

## Reviews

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**Time-integrative geographic information systems: management and analysis of spatio-temporal data** by T Ott, F Swiaczny; Springer, Berlin, 2001, 234 pages, €74.95 (£52.50, US \$74.95)  
ISBN 3 540 41016 3

Space and time have always been a part of our existence even though we tended to perceive and analyze them separately. The integration of time in predominantly spatially driven and static geographical information systems (GIS) has been biased towards theoretical concepts rather than practical solutions. This book by Ott and Swiaczny provides a new addition to the small but growing collection of textbooks that are available on temporal GIS. *Time-integrative Geographic Information Systems* is an attempt to summarize the existing solutions to conceptualizing and implementing time in GIS, with the aim of providing practical guidelines to those who did not have the opportunity to explore the theoretical background of the field. An overview of existing spatial concepts in GIS is presented, together with current barriers that limit the full integration of the time dimension in GIS. Eight chapters covering both theory and applications, an appendix, and a CD-ROM form the main contents of the book. A particularly useful resource if readers accept the open invitation to join, is the online forum at the authors' website (<http://www.time-gis.de>) for contributing and accessing new information about the subject.

An overview of the concepts of space and time, their relationships, absolute and relative perspectives, a brief history of time geography, and a compilation of the research on temporal GIS over the last fifteen years are provided in chapter 1. Although this chapter is fairly brief, the flow of the content is interrupted with the inclusion of a section dealing with 'further reading'. This section would have been best served as a separate appendix or as part of a later chapter.

Chapters 2 and 3 give a comprehensive synthesis of the geographer's perspectives about the real world using notions of space, time, and process within GIS databases. As stated by the authors, "in complete analogy to space, time can be understood as an *a priori* continuous and infinite dimension, which must be reduced in complexity so that it can be stored in GIS as finite and discrete data" (page 55). Issues ranging from the basics of GIS, through different types of time and temporal databases, to the conceptualization of time are reviewed in these chapters.

Chapter 4 is about 'how to implement' time in GIS databases and provides many well-illustrated diagrams to clarify the different approaches. This is the most informative chapter and is a good source of practical information for the temporal GIS scientist and professional. However, there is little or no reference to particular methods and approaches that readers might be interested in learning in greater detail. The object-oriented design could have been elaborated more, given it is a promising avenue for solutions in temporal GIS.

Once we have overcome the challenges of developing a temporal GIS database, we must examine spatial patterns and trends in our data. Chapters 5 and 6 deal with temporal analysis, queries, and visualization. The potential of multimedia animations for representing spatiotemporal data is also outlined. For those readers accustomed to analyzing spatial data at specific instants of time, these two chapters provide a new perspective on extending 2D spatial analysis to 5D GIS (x, y, z, time, and attribute data value).

In keeping with their promise of a solutions-oriented approach to presenting time in GIS, the authors give a wealth of interesting examples in chapter 7. The examples cover areas such as transportation research, cultural landscapes, property management, wildfires, urban growth, archaeology excavations, and business data analysis, but only three are available from the accompanying CD-ROM. A brief and forward-looking summary brings the main material of the book to an end.

There are some problems with the associated book materials. Although it is a good idea that the authors have provided a CD-ROM and hyperlink to their website, it was not possible to access the bibliography for new updates using the password and instructions provided. Also, there are several instances in the book where there are inconsistencies between the year given in citation and that given in the bibliography. For example, the Kilchenmann reference

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is stated as 1991 (page 121) but listed as 1993 in the bibliography. It is also assumed that readers of this book will have the know-how to use ESRI's ArcView and ArcExplorer software. This assumption may be unrealistic for some readers. However, these oversights do not detract from the main thrust of the book.

This book will be of use to graduate students and senior undergraduate students who wish to explore the concepts of time in GIS. A soft-cover format would make this book more widely affordable for students and a broader audience. Professionals whose work involves the development of spatiotemporal databases will find interest in this book.

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**Uncertainty in geographical information** by J Zhang, M Goodchild; Taylor and Francis, London, 2002, 266 pages, £39.99 (US \$63.98) ISBN 0 415 24334 3

In this thought-provoking volume Zhang and Goodchild have brought together a large and previously widely dispersed body of work concerning uncertainty as it affects GIS. This is reflected in the inclusion of over 330 references, most of which are drawn from the fields of spatial analysis, mapping, and statistics, mainly dating from the last decade. The presentation format and writing style are clear and informative, despite the underlying technical complexities of the subject. Overall the result is a work of both considerable interest and value to a broad range of academic researchers, GIS designers, GIS practitioners, planners, and spatial analysts. The 1989 book edited by Goodchild and Gopal on the accuracy of spatial databases, and also published by Taylor and Francis, provides an earlier but still very useful and approachable introduction to several of the topics covered in this new work.

In this latest study the authors define uncertainty in terms of the relationships between data and user rather than as a distinct property of the data contents (page 5): "uncertainty is a measure of the difference between the actual contents of a database, and the contents that the current user would have created by direct and perfectly accurate observation of reality." They are also acutely aware that uncertainty is not merely a matter of deviation of recorded results from some absolute truth, but a combination of data errors, randomness, and intrinsic vagueness. These issues are addressed in their initial analysis of GIS and uncertainty, which they follow with a review of field and object models in geographical research, arguing that both models are needed in combination for an adequate perspective on uncertainty.

