Concepts in Human Geography

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On Space and Spatial Practice in Contemporary Geography

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When first confronted with the literature on the nature of space, the new student finds a bewildering set of apparent alternatives. There is real space and perceived space, there is phenomenal space and behavioral space, there is ideal space and material space. Within the confines of this group of broader and contrasting conceptions, there appear to be another set of related contrasts, of place, region, site, location, locale, and situation; hence, we might have a view of the nature of the region within a material, an ideal, or a phenomenal view of space. Complicating the matter further, some students of space have suggested that we need in addition to attend to the language used in discussing space. Is it seen as a container or a network or a grid? The language used, these students assert, reveals deeper commitments to one of the views listed above. Finally, making matters even more complex is the fact that many of those advancing theories today about the nature of space maintain that they are the first to have done so and that previous works either did not exist or were simpleminded excursions in reportage. The matter already seemed difficult, but it now appears worse; we cannot even be sure where the landmarks are.[1]

In several ways, then, the student of the concept of space in geography finds a difficult and confusing situation. We can chalk this confusion up in part to disciplinary politics—one group's dismissal of another may just be a matter of its wish to assert its dominance; but I suggest that there is a second reason for the confusion. Many have not asked, and more find it difficult to answer, a very basic question: Where in the thinking and practicing of geography *might*

space be an issue? Instead, they have tended to imagine that the concept of space is important when it comes to the construction of theories and nowhere else.

This view, in turn, has come to be incorporated into the history of the discipline, so that it has become common to imagine that one can understand the ways in which the concept of space has been used in the discipline simply by looking at the theories that geographers have advanced about the nature of space. True, in the last few years some have begun to argue that we need to look beyond explicit theorizations and to the assumptions about space implicit elsewhere within empirical works. This, however, is less of a change than it might first appear, because it still assumes that the place of space in geography is in theory. This, in turn, suggests that before embarking on a research project the geographer needs to make a series of fundamental decisions about which conceptions to adopt.

This appears to leave the geographer with an insurmountable task. How do we choose which of these conceptions and approaches to adopt? How do we argue in favor of this or that conception? How do we do so without implicitly appealing to some set of unexamined spatial notions? Indeed, this way of thinking about the place of space within geography, and within science more generally, appears to leave us quite at sea.

A better approach to understanding the place of space in geography is surely needed, and I suggest that a better approach will be one that attends to the ways in which spatial notions are imbricated in the practices in which geographers engage. In fact, when we recast the matter in this way, the number of options diminishes dramatically; it turns out to be possible to understand the practice of geography as operating within only four families of spatial notions. It turns out, moreover, that these are long-lived notions; the oldest were codified some two thousand years ago; we can see the newest in a recognizable form as far back as two hundred years ago.

I begin by characterizing the ways in which, over the last two thousand years, these alternative conceptions of space have developed within Western thought. Then I turn to the works of geographers, describing the main schools of thought within geography today and characterizing them in terms of the categories they usually use to describe themselves. Finally, I shall show that these schools of thought can better be seen as the embodiments of the spatial conceptions that I earlier identified. Here, though, I suggest that the usual view—that over the course of that period we have seen the adoption of one notion of space and then its rejection and replacement by another—is quite wrong. Rather, I show that we find new conceptions of space developing alongside old ones, and even within the same works. If the old ones lose some theoretical attraction, cease being explicitly appealed to, and are applied within a more narrowly confined set of circumstances, they nonetheless remain important.

On Conceptions of Space

In Western thought there have been really only four main notions of space. Each has gained wide popularity, but each has at the same time been formally codified by a scientist or philosopher. I refer to these notions in terms of the formal codifications, but it is important to see that each has had an existence apart from the work of individual scientists or philosophers. The first, codified by Aristotle, is static, hierarchical, and concrete. It gives greatest attention to a concept of place. The second, which we usually associate with Newton, imagines space as a kind of absolute grid, within which objects are located and events occur. The third, found in Leibniz's work, adopts the scientific outlook of Newton but argues that we need, as Aristotle does, to attend to the relationships among objects and events to the extent that we come to see space as fundamentally relational and defined entirely in terms of those relationships. The last, codified by Kant, turns the tables: where Aristotle and Newton had seen discussions of space as essentially about the world, he argued that we need to see space as a form imposed on the world by humans.

Each of these constitutes a powerful image of space, but, of the three, the Newtonian is the one both most familiar and most often imagined to be accurate and to govern our activities and thoughts. Most people, that is, imagine that after all is said and done they live in a Newtonian world. However, I deny that this is true. In fact, I argue that of the three, the Aristotelian is by far the most important conception of space in everyday life and in the practice of geography. The Leibnizian conception, moreover, while little noticed, is fundamental to thinking within geography and the social sciences. The Newtonian, I grant, is also of fundamental importance, but largely because it is such a powerful *image* and an image that is supported in so many ways. The Kantian, despite its role in cultural studies and its popularity today in the form of the neo-Kantian view that all knowledge is somehow relative to the position of the speaker, exists only against the looming presence of a Newtonian absolutism.

On Aristotle and the Natural Place

When we think of the influence of Greek thinkers on geography, we normally think first of two people—Eratosthenes and Strabo.[2] Eratosthenes (c.273–c.192 BC) is sometimes characterized as the "father of geography," in

part because he was the first person to use the term and in part because of his famous attempt to measure the circumference of the earth and thereby take a mathematical and, hence, scientific view of it. George Sarton, for example, has called him—on the basis of this—"one of the greatest geographers of all ages" (Sarton 1959: 102). Strabo (64 BC–AD 20) is widely remembered as the person whose monumental work summarized for the future the geographical knowledge of the time. Even if both Eratosthenes and Strabo were important, however, it is difficult, really, to see their works as essential to, or even connected with, the current practice of geography. Indeed, characterizations like that of Lukermann (1961), to the extent that they show Strabo as developing a view of geography that involved a rich understanding of the interrelatedness of geography, chorography, and topography, demonstrate the extent to which modern-day geographers have failed to appreciate what is important in the work of their predecessors. Would contemporary geography be any different if they had never existed? It is hard to imagine that it would.

By contrast, the views expressed in and first codified by Aristotle (384–322 BC) remain of overwhelming importance today.[3] It would be easy here to misunderstand me. I don't mean to suggest that he was a person of such genius that he invented a philosophical and scientific system that has survived simply through the force of that genius. Rather, I suggest that he was the first writer to notice and elucidate something about the Western way of inhabiting and relating to space. His view has persisted for two reasons: one is that what he noticed was then so important, and the second is that his codification of it—because it was so popular—became deeply ingrained in discourse not only about space and place, but also about the world more generally. Long after his lifetime Aristotle's conception shaped Western discourse about space. When it comes to matters of space, we speak Aristotelian.

Aristotle's physics is based on the belief that what needs to be explained is change, particularly motion (change in location). He assumed that there needed to be a reason or cause for any motion, that motion did not simply occur; but there are really two sorts of motion. On the one hand, there is the motion of the planets and stars, and that motion by all accounts was circular and eternal (in his time and given the instruments available, there was no evidence of changes in such motions). On the other hand, there was the sort of change that we see on the earth, as when I throw a rock in the air and it falls to earth. To Aristotle and many of his contemporaries it seemed as though we actually needed two very different sets of explanations for those two apparently different sets of phenomena. In the celestial realm it appeared as though it was circular motion that needed explanation; in the terrestrial it was linear.

The explanation for the terrestrial is the more important here. It drew on the belief that the world was composed of four substances: earth, water, air, and fire. It did not escape Aristotle's notice that the earth appeared by and large to be composed of earth, that the oceans lay on the earth and were composed of water, that next there was the air, and finally fire. In fact, when left unfettered, earth appeared naturally to fall to earth, water fell to water, air rose to air, and fire continued upward. This change in location, he believed, was what characterized the terrestrial sphere, where what we see is constant degeneration and regeneration. It is here that the notion of place becomes important, because for Aristotle things tend naturally to move toward their own places; indeed, this is the very nature of natural motion.

