between scientific 'progress' and geographical 'exploration' are even more closely associated. Parry (1981, p. 3), for example, argues that, save for the arts of war and military engineering, geographical exploration was 'almost the only field' in which 'scientific discovery and everyday technique became closely associated before the middle of the seventeenth century'. Similarly, Hale (1967) suggests that the first scientific laboratory was the world itself, and O'Sullivan (1984, p. 3) that 'the voyages of discovery were in a way large scale experiments, proving or disproving the Renaissance concepts inherited from the ancient world'. In such scenarios the names of Bartholomew Dias, Vasco da Gama, Christopher Columbus, Fernand Magellan, and, perhaps most of all, 'Prince Henry the Navigator' assume hagiographic status. For these reasons, the Portuguese and Spanish voyages have been interpreted as precursors to the Scientific Revolution (Hooykaas, 1979).

most extreme forms, had removed people and societies from human geography and concentrated instead on the mathematical and statistical analysis of spatial patterns and structures. It was urgently necessary to *humanize* human geography, and ideas and concepts were drawn in from the humanities and the social sciences: in particular, from political economy, social theory and cultural studies (see CULTURAL GEOGRAPHY; HUMANISTIC GEOGRAPHY; MARXIST GEOGRAPHY). En route, however, it became clear that the reverse movement was equally (and ecumenically) important, because most of these were COMPOSITIONAL THEORIES which took no account of place, space and landscape. Some ten years after *Social justice*, therefore, Harvey had this to say:

> 'The insertion of space, place, locale and milieu into any social theory has a numbing effect upon that theory's central propositions . . . Marx, Marshall, Weber and Durkheim all have this in common: they prioritize time over space and, where they treat the latter at all, tend to view it unproblematically as the site or context for historical action. Whenever social theorists of whatever stripe actively interrogate the meaning of geographical categories, they are forced either to make so many ad hoc adjustments to their theory that it splinters into incoherence, or else to abandon their theory in favour of some language derived from pure geometry. The insertion of spatial concepts into social theory has not yet been successfully accomplished. Yet social theory that ignores the materialities of actual geographical configurations, relations and processes lacks validity (Harvey, 1984).

Since then, there has been considerable progress in sensitizing social theory and social thought more generally to these concerns: there has been an immensely productive dialogue between Marxist geography and urban and regional political economy; many commentators have hailed POSTMODERNISM as being emblematic of a distinctively geographical (or at any rate 'spatial') imagination (Soja, 1989); and the recent interest in POSTCOLONIALISM and POSTSTRUCTURALISM has contributed in still more radical ways to the critique of abstract and universal models of 'the human subject' and 'society' (cf. CONTEXTUAL THEORY; GRAND THEORY) and helped to bring about a clearer understanding of the significance of *situated knowledges*. At the same time, a series of changes in the organization and experience of social space (what is sometimes called 'the culture of space') have been registered not only in the academy (Harvey, 1990), but also in the media and through an explosion of interest in travel-writing and 'travelling theory' which has also had a major impact on social thought and cultural criticism (Gregory, 1993).

But there are, of course, other geographical imaginations: 'other' in the sense that there are geographies outside the Western academy (including indigenous geographies in other areas of the world and informal geographies inscribed in the TAKEN-FOR-GRANTED WORLD); and 'other' in the sense that there are (human) geographies which focus much more directly on CULTURAL ECOLOGY and the 'culture of nature' which, while they are connected to place, space and landscape, are by no means reducible to those concerns (Turner, 1991; Wilson, 1992).

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geographical information systems (GIS) Integrated computer tools for the handling, processing and analysing of geographical data. The software of a GIS is normally self-contained, and most often runs on a personal computer or workstation, although mainframes are common in many larger applications. Conservative estimates put the size of the GIS software industry's total business in 1991 at between US$ 1 and US$ 2 billion. In addition to software and processing hardware, a GIS normally includes specialized peripherals for input (digitizing) and output (printing or plotting) of mapped data. The cost of a modest GIS package and associated hardware and peripherals would be about US$ 15 000.