The main body of the book is taken up with a systematic investigation of uncertainty as it applies to different classes of data. Initially the authors consider continuous variables, focusing on terrain (DEM data) to illustrate the issues and problems that arise. A number of approaches to representing and handling uncertainty are covered, including Kriging methods and statistical modelling, followed by a detailed presentation of semivariograms and error-surface mapping. This leads on to a similar set of analyses of uncertainty as it affects categorical variables (for which the tools of fuzzy set theory are added to the arsenal of techniques previously discussed) and object models. In the latter area the view of objects and fields as completely distinct is argued to be unhelpful and a continuum view is felt to be more productive. Although a preference for one particular approach to handling uncertainty is not expressed, the authors feel that approaches that focus on field-based models and stochastic simulators have much to commend them. In addition, the role of visualisation is briefly considered and it is clear that there is considerable scope for development in this area. In the context of GIS, it is the role and arguably the responsibility of software and data vendors to provide the communications channel between user and data, ensuring that users are aware of the known and potential data uncertainties, scale generalisations, and software models being used for each software-generated process. There is scope, in this context, for national and international standards-making bodies to address such issues and for purchasers to ensure that suppliers conform to such standards.

Although mathematical and statistical in parts, the overall treatment in this study benefits from extensive explanations in the text and associated diagrams and screen shots—all of these are in monochrome and for some, colour versions within the book or links to accompanying

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full-colour web-based materials would be welcome additions. Occasionally less familiar terms or expressions are introduced without prior explanation (for example, the Dirac distribution, page 19) whilst elsewhere the same or similar topics are covered more than once but in different chapters. It would also be useful for researchers working in this field to examine the applicability of work from related disciplines and international standards authorities such as telecommunications and image processing, where issues such as error correction, explicit definition and communication of error characteristics and loss, and reversibility of data mappings have been the subject of detailed research over many decades. Recognising that much remains to be done, the authors conclude their book with a 'call to arms', inviting scientists and workers in the field to lead the way forward. Their research and this publication provide an important step along that path.

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**Environmental modelling with GIS and remote sensing** edited by A Skidmore; Taylor and Francis, London, 2002, 268 pages, £29.00 paper (US\$49.99) ISBN 0 415 24170 7

A wide range of activities are characterized as environmental modeling, but they fall essentially into two categories: models that attempt to replicate the operation of some dynamic environmental process, such as erosion or seed dispersal, over a differentiated geographic space; and models that compute useful indicators from a variety of static geographic inputs, in the style of Tomlin's cartographic modeling (Tomlin, 1990). The former category uses some form of iteration to represent time, results in a series of predictions of future states of the environment, and is perhaps best typified by the massive global climate models that now form a key component of studies of global climate change. The latter requires a single calculation, and is typified by the universal soil loss equation (Wischmeier and Smith, 1978).

The two types of models are very different in terms of the programming techniques required, their ability to support modeling in the environment provided by standard software such as GIS packages, and their mathematical underpinnings. Both have obvious ties to remote sensing and GIS as sources of data, and static models can be easily programmed in GIS environments with scripting languages such as Avenue or AML. Dynamic models are a different matter, however, because GIS architectures are typically not optimized for fast iteration. PCRaster is a significant exception—a GIS-designed specifically for dynamic environmental modeling (<http://www.pcraster.nl>), with its own specialized scripting language (van Deursen, 1995). But in general builders of dynamic models have tended to opt for programming in low-level languages such as C; if GIS is used at all, it is as a means of data preparation, and perhaps visualization and analysis of output.

Efforts to achieve better integration between environmental modeling and GIS go back more than a decade, to a series of conferences inaugurated in Boulder, Colorado, in September 1991 (Goodchild et al, 1993; 1996; Clarke et al, 2002; <http://www.ncgia.ucsb.edu/meetings.html>). Today, there are specialized texts on modeling specific environmental domains such as hydrology or ecology, and on systematic issues of modeling such as uncertainty or sources of data. But basic questions remain: under what circumstances is it worthwhile to make use of GIS in environmental modeling; how complete and reliable are the available sources of data; how can environmental models be validated; and what is the role of models in public debate and policy formulation?

This book is the latest in this growing literature on the roles of GIS and remote sensing in environmental modeling. It began as a one-week course offered to international students at ITC, the Netherlands International Institute for Aerospace Survey, and contains chapters developed from the course materials. Its aims are "to bring the literature up to date, as well as provide new perspectives on developments in environmental modelling from a GIS viewpoint" (page xi). It begins with a very useful taxonomy of models by the editor that distinguishes between models driven by induction and deduction; stochastic and deterministic models; models fitted to empirical data; and models representing a deeper understanding of process. A series

of chapters then reviews various aspects of the data supply, with the heaviest emphasis on remote sensing. Chapter 5 contains a comprehensive review of satellite monitoring of land-surface vegetation at regional and global scales, with an emphasis on AVHRR (the Advanced Very High Resolution Radiometer), and chapter 6 covers vegetation mapping and monitoring at more detailed scales, with an emphasis on SPOT and Landsat. The static–dynamic distinction appears in chapter 7, where it is used to differentiate between static modeling of habitat suitability, and dynamic modeling of species–environment relationships. Chapter 8 returns to the static emphasis, and includes a short discussion of BIOCLIM, a tool for relating species distributions to climate. Chapter 9 addresses hydrologic modeling, and includes an excellent overview of some of the principles on which dynamic hydrologic models are based, and on which they are linked to dynamic models of vegetation and the land–atmosphere interface. Chapter 10 describes the roles of GIS and remote sensing in natural disaster management, with an emphasis on mapping for disaster assessment, and a very brief mention of the very extensive work on dynamic fire models and the difficulties of linking them to GIS (“The main problems ... relate to the lack of flexibility of GIS spatial operators and the discrete time nature of the simulations”, (page 219). Chapter 11 covers the roles of GIS in land-use planning and environmental impact assessment.

