

## EDITORIAL

# Physical Geography and the Geographic Thought Course

KEVIN R. COX

Department of Geography, The Ohio State University, USA

### Introduction

Geographic thought courses are a common offering in geography graduate programs. There are many ways of constructing such a course. Invariably, however, one of the problems to be faced is how to integrate both human and physical geography into the course structure. The pressures in this direction are not just ones of principle and the need to represent the broad church that is geography. There is also the fact of diversity in many graduate programs in terms of the physical/human mix and the need to accommodate that variety of interest. In fact, and in my view, the advantages of a successful integration are quite compelling, as I wish to outline. But at the same time there are problems in execution. Indeed, the title of the paper indicates not just the failure to achieve this happy resolution but the one-sided character of most courses of this nature, and certainly of the texts currently available.

Bringing physical and human geography together under the common umbrella of geographic thought and its history is something that along with a colleague, John Arnfield, I have tried to come to terms with now for about eight years. Until 2002 we co-taught a graduate seminar in the history of geographic thought that lasted 10 weeks.<sup>1</sup> One of us is a human geographer and one a physical geographer. We both received our undergraduate training in the British system, which meant that we each had at least some familiarity across the physical–human divide. In this paper I want to share our experiences in conducting this seminar, identifying what the problems were in bridging that divide and what the advantages are, or could be, given a successful resolution of these problems.

In evaluating these efforts, however, and the subsequent discussion, the reader should be alert to the particular nature of the graduate education offered in geography at our university. Like all departments it has its peculiarities. There has been a strong emphasis historically on urban and economic geography. The spatial tradition has been emphasized and until recently there was little work on the human–environment interface. There is no historical geography in the formal sense. Physical geography is represented strongly but

---

*Correspondence Address:* 1106 Derby, 154 N Oval Mall, Columbus, OH 43210, USA. Tel: +1 614 292 7948; Email: cox.13@osu.edu

quite narrowly. Of seven physical geographers only one is not an atmospheric scientist or climatologist. The divide between human and physical geography would therefore look different in some other departments. Conceivably in those with a stronger human–environment tradition there might be more debate around such issues as the human impact on land forms and the social construction of nature.

The paper is divided into three parts. In the first part I outline precisely how the seminar is organized, indicating the various ways in which effort has been made to achieve representation of both physical and human geography in the readings and in subsequent seminar discussions. The second part outlines the difficulties of integrating physical and human geography in the same geographic thought course, while the final section discusses the benefits to be drawn from some sort of integration.

### **How the Seminar is Organized**

The seminar is organized around three modules. The first of these introduces the student to the three traditions of geography as set forth by Taaffe (1974) in his AAG Presidential address building on Pattison's earlier efforts in that direction: the now unfortunately named 'man–land' tradition, the regional and the spatial. In each case pains are taken to indicate the durability of the tradition, the various ways in which it has been re-worked over time, and how that re-working is related to emergent critiques. So, and for example, in addressing the environmental tradition reference is made to Semple and Sauer as representing counterpoised viewpoints, and political ecology as introducing a social mediation of environmental relations missing from both of those earlier efforts. The regional tradition, on the other hand, goes all the way from de la Blache, through Sauer's cultural landscape and Hartshorne's areal differentiation to more recent intimations of a 'new' regional geography. When it comes to the spatial tradition one of the things emphasized is its longevity, though typically students have a hard time disassociating it from the spatial–quantitative revolution and seeing the spatial as indeed a tradition that has been both reproduced and transformed and continues to be so to the present day.

The second module tries to address some of the central epistemological and ontological issues in geography. Given the rather short time available<sup>2</sup> this inevitably lacks the depth that would be preferable. The initial, motivating question is 'what is science?', including some discussion of geography's relationship to it historically. Inevitably, given what has transpired over the last half century, particularly in human geography, much of the focus is on the various forms of positivism and the critical reactions to them. Accordingly, a good deal of time is devoted to issues of description, explanation and prediction and the problems they raise both in themselves and in their relation to each other. Particular attention is given to the issue of what Dobson (1992) calls spatial vs. process logic: logics of understanding based on geographic form and those based on a knowledge of process.

The discussion of ontological issues is entirely consumed by a consideration of concepts of space and time in geography. This proceeds initially through some reading on the social construction of concepts of time and space, which means that there is inevitably an overlap with epistemology. Harvey's (1990) paper is drawn on here along with a transposition of Giddens's arguments about the commodification of time into the spatial domain (1981). Similarly, discussion of Sayer's (1985) 'the difference that space makes' raises, through its

implications for geography as a theoretical discipline, epistemological issues that take us back to its scientific status. The module then concludes with a review of the various ways in which time has been understood and incorporated into geographical explanation. Massey's recent contribution (1999) is of central significance here though there are important precursors for what she is saying about time-dependent processes, particularly in the work of Curry (1966) and at an empirical level in that of Hagerstrand (1984).

The third and final module is taken up with a consideration of diverse approaches to understanding the history of geographic thought. Given the past popularity of organizing that understanding in terms of a succession of paradigms it is reasonable that considerable attention is given here to the paradigm concept as enunciated by Kuhn (1962), its attractions, in particular the way it underlines the social character of science, and its various shortcomings. Kuhn's clear failure to take wider social contexts and academic politics into focus are underlined through readings of Harvey (1973) and Taylor (1976). His discontinuist conception of intellectual history then allows us to make some reference to rationalist understandings and a consideration of the relation between the history of geography and the idea of progress. This leads into a review of the contextual approach apparent in the work of people like Driver (1992) and Livingstone (1992). Stoddart's (1966) paper on Darwin and geography and Kearns's (1984) discussion of Jackson Turner and Mackinder are then used to illustrate the potential of this approach.