By contrast, when an object is moved away from its natural place, as when a rock is thrown into the air, what we see is not natural but "violent" motion. When that motion ceases, when its motive force is removed, the rock tends to return to its own natural location. This natural motion tends toward the natural place of things, that is, to their natural sphere. Because earth is the heaviest of the elements, things made of earth tend toward the center of the universe, which, in Aristotle's view, is the center of the earth. For Aristotle objects made of earth fall to the center because it is the center, not because they somehow are attracted by a gravity-like force to the mass already there; indeed, in Aristotle's conception of the world, if the earth were located somewhere else, objects would still fall toward the natural center.

There is a final feature of his physics that is of importance here. His work is overwhelmingly qualitative in thrust. Although Aristotle believed that there is a relationship between the weight of something and the way in which it falls, so that heavier objects fall faster than light ones, there are only a few places—his discussion of the circumference of the earth is a notable one—where he attempts to quantify phenomena. It might be thought that his physics, because it was a qualitative science based on the belief in the natural place of things, has long since been superseded, replaced by something that makes more sense. Before leaping to that conclusion, however, it is important to note that what many today take to be the commonsense view of things, that the universe is a void full of atoms and that space is a featureless grid, was well known to Aristotle. That very view had been developed in some detail by the Greek atomists and eloquently laid out, after Aristotle's time, in Lucretius's (d. 55 BC) *On the Nature of Things*. So Aristotle's failure to adopt this view was not a matter of its not having occurred to him. Rather, it was a result of his belief that such a view could not be developed in a way that saved the phenomena, that accounted for what was obvious to experience. Indeed, current historical work on the development of later alternatives to Aristotle's view suggests that, far from being attempts to develop theories that better fit the phenomena, they often were less, rather than more, successful than their predecessors. Their appeal lay elsewhere.

What does it mean to say that geographers, and people in general, live today in an Aristotelian world? There is, of course, the obvious answer: notwithstanding the Copernican revolution, everyday experience still tells us that the earth stands still while the sun, moon, planets, and stars move through the sky in a circular motion. Further, although we are now aware that stars come and go, the heavens appear to change little in comparison with what we see every day on the earth; for most of us the evidence of supernovas comes from the mass media and not from our own experiences. Moreover, the evidence of our senses suggests the truth of the view that water returns to water, earth to earth. Few of us can say that we have experienced the pull of gravity, but most have seen rivers, landslides, or the rise of a bubble through a body of water. Last, and perhaps most important, we live in a hierarchical world where things and people have places where they belong. We are taught early what it means to be out of place.

The Collapse of Hierarchy

Aristotle's view was enormously influential and because of its adoption by the Church remained so well through the Middle Ages.[4] In the seventeenth century it was displaced by a set of views developed by a group, including Descartes, Boyle, Galileo, Newton, and Leibniz, whose works came to establish a radically different understanding of space. Many would argue that these views have totally replaced the earlier view—certainly, when we speak today of space we likely think immediately of Descartes or Newton, or possibly Leibniz—but it should be clear from what I have just said that I believe this not to be the case.

Rather, what has prevailed is a set of *images* of space, images that guide the ways in which people think about space but do not necessarily affect the ways in which they actually organize or act within space. This new image, I suggest, has prevailed for two somewhat different reasons. First, it fit well into a technological consciousness that emerged as early as Roman land surveying and military organization and that flourished alongside these conceptions of space (Dilke 1971). Second, and in a sense more important, it provided an image of clarity of thought, a vision of such power that in a wide variety of areas, in art, architecture, and politics, as well as science and engineering, it came to be seen as defining the modern age. Its power has been such that it has been able to render almost invisible the omnipresent remnants of the Aristotelian view.

As I suggested earlier, we need to distinguish here between two rather different attempts to develop mechanical images of space, one found in Newton and Descartes, the second developed by Leibniz. Newton in the end won out,

but not before standing, through an intermediary, in battle with Leibniz. Leibniz's view, though, remains important, both because it provided an alternative to what was to become the orthodox image and because geographers today appeal to it in so many ways.

These notions of space did not emerge fully formed, and, indeed, it is difficult in retrospect to say at what point they fully distinguished themselves from the Aristotelian. For example, if we look back to Euclid, we may be led to believe that we are seeing a view of space that at the very least contains the seeds of the Newtonian. Perhaps more obviously, if we look at Gothic architecture with its extraordinary interplay of lines and spaces and if we compare it to the earlier Romanesque, we may wish to say that the Romanesque is Aristotelian and that the Gothic appears to embody a view of space as a system. Most strikingly, the movement from medieval painting to painting in the Renaissance appears to be an expression of a radically different understanding of space.[5] In medieval painting, although there is clearly a system of perspective involved, the arrangement of the objects and people in space appears to us almost primitive. To the modern eye the size and location of people is especially disconcerting, just because it looks so unreal. In fact, the organization of objects was the expression of a system of order different from ours in two ways. First, social or religious importance was the basis on which the size and location of figures was established. Second, paintings often embodied narrative elements, that is, a painting told a story through the juxtaposition of elements.

After a series of false starts this traditional system received what turned out to be a fatal blow in 1413. In that year Filippo Brunelleschi (c. 1377–1446) displayed a painting based on a mathematical system that placed the eye of the viewer at a single point and through the establishment of a series of lines appeared to place the objects within the painting in such a way that they looked real. It is easy to see this vanishing point perspective in painting and Gothic architecture as embodying new and radically different conceptions of space, but if both pointed in the direction of the modern and more rational view of space, both also viewed space as something created by the juxtaposition of objects within the building or the painting. If in one sense they allowed objects to be let loose within an empty space, in another that space remained confined, to the building or painting itself. In this sense there was little progress here, and what we see is little different from the demonstrations of Euclid, which need involve no space outside of that created within the demonstration itself.

The most important impediment to the move from the Aristotelian view of space, and from isolated systems embodying internal spatial orders to a view wherein space can be seen as an empty grid, was the persistence of the belief in the principle of sufficient reason.[6] This principle, essential to medieval and

later religious thought, held that in order for anything to occur, there needed to be a "sufficient reason." So, for example, an object could not move from point X to point Y unless a reason or cause existed, but the suggested abandonment of the notion of natural place seemed to leave no means for explaining why an object might be here rather than there. Because this seemed a clear violation of the principle of sufficient reason, this notion of space was rejected out of hand.

Ironically, perhaps, it was the action of the Church that helped undercut the Aristotelian tradition; indeed, in the Condemnation of 1277—a critique of the views of a set of radical Aristotelians—it was explicitly declared that God *could* create a void, and an infinite one at that. Here, again perhaps ironically, the Church aligned itself with traditional Stoic philosophy, against which Aristotle had argued for the existence of a vacuum. It was not until Descartes (1596–1650) that we begin to find enunciated a view of space that looks modern, and even here the view can be called modern only with substantial qualifications.[7]

In his *Principles of Philosophy* (1644) Descartes argues, "A space, or intrinsic place, does not differ in actuality from the body that occupies it; the difference lies simply in our ordinary ways of thinking . . ." (*Principles* 2: § 10). And "The terms *place* and *space* do not signify something different from the body that is said to be in a place; they merely mean its size, shape, and position relative to other bodies. To determine the position we have to look to some other bodies, regarded as unmoving" (*Principles* 2: § 12). So for him there can be no void, no empty space. Rather, we need to begin with the understanding that all of the characteristics of color, density, and so on that we associate with objects in space are really inessential features and that the only essential feature of objects is their extension, their length, breadth, and height. Once we remove the inessential features, we then see that what is left, extension, is just the same as space. Indeed, space cannot be seen as existing without matter and extension, so space consists simply of the relations among extended objects.

Even so, Descartes believed that space was without limit. "We see, furthermore, that this world—the totality of corporeal substance—has no limits to its extension. Wherever we imagine the boundaries to be, there is always the possibility, not merely of imagining further space indefinitely extended, but also of seeing that this imagination is true to fact—that such space actually exists" (*Principles* 2: § 21). From this it follows that where for Aristotle there had been one physics for the earth and another for the area outside of the moon, for Descartes there is only one. "We can also readily derive the result that celestial and terrestrial matter do not differ; if these were an infinity of worlds, they could not but consist of one and the same kind of matter; and thus there cannot be a plurality of worlds, but only one. . . . Thus it is one and the same matter that exists throughout the universe . . ." (*Principles* 2: § 21–22).