Although the first mention of GIS occurred in the literature in the mid-1960s, massive growth began only in 1980, with the introduction of superminicomputers by manufacturers such as Digital Equipment Corporation and Prime Computer. Growth in the software industry followed, led by Intergraph Corporation and the Environment Systems Research Institute (ESRI). The technology of GIS found practical applications in RESOURCE MANAGEMENT, particularly forestry, local government, utility companies and market research. More specifically, its uses include the automated measurement and analysis of geographically distributed resources, and the management of distributed facilities. Scientific applications also developed in the 1980s, as GIS was applied to the wide range of sciences and social sciences that deal with geographically distributed data and find value in a spatial perspective (see APPLIED GEOGRAPHY). These include epidemiology, archaeology, geology, ecology, geophysics, oceanography, REGIONAL SCIENCE and, of course, geography. The methods and concepts of GIS overlap strongly with the concerns of many more established disciplines, including CARTOGRAPHY (particularly COMPUTER-ASSISTED CARTOGRAPHY), REMOTE SENSING, photogrammetry, geodesy and SURVEYING.

Two major traditions have developed in GIS for representing geographical distributions. The *raster* approach divides the study area into an array of rectangular cells, and describes the content of each cell; while the *vector* approach describes a geographical distribution as a collection of discrete objects (points, lines or areas), and describes the location of each. In essence, the raster approach 'tells what is at every place' and the vector approach 'tells where everything is'. In addition, a GIS database contains information on the attributes of each cell or object, and on various kinds of relationships between objects. Broadly, the continuous view of space embedded in the raster approach is most commonly associated with environmental and physical science applications of GIS, while the view of space as a collection of discrete objects that is implicit in the vector approach has found more applications in the social and policy sciences, in the mapping industry, and in the management of geographically distributed facilities. Most currently available GIS software products can be identified with one approach, although most provide limited capabilities for handling the other.

The ability to couple the input and output functions of a GIS with its more exploratory functions of browsing and simple statistical analysis, and with more sophisticated CONFIRMATORY DATA ANALYSIS techniques, has led to many GIS applications in human geography and related disciplines. GIS has been used to implement models of regional economies, transportation systems and urban growth; to develop hypotheses from complex catalogues of spatially distributed artefacts; to develop understanding from patterns of social deprivation and disease; to analyse voting behaviour; and to understand the sacred meaning that many cultures give to space. In short, GIS has become a powerful tool for automating the geographer's processes of analysis and synthesis.

Currently, GIS remains firmly bound to its cartographic roots: maps continue to be the primary means of input and output. It provides tools for recording and processing the positions of features in space (as in SPATIAL SCIENCE), but has yet to develop much sophistication in its handling of time dependence (see TIME-GEOGRAPHY) or interaction. In this sense GIS preserves a

container-like view of SPACE, and cannot yet deal effectively with the temporal changes and interactions that drive or result from many social processes. However, current basic research efforts are likely to yield significant advances in these areas in the next few years. Moreover, the growth of GIS has led to renewed interest in many of the more fundamental issues of geography and cartography: the accuracy of abstracted views of geographical distributions; the effects of scale and resolution; languages for describing spatial relations; methods for exploring the spatial perspective; the role of geographical information in empowerment and domination; and the importance of geographical information to the decision-making process. MG

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geographical societies Voluntary bodies established to promote the discipline of geography. Some of the early societies, both national (e.g. the Royal Geographical Society of London and the American Geographical Society of New York) and regional (e.g. the Manchester Geographical Society), were major forces in the nineteenth-century development of geography and its establishment as a school and university discipline. They continue to play major roles in promoting geography, both as an academic discipline and as a subject of wider general interest.

Alongside these general societies, the late nineteenth and early twentieth centuries saw the establishment of a number of professional societies for geographers, such as the Geographical Association (for teachers, mainly at school level) and the Institute of British Geographers (mainly for researchers and for teachers in higher education) in the UK; the National Council for Geographical Education and the Association of American Geographers fulfil the comparable roles in the USA. These societies, through conferences, seminars, specialist meetings and publications, participate in the promotion and dissemination of material about research advances and promote the discipline both politically and professionally. RJJ

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geography Geography can be formally defined as the study of the Earth's surface as the space within which the human population lives (Haggett, 1990), or simply as the study of the Earth as the home of people (Tuan, 1991). The word is derived from the Greek *geo*, the Earth, and *graphein*, to write.