What I want to emphasize, however, is that throughout the seminar pains are taken to achieve as much *representation* as possible of both physical and human geography. In talking about the spatial tradition as much attention is devoted to Graf (1979) on changes in stream channel geometry, Van Loon & Rogers (1978) on teleconnections and Stoddart (1969) on areal associations between climate and landforms as to Bunge (1966) and Mackinder (1907). Graf also figures in discussion of the environmental tradition as does Oke (1988) and alongside representatives of human geography like Watts (1983), Sauer (1956), Semple (1911) and the environmental hazards perception school (White, 1973). Similarly in the second module dealing with issues of philosophy of science, much of the reading draws on the book by Haines-Young & Petch (1986) that was specifically written for a physical geography audience. Massey (1999), of course, has facilitated discussion of time and space in geography by drawing equally on physical and human geographers. So while Curry (1966) and Storper (1988) get their due, so too do Chorley (1965a, 1965b), Kennedy (1992) and Schumm & Lichty (1965). In the third module our critical review of the paradigm concept as applied to the history of geography is as much of the 'new geomorphology' as it is of the 'new human geography'. Strahler's (1992) autobiographical essay likewise provides excellent material for introducing complexity into discussions of why geographic thought takes the particular directions it does.

Obviously this is no mere token representation. It is also, however, more than representation. For what is underlined as students work through the contributions of both physical and human geographers is the advantages of openness to the streams of thought coming from the respective sub-fields. In particular the aim is to generate a re-evaluation of our conception of geography as a field of study as a result of the fact that it embraces both physical and human geography. This involves addressing the students in terms of both their interests as members of communities of physical or human geographers respectively and as geographers *tout court*. But before this is discussed some of the problems encountered along the way need to be addressed.

### The Difficulties

A major difficulty in creating the sort of seminar that is balanced with regard to both human and physical geography is the serious asymmetry in the literature. As far as human geography is concerned, issues in geographic thought, as in the three modules outlined above, are well treated, even copiously so. There is therefore a good deal to draw on when considering (e.g.) 'the difference that space makes', or even contextual approaches to geographic thought. But in physical geography there is considerably less, though with some outstanding exceptions such as the two-volume *The History of the Study of Landforms* (Chorley *et al.*, 1964, 1973; Chorley & Beckinsale, 1991).

In large part this asymmetry reflects differences in the relation of the two sub-fields to what one might call 'issues in geographic thought'. This is partly a matter of differences in the degree to which questions of methodology and conceptualization at more abstract levels are part of the stuff of debate. In human geography over the past 50 years or so debate has been nothing if not extraordinarily lively, even aggressive. In physical geography the analogues pale by comparison. The way in which air mass climatology took over from its predecessor was virtually without friction. In geomorphology, despite objections at the time from major figures like Wooldridge, what was then known as dynamic geomorphology easily displaced its Davisian predecessor with its emphasis on historical elements in the landscape. Likewise Terjung (1976) berated climatologists for the dominantly descriptive character of what they were doing in the 1970s; the field was subsequently transformed virtually in its entirety. Remnants continue in the form of teleconnection research (e.g. Van Loon & Rogers, 1978) but no one has said that that should comprise the climatologist's agenda and that Terjung was wrong to place it lower in his—clearly normative—system of 'levels'.

It is not just a matter of differences in the intensity of debate, however. There is also the fact that physical geography has been for the most part, and with some important exceptions like Chorley, much less concerned about its geographic credentials; in particular, whether or not its research is 'spatial'. Indeed, to physical geographers papers like that of Sayer on 'the difference that space makes' are mystifying as is the related debate about whether space should or should not be viewed as a container. This is not to paint physical geography as homogeneous in these regards. The raw materials one can extract for a seminar on geographic thought are in more ample supply in the case of geomorphology (e.g. Chorley *et al.*, 1964) than in climatology. There has also been some increase recently in the level of interest of geomorphologists as in the work of, among others, Barbara Kennedy (1992), Bruce Rhoads and Colin Thorn (1994), Jonathan Philips (1999, 2004) and including some interest in the realist philosophy of science (for example, Keith Richards, 1996).<sup>3</sup> But climatology has been much less caught up in these sorts of issue.

These differences between human and physical geography are reflected in a varying ability to elicit the cooperation of the students. The human geographers among them are, for the most part, more enthusiastic participants than the physical geographers.<sup>4</sup> In fairness though, the human geographers show little interest in including physical geography under the rubric of a course in geographic thought.<sup>5</sup> It is, in other words, not just a problem of the relation of a sub-field to geographic thought. It is also a problem of the relations between physical and human geographers.

### Advantages

Nevertheless, despite this disparity in the resources available, and the sometimes reluctant cooperation of the students, persistence seems warranted. This is because the geographic thought seminar is one of the few contexts in which physical and human geographers are forced to confront the issues, the principles of thought that bind and divide them. In consequence it provides an important arena for coming to terms with the essence of the discipline.

In the first place it helps in underlining the specificity of the two sub-fields. It heightens the awareness of human geographers as to what makes human geography different from physical geography, the social sciences from the physical sciences; and so too is it with the physical geographers. There are several related aspects to this.