If this view is in some respects familiar, it is in others quite puzzling, especially in its identification of space and matter. It is also one that has more than a few shades of Aristotle, yet behind it we need to see three related features, which were to overwhelm the Aristotelian elements of that work and thereby point to a more modern view. First, in his *Geometry* Descartes developed the connection between algebra and geometry, making possible a move beyond the traditional picture of mathematics. Second, he presented a view wherein mathematics is the model of certainty and, indeed, of all knowledge. Aristotle's physics had been purely qualitative, and in the Middle Ages the Church had actually proscribed the application of mathematics to science; now mathematics became not merely a tool for science, but the very model of science. Finally, Descartes developed a view wherein knowledge developed as a result of "mental vision." Here, echoing Brunelleschi's system of linear perspective, he laid out a way of thinking about the act of acquiring knowledge that made it possible to see the knower as standing outside of any possible situation and viewing it from that detached position.

Newton and Absolute Space

The implications of these views were worked out by Newton (1642–1727) in his *Fundamental Principles of Natural Philosophy* (1686). In the famous "Scholium to the Definitions," he laid them out in the starkest and most straightforward way.

> Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces. . . . Absolute and relative space are the same figure and magnitude, but they do not always remain numerically the same. For if the earth, for instance, moves, a space of our air, which relatively and in respect of the earth remains always the same, will at one time be one part of the absolute space into which the air passes; at another time it will be another part of the same, and so, absolutely understood, it will be continually changed. (Scholium: § 2)

One consequence is that we need to think of motion in a very different way.

> Absolute motion is the translation of a body from one absolute place into another, and relative motion the translation from one relative place into another. Thus in a ship under sail the relative place of a body is that part of the ship which the body

> possesses. . . . Wherefore, if the earth is really at rest, the body, which relatively rests in the ship, will really and absolutely move with the same velocity which the ship has on earth. (Scholium: § 4)

Why do people fail to see that space is absolute?

> [B]ecause the parts of space cannot be seen or distinguished from one another by our senses, therefore in their stead we use sensible measures of them. . . . And so, instead of absolute places and motions, we use relative ones, . . . but in philosophical disquisitions, we ought to abstract from our senses and consider things themselves, distinct from what are only sensible measures of them. (Scholium: § 4)

If today we see Newton's work as strictly secular, we need to recall that it in fact has substantial religious overtones. In his "General Scholium" he argued that God "is eternal and infinite, omnipotent and omniscient. . . . He endures forever and is everywhere present. He is omnipresent not *virtually* only but also *substantially*. . . . In him are all things contained and moved, yet neither affects the other; God suffers nothing from the motion of bodies, bodies find no resistance from the omnipresence of God." Yet those overtones have long since faded away, and what has remained is a view of a universe of matter, floating in a space that is infinite, absolute, and eternal. This is an image of extraordinary power. It is an image that seems strikingly clear, certainly subject to quantification, and surely consistent with the requirements of science. Notwithstanding the twentieth century's flirtations, via the popularizations of Einstein's work on space and time, with alternatives, it remains a basic feature of common sense.

Leibniz and Relational Space

But not everyone has been seduced by its power. Indeed, Newton's contemporary, Leibniz (1646–1716), lashed out, arguing that Newton's view of space was literally nonsensical. In a series of letters with Newton's proxy, Samuel Clarke (Alexander 1956), he developed this argument. In a famous passage he noted how people come to believe in space through the concept of motion.

> They consider that many things exist at once and they observe in them a certain order of co-existence, according to which the relation of one thing to another is more or less simple. . . . When it happens that one of those co-existent things changes its relation to a multitude of others, which do not change their relation among themselves . . . we then say, it is come into the place of the former; and this change we call a motion in that body. (Leibniz, fifth paper: § 47)

The way in which we understand motion leads to the belief in the existence of absolute space. "And supposing, or feigning, that among those co-existents, there is a sufficient number of them, which have undergone no change; then we may say, that those which have such a relation to those fixed existents, as others had to them before, have now the *same place* which those others had. And that which comprehends all those places, is called *space*" (Leibniz, fifth paper: § 47).

So the belief in the existence of absolute space arises simply by virtue of our noticing that among the objects in the world some appear to move, while some appear not to. To go along with Newton, however, and move from this perception to the conclusion there is something called "absolute space" is to move from the realm of science to that of metaphysics.[8] In order to stay within the bounds of science, he argued, we need to understand that space is nothing more than "something merely relative, as time is; that I hold it to be an order of coexistences, as time is an order of successions" (Leibniz, third paper: § 4). Space, that is—and as according to Descartes—is purely relational; but in contrast to Descartes, Leibniz does not believe that space and matter are identical: space is relational but consists just in those relations and nothing else.

Kant and the Second Copernican Revolution

The dispute between Newton (or his proxy, Clarke) and Leibniz took place between 1715 and 1717, and they seemed to have laid out for the next sixty-five years the main alternatives in discussions about the nature of space. Then, in 1781 Immanuel Kant (1724–1804) published the *Critique of Pure Reason*, a work that fundamentally recast debates about the nature of space.[9] His view is the final of the four alternatives widely subscribed to today.

Kant described himself as having created a "Copernican revolution" in philosophy. Where Copernicus had moved the earth from the center of the universe and replaced it with the sun, Kant had moved the locus of debate about knowledge from the known to the knower. In doing so he recast the question about the nature of space from one about the nature of the world to one about the nature of human knowledge.

His work is notoriously difficult, but, to simplify his argument greatly, he stated that previous accounts of the nature of knowledge—and here he referred to scientific knowledge—could not make sense of that knowledge. In particular, we know that there are certain branches of knowledge, such as mathematics, where we can have certain knowledge, but we never really have a perception of certainty, we never actually see or experience it in the world. From where, then, does it come? His Copernican revolution claimed that the

certainty comes from within, that it is built into the way in which we know the world; so, for example, we never actually perceive causes in the world, but we naturally impute causality to the relationships among objects.

If this is true of the imputation of conceptual relationships like causality, it is also true more basically of space and time. In fact, we never actually perceive either. Rather, we perceive a series of instants, or we perceive objects close to or far from one another or objects that seem to occupy volume. He argues in the case of space, however, that if we did not already have built into us in some way the notion of space, the possibility of ordering things in spatial terms, we would be unable to say, "This is next to this." As he put it:

> Space is not an empirical concept which has been derived from outer experiences. For in order that certain sensations be referred to something outside me (that is, to something in another region of space from that in which I find myself), and similarly in order that I may be able to represent them as outside and alongside one another, and accordingly as not only different but in different places, the representation of space must be presupposed. (*Critique of Pure Reason*: A23/B38)

This means that the whole way of discussing space that we find in Aristotle, Newton, and Leibniz needs to be abandoned. It is not only wrong, but also incoherent, because if space is a condition of our understanding the outside world, we can never ask, "What is the world really like spatially?" All of our perceptions of the world are already spatial; we will never be able to get beyond our own perceptions.[10]

Kant himself believed strongly in the truth of Euclid's account of geometry and Newton's account of the physical world—indeed, he believed both to be final and definitive—and yet, by recasting the question of the nature of knowledge in this way he opened the door for a critique of Newton and Euclid and, indeed, for the development in the nineteenth and twentieth centuries of more complex understandings of the nature of space. In fact, it would not be going too far to say that all studies of culture today are a footnote to Kant. Exactly how this happened is not relevant here, but what is is this: during those two centuries, Euclidean geometry, clock time, and Newtonian physics each came to be seen as only one of several possible alternatives. The development of non-Euclidean geometry, for example, suggested that we may perceive space in radically variable ways.

The undercutting of the belief in the universality of traditional absolutist views of space was augmented both by the increasing awareness of alternative cultures and by the romantic reaction in the West to the increasing force of industrialism and urbanism. In this way, by the turn of the twentieth century and by the time that geography began to be constituted as a modern discipline,

a set of views that would allow for the belief in real differences in the human occupation of the world and organization of space was solidly in place—but so too were the Newtonian view of space as absolute and the Leibnizian view of space as relational.