The final chapter provides a general assessment, and results from discussions during the course between the participants and lecturers. Many of the participants occupy senior management positions and have substantial experience in environmental issues, so the conclusions merit attention. Perhaps most interesting is the final conclusion, “that the problems perceived with GIS modelling for environmental applications ... has (sic) not changed in the last decade” (page 258). Problems include systems (there is never enough power to model as quickly and with as much detail as one would like), data (the data supply is never sufficiently accurate, detailed, current, and comprehensive), tools (GIS tools are never as integrated, flexible, and easy to use as one would like), and documentation (models are never sufficiently well described and validated). But of course these problems will always be with us, because models must by definition and of necessity be simpler than the world they attempt to describe and predict.

As far as I can tell the course has been given only once, and as a result there has been little opportunity to iterate the contents, to respond to the comments of the participants, and to fill gaps in the coverage—the book succeeds as a collection of parts more than as a well-integrated whole. The emphasis through most of the book is on data, and there is surprisingly little discussion of dynamic models, with few examples discussed at any length. A table added to chapter 8 provides the only approximation to a comprehensive survey. There is no mention of PCRaster and its modeling language, which must rank as among the most important advances in dynamic modeling with GIS of the past decade. Most surprising perhaps is the absence of any reference to the emerging field of geocomputation, with its emphasis on “process over form, dynamics over statics, and interaction over passive response” (Longley, 1998, page 3). In sum, the book succeeds in its objective of updating the literature only in some areas, notably in mapping and monitoring with remote sensing. That said, however, there is little doubt that the course was a success, and that the book could form a very useful text for similar courses and for similar audiences elsewhere: it provides an excellent and comprehensive introduction to the roles being played by GIS and remote sensing in environmental management.

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**Local Strategic Partnerships: lessons from New Commitment to Regeneration** by H Russell; The Policy Press, Bristol, 2001, 70 pages, £13.95, ISBN 1 86134 370 1

It has been often pointed out by those in the field that urban regeneration policy in the United Kingdom is moving into a qualitatively different stage. Years of disconnection between mainstream spending in public services and specialised urban regeneration initiatives—and between initiatives themselves—have not helped in the effort to tackle urban deprivation. As the earlier generations of competitive regeneration programmes come to the end of their life, there is an increasing perception that long-term transformation cannot be sustained by one-off interventions, and requires changes in the way mainstream public spending applies to deprived areas, together with the enduring commitment of all those with a stake in those areas. Moreover, the disjointed outcomes of the multiplicity of regeneration initiatives demonstrate that a strategic overview is required to make the most of potential synergies between initiatives and mainstream spending, and to provide a focus for action. Recent efforts by government to produce 'cross-cutting' policies, 'joined up' policy delivery, and increased community involvement in both fit into this new approach.

In this context Local Strategic Partnerships (LSPs) have emerged as potentially powerful instruments in an integrated, more strategic and inclusive approach to urban regeneration. However, as with many new initiatives, the risk is that previous experiences are not examined properly and vital lessons are not learned. In this regard, the main theme of Russell's book is a promising one. LSPs are not the first attempt at producing strategic and holistic partnerships in urban regeneration: the New Commitment to Regeneration (NCR) initiative was a recent and important precedent, and understanding the successes and difficulties faced by the NCR pathfinders is essential if the new LSPs are to succeed.

And that is what the book is mostly about. It explores the formative and developmental experiences of ten of the first group of NCR pathfinders over the first two years of their existence, and tries to derive generic lessons for the newer and potentially more significant LSPs. The book looks at what pathfinders have achieved as catalysts for strategic focus in urban regeneration and highlights the challenges, especially in relation to engaging a broad range of partners, rationalising the plethora of existing partnerships and strategies, and finding solutions for the complex issue of accountability.

Does the book develop its approach well? Yes and no. It should be said, first, that the book is really about the experiences of NCR pathfinders, and in that its title is slightly misleading. LSPs are currently at a very early stage in their development, and there is a limit to what can be said about the usefulness of lessons from elsewhere. It is not a coincidence that the book deals specifically with LSPs and the lessons they should learn in the concluding chapters. Not that this should compromise the book's main aims: as both initiatives are likely to tread similar paths, a good analysis of the challenges NCR pathfinders faced and how they confronted them should help LSPs, even if it is not possible at the moment to be precise about the how and when.

More of a problem is the fact that the book occupies a middle ground between a research report and a 'good practice' guide. In common with many of such guides, bullet point lists of key issues and plenty of insets describing examples of good practice replace a nuanced discussion of findings and an exposition of the actual complexity of real-life cases. Although this has its usefulness, in this case it removes the context in which problems presented themselves and particular solutions became successful. The experience of the NCR pathfinders comes through

as a linear process without sense of the challenges, dead ends, and about-turns practitioners are likely to have experienced and for which solutions had to be devised. Perhaps inevitably, the book's conclusions are in the most part a set of generic recommendations on issues of geographic coverage, engagement, accountability, and rationalising competing strategies and partnerships, which for the most part repeat similar prescriptions in the now extensive literature on partnerships.