### *Human Agency*

Human action, unlike that of physical objects, is intentional, conditional upon understandings, creative, potentially novel, and dependent on material conditions, technologies for instance, that themselves are humanly transformable. In an epistemological sense this is something alien to the world of the physical geographer. This is because it means that what the human geographer studies is subject to change in a sense that cannot be applied to the physical world. The structures of relations through which change occurs in human geography, through which the understandings and material conditions of all labour processes are changed, are themselves human constructions: the reproduction and transformation of social structures cannot be divorced from the fact of agency. This does not mean that any social structure, and therefore any human geography, is possible. It has to be consistent with material possibilities and constraints, as in Marx's materialist principle. But there can be no sense as there can be in physical geography of the eventual possibility of an exhaustive mapping of the objects of study and their characteristic ways of acting, except perhaps at such a high level of abstraction as to severely limit their purchase on the concrete.

However, as investigators, of course, both human and physical geographers alike are agents whose activities and subsequent understandings likewise depend on the meanings, and the changing meanings, that they assign to their objects of study as well as on the changing nature of their instruments of labor: social theories, tape recorders, GIS software, ice core technology. The concept of the academic labor process is apposite and is helpful in understanding the ways in which human and physical geography both have changed. Kuhn emphasized the social character of science; the way in which what is observed is concept dependent<sup>6</sup> and how those concepts can change as in his famous notion of paradigm shift. To be sure this helps undermine the positivist notions of method that many students bring to the seminar. But, and whatever the deficiencies of Kuhn's paradigm notion, it underlines the active nature of science. Kuhn emphasized the conceptual resources that scientists bring to bear. This is supplemented in the seminar by identifying the way in which changing understandings also depend on hardware (and increasingly software). A useful reference here is Dobson's (1992) discussion of the acceptance of Wegener's original notions of continental drift. He shows that these were eventually accepted when, courtesy of improved observational techniques, it was possible to elaborate the theory of plate tectonics.

This is a discussion that can be extended so as to take on the changing organization of the discipline and the deepening of the division between human and physical geography. The organization of the discipline of geography has surely changed. The days when a faculty member would teach courses on South Africa and the geomorphology of the Scottish Highlands are long gone. The historical emergence of separate publishing outlets has reflected this and added its own impetus to the process. That agency has been centrally involved seems irrefutable: something akin to the will to power that Taylor discussed in his article on the quantification debate in British geography.

### *Objects of Study*

The fact of agency underlines an essential difference between the objects of study of human and physical geographers. Agency depends on the attribution of meaning to the world around them by agents, in fact to *differentiating* the world around them to begin with. What people imagine makes a difference to the (material) geographies that they construct. Likewise, what they imagine to begin with is structured by intentionality, which they themselves can change as a result of even newer imaginings. One source of those imaginings, of course, is academic discourse. There is a sense in human geography in which academic work is internal to society. This works both ways. Academic geographers are involved in the lay world and assimilate ideas from it, ideas that can affect the way in which they structure their interpretive frameworks as geographers. But this is a potential pitfall since a distinguishing trait of lay discourse, as Sayer argued, is its unexamined character.

The actions which are the focus of physical geographers, on the other hand, are quite different from the commuting, the migration and the locations that human geographers study. Rivers erode and deposit, land slides, rocks are subject to weathering agencies, and so on. These actions, however, have nothing to do with the imputation of meanings. Land forms and natural forces do not construct a set of meanings about each other with respect to which they act. Nor are they purposive in any sense. The fact that streams are often aligned with fault lines has nothing to do with any intentionality on the part of streams, for example; which is in contrast with the linear patterns that medieval villages often formed at spring lines in England's scarplands. So while our ideas as human geographers are part of the object studied and can affect its development, this is not the case in physical geography. On the other hand, we should not ignore the potential for the physical geographer's interpretive frameworks to bear the influence of a lay discourse. The fact that streams were seen as competing with one another, indeed capturing one another, has a metaphorical value, for sure, but might well have marginalized other sorts of activity that did not fit quite so well into the imagery of market behavior.

The fact that the imaginary is an essential aspect of human activity, however, does not mean that meanings and intentions are immune to the material possibilities and necessities of the human organism at any one time. As noted above, the materialist principle is fundamental. Meanings have to work, and to be effective in realizing intentions; and intentions that aren't realized will not be intentions for long. Yet in an important sense it is through the development of new ideas—ideas that work in terms of natural laws—that exploit naturally occurring substances and forces that those material possibilities and necessities are what they are, that they change in the ways that they do. This is very clear in terms of the powers of people to move over space, for example—something denied to other organisms.

These observations concerning contrasting objects of study in human and physical geography respectively also help students understand the question of prediction, something that is considered in the seminar under discussion when attention turns to the second module having to do, among other things, with issues of epistemology. The difficulties surrounding prediction are various but in one regard human geography is unique. The fact that the meanings assigned to social objects affect how people relate to them is crucial here. For, to the extent that human geography comes up with new understandings, those meanings are internal to society and can result in a change in material practice—a change that vitiates any predictive purpose those academic understandings might have entailed. This is the self-fulfilling (or self-countervailing) prophecy. Human geographers may well have contributed to the construction of the problem of the inner city. To what degree, for example, have their forecasts of continuing decline become part of a conventional wisdom that results in redlining (among other things) so that the prediction actually becomes true, is in fact, self-fulfilling?

On the other hand, the very fact that people understand the world through imputing meanings to it also serves to bring human and physical geographers together again and, beyond that, to subject their activities to social processes of a very similar if not identical nature. Geographers, regardless of their objects of study, all draw on interpretive frameworks that are negotiated, applied, fought over and transformed. Accordingly, to the extent that the idea of paradigm can be applied to geography, then it can be applied equally to human and physical geography.

