INTRODUCTION

As part of a widespread reassessment of the positivist movement in science, this study considers its impact on geography during the period from 1600 to 1860, commencing with the sense-empiricism of Francis Bacon and concluding with the work of Alexander von Humboldt. A founder of modern geography, Humboldt was convinced of the need to change the established model of scientific procedure in his day: the formulation of that model during the preceding two centuries is examined here, along with concurrent developments in geographical thought, as shown in the leading texts of the time. That period, largely one of decline in geography, has received little attention from geographers themselves, who furthermore have tended to consider the history of the subject in isolation rather than in relation to contemporary developments in philosophy and science; in the absence also of any serious attention to the position of geography in recent works on the history and philosophy of science, the present study aims to provide a framework for further research and criticism. It is suggested that the theories of Humboldt, advanced in the same period as the positivism of Comte and Mill, or the historical materialism of Marx and Engels, offer a meaningful alternative for science today, leading to a new form of social empiricism. For geography, currently engaged in an effort to reconcile the radical–activist movement of the 1970s with the positivism of the mid-century quantitative revolution, the ferment of debate in the early nineteenth century shows a remarkable similarity with present conflicts in the sciences.

In the face of mounting world problems the entire scientific movement in the late twentieth century is undergoing a major revision of its aims, its methods, and its impact on society and the earth as a whole. Demands for social responsibility in science and a growing scepticism about the so-called scientific method itself are leading to a massive reappraisal of the whole philosophy of science that has been dominant for three centuries, and many observers see this as a new scientific revolution. One of the strongest pressures for change is a deepening concern that scientists will prove incapable of responding in time to solve the complex social and environmental problems now seen to be threatening the global ecosystem – problems that science frequently helped to create. Under the established framework of
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theory, technology and organizational structure in the sciences, most effort in the past was directed towards the solution of more specialized problems through relatively isolated programmes of research. Those areas of inquiry which were not considered amenable to standard scientific methods, or did not pursue the same kinds of questions, were excluded from the sciences, and those like geography which aspired to join their ranks were obliged to adapt the questions they asked and accept the kind of limitations imposed by the traditional model of ‘exact science’. In a number of studies, including economics, psychology, education and geography, which after the Second World War attempted to identify with that model, the outcome was apparent: a trend towards specialization and restriction of inquiry, a preoccupation with data easily adapted to quantitative analysis, a rejection of wider moral issues and a reorientation of the entire discipline towards the accomplishment of precisely formulated research projects, a neglect of history and philosophy, and a concomitant loss of general theory. With the gradual recognition that earlier promises of rapid progress were not to be fulfilled, this approach has come under increasing criticism for its conceptual poverty and ineffectuality in dealing with contemporary problems. Drawing attention to the failure of the demigod scientist to cope with these issues, Wilbur Zelinsky, as a leading economic geographer, joined those Western critics who for some years had called for a revolutionary change in outlook, and in his 1974 Presidential Address to the conservative Association of American Geographers he emphasized ‘the need for a profoundly different approach and perhaps even a totally novel philosophy of science’.

The construction of a coherent alternative framework presents one of the major challenges of the next decade, and although Zelinsky’s own Address offered little guidance on what form the new philosophy should take, it is clear that one of the first tasks of the growing revisionist movement is a more searching reassessment of the previous framework, in particular its prescriptions for scientific method and the theory of knowledge on which these were based.

Compounded of many ideas and subject to constant modification after it was formulated in the seventeenth century, the empirical method, as it came to be known, has played a significant part in directing the course of modern science. While it proved highly effective in organizing inquiry in numerous specialized sciences during the last three centuries, that method appears to have been largely inimical to the development of geography and so the position of this subject is of particular interest in the current debate. Until recently geographers showed a marked reluctance to engage in serious criticism of the established theory of science and in consequence allowed their study to remain methodologically at a disadvantage in relation to sciences like physics and chemistry for which the empirical method was expressly formulated. A large measure of the strength and apparent impregnability of the scientific movement since the seventeenth century has been
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derived from the theoretical justification it received in the form of a theory of knowledge developed and refined by a long line of philosophers, commencing with the British empiricists and continuing through to the modern positivists. In order to change that theory of scientific procedure it is necessary, as Humboldt saw over a century ago, to propose an alternative procedure based on a more appropriate theory of knowledge.