At the same time, the book also makes significant positive contributions to that literature. Evaluating partnership formation and development processes poses conceptual challenges, as there might not be clearly defined outputs that can be used to measure success. The book proposes a change-management perspective for this problem, focusing on a framework of qualities that should be pursued by strategic partnerships (leadership, trust, common knowledge base, capacity to focus, coordinated planning and action, synergy in deployment of resources among key partners, effective review and evaluation, capacity building, effective accountability, and integrated participation) and emphasising partnership formation, strategy development, and joint delivery as key stages in a partnership's life whose quality and effectiveness need to be assessed. This comes out as an effective basic framework for assessing strategic partnership work and begs further development.

The book also deals effectively with the key issues of community participation, and the nature of the links between local level partnerships and central government, and the two chapters on those topics are particularly good.

Overall, the book is a welcome attempt to transfer lessons from one experience in strategic partnerships and applying it to another. Perhaps it would have gained if the context for the good practice it recommends had been made more evident. Learning from the real hard choices and difficulties NCR pathfinders faced is surely vital for the success of LSPs.

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**Inclusive design: designing and developing accessible environments** by R Imrie, P Hall; Spon Press, London, 2001, 187 pages, £29.99 paper (US \$47.95) ISBN 0 419 25620 2

This is an excellent book which can be read with great profit by a far wider audience than its title might first suggest. The book examines the attitudes and practices of those involved in property development (developers, architects, and surveyors especially) towards inclusive design (that is, design and development of buildings that do not ignore and devalue the requirements of large proportions of the population and, in particular, disabled people). As the authors point out, this focus allows it to complement analyses of the attempts at state regulation of access which, typically, concentrate on the attitudes and activities of government, public agencies, and public sector employees. In most countries, creating an accessible built environment—that is, buildings and routes to them useable by virtually the whole population—will depend heavily on the cooperation and effective regulation of property developers. So those working for change need a good analysis of how developers and their advisers perceive inclusive design. There are huge international variations in the dynamics of property development industries, but this book provides a path-breaking analysis of the situation in Britain (with some additional evidence from Sweden) which may have resonance in similar countries, and should also inspire and guide research in countries which are very different economically and institutionally.

The book is based on a number of funded research projects, and is underpinned by the senior author's extensive knowledge of, and contribution to, the burgeoning social scientific literature on disability. The first of its three parts provides a theoretical and institutional framework for the findings and case studies of part 2. Thus it discusses the contested notion of disability, ways of understanding the property-development process, and the strengths and limitations of current regulatory regimes which seek to improve access in the built environment. Not only are these helpful in guiding the reader through the analysis of subsequent chapters, they also serve as an excellent introduction to contemporary discussions of disability and access.

The book's central chapters report findings about attitudes and practices in the development industry. Very often these make for depressing reading, as the ignorance of developers about the issues involved in inclusive design is matched by the shortcomings of their professional advisers. However, a great strength of the analysis is that it eschews simplistic generalisations. The authors provide detailed illustrations (in inserted boxes) which bear out their theoretical position that the property development industry cannot be analysed as a homogeneous entity: these include some examples of excellent practice in relation to inclusive design, including one of the United Kingdom's best-known regional shopping centres. I would have welcomed some more discussion of whether anything systematic can be said about the relationship of different 'structures of building provision' (a concept the book borrows from Michael Ball) to receptivity to ideas of private sector inclusive design. Such a discussion might also have explored the significance of national institutional factors and thereby made more of the interesting Swedish material.

These quibbles do not detract from the overall value of a book which relates theory so fluently to the minutiae of the development process: expounding—on the one hand—the social model of disability and—on the other—exploring the impact of procurement processes on sensitivity to the requirements of inclusive design. It is a book with something for any student in the built environment professions: those already in practice (including developers) will benefit from reading it (especially, perhaps, the case studies), and researchers will mine it for many years to come.

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**The European dimension of British planning** by M Tewdwr-Jones, R H Williams; Spon Press, London, 2001, 190 pages, £50.00 cloth, £19.99 paper (US \$80.00, \$31.95) ISBN 0 415 231817, 0 415 23405 0

Not long ago I received a report from an anonymous referee, in response to a paper that I had submitted for publication on the topic of planning regulation, which stated that the EU has no legal remit within the area of town and country planning. As anybody familiar with the Treaty of Rome would know, this assertion is incorrect. Nevertheless, given that many planning texts give little more than passing references to the EU this factual inaccuracy made by a planning academic came as little surprise. Against this background, Tewdwr-Jones and Williams's book is most welcome.

The book is divided into three parts: "The European context", "British planning in practice", and "Changing agendas and trajectories". In the first part the authors explain the historical development of the EU's involvement in the area broadly defined as 'spatial planning' through such initiatives as the programmes of financial support to economically deprived areas. More recently the EU has sought to bring such initiatives under the broader umbrella of what it refers to as its European Spatial Development Perspective (ESDP), a central objective of which is to ensure "... balanced and sustainable development, in particular by strengthening economic and social cohesion". Achievement of this objective will become far more difficult—but even more imperative—with the planned enlargement of the EU from fifteen to twenty-five member states.