### *Geographic Thought and Society*

Module 3 in the seminar is about the various approaches through which we can try to understand the history of geographic thought. In discussing the ‘succession of paradigms approach’ considerable attention is paid to the way in which Kuhn abstracts from questions of power and one of the readings used to illustrate this is David Harvey’s (1973) essay on revolutionary and counter-revolutionary theory in geography. In this essay Harvey puts particular emphasis on the idea of anomalies as signifying that a paradigm is no longer working. The particular anomalies he is interested in highlighting, however, are not those which Kuhn implicitly locates within a field of study, a science; rather they are between a science and the objective of material manipulation and control in society at large. Paradigms, in other words, are called into question because they no longer seem to answer to pressing social needs, though as he points out these are always needs for some and not for all.<sup>7</sup>

Kuhn, of course, had claimed that the social sciences were in a pre-paradigmatic phase since in none of them, unlike in the natural sciences, had any particular paradigm succeeded in becoming hegemonic. For Harvey, on the other hand, this is evidence that the natural sciences are pre-social; that the struggle over paradigms that rages within the social sciences is evidence of the conflict of serious social interests outside the academy. But even if natural science *were* to become ‘social’ in Harvey’s terms it is not clear that symmetry reigns in this regard between social and physical science and therefore between human and physical geography. For Harvey’s conception of revolutionary and counter-revolutionary theory in social science is not one that can be replicated in the physical sciences. In the social sciences it is truly a struggle around theory and is rooted in the unity of theory and practice central to Marx’s dialectic. It is, in other words, not a question of social priorities—of butter instead of guns. But in the natural sciences that is exactly what

it is: the peaceful uses of nuclear energy, prioritizing the health problems of the poor rather than those of the wealthy and so on. As a theory of society Marxism, unlike mainstream social theory with what Harvey would define as its status quo categories, is a theory for the working class: it identifies the source of the exploitation of the working class and hence the way to abolishing it. There seems, however, no clear analogue in the natural sciences: no working-class physics, let alone a working-class physical geography—no new structure of ideas that produces results which aid the struggle of a particular social fraction, therefore.

### **Peculiarities and Commonalities**

These notes underline the potential for helping both physical and human geographers appreciate the peculiarities of their respective sub-fields by placing them in a comparative context. But as well as ways in which they are distinct with regard to each other, when we move to higher levels of abstraction there is also a degree of commonality between them; and indeed for it to be otherwise would be remarkable given their shared status as spatial sciences and, therefore, defensibly, part of the same intellectual tradition. Nevertheless the tension between abstract conceptions and concrete realities has been a source of persistent frustration within geography. People inhabit the same department,<sup>8</sup> sometimes go to the same conferences, but do not have much in a professional sense to say to one another. Not surprisingly, therefore, there have been a number of attempts to identify some sort of theoretical unity between the two sub-fields.

Since the 1950s there appear to have been three of these. In the seminar their respective significance and limitations are emphasized, though each is introduced quite separately from the others and their relationship to each other is only remarked on in passing. They are now considered in turn.

### *Geography as Space Relations*

The first of these was a spin-off from the spatial–quantitative revolution. In his book *Theoretical Geography*, Bunge claimed that putting space relations at the center of the discipline would allow an integration of human and physical geography; that it was through their shared character as spatial sciences that they could be united. He himself provided examples of how this would work out in practice. An interesting feature of what we might arguably call ‘his manifesto’ was the spatialization of concepts from other sciences. This undoubtedly lent impetus to his conviction that space relations were the key to what Anuchin later called ‘a geography without adjectives’. This was because each of his spatializations could be nicely exemplified from both human and physical geography. The idea of spatial prediction,<sup>9</sup> for example, seemed to apply equally to central place landscapes and to the climates of Koeppen’s idealized continent.

This was a conception of the relations between human and physical geography that resonated more widely. A notable example of this was Peter Haggett’s (1967) use of Robert Horton’s work on stream bifurcation angles and their relation to respective stream flows in an attempt to shed light on the bifurcation angles of highways in Portugal using traffic flow as the explanatory variable.<sup>10</sup> Other names closely associated with this work were those of Leslie Curry and Michael Woldenberg. An important part of this project, therefore, was the use of analogical reasoning: the use of physical geography to generate models that could then be applied to human geography. Interestingly, though, the balance



of trade between the two sub-fields seems to have been to the advantage of physical geography since the latter did most of the exporting and very little of the importing.

Another aspect was the exploration of the potentially unifying character of spatial statistical models. Quadrat count analysis started in plant ecology, was taken up in the exploration of settlement patterns and then returned to physical science in attempts to characterize, among other things, the geography of sinkholes. John Rayner pioneered the use of spectral analysis in characterizing the scale features of climate and later, along with Golledge, used the technique in describing the scale characteristics of settlement patterns (1972, 1973).

But emphatically not much work was done along these lines and one can only speculate why that was. One possibility is that while at a very high level of abstraction physical and human geography are concerned quite centrally with space relations, differences in substance mean that the space relations they are concerned with at more concrete levels only overlap to a limited degree. In physical geography the vertical aspect of space relations, as in adiabatic lapse rates in climatology and the potential energy of elevation in geomorphology, is much more prominent. Movement in the three spatial dimensions takes center stage as compared with human geography where by and large, and with some notable exceptions like transhumance, one can safely confine oneself to two.

More fundamentally, space is not the issue for physical geographers that it is with human geographers. Moreover, since human geographers worry over the meaning of space and its importance for understanding human geography, they are often puzzled as to why there is no similar debate in physical geography. On the whole, physical geographers do not worry about such issues, which is one reason why there is so little written on the topic and therefore why it is not an easy thing to put together a course in geographic thought that gives equal billing to physical geography.

