as Gaston Bachelard (*The Poetics of Space* [1964; French ed., 1957]), Henri Lefebvre (*The Production of Space* [1991; French ed., 1974]), Georges Poulet (*Proustian Space* [1977; French ed., 1963]), Rik Pinxten and others (*The Anthropology of Space* [1983]), Robert Sack (*Conceptions of Space in Social Thought* [1980]), and Kathleen Kirby (*Indifferent Boundaries: Spatial Concepts of Human Subjectivity* [1996]) to name, almost at random, six theoreticians whose ideas about space are light-years removed from the empirical Cartesian space Kitchin and Blades believe we live in.

It has not occurred to the authors that the reason their theories and findings are so impoverished is because their concept of space refuses to acknowledge that no progress can be made in the human cognition of geographical space until humans are put back into it—socially constituted as they in fact are with all their motives and emotions—along with the geographical space that no number of in-room mazes, paper-and-pencil tests, and slide or monitor simulations can begin to replicate. But then, the only route to knowledge Kitchin and Blades can acknowledge is experimental; and, as they put it, given the difficulty of manipulating the real world, to say nothing of subjects in naturally occurring situations, there seems to be no way to let people in. Perhaps it was simply Kitchin and Blades's inability to conceive of studying naturally occurring populations learning large, complex, unfamiliar environments that led them to deny the existence of such work, but this is precisely what Robert Beck and I did in 1971 when we accompanied thirty-one American teenagers and five adult teacher-counselors on their first trip to Europe. It is not that Kitchin and Blades do not cite and discuss five of our articles and chapters derived from my dissertation, and another article by others that validates our methods, but that, despite this, Kitchin and Blades were blinded to what we had done. But if we want to understand anything about the cognition of geographical space, we must move out of the laboratory and into the geographical space in which the cognition occurs. What did the cognitive anthropologist Edwin Hutchins call his seminal 1995 study (not cited by Kitchin and Blades) of spatial cognition on a navy cruiser? *Cognition in the Wild.* Yes, in the wild; that is where it takes place!

The Cognition of Geographic Space is an adequate survey of a handful of research questions concerned with estimations of distances and directions in experiments conducted under laboratory conditions. It does not have anything to do with the human cognition of geographical space. If Kitchin and Blades's book can act as a tombstone for this peculiarly self-limiting line of inquiry, it will have played a role important beyond its wildest ambitions. The cognition of geographical space: May it rest in peace!—DENIS WOOD, *independent scholar*

REPRESENTATIONS OF SPACE AND TIME. By DONNA J. PEUQUET. xii and 380 pp.; maps, diagrs., ills., bibliog., index. New York and London: Guilford Press, 2002. $45.00 (cloth), ISBN 1572307730.

This book is hopelessly ambitious. It attempts to present a comprehensive overview and integration of philosophical, scientific, and technical work on geospatiality and geotemporality as they exist on our planet, in our minds, and in our computer data-

bases. The task is so ambitious because it requires expertise in many diverse intellectual fields. These include significant portions of geography, cartography, surveying, mathematics, computer science, psychology, philosophy, and linguistics. To be factually correct and complete about all of these is challenging, if not impossible. But even more, this book is hugely ambitious because it calls for the effective integration of so much material from within each of these fields. This integration has never been achieved, and I know of no single person in the recently emerged community of geographic information science (GIScience) who could pull this off extremely well. I certainly could not; I cannot even comment authoritatively on everything in this book.

Donna Peuquet at least deserves credit for making one of the few serious attempts to present a comprehensive and integrative synthesis. During the last two decades a few key publications have attempted to set out the basic topical and methodological domain of GIScience: the proceedings of the Conferences on Spatial Information Theory and of the International Conferences on GIScience; reports from the National Center for Geographic Information and Analysis, including its Varenius Project; the research agenda of the University Consortium for GIScience (UCGIS), which, I am assured, is slated to appear in print soon; and various other books and articles, including Michael Goodchild's 1992 article in the *International Journal of Geographical Information Systems* that described the scope of GIScience and gave it its name. But none of these attempts a comprehensive and integrative exposition of theories and concepts in GIScience. As a rare example of such an attempt, Peuquet's volume bears notable comparison with the recent book by Jonathan Raper on *Multidimensional Geographic Information Science* (2000). Her book reads better than Raper's, but it too falls short of its promise. That is unfortunate for the young field, because this integration of many diverse areas of intellectual content and method is perhaps GIScience's central challenge.

Peuquet organizes her book's thirteen chapters into two main sections, "Theories of World Knowledge Representation" and "The Computer as a Tool for Storing and Acquiring Spatial Knowledge." This signals her focus on two of the major issues of GIScience, the cognitive and the computational (embedded in the context of the geographical). Unlike much conceptual work in GIScience, including Raper's book and the UCGIS research agenda, Peuquet's book excludes social issues in GIScience. Thus some people will probably find her book seriously incomplete or misleading, but others will not be bothered by the omission because they probably do not think political and humanistic aspects of the field constitute "science," no matter how important they are or how much they are of interest to the GIScience community. As part of her organization, Peuquet equates the philosophical with the cognitive, opposing them to the formal and natural scientific. I do not particularly agree with this organization. The current philosophical concern with ontology, to take a case in point, is about the ultimate nature of geographical reality, not its conceptualizations by humans, at least when understood as part of the traditional philosophical study of metaphysics. Likewise, experimental psychologists or

cognitive scientists would not like to contrast the study of cognition with the study of science—they would consider cognition simply to be the subject matter of their science and would see themselves as allied with natural scientists more than with philosophers. Finally, formal modeling can readily be understood as part of mathematics or logic, which are components of quantitative philosophy, not science.