The more narrowly defined, and more legalistic, area of 'town and country planning', focused essentially on land-use regulation, did not fall within the competence of the EU until 1992 when the Treaty of the European Union (Maastricht) amended the Treaty of Rome and inserted A.130s (now A175). But because proposed measures falling under town and country planning require an absolute, as opposed to the more normal qualified, majority within the European Council, my friend the anonymous referee, can claim, with some legitimacy that, to all intents and purposes, this area does lie outwith its *de facto* jurisdiction.

The first section of the book is concluded by an attempt to summarise the implications that EU directives and policy have had on national and regional planning in the United Kingdom, through an analysis of Planning Policy Guidance notes (and NPPGs in Scotland) and Regional Planning Guidance notes. Although this exercise is potentially useful and informative, no mention is given as to whether or not the contents of relevant directives are directly effective,

conferring rights which individuals could, if necessary, invoke against their own government in instances of inadequate implementation. Indeed, put more bluntly, there is little to suggest that the authors were aware of the vitally important concept of 'direct effects'.

The second section is comprised of a series of case studies focusing on the implications that EU initiatives have had on planning policy and decisionmaking within six different (four urban and rural, one urban, and one rural) areas of Britain. Quite appropriately, given its location, the county of Kent provides the content of the first chapter. It includes coverage of the important European Court of Justice decision blocking Associated British Ports proposed expansion of Sheerness into an environmentally sensitive mudflat area (the Lappel Bank case). Since judgments such as this have been so important in determining the construction and interpretation to be placed upon EU directives covering matters such as environmental assessment and habitats protection, it is a pity that no mention was made of them in the first part of the text.

The remaining five chapters of this second part cover Northamptonshire, Strathclyde, Mid Glamorgan, Leicester, and Gwynedd. These chapters provide the empirical research substance of the book and are generally extremely informative and well written. My only slight criticisms concern the somewhat unequal coverage of the case studies—for example, sixteen pages of text are devoted to Strathclyde but only three to Leicester—and the use of the awful expression "on board" (page 88).

In the final part the authors bring the different elements together in order to provide an overall assessment of the impacts that the EU has had, and is likely to have, on the operation of the British planning system. There is a useful attempt to provide a typology of spatial planning scales—from 'local planning' through 'national' all the way up to 'supranational'—as a reference point for policy analysis. There is also an explicit reference to future research agendas which, somewhat surprisingly, omits reference to the issue of enlargement notwithstanding the impact that it is likely to have on the trajectory of EU-wide planning.

This book was completed just before motor neurone disease tragically ended the distinguished career of Richard Williams. As his former colleague Patsy Healey states in the acknowledgements, Richard was a tireless promoter of the European agenda throughout his long academic career. One of the few times that I was fortunate to meet him was just before I gave my first ever paper at an academic conference where his calm gestures extinguished any nerves that I had. In managing to complete the manuscript, which bares so much of Richard's intimate knowledge of European matters, Mark Tewdwr-Jones, his coauthor, deserves much credit. It is a text that students and planning academics alike will want to consult.

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**Cities for the new millennium** edited by M Echenique, A Saint; Spon Press, London, 2001, 182 pages, £32.50 paper (US \$52.95) ISBN 0 415 23183 3

The outcome of a conference, this book is a series of commissioned papers under five major themes: compaction, dispersal, regeneration, technical issues, and lessons from history. The contributors include some of urbanism's heaviest hitters: Richard Rogers, Richard Sennett and Tom Bloxham accompany leading academics and practitioners from both sides of the Atlantic like Michael Breheny, Harry Richardson, Peter Gordon, and the editors.

So far so good, but—as always in such symposia—there's the basic question: has the book a central unifying theme? It turns out that it has, but that it's not always evident. The theme is the compact city; the question is whether, in an advanced postindustrial country like the UK or US, it's either desirable or feasible. Richard Rogers and Richard Burnett are in no doubt at all, as illustrated by the in-your-face title of their introductory offering: "Let's cram more into the city". Chair and member of the UK's Urban Task Force, respectively, they have the zeal of the true religious believer. But the essays that follow—from Echenique, Breheny, Richardson, and Gordon—meticulously unpick the evidence, from the UK and elsewhere, to show that the evidence supporting densification is far from clear or unambiguous.



Brehehy's paper, which deserves to be cited wherever people discuss such questions, meticulously reviews his own work and that of others, showing that the key evidence—particularly that relating densities to energy used in transport—is far less clear than we supposed when Peter Newman and Jeff Kenworthy first published their work. (Echenique reaches the same conclusion from an analysis of international data, and Koen Steemers shows that the relation between urban form and building energy is a complex one, in which increased building density may not lead to reduced car traffic.) Further, it is not evident in a British context that we can even achieve a major increase in the amount of development that takes place on brownfield land. Richardson and Gordon review a huge amount of American work, theirs and others, concluding that—contrary to the received wisdom—urban dispersal does not result in longer journeys or traffic congestion. Further, the conventional solution—building new urban rail lines—is expensive and ineffective. Perhaps the best conclusion is that dense urban living may suit some people and some groups, and that it proves successful in the right contexts—Manchester and Rotterdam are two cases illustrated here—but it does not provide the panacea that some evangelists argue.