There are several possible reasons for this disinterest. According to John Arnfield (personal communication), it might have something to do with the spatial—or aspatial—character of cognate disciplines. Those cognate to physical geography—geology and meteorology—tend to be already spatial. They both make heavy use of maps and draw on spatial ideas like the general circulation of the atmosphere, continental drift or palaeogeography. Those related disciplines on which human geography draws, however, like political science, economics and sociology, have tended, by and large, to be aspatial in their theories and research practices. As a result it seems a defensible claim that human geographers saw the adoption of space as a focus as more of a disciplinary demarcation than did physical geographers. The remaining problem then would be that in order for space to be so defined it had to be seen as separable to begin with.

This brings us to the second possibility for why physical geographers have tended to be less concerned about theorizing the role of space in what they study. In physical geography there is not the same separation of space and matter/material process as in human geography. For the most part physical processes take their own spatial trajectories and fill up their own spaces and we cannot alter them in contrast to the way we alter the spatial form of social processes like the labour process or the division of labour. We cannot, for example, alter the path of a tornado, change the geography of the permafrost zone—at least not intentionally—or make slopes retreat more rapidly, but firms alter their geographic divisions of labour as a matter of course. Space is clearly important in understanding physical processes: wind *direction* affects whether a beach is being eroded away or subject to deposition, *areas* are subject to uplift, erosion may be *headward*, lakes

overflow through *spillways*, and the rate of erosion is affected by *slope angles*. But in physical geography space never gets separated from substance: streams *have* to erode headward, winds *have* to flow from areas of high pressure to ones of low pressure, lakes *necessarily* overflow through *spillways*, and so on.

In human geography, on the other hand, space can appear as an objective property separate from substance. This is because of the way in which (social) space is both conceptualized and practiced in the everyday life of a capitalist society: as something that bears no necessary relation to substance but also something which we have to control/intervene in if we are to make a profit, earn a wage, etc. So in human geography we tend to see space as malleable, as constructed, as indeed transformed through the fixed investments of transportation infrastructures, cities and the like. In physical geography there has been no similar separation, since the space of physical processes is inseparable from them and from an evaluation of the causal effects of those processes.

### *Geography as the Study of Systems*

If the spatial relations approach tended to abstract from questions of substance, however, the second approach to be referred to here tried to bring them back in. This was the notion of systems analysis as a way of bringing physical and social processes together, but subordinated to a vision of geography that moved away from the spatial tradition towards the environmental.

The principle impetus here came from physical geographers, including in particular Chorley & Kennedy (1971), the geomorphologist Strahler (1980) and the climatologist Terjung (1976). Each of these conceived of research as defined by its form; and the forms in turn slotted into a hierarchy of levels. The hierarchy moved from the study of morphological relations between system elements (as in the morphometric studies of the geomorphologists), through the study of cascading systems which defined the flows of energy and mass through the system, to process-response studies; in the latter, morphology would be connected to cascading systems in an attempt to shed light on the functioning of the system as a whole. The connection to social process would be through a higher level characterized by feedback as organizations and people intervened in physical processes in order to create outputs (morphologies) more enhancing to the realization of their interests; flood control, irrigation, the creation of artificial environments, which might in turn have unintended effects on cascading systems.<sup>11</sup>

As soon as the issue of human intervention is broached, however, this calls for a knowledge not just of physical processes but also of the social, and few have tried to venture into that territory. In fact the only instance I have been able to locate is the very long book by Bennett & Chorley (1978). For while such a systems approach seems attractive by virtue of its holistic character and its seeming ability to take dynamics, including feedbacks, into account, in practice it is very difficult to achieve. For sure there are social theories that seem appropriate to this purpose. But systems theory, as in the hugely influential *Limits to Growth* report of 1972, has tended to abstract from the very real political character of social process, including social science as part of that process: something Harvey tried to underline in his distinction between revolutionary and status quo theory. In his paper (1974) on neo-Malthusianism, for example, he stated how “in other words, if we become the prisoners of an ideology, prisoners of the concepts and categories handed down to us, we are in danger of making the neo-Malthusian conclusions true, of making environmental determinism a condition for our existence” (p. 271).

*Geography as a 'Complex, Historical Science'*

More recently there have been some currents of thought in both human and physical geography that Doreen Massey (1999) has brought together in an important paper on time and space in the two sub-fields. Massey defines both human and physical geography as 'complex and historical sciences' and sees this status as a basis for what she calls a conversation between the two.

This is not her only objective. By defining them in this way she is also at pains to distance them from the world of time-independent, equilibrium processes so central to the project of classical physics. As the quintessential 'science' physics has been the model all other sciences have tried to emulate, provoking in the course of this what she calls 'physics envy'. This she believes to have been thoroughly misguided, not just because geography along with many other fields, including geology, biology and the social sciences, cannot possibly confine itself to such a research program given the nature of its objects of study, but also because it is a mischaracterization of contemporary physics.

For Massey both physical and human geography would benefit from the recognition that many of the processes they deal with are of a time-dependent nature. History matters. As human and physical geographers we deal with systems of relations that are subject to emergence, bifurcation points, path dependence and multiple equilibria. Her model for complex and historical sciences is evolutionary biology. This is the world of what she calls sequence as opposed to progression. This entails a vision of change over time and space that recognizes its essential openness and which is not self-limiting through the identification of end-states towards which processes *must* ultimately go.