Science and empiricism

In general, science from its original connotation of ‘knowledge’ (Latin scientia) has come to imply the constant extension of knowledge about the world in accordance with an approved method for conducting inquiry. The first step in any programme of constructive change is then to consider what is meant by knowledge in this context and to examine the traditional claims for the validity and universality of the scientific or empirical method. Although the term ‘empirical’ is used frequently in connection with scientific inquiry, its definition and its implications are rarely examined. David Harvey for instance, in 1969 directed his major methodological study Explanation in Geography to the provision of ‘guidelines for the conduct of empirical research in geography’, without discussing the term ‘empirical’ itself or including it in his index.2 Not only among practising scientists but even among reputable historians or philosophers this term has been used as if its meaning were self-evident, with empirical research commonly assumed to involve in the first instance some sort of direct contact through observation or experiment with the objects of study, a form of contract in which ideas or theory supposedly play no part at all. The historian Sir George Clark, for example, in considering the legacy of seventeenth-century empiricism, repeated that view without question: ‘This immediate contact with the facts of nature, this attention to what is perceived by the senses, is a characteristic of modern science.’3 The source of such a view can be traced to what is called the sense-empiricism of Francis Bacon. Founder of the British empiricist school of philosophy, Bacon gave expression to some of the most significant elements of later scientific method, and an important task in the search for a new theory is a critical re-examination of his views.

An essential characteristic of empiricism, which takes its name from the Greek word for experience (empeiria), is its commitment to the position that all knowledge is dependent upon experience, and this remains a widely accepted tenet of contemporary science and education: the main difficulty comes from the interpretation of experience. Where this is identified purely with some form of first-hand sense-experience, as in the Baconian tradition, the empiricist position can become restricted to a kind of sensationism which regards knowledge as a series of sense-impressions, or even to the sort of objectivism mentioned earlier which suggests that objects themselves, directly impinging on the senses, can provide accurate knowledge as long as
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the mind is not permitted to intervene. Prominent in scientific empiricism during the last three centuries, sensationist and objectivist views have been linked closely with the doctrine of materialism that led scientists to consider the world in terms of the mechanical actions of matter. Together, those views provided the foundation for what became the standard scientific method, as one based not on theories but on ‘facts’ obtained by strict observation and measurement, with the aim of securing exact knowledge through ‘induction’, by a procedure of dispassionate mathematical and logical analysis leading to the discovery of general laws. Science itself was extolled as a means of increasing man’s power over the material world. In extending that method to the new study of sociology in the early nineteenth century, Auguste Comte gave the name of positivism to the movement which came to dominate the emerging social sciences as well as the physical sciences in the following years.

Positivism, as an extension of Bacon’s form of sense-empiricism, gained its main strength throughout the nineteenth century by promising a sure means of progress for Western man in the use of knowledge for the control of nature, and its success was linked with the rise of industrial capitalism. A practical science, freed from abstractions and moral issues, was seen as the key to technological progress, and beyond this positivists regarded the scientific method of induction from facts or natural phenomena as the only acceptable and valid means of obtaining knowledge: all speculation on questions that could not be tested by experiment or were beyond the range of sense-experience was rejected, for it was claimed that the new positive science would eliminate traditional religion, idealist philosophy, and metaphysics, replacing these with ordered, objective and reliable knowledge of both man and nature. Social reformers, like Comte in France and the British utilitarians James Mill and his son John Stuart Mill, argued further that scientific progress through positivism would lead to a perfect form of society.

Few of its followers questioned the foundations on which the positivist programme rested, for one of its fundamental prescriptions was to rule out any discussion on the general assumptions underlying its formula for scientific method. Positivist philosophers themselves avoided such theorizing as ‘metaphysical’ and unscientific: John Stuart Mill, for example, concentrated on explaining the principles of logic involved in induction, while the school of logical positivists in the first half of the twentieth century went on to examine the limits of scientific knowledge and the problem of verifiability, using techniques of logical and linguistic analysis as a means of following the positivist dictum that scientists should restrict their attention to observable phenomena which can be measured, predicted or controlled. Practising scientists meanwhile readily adopted the precepts of Lavoisier, the French founder of modern chemistry, who in 1789 advised his followers to keep to the method of Bacon, working only from direct observations and modern
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experiments, and dispensing with the study of both philosophy and history, as impediments to progress in science. This anti-philosophical and anti-historical approach contributed to the rigid character of later positivism and proved an obstacle to its reform.