In one remarkable essay Alan Baxter looks at infrastructure options for cities. He shows that the UK almost certainly invests far too little in infrastructure, either in its construction or in its maintenance. Yet echoing Gordon and Richardson, he also demonstrates that some fairly effective investments, like guided busways, can be built relatively cheaply and that in the future, information technology may deliver even more effective results at modest cost—but that few major urban investments ever come in on time or within budget. “Perhaps a hand-held electronic guide telling us how we might make multi-faceted journeys”, he writes, “will enhance our lives in cities much more than mega-civil-engineering projects with a single focus.” An argument, perhaps, for many modestly scaled schemes—which could be more effective in a dispersed environment.

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**Valuing environmental and natural resources: the econometrics of non-market valuation**

by T C Haab, K E McConnell; Edward Elgar, Cheltenham, Glos, 2002, 326 pages, £65.00 (US \$95.00) ISBN 184064 704 3

Over the last decade there has been a growing interest in attempting to make economic valuations of environmental and natural resources (Hanley and Spash, 1993). There are many motivations for this type of study. One of the reasons behind this growth in nonmarket evaluation of the environment is the belief, held amongst some economists and environmental scientists, that if the environment is not given an economic value it may be excluded from policymaking. Obviously, as environmental economists have examined the nonmarket evaluation of nature, then different methods have been developed. This new book aims to make available empirical approaches to nonmarket evaluation in a single volume. Two major approaches are explored in depth: stated preferences and behavioural approaches.

The book consists of ten chapters. Chapter 1 outlines the welfare economic basis for non-market evaluation. This is then followed by a detailed discussion of the basic econometric responses to dichotomous contingent valuation (CV). The purpose of CV is to estimate individual willingness to pay (WTP) for changes in the quality or quantity of the goods or services not normally in the market. The parametric models of the standard discrete response to CV are examined in chapter 2. This includes four case studies: one on the impact of DDT and PCB (polychlorinated biphenyl) on the Southern California bight and three studies on water use in the South Platte River, Colorado. Chapter 3 explains the use of distribution-free models of analysing CV data. Chapter 4 deals with the statistical distribution of WTP estimates, and chapter 5 examines the more specialised topics that arise in the application of parametric models. Chapters 6–8 examine empirical models of the demand for outdoor recreation. This section of the book begins with the familiar travel cost model and then explores the single site (chapter 7) and multiple sites (chapter 8). Again the details required for making such studies are explained clearly and anyone using this approach to valuing environmental resource use would benefit from perusing these chapters. The penultimate chapter explores hedonic

pricing where some aspects of the problem have a market value: for example, housing, and water quality associated with water supply from wells are evaluated. Finally, chapter 10 examines some of the new directions in this research, including logit analysis and modelling of stated and revealed preferences.

Throughout the book, emphasis is on empirical modelling. It should, however, be noted that the authors concede that the book is not strictly speaking an econometric text nor is it a text on nonmarket evaluation. The authors do, however, address the issues associated with defining the research problem, designing questionnaires, and making empirical estimates of economic evaluation of the environment. One of the weaknesses in this entire approach to nonmarket evaluation is the often large error terms associated with different empirical estimates. Some early studies showed massive differences in the estimates of WTP, and this area of research still needs further attention. Environmentally concerned readers may, however, be alarmed that little mention is made of specific impacts on the environment in the text. The more philosophical reader may ask what do economic valuations of the environment leave out of the calculus and are those omissions important? But it is on these philosophical questions that the debate between promarket economists and environmental ethicists remains unresolved (Norton, 1994).

The book will appeal to environmental economists researching into the nonmarket evaluation of environmental and natural resources. The examples are drawn mainly from OECD countries. It would have been useful if case studies from different environmental problems had been included. Such examples may help to offer these methods to a wider audience—although this text is really aimed at a research audience. For researchers the different methods of evaluation are competently described in the text and in the two technical appendices. For those wanting to read the original articles a good, up-to-date set of references is included. The book is expensive (£65, \$95) and, at this price, it is a moot point whether or not research students will be willing to pay.

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### **Uncertainty and the environment: implications for decision making and environmental policy**

by R A Young; Edward Elgar, Cheltenham, Glos, 2001, 249 pages, £59.95 (US \$85.00)

ISBN 184064 626 8

This volume is the latest addition to the book series on *New Horizons in Environmental Economics*, edited by Wallace Oates and Henk Folmer. Richard Young's book is concerned with the issue of uncertainty in environmental decisionmaking. This book is motivated by the premise that uncertainty is a key issue that must be addressed in environmental decisionmaking if sustainability objectives are to be met at a project or policy level. The research that forms the basis of this book was carried out as part of the author's doctoral dissertation at the University of Glasgow.

The book is organized into ten chapters with four appendices. Chapter 1 discusses the necessity and significance of dealing with uncertainty in environmental decisionmaking, followed by an introduction to the decisionmaking context of cost–benefit analysis and the valuation of environmental resources in chapter 2. Chapter 3 reviews a general framework that identifies the different modalities of uncertainty, which was used to highlight the different types of uncertainties in environmental policymaking. Young argues that many environmental problems are conditioned by hard uncertainty, in which the set of possible actions or future states is unknown or where the probability distribution for such outcomes is unknown or not fully definable. Chapter 4 presents a critique of the use of probability in environmental decisionmaking in the face of hard uncertainty and the need for an alternative framework to that of expected utility. The Shackle model is introduced in chapter 5 as an innovative alternative in

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the context of environmental uncertainty and its applications in decisionmaking. The author believes that the three key elements in the Shackle model—degree of surprises, action choice index, and the gambler's preference map can better handle hard uncertainties than the traditional probability-based framework. Chapter 6 introduces the case study on the environmental impacts of the Belize Southern Highway project. The environmental and political contexts of the project are described in detail. Chapter 7 describes the methodology used to carry out the fieldwork. The author relied primarily on a set of qualitative approaches coupled with on-site interviews and scenario analyses for this project. Chapter 8 assesses whether the evidence suggests that the model is useful in explaining decisionmaking under uncertainty, especially under hard uncertainty. Chapter 9 examines the way that uncertainty is handled at a more general level in the decisionmaking process and develops a normative framework for dealing adequately with uncertainty. Conclusions are drawn in chapter 10.