Geography in the Twentieth Century

When we look merely at the explicit claims that contemporary geographers make, it is possible to speak—generalizing only a little too rashly—of their understanding of the nature of space and place as having moved within two different, and even separate, streams, streams that diverged perhaps one hundred years ago. For those in the first stream, *place* is a concept about which it is not possible to say anything interesting. Rather, *space* is at the center of attention, and *location* is the concept of preference, where location is seen as a feature of objects or events in *space*. On this view there is something called space, which is typically seen as both real and absolute: a thing's location is simply where it exists within that space. This view has often been cast in terms of a distinction between the characteristics of a site, what a place is like, and its situation, its location in relation to other places or in terms of some abstract grid.

This view has typically been taken to be a commonsensical one, deriving from the Cartesian and Newtonian turns in Western thought. As such it has formed the uncontested groundwork of much thinking in this century about the nature of space and related concepts such as region and place. For example, the first great theoretical tome in modern geography, Hartshorne's 1939 *The Nature of Geography* (see also Hartshorne 1958), argued that the task of geographers was to study the differentiation of phenomena on the surface of the earth. Although Hartshorne devoted much attention to the nature of regions, he took space itself to be unproblematic.

Beginning in the early 1950s, a number of attacks were launched at Hartshorne. His attackers proposed what they took to be a dramatically different view of the discipline, one that would see it as fundamentally the science of space. In doing so they took on the mantle of what is usually termed positivism. Notable among these scholars were Schaefer (1953), Stewart and Warntz (1958), Ullman (1954), Bunge (1973/1962), and the rediscovered Christaller (1966/1933).

There were in several respects important disagreements between Hartshorne and these authors; they argued that geography ought to join the ranks of the sciences, while he demurred. With respect to space, too, there was a certain disagreement: Hartshorne saw space as basically a neutral container, while his opponents gave it greater explanatory efficacy. Notwithstanding this

disagreement, though, all of these authors shared the view that space itself is absolute, rigid, and unproblematic.

Alongside this tradition developed a second stream, one that embodied a very different view of the issues of space and place. Developed in France at the turn of the century and then separately in the United States beginning in the 1920s and 1930s, this tradition focused on the ways in which people create cultural areas (Vidal de la Blache 1928/1911; Sauer 1963/1925; Wright 1947, 1966; Brown 1948). Each of these authors argued that different combinations of beliefs and practices lead human groups to occupy and manipulate the earth in different ways. From a set of raw materials with one structure is created a new structure, one in which locations acquire meaning as places and in which human activity is carried on in terms of systems of space.

Although they were interested in the development of places and regions, these authors did not really consider the nature of space itself. Still, because they saw as fundamental to their task the understanding of the human construction of places, their work embodied an attitude toward the nature of both space and places. Many, it should be granted, undoubtedly assumed with the positivists that behind the human constructions of places was a "real," objective space. Nonetheless—and this is the crucial point—they rejected the notion that any absolute or nonhuman space had causal efficacy and hence was worth troubling with.

Through this empirical (albeit in some ways theoretically uninformed) work, Vidal, Sauer, Brown, and Wright laid the groundwork for what was characterized in the early 1970s as a humanistic break with positivist orthodoxy. The earliest figures in this break were Buttimer (1971), Relph (1976), and Tuan (1974a, 1974b, 1977), all of whose works in the initial stages referred in some ways to phenomenology (although it seems fair to say that none took it very seriously). Here Relph argued that there once had been a world of "real" places and that now, under the onslaught of modernism, that world was disappearing and being replaced by one in which people no longer are attached to places. Buttimer followed in this tradition at least to the extent that she focused on human experience. By contrast, here and in later works (1982) Tuan adopted a more synoptic view, one that took as its premise the need to specify the differences among conceptions of space and place and that involved the laying out (nongeographers would say mapping) of the range and types of places that humans construct and associating those places (or those conceptions of space) with various kinds of bases.

None of these authors could be seen today as taking seriously the assertion that they were working within a strictly phenomenological tradition, but there have remained, from time to time, attempts to develop such a tradition in geography. David Seamon (Seamon and Mugerauer 1989) and John Pickles (1985) have fought this out, with Seamon adopting a soft, furry phenomenology and Pickles taking on the mantle of Husserl's Cartesian, rationalistic phenomenology. Here, occasionally, Bachelard's (1969/1958) phenomenology is mentioned, but these are inevitably just mentions.

As the geography of places developed in the 1970s, positivist geographers were hard at work continuing their attempts to develop a spatial science and applying both mathematical models and statistical devices to the project (see, for example, Gatrell 1983 and Juillard 1972). Elsewhere within the discipline, however, there were changes on two fronts, both related to the issue of space. On one front a group of geographers began to work from a neo-Kantian premise (this was actually news, since most geographers could be seen as pre-Kantian), that people construct their own perceptual worlds. Turning to the issue of space, they argued that people carry "mental maps" of the world around in their heads and that these maps vary from place to place and time to time. There was a real cottage industry of these studies, but most notable were works by Gould (Gould and White 1974) and Downs (1970; Downs and Stea 1973).

Although we might want to see this work as operating within the tradition of cultural anthropology, all of it came directly out of the positivist tradition in psychology. In fact, in an important sense those who worked on mental maps can be seen as having been subcontractors, attempting to replace the inadequate "real" metric space developed by the original large-scale modelers with a more adequate "perceived" space. Notwithstanding the connection to the well-known cartoon version of "The New Yorker's View of the World," this work remained strongly within a positivist and absolutist project, one that argues that behind these mental maps is a real and objective space, accessible to those who have the right tools—reason and the scientific method. This work is still seen, but its initial proponents quickly found the metaphor exhausted and moved on.

The second movement was the attempt to bring a critical, Marxist approach to the discipline. Although for a time there was general use of the term "space economy," (see Harvey 1972 and many others), there was little in this literature in the way of conceptualization of the nature of space. By and large, this work was content to attach a political (and, to a degree, methodological) point of view to standard positivist approaches to space. Typically, arguments in favor of the consideration of places and regions were regarded as fundamentally conservative diversions from the project of developing a more general understanding of the larger space economy.

In the 1980s and early 1990s this simple dichotomy was complicated by several developments with respect to the issues of space and place. These developments have from time to time made it appear that those working within one

stream have jumped ship and moved to the other. First, a group sometimes referred to as the new cultural geographers has taken the culturalist/humanist/phenomenological orthodoxy, that both space and place are human constructions (and are conceptually separate), and moved it in a series of directions, both contemporary and historical. Most notable among this group are Cosgrove, Daniels, the Duncans, and Ley (see their contributions in Barnes and Duncan 1992; Duncan and Agnew 1990; and Cosgrove and Daniels 1988; and see below). It is probably fair to say that by now this is a well-developed subdiscipline. Notwithstanding its reliance on the tradition of the study of places within geography, most of its advocates have looked outside the field rather than to their predecessors within the field for intellectual sustenance.

Second, cracks have begun to develop in the Marxist refusal to appeal to other than absolutist views of space. One sign of this is the development of the *locality* movement (see, for example, Cooke 1987a, 1987b; Massey 1985; Lovering 1989; Cox and Mair 1989; and Duncan and Savage 1989), which has developed new and politically progressive regional studies. The localities debate has arisen, in part, as a result of the suggestion that in a global and post-Fordist era we really can make sense of some features of economies at a local level (and that localities in fact retain their importance, rather than becoming less so, or placeless). Still, from the point of view of their approach to space the advocates of localities studies appear not to have broken with their Marxist and positivist predecessors; the locality exists within what is assumed to be an absolute space. Further, and as in the case of the new cultural geography, the localities debate has involved an attempt to reinvent a concept, here the *region*, without reference to its predecessors.

Third, work in geography and gender has begun to become more fully institutionalized (as evidence a new journal on gender and place). Here it is hard to make generalizations about the conceptions of space and place that are involved, other than to say that the work might be seen as integrating elements also found in (but not necessarily derived from) the new cultural geography and various progressive movements. Just a few of these works are Bowlby et al. (1989), Christopherson (1989), Bondi (1990), Foord and Gregson (1986), McDowell (1983; 1988), Mackenzie (1988), and Peake (1985).