Today, as traditional positivism comes under increasing attack and it becomes clear that future progress depends on a reorganization of science to deal with world problems, a renewed significance is given to research on the history and philosophy of science in the task of re-evaluating traditions and restructuring the entire framework, or – to use an effective term – the whole paradigm of shared concepts, methods, goals and rewards, within which scientists operate. The current emergence of a new pattern can be traced in a number of sciences, and indeed the high degree of concurrence evident in trends occurring in a wide variety of disciplines, in different parts of the world, lends support to the view that what Thomas Kuhn called a paradigm shift is now taking place.

Geography and positivism

In geographical thought the reaction against positivism followed rather rapidly upon its serious introduction into the subject in the mid twentieth century. Geography entered its positivist phase much later than most other sciences, for until the 1950s it was generally considered that the scientific method was not strictly applicable in geography, with its emphasis on regional studies, lack of experimental research and inability to discover precise natural laws. In 1953 Fred Schaefer in the United States strongly criticized this ‘exceptionalist’ position for geography and called for geographers to use the same method as the other sciences but to differentiate their own study by limiting themselves to a concern with spatial relations: ‘Spatial relations are the ones that matter in geography and no others.’ Schaefer’s work had a tremendous impact in establishing the school of spatial analysis, and over the next decade a great deal of research in both physical and human geography was adapted to the current scientific model. That model, although Schaefer did not use the term, was clearly a positivist one, and the conflicts and changes that ensued in geography were associated with this.

It has become customary to describe the major changes as revolutions: the quantitative revolution of the fifties and sixties when a strong effort was made to introduce the standard scientific method, especially mathematical analysis, into geography, and then the radical revolution of the seventies, when social reformers and conservationists joined forces to call for new goals, new methods and a new focus for research. The present effort to reconcile those two movements in some kind of alternative framework represents, as I see it, a third revolution, both conceptual and social in its implications, and one that is liable to change the direction of geography for the rest of the century.
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Signs of a growing criticism of positivist views began to emerge in geography during the 1960s. Throughout the previous decade, few geographers had followed John Kirtland Wright’s tentative exploration of a new field in his 1946 Presidential Address to the Association of American Geographers on the place of imagination in geography. Wright defended the place of aesthetic subjectivity, the intuitive, and the methods of the humanities, alongside what he evidently accepted as the ‘impersonal objectivity’ of scientific geography. His position remained defensive and was scarcely strengthened by his rather coy references to imagination as ‘hearkening to the Sirens’: he attempted to moderate, but not to deny, ‘the lofty observation point of the objective’. Sensitive and far-seeing, nonetheless, Wright recommended attention to the geography of knowledge and especially to what he called geosophy, described by him as an aspect of the sociology of knowledge concerned with the study of geographical ideas, both past and present, and including ‘the relations of scientific geography to the historical and cultural conditions of which it is a product’. Constantly, he entered a plea for the history of geography, viewed more comprehensively than the traditional record of knowledge acquired in ‘the core area of scientific geography’.7

In 1961 David Lowenthal went on to explore Wright’s field of geosophy, with a paper ‘Geography, experience, and imagination’ which incorporated recent research in psychology, sociology and the philosophy of science, and dealt with important questions of epistemology or theory of knowledge (Greek epistêmê, knowledge).8 In particular it drew attention to both the limitations and the complexity of human perception. Lowenthal’s argument was a challenging one: ‘sensing, thinking, feeling, and believing are simultaneous, interdependent processes’. Perception, he pointed out, is not a matter of the senses alone: seeing is conceptual as well as visual, involving information acquired prior to the present experience; thus all interpretations of stimuli are culturally conditioned. Acknowledging the separateness of individual experiences and the subjectivity of the private milieu, he emphasized at the same time the significance of the shared world view. Science as well as common sense, he argued, depends basically on a measure of concurrence regarding the nature of things, and for this he found support in Michael Polanyi’s substantial work, Personal Knowledge (1958), with its criticism of naive objectivism in science.9

On the whole, however, the positivist view of science remained unshaken in geography during the 1960s and Lowenthal’s moves towards an alternative epistemology received no consistent development. Following the work of William Kirk in 1963, developing his earlier concept of the behavioural environment,10 research in that field increased and perception studies multiplied, yet these were concerned invariably with the perceptions, not of geographers themselves, but of other groups such as the Chimbu or the Great Plains farmers. Although Harold Brookfield, in his 1969 article, ‘On
the environment as perceived’, claimed that the growth of the humanistic view in science had dislodged the nineteenth-century idea of *absolute rationality*, the objectivity of the scientific observer was rarely questioned: while it was recognized that the Chimbu are not always rational in their view of the world, it was assumed that scientists – and hence scientific geographers – would be rational and objective in their research. One of the strongest attacks on such objectivism was made by Preston James in 1967:

the direct observation of things and events on the face of the earth is so clearly a function of the mental images in the mind of the observer that the whole idea of reality must be reconsidered.