Until recently, George Shackle's work has not been appreciated adequately by mainstream economists. Young's book is the first attempt to use the Shackle model to handle the hard uncertainty issue in environmental decisionmaking. Such an approach could be fruitfully applied to other case studies involving environmental decisions as well as other nonenvironmental decisions conditioned by hard uncertainty. This book has succeeded admirably in demonstrating how to apply an abstract theory in tackling problems in a real-world situation. This volume represents a major contribution to environmental economics. Besides presenting a thoughtful critique of the conventional expected-utility approach, Young's book has made a convincing case that the presence of hard uncertainty radically alters the way in which environmental uncertainty can be dealt with at both an epistemological and a practical level. The book is very well written and logically organized. It will be of great interest to both academic as well as policy audiences.

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**Spatial data quality** edited by W Shi, P F Fisher, M F Goodchild; Taylor and Francis, London, 2002, 313 pages, £59.99 (US\$95.95) ISBN 0 415 2583 9

It has become something of a custom to denigrate collections of essays that emanate from a conference—often without enquiry regarding the refereeing structure of that event or of the selection procedure that has led to the volume. Yet such meetings are the very place where new ideas are aired, debated, refined, and developed into new opportunities and practices upon which we all depend. This volume is a collection of essays based on presentations made at the 1999 International Symposium on Spatial Data Quality, held in Hong Kong. The authors and editors are noted experts in their various approaches to the issues of spatial data quality, and as such this work is authoritative.

The editors preface this volume with the comments "Quality is an issue for any kind of information ... if modern society cannot depend on information to be accurate, then many of its activities quickly become impossible" (page XV). However we define GIS, and whether as systems or science, it is inevitable today that computer processing will be a fundamental component. It has long been an adage of the computing world that garbage-in yields garbage-out. Yet how often do we, in the spatial community, consider properly the information we are working with, the methodology that we are applying, and the impact this has on the nature of our results? Many people believe the precise results of computation, which may specify a resulting location in terms of microns, but few acknowledge that the positional accuracy of the original measurements may have been to the nearest ten, or more, metres. "From a user point of view, there seems to be no link between geographical databases and scale ... this can lead the user of geographical data to believe that data are relevant whatever the scale" (Vaughlin, page 125).

For most people, scale is a cartographic concept connected to paper maps. Many users of spatial information, however, have progressed to the replacement of the conventional map with a flexible, spatially keyed, electronic database (Burrough, page 19). Many are running desktop GIS solutions and seeking to base decisions on their results, yet have little understanding of what levels of uncertainty are inevitable because of the source data, representation, or methodology. In many disciplines it is normal to model the error status, or confidence limits,

throughout an analysis and to present these metrics alongside the results: as several of the contributors ask, why don't we? The very way we represent real-world phenomena introduces issues of quality, accuracy, precision, and 'fitness for use': what steps can we take to ensure that these issues are tackled in a professional manner? As Duckham and McCreadie point out, "the inclusion of error handling capabilities within GIS is often viewed as crucial to the future commercial and legal viability of the technology", yet few of the commercial GIS packages offer any rigorous methodology for handling error (page 62). How many of us have noticed this deficiency? Are we pressuring our vendors to deliver proper definitions of the algorithms employed and effective tools to measure the reliability of the operations undertaken?

The range of topics in this collection will lead the reader through considering issues of uncertainty that are intrinsic to our present GIS, to challenging our approaches to data and method, and to the way we deliver our results. Even though not all the ideas presented may seem appropriate to our own situations, there is much here that should inspire us towards better methodologies and approaches to both uncertainty and error. Chapter 10, "Visualisation of uncertainty in geographical data", should inspire us to be thinking how to display meaningful measures of confidence in both data and technique. Although the case studies towards the end of the book focus more on cartographers' concerns, each of us presents the results of spatial analysis in a form that resembles a map from time to time! In addition, these later chapters introduce issues of presentation that go far beyond the paper map.

The book benefits greatly from the breadth of cover that its conference origin provides: although it may be that not every chapter is relevant to everybody, everybody should find that several chapters are important to their work and items of interest in the rest. The size of the volume, some three hundred pages, means that there are spatial data quality topics that are not covered: the editors acknowledge this inevitability and point to some of these issues. The bottom line, however, is that this is a volume of which each one of us should have a well-thumbed copy on ourselves.

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**Innovations in GIS 8. Spatial information and the environment** edited by P Halls; Taylor and Francis, London, 2001, 284 pages, £69.99 (US \$110.00) ISBN 0 415 25362 4

The annual GISRUK (GIS Research in the UK) conference is now an established forum for both recognized and early-career proponents and has lost (if ever it had) the tag of a UK-only attraction. The focus has always been to present both polished research and research at the drawing-board stage. Indeed, many of the more stimulating (and heated) discussions that take place in the evenings are ones that challenge established methodologies through the promotion of innovative, even daring, assertions by the younger members of our GIS fraternity.