Fourth, some geographers have attempted to develop various versions of postmodernism. This has often (as in Dear 1988 and Soja 1989) meant the adoption of an "anything goes" attitude toward space. There have been, of course, a stream of critics, such as Harvey's in his neopositivist *The Condition of Postmodernity* (1989) and the very different pieces by Massey (1991) and myself (1991).

Fifth, these and others have begun to take heart in the interest by nongeographers in issues of space and to argue that this interest is evidence of the coming of age of the discipline. The work of Anthony Giddens (1984) was among the first to be greeted in this way, but so too has that of Foucault (1984/1982 and even his 1986). In part, this has involved a linguistic turn in geography, with much talk of language and metaphor, along with critiques of containerism and the like. More recently, Lefebvre's (1988) *The Production of Space* has been much cited, although it is hard to know its real effects.

Sixth, some geographers have begun to argue against an "absolute" notion of space and in favor of what they term a "relational" view. Because the place tradition sees places as defined often in terms of relations of objects or activities, this move to relational space might in one sense be seen as a move toward convergence. That it is not can perhaps be understood best by considering the extent to which visual metaphors dominate images of relational space while remaining fundamentally at odds with images of place. There is, too, a second point of divergence: whatever their theoretical bent, studies of places tend to reject the desire to be synoptic, while advocates of notions of relational space are operating more often within neopositivist notions of grand theory.

Seventh, the development of computer-based geographic information systems has given a new lease on life to the otherwise moribund absolutist, scientific view of space as a Cartesian grid. Here the ability through computers to manipulate coordinate systems rapidly and easily has allowed geographers to deal with the apparent difficulty—that the world is not Cartesian—that had plagued their predecessors and it has allowed them to do so without abandoning their belief in absolute space.

Finally, there have been a number of recent works about the history of space in social thought, most notably Sack (1980) and Entrikin (1991). These works have attempted to make sense of the arguments between advocates of the study of space and of the study of place.

On Space and Spatial Practice

It might seem difficult to generalize about all of these developments. Indeed, almost all that we might feel safe in saying is that there are a wide range of approaches to space and place within geography and that there is little discussion by one group of the work of others. In fact, many of the moves toward an understanding of the nature of places and regions that have been made by groups previously dismissive of the subject have turned to authority figures outside the discipline, and this appears to make the matter even more complicated.

If we turn, however, to the ways in which conceptions of space are integrated into academic practice, matters are simpler. We find that the many

groups mentioned in the previous section have much in common. There is not room here to lay out all of the similarities—and differences; rather, I shall confine myself to pointing to ways in which each of the conceptions of space that I mentioned earlier can be found.

I suggested earlier that most geographers today are Aristotelians. This may have seemed a rash assertion, just because so few today would claim to have intellectual roots extending much beyond Newton, and yet, if we look at the geography of the everyday practice of geographers, it is shot through with Aristotelian assumptions. Most important is that we can see the world in terms of objects and events, each of which having its natural place. If for Aristotle earth, air, fire, and water had a natural place, for the contemporary geographer the list is rather different; women, ethnic groups, economic activity, trees, and rocks all have their own natural places today. Indeed, to be out of place is to be a possible subject of research and to be comfortably where we belong is to be rendered invisible. For example, until very recently geographers assumed that women belonged in the home. As a result, they paid virtually no attention to them. Studies of economics and culture focused on men, and data categories were established in ways that made the activities in which women engaged difficult to see. It was only when on two fronts women became visible—by making it clear that the home was not the only place in which they might fit and by in fact taking up stronger positions outside the home—that geographers began to look more closely at the position of women in society and to notice that they had all along been engaged in important activity.

This example, it should be noted, points to an important feature of the contemporary version of Aristotelianism, that is, that to refer to something as being in its natural place is not simply to make a factual statement, it is also to make an evaluative claim. In contemporary society, to say that something is where it belongs is to say that it ought to be there. Nowhere is this more true than in the thinking of academic geographers about where they themselves belong. If those who characterize themselves as radical have in other ways criticized the academy, they have at the same time claimed—as have women and members of ethnic groups—that they belong there.

In pointing out these features of contemporary geographic practice I am not, I hasten to add, attempting to be critical of those who appeal to these Aristotelian terms. At least, I am not criticizing them insofar as they are ready to notice that is what they are doing. Quite to the contrary, it appears to me that these sorts of appeals are quite inescapable, and so, in pointing to them I am both making a claim about the sorts of things about their own lives and their own world that academics ought to notice and at the same time making a claim about the perspicacity with which Aristotle saw the world.

If we turn to the Newtonian image of space, matters are quite different. We

are likely inclined to believe that his image of the world as an object located in a vast and undifferentiated space is the one that we all use, to which we all appeal. The facts, though, are quite otherwise. It may seem baffling that I say this, but if we turn back to the debate between Leibniz and Newton we can see why I do. Recall that Newton argued in favor of the independent and absolute reality of space and that Leibniz countered that the whole notion was incoherent because we could never tell where we really were. Newton's argument, like the arguments of the other absolutists (as in Kant's early work on space), was not that we have evidence that space is absolute and independent, but rather that we must believe that space is absolute and independent. Leibniz's argument is that space is relational because our only way of determining where things are appeals to relations; Newton makes a wholly different argument, that if we do not believe in absolute space we must as a consequence abandon other beliefs and that those other beliefs are not ones we are prepared to abandon.

In fact, then, Newton presents less a falsifiable theory of space than an image of space, and in geography, as elsewhere, it is as an image that space has been important. The image, in effect, provides a backdrop against which those who attempt to develop timeless and universal theories can set their work. In one sense this is a matter of the establishment of what look like grounds for believing that work can be permanent, that the researcher can come back later to what is truly the "same place." There is, however, another and perhaps more vital sense in which the Newtonian image has been important, and that is as a model for the very operation of society. Newton's work was the culmination of what E. J. Dijksterhuis (1961/1950; see also Koyré 1957) has called the "mechanization of the world picture." As such, it provided an image of the ways in which things work and thus, an image of the kinds of explanations that ought to be offered. It has been concluded that these explanations ought to see the world as composed of elements or actions that are interchangeable and that maintain their characteristics when moved to different places.

The influence of this view is obvious. In the classic works on central places, agricultural location, and industrial location the assumption was always that there was some crucial element of the explanation, often utility or buying power, that was absolutely footloose. We see the same view in other, perhaps less obvious, places. Early Marxist works, for example, denied the reality of place and nature but viewed use and exchange value as mobile elements; if their critique of capitalism was that it treated the worker as an atom in Newtonian space, it did so by appealing in its own way to that same image. Finally, contemporary works on spatial perception have tended to adopt a view that is Newtonian in another way. They have couched their analyses of the spatial perceptions of others in terms of a kind of "deviation from the real," where the

real is absolute and unchanging—and where the geographer is able for the purpose of analyses to step outside of space.

If the Newtonian view of space has in various ways provided a guiding image for those engaged in geographical work, its very nature—as a view supported by argument rather than evidence—has prevented its use as anything other than an image. In fact, in their everyday work, when geographers are not being Aristotelian, they are unrelentingly Leibnizian. This may seem an odd thing to say. After all, David Harvey, for one, has recently argued that geography made a wrong turn in adopting Newton and ought now to abandon the Newtonian ship and sign on with Leibniz. Once we see the extent of the Leibnizian view, the matter will seem obvious.

If we turn back to Euclid and Brunelleschi, we likely see their work on geometry and linear perspective as presaging the development of the Newtonian view. This, though, is quite wrong. Euclid, for example, attempted to show how certain truths could be deduced from a set of axioms and postulates. In effect, he argued that we could construct the system of geometry simply from them. What is missing here? The rest of the world. In fact, Euclid's geometrical system is completely closed; it exists simply as a system. Much the same can be said of linear perspective in painting. From our point of view it looks as though the Renaissance development of the system of perspective in painting was an attempt to make painting consistent with what later came to be the absolutist, Newtonian view. In fact, though, as in Euclid, the system of a painting is quite closed; it includes only the elements of the painting, along with the viewer. Nothing else matters.