Obviously accepting the positivist definition of the term ‘empirical’, however, he went on virtually to reject empiricism altogether:

Empirical means wholly dependent on experience and observation without any reference to theory. But the discussion of the relationship between percept and concept suggests that anyone who claims to approach the observation of things and events with a blank mind is either fooling himself, or is a candidate for an insane asylum. Truly empirical study . . . does not exist.

James raised a further important and related issue by questioning the notion of a purely inductive scientific method, proposing instead an inductive–deductive approach to explain the way the process of inquiry actually operates, and in a later work he continued his own contribution with his *All Possible Worlds* (1972), a lengthy study in the history of geographical ideas. The confusion evident in his 1967 statement on empiricism, however, points to the need to clarify the distinction between the particular form of sense-empiricism known as positivism, and a wider interpretation of empiricism based on a less narrow concept of experience – one which acknowledges both the intellectual processes involved in experience and the dynamic social–environmental context in which it occurs.

An alternative to positivism: social empiricism

All science at present is faced with the need to formulate a new kind of empiricism, one that can offer an effective alternative to the positivist methodology, while retaining the useful guidelines it provided for research and the process of ordered inquiry. A number of trends are already evident, in geography as in other sciences, and the present question is whether these can be given co-ordination and coherence to form as it were a new paradigm. The first of these, a more rationalist approach stimulated by the work of Karl Popper and the neo-positivists, began to appear in geography during the sixties, in the form of a greater attention to theory as an essential part of the empirical method, a recognition that facts are always interpreted in terms of a theoretical framework, and a growing interest in the general concepts and propositions by which each discipline is identified. Wayne Davies in 1972
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described these as amounting to a conceptual revolution in geography, and he noted the simultaneous emergence of general systems theory, stemming from Bertalanffy’s earlier application of that theory in biology, as an indication of a return to integrating concepts and a concern for synthesis, in contrast to the kind of compartmentalization associated with the analytical method of a naive empiricism.¹⁴

These developments are reminiscent of views being advanced in opposition to Comte’s positivism in the early nineteenth century, when Alexander von Humboldt, as an acknowledged leader in applying the latest empirical methods in a number of sciences, was one of the first to call for a more rational empiricism. That period also was noted for its concern for organic and holistic views of man in nature, views that were castigated by the positivists of the time as idealism or romanticism, more suitable for poets than for practical scientists and with implications obviously unwelcome in the current economic and political climate. Given the context of Western industrialization with its destructive impact on both the landscape and the working classes, along with the world-wide extension of colonialism in the search for raw materials and markets, it is not surprising that the established view was a comfortable dualism, the model of man as master of nature.

After a long period when the mechanist and dualist views associated with the scientific revolution of the seventeenth century effectively deprived geography of a central integrating concept of nature, the current revival of holistic views in ecosystem studies now offers a more coherent framework for a subject dealing with the earth and its inhabitants. It is significant, again, to note that Humboldt, who emerged as one of the architects of a modern scientific geography, was also a pioneer in ecology, with his research on living plant communities in the early nineteenth century – studies that helped found biogeography and inspired the life work of Charles Darwin. Although it was the German naturalist Haeckel who coined the term ecology in 1868 for the study of organisms in relation to their environment, the foundations were already laid in Humboldt’s plant geography, while the more comprehensive ecosystem concept of recent decades, which considers organisms and their environment as a single interacting system, can be seen outlined by 1850 in his final work Kosmos, where Humboldt wrote of man’s place in the dynamic community of nature and even extended this early concept of a global ecosystem to include human culture and ideas.¹⁵