In arguing thus Massey explicitly draws on the work of others, particularly in geomorphology. The 'new geomorphology' which came to dominance during the 1960s and '70s and which counterpoised a focus on timeless process and equilibrium to the time-dependent one of Davisian geomorphology is now being challenged in a variety of different ways. But what they all share is a recognition that while the 'new' geomorphologists were correct to reject the Davisian model for its closed system assumptions, they were wrong in not recognizing the openness of geomorphic systems over *all* time-scales and not just the short term, and how equilibrium over the short term could coexist with disequilibrium over the long term. An early recognition of this was the paper by Schumm & Lichty (1965) but their earlier insights have since been sharpened by the work of people such as Barbara Kennedy (1992) and J. B. Thornes (2003).

One can also trace antecedents in human geography. Hagerstrand's work has always been distinctive but perhaps no more so than during the spatial-quantitative revolution. The locational analysis dominated by central place theory, urban rent theory, Von Thunen and the like was by and large one of spatially equilibrating, time-independent processes. Hagerstrand's formulations were quite different. They emphasised the role of history, and the way in which chance events could influence the specificity of geographical outcomes. Curry (1966) was clearly influenced by this in his own arguments about the importance of contingency and the direction it could give to the spatio-historical. These are themes that have been picked up in recent years by Michael Storper (1988) and by the growth of interest on the part of economic geographers in path dependence.

Massey's contribution, however, is not just to bring these arguments together but to extract from them a novel vision of geography's central concept, space: this is of space as space-time. Through juxtaposition in space-time, processes of emergence are set in train

generating path dependences. These may or may not end in equilibrium states. In the study of new industrial districts, for example, there is no vision of some stable condition. Yet in studies of climatic change, to use one of the examples drawn on in the seminar, there is, as in the shift from the Pleistocene to the Holocene.

To some degree Massey picks up on earlier discussions by Hagerstrand (1984). In contrast to the separating out of objects from their environments, he argued for enclosing a part of the world as it is found with its mixed assortment of beings—to put things in context, in other words. For it is only by putting objects and laws in particular contexts that we can see how they work out in terms of empirical effects:

With his law of gravitation Newton could predict how an apple accelerates when it falls to the ground from its branch. Perhaps somebody has calculated the strength of apples seen as material. But none of these general pieces of knowledge are sufficient to tell if Newton's apple would get crushed or not after reaching the ground. In order to judge that part of the event, one needs to know if the ground is made up of, for example, grass or hard pavement. One must, in other words, look into the diorama which shows in what ways things are present with respect to each other just where events happen. (1984: pp. 3–4)

This will recall some of the arguments that the critical realist Sayer made about the importance of spatial arrangement; the effect of dropping an atom bomb depends on spatial arrangement, whether it is dropped on a city or in the desert, for example (Sayer, 1992). The point that Hagerstrand is trying to make, therefore, is that context (cf. Sayer's 'spatial arrangement') is essential to understanding empirical outcomes.

He argues further that contextualizing processes, evidence of all sorts, requires skills of an interpretive sort. He refers to this as a matter of developing a sense of context. In referring to the work of archeologists trying to understand the significance of what they have found, he suggests that: "The remnants themselves and their precise locations are fragments of a text which the researchers must try to fill out to a complete story." This is certainly consistent with certain practices not just in human but also in physical geography (Dury, 1959; Sugden, 1996) and, of course, with Massey's concern for space–time juxtapositions and geography as a 'complex and historical discipline'—presumably like archaeology, as well as geology, epidemiology and all the other spatial sciences. The reference to 'remnants' also recalls an earlier phase of contextualizing in geomorphology: the study of denudation chronology.

### **Concluding Comment**

All of these arguments are pitched at a very high level of abstraction. Accordingly, the notion of a unity between physical and human geography at the level of empirical research, one that confronts the specificity of physical and social processes in the context of particular concrete problems, is missing. The recent interest in global change/sustainable development has made this an enticing prospect, though some of the work in the environmental tradition also called for, and came close to delivering, this sort of unity. Pierre Gourou's *The Tropical World* sought an understanding of the low population densities of the equatorial forest regions of the world. The prevalence of shifting cultivation was the answer provided, but this was argued largely in terms of the specificity

of edaphic processes in the tropics. Gourou was also alive to the importance of the social through its effects on technology, though perhaps not to the extent of avoiding a flirtation with an ecological determinism. In other words, in tackling a problem that required attention to both physical and social processes he was a little stronger on the former.

But just how general is this? Is it not fair to say that for the most part the problems that human geographers study require little or no knowledge of physical processes and vice versa? Graf (1979) can write productively on the role of human intervention in the form of deforestation in arroyo formation without a discussion of the social relations that induced the mining activity that led to that deforestation in the first place. Similarly when Oke (1988) discusses the effect of urbanization on micro-climates he does not need an understanding of the political economy of urbanization. The same goes for many of the problems that human geographers have studied in the past. The study of central place systems does not require a knowledge of the processes that physical geographers study and nor does the study of new industrial districts. In short, a geography which limited itself to problems that required knowledge of both social and physical processes would be a rather strange animal. It would risk marginalizing the sorts of problems geographers have worked on hitherto. And it is far from clear that that marginalization could be justified either in terms of social needs or in terms of more disembodied notions of scientific progress.

Emphatically, however, this does not mean to say that, to use Doreen Massey's (1999) metaphor, conversations between human and physical geographers are futile. Through the sort of seminar I have described here it is possible for students to understand both the specificity of what they do as geographers and what they share. Crucially, human and physical geography differ in their objects of study. This is particularly important in arriving at a common view of what appropriate method might look like in human and physical geography respectively and in placing limits on extending method from one to the other. But they also have commonalities. They are both spatial sciences, despite variable concern of an explicit nature with the spatial, and they are both, if somewhat paradoxically, 'complex historical sciences'.