If we turn to geography and to works that look Newtonian, we find much the same thing. The most abstract models are inevitably simply that: models. They consist of elements and relations that are—and, indeed, endeavor to be—utterly self-contained. Today this is perhaps most obvious in the case of geographic information systems; although they appear to be absolutist in intent and although they certainly are in imagery, they are distinctively relational in their understanding of space. When we move beyond the model and theory, matters change very little. Descriptions of the movement of people and goods are couched in terms of locations, but the locations are never absolute; they are always, in turn, characterized in terms of yet other locations in what ultimately becomes a self-enclosed system.

Existing alongside these three notions of space is the fourth, the Kantian. As I suggested earlier, this view directs its attention in a very different way. Where the others saw the question of the nature of space as a question about the nature of the world, for the Kantian the tables are turned, and it becomes a question about the nature of the observer. If for Kant himself this changed little, and Newton was still right, for those who have followed in his footsteps

it has been an easy move to the belief that different people live in worlds that are themselves spatially very different.

The Kantian turn in the understanding of space has appeared to be most clearly in evidence in the area of perception studies, in which beginning in the 1970s a group of geographers began to consider the perception of space and of hazards among various groups. Differential perceptions were, of course, central to the work in hazards (Burton and Kates 1964; Kates 1962; Saarinen 1966). In the case of hazards research, however, where the interest was in the perception by residents of flood plains, for example, of the risks of living there, the aim was always to compare the perceived risks with the real risks. To the extent that this notion of the "real" was not problematized by calling into question the objectivity of the researcher, this is not really a Kantian view at all, since it does rest on the belief that there is an identifiable real.

Much the same can be said of most of the work on spatial perception; while it appears to be concerned with space as perceived, there is almost always the underlying assumption that perceived space can be compared with the space that is really out there. There is, of course, another set of works on space and place, that done by people whose concern might best be termed *cultural*. These works (for example, Barnes and Duncan 1992; Cosgrove 1985; Entrikin 1991; Tuan 1982) have tended not to be explicitly reflexive in form but have nonetheless made it clear that the means of conceptual or other ordering of space and place that they describe ought to be seen as applying as much to the author as to the subject. If we thus leave our sights on the general conceptual form of geographical arguments, it turns out to be actually quite difficult to come up with examples of works that see all perceptions of the world as structured by the knowing subject; it is far more common to see it assumed that everyone but ourselves is seeing the world through conceptual blinkers, while we ourselves are the only ones able to see it as it really is.

At the same time, there is a sense in which it is quite common to accept the mental structuring of perceptions of the world, and this is in the matter of the organization of knowledge itself. If we turn back to the recent past, we often find discussions of the organization of science that assert that disciplines are distinguished by their subject matter, so that sociology studies societies, economics studies economies, and geography studies regions. In the last few years, though, this view has come undone, as it has become more and more clear that members of all of the disciplines appear to be studying more or less the same subject matter. In the place of the earlier view one has appeared in which disciplinary divisions are seen as matters of perspective, so that sociologists study the world from the point of view of sociological concepts, geographers through geographical concepts, and so on. To the extent that we do not assume that it is possible to construct a kind of supra-discipline that transcends

all of these differences, we are being Kantian in our approach. Indeed, we might be tempted to say that here we are all Kantians, forced to be so by our libraries and publishers.

Conclusion

The concept of space in geography, then, turns out to raise a set of difficult issues. Far from being a matter about which we can adopt a position and from it spin out a coherent and inclusive set of accounts of the world, the issue of space raises problems everywhere. The geographer who wishes to adopt a view of space based on its own obvious merits finds all the ways blocked and is forced to adopt particular notions of space.

These notions are built into our society. They are built into our language and into our means of discussion. They are built into our libraries and into our legal system. They are built into the productive apparatus that we see all around us. Indeed, we are saturated in objects and words that tell us how to think about space and how to talk about it. It is this that makes the question of space so complex. It is not that we are lacking answers, but rather that we are up to our necks in answers. The difficulty is in sorting them out.

I have suggested that there are four different ways of thinking about space. It is now clear that I believe that each of us uses all four. In our everyday lives, discourse, and activity we are all Aristotelians, seeing the world as a place where things belong here and not there, where there are real and palpable hierarchies. In our reflections about space we by and large become Newtonians; we imagine that we exist somewhere within a vast and directionless space, one timeless and utterly unaffected by anything that we do. As we attempt to construct conceptual systems that will comprehend the world, we become Leibnizians, seeing the world in terms of a set of axioms and assumptions that are a world unto themselves. Finally, as we survey the world from our own disciplinary vantage point, seeing that point as one of many, we become Kantians.

If each of us at some point falls into all of these categories, we should not conclude that this must necessarily be so. For some groups, for some societies, one or the other view of space must surely be beyond the pale, an incomprehensible deviation from that which everyone knows and does. Rather, these views of space are supported by a wide range of institutions, by patterns of technological and economic activity—and by the very organization of space that they attempt to explain. If in one sense, then, we may wish to consider the various notions of space as an initial means, or prolegomenon, to the study of geography, they also constitute an important topic of study in their own right.

Notes

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1. Note that my discussion here is confined to the issue of *space* and that the concept of *place* is discussed only where place has been viewed as an essential element of spatial theorizing. Those who see place as simply one end of a continuum stretching from the universal to the particular may find this a perplexing approach. Nonetheless, I would argue that the best works on the nature of place (Tuan 1977, 1982; Entrikin 1991) support my view.

2. James and Martin (1981) provide a useful chronology of ancient geography. Bunbury's (1959/1883) is dated but is in a way more useful now for what it tells us about his own era. From within the history of science Sarton's *Introduction to the History of Science* (1959) is the standard work. A more recent and very useful summary of these issues through the end of the Middle Ages is Lindberg's 1992 history. G. E. R. Lloyd's works (1970, 1973, 1979, 1987) are always interesting and provocative. Finally, two useful works more explicitly concerned with physics and astronomy are Crowe (1990) and Pederson (1993).

3. The essential works here are the *Physics* (Physica 1941) and *On the Heavens* (De caelo 1941), both available in many editions. The literature on his scientific work is quite massive; see the bibliography in Pederson (1993).

4. There is a substantial body of work on medieval conceptions of space; Edward Grant's stands out. He has published a long series of articles (1964, 1969, 1976) and books; see especially his 1981 *Much Ado About Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution.*

5. The best recent work on this development is Kemp's *The Science of Art: Optical Themes in Western Art from Brunelleschi to Seurat.* Edgerton (1975), Panofsky (1972), and White (1967) provide interesting accounts of the development of pictorial space; Sypher (1955) and Giedieon (1967) argue within the context of art and architecture for the importance of changes in spatial conceptions.

6. See especially Lovejoy (1936); for more recent discussions, all deriving from Lovejoy, see Kane (1976), Knuuttila (1981), Kuntz and Kuntz (1988), and Kuntz (1971).

7. The essential works here are the *Discourse on Method, Principles of Philosophy, Meditations, Optics,* and *Rules for the Direction of Mind.*

8. It is important here to note that although the arguments of Descartes, Newton, and Leibniz can be easily translated into contemporary secular and scientific terms, the work of each was in fact steeped in a concern about the relationship of these issues to religious belief. The Leibniz-Clarke correspondence, for example, begins with Leibniz noting that Newton had called space the sensorium of God; he replies that this is utterly preposterous. Similarly, Leibniz himself argues against the existence of a vacuum on the basis that God would not, and in a sense could not, have created empty space; appealing to what A. O. Lovejoy has called the principle of plentitude, he ar-

gues that God must have created everything that could have been created and that empty space was a denial of God's power. If this set of arguments now seems quaint, Leibniz does refer to a principle of sufficient reason that has been seen in a secular twentieth-century version to have general applicability. As codified in the seventeenth century this principle holds that God must have had sufficient reason for making things one way or another. The consequence, Leibniz argued, was that the idea of absolute and empty space left no reason for an object's being here rather than there, and one was thereby forced to adopt a relational view of space. A twentieth-century version of this, albeit one that has not been applied to the question of space, is the principle of the identity of indiscernibles. It holds that if we have no means of distinguishing between two objects, then there must in fact be only a single object. This view was fundamental to thinking, in the form of the verification principle, in the early twentieth-century logical positivist philosophy of science.