The radical implications of the ecosystem concept, in challenging the basis of the positivist world view, became apparent a century later in the conservationist movement of the 1970s when a series of United Nations conferences on the environment provided a focus for a growing number of publications and pressure groups expressing concern over the fragility of life-systems and protesting that the continued use of Western technology in
the reckless exploitation of land and people could no longer be tolerated on what was now aptly called spaceship earth. In geography the growth of ecosystem studies was accompanied by the emergence of social activists in the radical revolution of the seventies, although many of the new socialists, including William Bunge, Michael Eliot Hurst and Richard Peet, adopted Marxist views involving a materialist position and a theory of knowledge more in line with that of the positivism they were attacking. Others like Annette Buttimer, using the approach of continental existentialism and phenomenology, with its emphasis on the lived-world of personal experience, criticized positivist attempts to separate values from facts, intentionality from behaviour; they joined with Marxists in affirming the sociology of knowledge, a theory of knowledge which emphasizes the influence of the social context on all thought and thus on all scientific research. It can be seen that such a theory can be interpreted as an ecological approach to knowledge, and some implications of this are explored later in this work.

So far, then, three main trends have been noted in recent attempts to modify the positivist model: the development of rationalist views, the rise of the ecocide movement, and an increase in radical demands for social action. Along with these can be discerned a strengthening of the tradition of liberal humanism, now no longer content to identify with the arts or humanities but actively criticizing positivism itself and demanding that science should contribute more effectively, not merely to a materialist ideal of progress, but to the conservation of life-systems and the creation of a more humane society. Whether it is to be expected that all these movements should be linked in some way remains an interesting question; however, it seems fair to say that elements of them all will be incorporated in the new paradigm for science, and that far from rejecting the empirical method entirely this will involve replacing the positivist version, based on Bacon’s kind of sense-empiricism, with one that gives due recognition to the intellectual and social aspects of knowledge, as well as to the clear importance, underlined by radicals and humanists alike, of stressing the social responsibility of scientists. To take account of these aspects the term social empiricism has been introduced here in referring to the new theory, for although this might be regarded simply as a reformed version of positivism, the extent of the changes involved seems to justify the use of a different name.

An important element in social empiricism is an appreciation of the historical continuity of knowledge, as this is communicated through concepts and symbol systems. To understand the present, it is essential to be aware of traditions inherited from the past. History, in the sense of what we know about the past, is thus an integral part of the current world of ideas, and indeed the positivist neglect of the history of ideas has been a reflection of the poverty of scientism. In the search for a new scientific paradigm, historical research has a valuable function to perform, for the complex of
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beliefs, procedures and concepts that provided the operational framework for modern science is exceptionally difficult to analyse if observation is limited to the twentieth century. Even at the present time, some of the significant elements remain tacit rather than explicit, and numerous inconsistencies baffle any logical analysis. A historical study can show how the scientific movement evolved, incorporating various ideas, responding to particular problems and then tending to absolutize its procedures.

In geography the widespread neglect of historical and philosophical research during the positivist period had unfortunate consequences. Indeed, at the height of that period geography seemed to be facing the danger of approaching the end of the twentieth century as a discipline without a history, for in many institutions a generation of students was introduced to research in the subject with practically no awareness of its earlier traditions or its potential significance in a new phase of science; in terms of scientific theory they were taught virtually to be followers, where their general theory was limited to a study of methodology over the last century, for at that time geography appeared constantly in a defensive position, more preoccupied with adapting to the accepted notion of scientific procedure than with directing energy towards restructuring that theory.

More recently the followers of Marx have begun to restore some historical perspective by returning to a study of his works; however, their studies tend to be limited to the nineteenth century and face the serious problem of dealing with the complexities and apparent contradictions in Marxist writings – a problem made more acute by the inexperience of almost all geographers in such inquiry. A longer perspective is useful at this point, to show the continuity of positivist theory from the time of Francis Bacon and draw attention to the alternative to the theories of both Comte and Marx that was being formulated during the same period in Humboldt’s work. In the two centuries between Bacon and Humboldt, philosophers and practising scientists combined to formulate, in the empirical method, a powerful instrument for inquiry, and its successes – particularly after Newton – tended to mask its deficiencies. The impact of this method on geographical thought during that time has received little attention, however, from either historians of science or geographers themselves, the present study being evidently the first in English for the period under review.17 Indeed the two centuries before Humboldt have been called ‘a dark age in the history of academic geography’.18

Empiricism and geography, from Bacon to Humboldt

As far as geography was concerned, the initial encounter with scientific empiricism was close to disastrous. Following the introduction of the new method during the seventeenth century, geography soon became obviously outpaced, and even displaced, by the progress of the specialized empirical