Perhaps the best known formal definition of the field was provided by the American geographer, Richard Hartshorne, in his *Perspective on the nature of geography* (1959): 'geography is concerned to provide accurate, orderly, and rational description and interpretation of the variable character of the Earth surface'. The last two terms in this definition need some elaboration. By 'variable character' geographers mean the spatial variation that can occur between the character of the Earth's surface at one location and another. This variation may occur at all map SCALES from the globe itself, say between continent and continent, down to a very local level, say between one district and another within an urban area. By 'Earth surface' is meant that rather thin shell, only about one-thousandth of the planet's circumference thick, that forms the habitat or environment within which the human population is able to survive.

As defined above, geography occupies a puzzling position within the traditional organizations of knowledge. It is neither a purely natural science nor a purely social science. Its intellectual origins as a distinctive field of study pre-date such a separation, going back to classical Greece; people were viewed then as an integral part of NATURE. In that period a geography of any area would be written so as to include descriptions of both the animate and inanimate things found there (See CHOROLOGY.). Although individual scholars or small clusters of scholars wrote geographical descriptions of various parts of the world over the ensuing centuries, and although GEOGRAPHICAL SOCIETIES flourished from the early nineteenth century onward, geography established itself as a university discipline rather late. (Separate departments of geography had emerged in German-speaking countries by the 1870s but not generally until the present century in the case of Great Britain and the USA: Taylor, 1985.) By then, the division of academic studies within universities into the natural sciences on the one hand and the humanities and social sciences on the other had already become crystallized in formal faculty organization. In practice, therefore, geography had to be fitted, albeit somewhat awkwardly, into an already established scholarly order. Sometimes it found itself part of a natural-sciences faculty, sometimes in an arts or social sciences faculty, sometimes divided between the two. In consequence there have been rather powerful external forces (as well as an internal logic) which have tended to split geography into two parts: a geography of the natural world, termed 'physical geography', and a geography of the human-created world, termed 'HUMAN GEOGRAPHY'. This pressure has sometimes been sufficiently strong, as in some Scandinavian and all Dutch universities, to lead to the establishment of separate departments of physical geography and human geography with rather tenuous cross-links.

While the short-term advantages of this separation were apparent in terms of the integration of one part of geography with its neighbouring science, e.g. geomorphology with geology, most geographers have viewed such moves with concern. They argue that the distinction between natural phenomena and those made by humans is unhelpful, since it obscures some of the essential characteristics of geographical study and therefore undermines its long-term rationale as a university discipline.

What, then, are these essential geographical characteristics, and why were they considered so important? At least three can be readily identified.

(a) The first characteristic is an emphasis on *location*. Geography is concerned with the locational or spatial variation in both physical and human phenomena at the Earth's surface. It tries to establish locations accurately, to represent them effectively and economically (see CARTOGRAPHY), and to disentangle the factors that lead to particular spatial patterns (see, for example, LOCATION THEORY). In human geography it may also propose alternative spatial patterns which are more equitable (see WELFARE GEOGRAPHY) or more efficient (see ECONOMIC GEOGRAPHY). It is significant that many of the techniques developed within geography for the study of such spatial variation are general in character, and not specific to phenomena studied in either physical or human geography.

(b) A second characteristic is geography's ecological emphasis on *society–land relations* (see ECOLOGY). Here the stress is on the interrelations of phenomena, the links between aspects of the natural environment of a particular area, and the human population occupying or modifying it. In this type of analysis, geographers shift their emphasis from the study of spatial variations between areas (these may be thought of as horizontal bonds) to the study of ecological links within a bounded geographical area (vertical bonds). It is worth noting that the bonds may be two-way (i.e. the impact of people on land, as well as land on people) and that the bounded area may be anything from the globe itself to a very small locality.