9. Kant had in fact written his inaugural dissertation on space. That work, entitled *On the First Ground of the Distinction of Regions in Space* (1768), has been widely seen as the expression of an earlier and abandoned view of space; scholars have generally divided his work into two periods, with the 1781 publication of the *Critique of Pure Reason* signaling a change of heart. More recent work, though, suggests that with respect to the issue of space there may in fact be more continuity than has been believed (Guyer 1987).

10. There is, of course, another way in which geographers have appealed to Kant. Drawing from his assertion that the world is first organized in terms of space and time and then in terms of concepts, they have suggested that geography and history are the "exceptional" studies of the world, in terms of space and time, and that other sciences, such as physics, operate within the subsequent conceptual realm. We often find this view in discussions that attempt to define geography conceptually. Unfortunately, these works (Hartshorne's discussions of the discipline are an example) typically miss the real significance of Kant's understanding of the nature of space, which is its relationship through neo-Kantianism to the development of the theory of culture.

References

Alexander, H. G., ed. 1956. *The Leibniz-Clarke correspondence, together with extracts from Newton's Principia and Opticks*. New York: Barnes and Noble Imports.

Aristotle. 1941. De caelo. In *The basic works of Aristotle*, ed. Richard McKeon, trans. J. L. Stocks, 398–469. New York: Random House. [Written circa 330 B.C.]

———. 1941. Physica. In *The basic works of Aristotle*, ed. Richard McKeon, trans. R. P. Hardie and R. K. Gaye, 218–397. New York: Random House. [Written 330 B.C.]

Bachelard, Gaston. 1969/1958. *The poetics of space*, trans. Maria Jolas. Boston: Beacon Press.

Barnes, Trevor J., and James S. Duncan, eds. 1992. *Writing worlds: Discourse, text, and metaphor in the representation of landscape*. London: Routledge.

Bondi, Liz. 1990. Feminism, postmodernism, and geography: Space for women? *Antipode* 22 (2): 157–65.

Bowlby, Sophie, et al. 1989. The geography of gender. In *New models in geography*, vol. 2, ed. Richard Peet and Nigel Thrift, 157–75. London: Unwin Hyman.

Brown, Ralph H. 1948. *Historical geography of the United States*. New York: Harcourt, Brace, and World.

Bunbury, E. H. 1959/1883. *A history of ancient geography*, 2 vols. New York: Dover.

Bunge, William. 1973/1962. *Theoretical geography*, 2nd rev. and enlarged ed. Lund, Sweden: C. W. K. Gleerup.

Burton, Ian, and Robert W. Kates. 1964. The perception of natural hazards in resource management. *Natural Resources Journal* 3: 412–41.

Buttimer, Anne. 1971. *Society and milieu in the French geographic tradition*. Chicago: Rand McNally.

Christaller, Walter. 1966/1933. *Central places of southern Germany*, trans. C. Baskin. Englewood Cliffs, N.J.: Prentice-Hall.

Christopherson, Susan. 1989. On being outside "the project." *Antipode* 21 (2): 83–89.

Cooke, Philip. 1987a. Individuals, localities, and postmodernism. *Environment and Planning D: Society and space* 5: 408–12.

———. 1987b. Research policy and review 19: Britain's new spatial paradigm: Technology, locality, and society in transition. *Environment and Planning* A 19: 1289–1301.

Cosgrove, Denis. 1985. *Social formation and symbolic landscape*. Totowa, N.J.: Barnes and Noble.

Cosgrove, Denis, and Stephen Daniels, eds. 1988. *The iconography of landscape: Essays on the symbolic representation, design, and use of past environments*. Cambridge: Cambridge University Press.

Cox, Kevin, and Andrew Mair. 1989. Levels of abstraction in locality studies. *Antipode* 21 (2): 121–32.

Crowe, Michael J. 1990. *Theories of the world from antiquity to the Copernican revolution*. New York: Dover.

Curry, Michael R. 1991. On the construction of post-modern worlds: Language and the strains of modernism. *Annals of the Association of American Geographers* 81: 210–28.

Dear, Michael J. 1988. The postmodern challenge: Reconstructing human geography. *Transactions of the Institute of British Geographers* N. S. 13: 262–74.

Descartes, Rene. 1971/1637. Discourse on the method. In *Descartes' philosophical writings*, ed. G. E. M. Anscombe and Peter Geach, 5–58. Indianapolis: Bobbs-Merrill.

———. 1971/1641. Meditations on first philosophy. In *Descartes' philosophical writings*, ed. G. E. M. Anscombe and Peter Geach, 59–124. Indianapolis: Bobbs-Merrill.

———. 1988/1637. Optics. In *Selected philosophical writings*, trans. John Cottingham, Robert Stoothoff, and Dugald Murdoch, 57–72. Cambridge: Cambridge University Press.

———. 1971/1637. Principles of philosophy. In *Descartes' philosophical writings*, ed. G. E. M. Anscombe, and Peter Geach, 181–238. Indianapolis: Bobbs-Merrill.

———. 1971/1628. Rules for the direction of the mind. In *Descartes' philosophical writings*, ed. G. E. M. Anscombe and Peter Geach, 151–80. Indianapolis: Bobbs-Merrill.

Dijksterhuis, E. J. 1961/1950. *The mechanization of the world picture*, trans. C. Dikshoorn. Oxford: Clarendon Press.

Dilke, O. A. W. 1971. *The Roman land surveyors: An introduction to the* agrimensores. New York: Barnes and Noble.

Downs, Roger. 1970. Geographic space perception: Past approaches and future prospects. *Progress in Geography* 2: 65–108.

Downs, Roger, and David Stea, eds. 1973. *Image and environment.* London: Edward Arnold.

Duncan, James and Nancy Duncan. 1988. (Re)reading the landscape. *Environmental and Planning D: Society and Space* 6: 117–26.

Duncan, James, Nancy Duncan, and John Agnew, eds. 1990. *The power of place.* London: Allen and Unwin.

Duncan, Simon, and Mike Savage. 1989. Space, scale, and locality. *Antipode* 21 (3): 179–206.

Edgerton, Samuel Y. 1975. *The Renaissance rediscovery of linear perspective.* New York: Harper and Row.

Entrikin, J. Nicholas. 1991. *The betweenness of place.* Basingstoke, England: Macmillan.

Foord, Jo, and Nicky Gregson. 1986. Patriarchy: Towards a reconceptualization. *Antipode* 18: 186–211.

Foucault, Michel. 1984/1982. Space, knowledge, and power. In *The Foucault reader*, ed. Paul Rabinow, 239–56. New York: Pantheon.

———. 1986. Of other spaces. *Diacritics* 16: 22–27. Trans. Jay Miskowiec.

Gatrell, Anthony C. 1983. *Distance and space: A geographical perspective.* New York: Oxford University Press.

Giddens, Anthony. 1984. *The constitution of society: Outline of the theory of structuration.* Berkeley: University of California Press.

Giedion, Siegfried. 1967. *Space, time, and architecture: The growth of a new tradition*, 5th ed. Cambridge: Harvard University Press.

Gould, Peter, and R. White. 1974. *Mental maps.* Harmondsworth, England: Penguin.

Grant, Edward. 1964. Motion in the void and the principle of inertia in the middle ages. *Isis* 55: 265–92.

———. 1969. Medieval and seventeenth-century conceptions of an infinite void space beyond the cosmos. *Isis* 60: 39–60.

———. 1976. Place and space in medieval physical thought. In *Motion and time, space and matter: Interrelations in the history of philosophy and science*, ed. Peter K. Machamer and Robert G. Turnbull, 137–67. Columbus, Ohio: Ohio State University Press.

———. 1981. *Much ado about nothing: Theories of space and vacuum from the Middle Ages to the scientific revolution.* New York: Cambridge University Press.

Guyer, Paul. 1987. *Kant and the claims of knowledge.* Cambridge: Cambridge University Press.

Hartshorne, Richard. 1939. *The nature of geography: A critical survey of current thought in light of the past.* Lancaster, Pa.: Association of American Geographers.

———. 1958. The concept of geography as a science of space, from Kant and Humboldt to Hettner. *Annals of the Association of American Geographers* 48: 97–108.

Harvey, David. 1972. *Society, the city, and the space economy of urbanism.* Commission on College Geography Resource Paper, No. 18, Washington D.C.: Association of American Geographers.