Beyond these considerations, there is also the fact that human and physical geography share a social world. As disciplines both have been subject to similar sorts of social conditionings. In interpretations of their histories, struggles within the discipline—in this instance, within the *sub*-disciplines—are a significant part of the story; less so in physical geography than in human geography, but apparent nonetheless, at least in the recent history of geomorphology. Likewise neither sub-discipline has changed in ways that cannot be related to a wider set of influences. It seems hard to imagine the rise of quantitative geomorphology outside the support of the US Geological Service for fluvial research, mainly as a function of its interest in flood control; or of the rise of air mass climatology outside the demands of weather forecasting. In a similar way, Harvey saw the links between the spatial–quantitative revolution and “outside pressures to discover the means for manipulation and control in what may broadly be defined as ‘the planning field’” (1973, p. 124). Physical and human geographers, therefore, can not only learn from one another, they can also understand the histories of their respective sub-disciplines in very similar terms.

Given the imbalance in the relevant literatures from the two sub-fields, I would not claim that putting together a seminar of this type is an easy project. Nor is it easy gaining the cooperation of students who have extremely specialized backgrounds. But so long as there is a broad church called geography, it seems important that the attempt be made.

## Acknowledgements

Thanks are offered to Kendra McSweeney and Paul Robbins for a number of very helpful comments on an earlier draft of this paper.

## Notes

- <sup>1</sup> Since John Arnfield's retirement in 2003, I have continued with the same conception that we developed together.
- <sup>2</sup> Given the quarter system, this is a seminar that has to be completed in only 10 weeks.
- <sup>3</sup> See also the Forum (1999) On Methodology in Physical Geography, *Annals of the Association of American Geographers*, 89(4), pp. 677–778.
- <sup>4</sup> Though this may owe something to the fact that we teach in a department where physical geography means climatology.
- <sup>5</sup> We should note here that there is also a certain sub-field imperialism in that although books about geographic thought proclaim themselves as representing the field in its entirety (as indicated by the various book titles) this is virtually never the case and physical geography struggles to get a look in.
- <sup>6</sup> Though, emphatically, not concept-determined!
- <sup>7</sup> Specifically: "... 'manipulation and control' means manipulation and controls in the interests of particular groups in society (specifically, the industrial and financial community together with the middle class) rather than in the interests of society as a whole" (p. 122).
- <sup>8</sup> That is the case at least in Britain and the United States though not apparently everywhere; Sweden is an oft-cited instance where there are Departments of Human and Physical Geography respectively.
- <sup>9</sup> The idea of spatial prediction was another fascinating product of Bunge's lively imagination. By this he meant extrapolating in the two dimensions of space as opposed to the one dimension of time.
- <sup>10</sup> See also Haggett and Chorley (1969) on networks in human and physical geography.
- <sup>11</sup> As in Oke's (1988) work on the impact of the built environment on micro-climates.

## References

- Bennett, R. & Chorley, R. J. (1978) *Environmental Systems: Philosophy, Analysis and Control* (Princeton, NJ: Princeton University Press).
- Bunge, W. (1966) *Theoretical Geography* (Lund: C.W.K. Gleerup).
- Chorley, R. J. (1964) Geomorphology and General Systems Theory, *U.S. Geological Survey Professional Paper*, 500B (10 pp.).
- Chorley, R. J. (1965a) A re-evaluation of the geomorphic system of W.M. Davis, in: R. J. Chorley & P. Haggett (Eds) *Frontiers in Geographic Teaching*, pp. 21–38 (London: Methuen).
- Chorley, R. J. (1965b) The application of quantitative methods to geomorphology, in: R. J. Chorley & P. Haggett (Eds) *Frontiers in Geographic Teaching*, pp. 147–163 (London: Methuen).
- Chorley, R. J., Dunn, A. & Beckinsale, R. P. (1964) *The History of the Study of Landforms; Or The Development of Geomorphology Vol. 1* (London: Methuen).
- Chorley, R. J., Dunn, A. & Beckinsale, R. P. (1973) *The History of the Study of Landforms; Or The Development of Geomorphology Vol. 2* (London: Methuen).
- Chorley, R. J. & Beckinsale, R. P. (1991) *The History of the Study of Landforms; Or The Development of Geomorphology Vol. 3* (London: Methuen).
- Cox, K. R. (1995) Concepts of space, understanding in human geography and spatial analysis, *Urban Geography*, 16, pp. 304–326.
- Curry, L. (1966) Chance and landscape, in: J. W. House (Ed.) *Northern Geographical Essays in Honour of G.H.J. Daysh*, pp. 40–55 (Newcastle on Tyne: Oriol Press).
- Dobson, J. (1992) Spatial logic in paleogeography and the explanation of Continental Drift, *Annals, Association of American Geographers*, 82, pp. 187–206.
- Driver, F. (1992) Geography's Empire: Histories of geographical knowledge, *Environment and Planning D: Society and Space*, 10(1), pp. 23–40.
- Dury, G. H. (1959) *The Face of the Earth* (Harmondsworth: Penguin Books).