Inevitably, the reader can find factual shortcomings with the portion of the book about which he or she is most knowledgeable. I will not bother doing that here, for Peuquet's relative mastery of diverse topics is more notable than her occasional misstatements or misrepresentations. I do believe it is worth noting that she makes some rather inflated claims about the similarity between cognitive and geocomputational representations. In essence she equates data structures (vector, raster, and so on) with cognitive representations, for instance, claiming that it turns out that data-structure distinctions nicely reflect cognitive-structure distinctions. She posits that a dual integrated spatio-temporal object-oriented implementation of GIS is the way to go because it faithfully reflects how human cognition works. Her "basic premise" is that "the design of digital geographic representation models is best informed by human cognition" (p. 321). I am not saying that she is wrong or right about this ultracognitive position, only that neither conceptual nor empirical argument can support the position in its strong form at this time.

I accept that interesting and important research questions exist concerning the acquisition, processing, storage, analysis, and communication of geographical information. Without a doubt, significant scientific issues concerning geographical information go far beyond the mundane. I also accept the validity of what might be called the "cognitive insight" in GIScience: that finding answers to questions about human cognition of the earth and information phenomena are legitimate issues for basic research and may be of great applied value for improving the effectiveness and efficiency of geographical information and technologies. No surprise, given that my main area of expertise in GIScience concerns cognition. In fact, for some time I have been able to offer a straightforward, commonsense argument in support of the cognitive insight in GIScience that I personally still find undeniably persuasive. But at the risk of devaluing my own research specialty, I must admit that the cognitive insight has not been proved, particularly in its applied version. This caveat is especially true with respect to the idea that data models and other "internal" aspects of representation (as opposed to aspects of interfaces) should reflect human cognition. It is only a hypothesis, perhaps no more than a speculation, and good arguments can be made against it.

The shortcomings of GIS that this book intends to help ameliorate are the usual litany of complaints about existing technologies I have heard ever since I entered the disciplines of geography and GIScience more than ten years ago: that GIS cannot handle time very well, does not integrate analytic capabilities (statistical, for example) well, is too two-dimensional, needs effective metadata about data quality (whatever "effective" might mean here), runs into a myriad of interoperability problems when one leaves a single system at a single laboratory or department at a

single institution or company in a single country, is insufficiently flexible (for example, with respect to multiple scales), cannot help implying excessive precision, is undemocratic because it is opaque to people without high-level training who are not from privileged parts of the world, and so on. The whine was in the bottle then, and it continues to age. From my first days in GIScience I have found these complaints amusing because they are so much like the weather—everyone talks about them but no one seems to know what to do about them. But I recognize now how important and difficult these problems are. So I can tip my hat to Peuquet for her attempt to help find solutions for them, even if (as she recognizes) most of those solutions are still off in the future.—DANIEL R. MONTELLO, *University of California, Santa Barbara*

GIS AND PUBLIC HEALTH. By ELLEN K. CROMLEY and SARA L. McLAFFERTY. xx and 340 pp.; maps, diagrs., ills., bibliog., index. New York, London: Guilford Press, 2002. $45.00 (cloth), ISBN 1572307072.

This book introduces the materials, methods, and institutional context of geographic information systems to those who intend to adopt GIS for public health. It is undoubtedly a timely text: It came on the market riding a wave of interest in the technologies of GIS within the medical and public health communities. The nursing profession, for example, has just begun to learn about GIS, and some nurses are showing great enthusiasm for it. Within medical/health geography, GIS has been one of the most productive and useful components in the analysis of spatial patterns of disease and health care delivery. This is practical stuff, it produces results, it can be visualized, and it can even be fun. GIS in health is a good field to enter: It attracts grant money, establishes ties with government and private agencies, and has the potential to influence health policy.

I can think of no better geographers than Ellen Cromley and Sara McLafferty for presenting the methodologies and research findings of GIS for health. *GIS in Public Health* is a comprehensive compendium, including an introduction to GIS, spatial data, spatial databases, and mapping health information, as well as applications of GIS to the analysis of the spatial clustering of health events, environmental hazards, risk and spread of infectious diseases, the ecology of vector-borne diseases, and access to and location of health services. Especially noteworthy are a very fine set of illustrations, a fairly deep discussion of spatial analytical concepts and techniques such as spatial autocorrelation and location/allocation models, an interesting chapter on public participation GIS, and the use of an up-and-running central Connecticut spatial database to illustrate various GIS applications in public health.

Having lavished some well-deserved praise on *GIS in Public Health*, I will use this forum to emphasize the importance of two issues about which the book, to its credit, expresses great concern. The first, caveat emptor, has to do with the decision health care professionals and researchers must make about how deeply they wish to become involved in using GIS or whether they should use it at all for a particular