———. 1989. *The condition of postmodernity: An enquiry into the origins of cultural change.* New York: Basil Blackwell.

James, Preston, and Geoffrey Martin. 1981. *All possible worlds: A history of geographical ideas,* 2d ed. New York: Wiley.

Juillard, Étienne. 1972/1962. The region: An essay in definition. In *Man, space, and environment: Concepts in contemporary human geography,* ed. Paul English and Robert C. Mayfield, 429–41. New York: Oxford University Press.

Kane, R. H. 1976. Nature, plenitude, and sufficient reason. *American Philosophical Quarterly* 13: 23–31.

Kant, Immanuel. 1965/1781, 1787. *The critique of pure reason,* trans. Norman Kemp Smith. New York: St. Martin's Press.

———. 1929. On the first ground of the distinction of regions in space. In *Kant's inaugural dissertation and early writings on space,* trans. John Handyside, 19–29. Chicago: Open Court.

Kates, Robert W. 1962. *Hazard and choice perception on flood plain management.* Research Paper No. 78. Chicago: University of Chicago, Department of Geography.

Kemp, Martin. 1990. *The science of art: Optical themes in western art from Brunelleschi to Seurat.* New Haven: Yale University Press.

Knuuttila, Simo, ed. 1981. *Reforging the great chain of being: Studies of the history of modal theories,* Dordrecht: D. Reidel.

Koyré, Alexandre. 1957. *From the closed world to the infinite universe.* Baltimore: Johns Hopkins University Press.

Kuntz, Marion Leathers, and Paul G. Kuntz, eds. 1988. *Jacob's ladder: Concepts of hierarchy and the great chain of being,* rev. ed. New York: Peter Lang.

Kuntz, Paul G. 1971. Hierarchy: From Lovejoy's great chain of being to Feibleman's great tree of being. *Studium Generale* 24: 678–87.

Lefebvre, Henri. 1988. *The production of space.* New York: Basil Blackwell.

Leibniz, Gottfried Wilhelm. 1982. *New essays on human understanding,* abridged ed., trans. and ed. Peter Remnant and Jonathan Bennett. Cambridge: Cambridge University Press.

Lindberg, David C. 1992. *The beginnings of Western science: The European scientific tradition in philosophical, religious, and institutional context, 600 B.C. to A.D. 1450.* Chicago: University of Chicago Press.

Lloyd, G. E. R. 1970. *Early Greek science: Thales to Aristotle.* London: Chatto and Windus.

———. 1973. *Greek science after Aristotle.* New York: W. W. Norton.

———. 1979. *Magic, reason, and experience.* Cambridge: Cambridge University Press.

———. 1987. *The revolutions of wisdom: Studies in the claims and practice of ancient Greek science.* Berkeley: University of California Press. [Sather classical lectures, Vol. 52].

Lovering, John. 1989. Postmodernism, Marxism, and locality research: The contribution of critical realism to the debate. *Antipode* 21 (1): 1–12.

Lucretius. 1951. *On the nature of the universe,* trans. R. E. Latham. Harmondsworth, England: Penguin.

Mackenzie, Suzanne. 1988. Building women, building cities: Toward a gender sensitive theory in the environmental disciplines. In *Life spaces,* ed. Caroline Andrew and Beth Moore Milroy, 13–30. Vancouver: University of British Columbia Press.

Massey, Doreen. 1991. Flexible sexism. *Environment and Planning D: Society and Space* 9: 31–57.

McDowell, Linda. 1988. Coming in from the dark: Feminist research in geography. In *Research in human geography: Introductions and investigations,* ed. John Eyles, 155–73. Oxford: Basil Blackwell.

———. 1983. Towards an understanding of the gender division of urban space. *Environment and Planning D: Society and Space* 1: 59–72.

Newton, Isaac. 1953. *Newton's philosophy of nature: Selections from his writings,* ed. H. S. Thayer. New York: Hafner.

Panofsky, Erwin. 1972. *Renaissance and renascences in Western art.* New York: Harper and Row.

Peake, Linda. 1985. Teaching feminist geography: Another perspective. *Journal of Geography in Higher Education* 9: 186–90.

Pederson, Olaf. 1993. *Early physics and astronomy,* rev. ed. Cambridge: Cambridge University Press.

Pickles, John. 1985. *Phenomenology, science, and geography: Spatiality and the human sciences.* Cambridge: Cambridge University Press.

Relph, Edward. 1976. *Place and placelessness.* London: Pion.

Saarinen, Thomas F. 1966. *Perception of the drought hazard on the Great Plains.* Chicago: University of Chicago, Department of Geography.

Sack, Robert D. 1980. *Conceptions of space in social thought: A geographic perspective.* Minneapolis: University of Minnesota Press.

Sarton, George. 1959. Geography and chronology in the third century: Eratosthenes of Cyrene. In *A history of science*, vol. 2, 99–116. Cambridge: Harvard University Press.

Sauer, Carl O. 1963/1925. Morphology of landscape. In *Land and life: A selection from the writings of Carl Ortwin Sauer*, ed. John Leighly, 315–50. Berkeley: University of California Press.

Schaefer, F. K. 1953. Exceptionalism in geography: A methodological examination. *Annals of the Association of American Geographers* 43: 226–49.

Seamon, David and Robert Mugerauer, eds. 1989. *Dwelling, place, and environment.* New York: Columbia University Press.

Soja, Edward W. 1989. *Postmodern geographies: The reassertion of space in critical social theory.* London: Verso.

Stewart, John Q. and William Warntz. 1958. Macrogeography and social science. *Geographical Review* 48: 167–84.

Strabo. 1917. *The geography of Strabo*, 8 vols., trans. H. L. Jones. London: Heinemann.

Sypher, Wylie. 1955. *Four stages of Renaissance style: Transformations in art and literature, 1400–1700.* Garden City, New York: Doubleday.

Tuan, Yi Fu. 1974a. *Topophilia: A study of environmental perception, attitudes, and values.* Englewood Cliffs, N.J.: Prentice Hall.

———. 1974b. Space and place: A humanistic perspective. *Progress in Geography* 6: 211–52.

———. 1977. *Space and place: The perspective of experience.* Minneapolis: University of Minnesota Press.

———. 1982. *Segmented worlds and self: Group life and individual consciousness.* Minneapolis: University of Minnesota Press.

Ullman, Edward L. 1954. Geography as spatial interaction. *Annals of the Association of American Geographers* 44: 283–84.

Vidal de la Blache, Paul. 1928/1911. *The personality of France*, trans. H. C. Brentnall. London: Alfred A. Knopf.

White, John. 1967. *The birth and rebirth of pictorial space*, 2d ed. London: Faber and Faber.

Wright, John K. 1947. Terrae incognitae: The place of the imagination in geography. *Annals of the Association of American Geographers* 37: 1–15.

———. 1966. *Human nature in geography: Fourteen papers, 1925–1965.* Cambridge, Massachusetts: Harvard University Press.

2

The Way We Were: Deployments (and Redeployments) of Time in Human Geography

David Hornbeck, Carville Earle, and Christine M. Rodrigue

Time is essential. It organizes and sustains our physical and biological systems. It is a basic human cognitive structure that defines our behavior and our view of our existence. Time is a vehicle that enables group interactions and the creation of society via the synchronization of interactions. Of all the symbolic forms that the human mind has invented, time is the most encompassing and the most deceptive. With time we can create order and even discipline; we can classify, arrange, categorize, and shape the world in which we live (Rifkin 1987: 9). The way we conceive, define, utilize, and implement time shapes much of our daily life. Time is at once limiting and versatile, paradoxical and aggravating. We can ponder what lies ahead, we can scrutinize the past, and we can even detach ourselves from the present, yet we do all this with little understanding of time and its influence on the patterned conduct of our lives (Newton-Smith 1986).

Time is difficult to discuss: it is at once familiarly obvious and inscrutably unknown. As George Kubler observes (1962: 13) in his wise and learned volume on the subject, "time, like mind, is not knowable as such. We know time only indirectly by what happens in it: by observing change and permanence, by marking the succession of events among stable settings, and by noting the contrast of varying rates of change." Time resists simple definition. Our