- Giddens, A. (1981) *A Contemporary Critique of Historical Materialism* (London: Macmillan).
- Gourou, P. (1953) *The Tropical World* (New York: Longmans, Green).
- Graf, W. L. (1979) Mining and channel response, *Annals of the Association of American Geographers*, 69(2), pp. 262–275.
- Hagerstrand, T. (1984) Presence and absence: a look at conceptual choices and bodily necessities, *Regional Studies*, 18(5), pp. 373–380.
- Haggett, P. (1967) On the extension of the Horton combinatorial algorithm to regional highway networks, *Journal of Regional Science*, 7, pp. 281–290.
- Haggett, P. & Chorley, R. J. (1969) *Network Analysis in Geography* (London: Edward Arnold).
- Haines-Young, R. & Petch, J. (1986) *Physical Geography: Its Nature and Methods* (London: Harper & Row).
- Harvey, D. (1973) *Social Justice and the City* (London: Arnold).
- Harvey, D. (1974) Population, resources and the ideology of science, *Economic Geography*, 50(3), pp. 256–277.
- Harvey, D. (1990) Between space and time: reflections on the geographical imagination, *Annals, Association of American Geographers*, 80, pp. 418–434.
- Jackson, P. (1989) *Maps of Meaning* (London: Unwin Hyman).
- Kearns, G. (1984) Closed space and political practice: Frederick Jackson Turner and Halford Mackinder, *Environment and Planning D: Society and Space*, 2(1), pp. 23–34.
- Kennedy, B. (1992) Hutton to Horton: views of sequence, progression and equilibrium in geomorphology, *Geomorphology*, 5, pp. 231–250.
- Kuhn, T. S. (1962) *The Structure of Scientific Revolutions* (Chicago, IL: Chicago University Press).
- Livingstone, D. (1992) *The Geographical Tradition* (Oxford: Blackwell).
- Mackinder, H. J. (1907) *Britain and the British Seas* (Oxford: Clarendon Press).
- Massey, D. (1999) Space–time, ‘science’ and the relationship between physical geography and human geography, *Transactions of the Institute of British Geographers*, 24, pp. 261–276.
- Oke, T. R. (1988) Street design and urban canopy layer climate, *Energy and Buildings*, 11, pp. 103–113.
- Philips, J. V. (1999) *Earth Surface Systems. Complexity, Order, and Scale* (Oxford: Basil Blackwell).
- Philips, J. V. (2004) Laws, contingencies, irreversible divergence, and physical geography, *Professional Geographer*, 56, pp. 37–43.
- Rayner, J. N. (1971) *An Introduction to Spectral Analysis* (London: Pion).
- Rayner, J. N. & Golledge, R. G. (1972) Spectral analysis of settlement patterns in diverse physical and economic environments, *Environment and Planning A*, 4, pp. 347–371.
- Rayner, J. N. & Golledge, R. G. (1973) The spectrum of U.S. Route 40 re-examined, *Geographical Analysis*, 5, pp. 338–350.
- Rhoads, B. L. & Thorn, C. E. (1994) Contemporary philosophical perspectives on physical geography with emphasis on geomorphology, *Geographical Review*, 84, pp. 90–103.
- Richards, K. S. (1996) Samples and cases: generalization and explanation in geomorphology, in: B. Rhoads & C. Thorn (Eds) *The Scientific Nature of Geomorphology*, pp. 171–190 (New York: Wiley).
- Sauer, C. (1956) Agency of Man on Earth, in: W. L. Thomas (Ed.) *Man's Role in Changing the Face of the Earth*, pp. 49–69 (Chicago, IL: Chicago University Press).
- Sayer, A. (1992) *Method in Social Science* (London: Routledge).
- Sayer, A. (1985) The difference that space makes, in: D. Gregory & J. Urry (Eds) *Social Relations and Spatial Structures*, pp. 49–66 (London: Macmillan).
- Schumm, S. A. & Lichty, R. W. (1965) Time, space and causality in geography, *American Journal of Science*, 263, pp. 110–119.
- Semple, E. C. (1911) *Influences of Geographic Environment, on the Basis of Ratzel's System of Anthropogeography* (New York: Henry Holt).
- Stoddart, D. (1966) Darwin's impact on geography, *Annals, Association of American Geographers*, 56(4), pp. 683–698.
- Stoddart, D. (1969) Climatic geomorphology: review and re-assessment, *Progress in Geography*, 1, pp. 159–222.
- Storper, M. (1988) Big structures, small events, and large processes in economic geography, *Environment and Planning A*, 20, pp. 165–185.
- Strahler, A. N. (1980) Systems theory in physical geography, *Physical Geography*, 1, pp. 1–27.
- Strahler, A. N. (1992) Quantitative/dynamic geomorphology at Columbia 1945–60, *Progress in Physical Geography*, 16, pp. 65–84.
- Sugden, D. (1996) The East Antarctic Ice Sheet: unstable ice or unstable ideas?, *Transactions of the Institute of British Geographers*, 21(3), pp. 443–454.

- Taaffe, E. J. (1974) The spatial view in context, *Annals, Association of American Geographers*, 64, pp. 1–16.
- Taylor, P. J. (1976) An interpretation of the quantification debate in British Geography, *Transactions of the Institute of British Geographers*, NS 1, pp. 129–142.
- Terjung, W. H. (1976) Climatology for geographers, *Annals, Association of American Geographers*, 66, pp. 199–222.
- Thornes, J. B. (2003) Time, change and stability in environmental systems, in: S. Holloway, S. P. Rice & G. Valentine (Eds) *Key Concepts in Geography*, pp. 131–150 (London: Sage Publications).
- Van Loon, H. & Rogers, J. C. (1978) The seesaw in winter temperatures between Greenland and Northern Europe, Part I: general description, *Monthly Weather Review*, 106, pp. 296–310.
- Watts, M. (1983) Hazards and crises: a political economy of drought and famine in Northern Nigeria, *Antipode*, 15(1), pp. 24–34.
- White, G. F. (1973) Natural Hazards Research, in: R. J. Chorley (Ed.) *Directions in Geography*, pp. 193–216 (London: Methuen).