The conference in 2000 was held in York and attracted far more submissions than could sensibly fit within the traditional two-day format and even fewer within the proceedings book—the regular *Innovations in GIS*. In this, the eighth in the series, the editor, Peter Halls, has promoted the book with the theme of "spatial information and the environment". Within this frankly broad, sweeping title the book is further subdivided into four equally inclusive sections: information acquisition; tools, visualisation, and navigation; computation and modelling; and decision support. The broad headings are understandable given the breadth of research emanating from many varied disciplines, and their multiplicity also serves to highlight the vitality and expansion of GI-science research.

The first section on information acquisition is heavily weighted towards information from satellite imagery. All five chapters acknowledge the utility of remote sensing to provide more accurate biophysical information (Trotter et al), non-region-specific automated land-cover detection (Comber et al), the use of national mapping point-based data to classify residential land use (Harris and Longley), field boundary classification using artificial neural networks (Kavzoglu et al), and spatial location of erroneously classified pixels (Vieira and Mather).

The second section is an intriguing collection of chapters dealing with various developments in data models and spatial representations. The work by Dæhlen et al investigates a triangle-based representation of terrain surfaces and curve networks, focusing on the need to

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develop data models that can more efficiently handle multiresolution information. Multiplicity is further examined by Frank and Kemp who propose a flexible component-based environmental GIS not only to handle data from various formats but also to accommodate temporal dynamism. The formalism of data models can also produce simulations for understanding process monitoring decision scenarios, and even the training of users. All of these are encompassed by a knowledge-based prototype described by Barbe et al, who outline a maritime navigation simulation model to help monitor (and ultimately avoid) risks of collision and running aground. The section is completed by Hochmair who outlines an innovative methodology to allow humans to navigate through an unknown environment with the aid of a partially incorrect map—definitely worth a read.

The third section on computation and modelling is heavily focused on the environment. Gruener implements a cellular automation approach to modelling plant-dispersal processes, and Jelasja establishes relationships between environmental indicators and plant diversity. More theoretical contributions are by Kidd, who develops a hybrid interpolation network surface, and Miller, who assesses the utility of a viewshed approach to land-cover inventories. The final section on decision support is a compilation of systems-support techniques (a collaborative approach by Beedasy et al) and decisionmaking applications (brownfield redevelopment by Boott et al, map comparisons by Herwijnen and Janssen, and classification statistics for habitat change monitoring by Watkins et al).

Overall, the seventeen chapters represent a broad range of research that are typically symptomatic of an international conference. As such the book is probably more useful to GIS professionals than to students, especially when you factor in the rather hefty price of £45.00. For me, the *Innovations* series has always provided a good record of some of the best papers from the GISRUK conference (especially when I have been unable to attend), but it is no substitute for the real live event with its debates, deliberations, and radical assertions.

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**Planning for crime prevention: a transatlantic perspective** by R H Schneider, T Kitchen;  
Routledge, London, 2002, 331 pages, £65.00 cloth, £24.99 paper (US \$100.00, \$39.95)  
ISBN 0 415 24136 7, 0 415 24137 5

Because of the distinct lack of textual material and empirical analysis in this field of research the authors have clearly aimed this book at both students and practitioners interested in the field of crime, environmental design, and planning. However, it is not the authors' intention to limit the audience only to those who have already developed such an interest; one of the major, recurring calls in the book is for a greater appreciation of the significance of this topic by all involved in city planning. It is effectively argued that crime-prevention measures should be of fundamental concern to all planning professionals, whose remit is essentially concerned with quality of environment and thus quality of life. Issues affecting crime and the fear of crime should therefore be paramount in the planning mind, and thus the lack of professional engagement coupled with the low priority in education curricula are exposed and questioned. Furthermore, the authors appropriately urge that crime and fear, although related, should be approached separately rather than as "two sides of the same coin" (page 262).

Two clear objectives are detailed from the outset: (1) to encourage planning professionals to engage actively with the issues raised by the complex relationship between crime prevention and planning, and (2) to promote more "evidence-driven approaches" and empirical evaluation of planning schemes (page ix). The text is well focused to achieve both of these objectives and most effectively utilises the few other sources detailing this topic. Indeed, this book is a valuable contribution to a void in the literature base and yet still remains refreshingly modest, unashamedly exposing its own limitations. Schneider and Kitchen are explicit in what they hope this book can achieve: it is not a 'cookbook' solution with all the answers to all the problems. For a subtopic still in such relative infancy attempting to detail a future that could direct all schemes to success would be futile.

In the recent political climate on both sides of the Atlantic it is increasingly demanded that projects deliver and meet targets, and that performance is verified and quality assessed. However, it seems that over the past decade or so, despite many crime-prevention schemes being elevated high in public awareness, there has been a dearth of effective evaluation of crime prevention measures, thus often leading to widespread public cynicism (page 6). The authors therefore persistently demand more conclusive proof on the efficacy of many planning projects, highlighting this as one of the major limitations in the field today.

The book is well structured and clearly signposted from the introduction. The development through the three sections is explained and the content of each chapter summarised. A 'route-map' is also given to assist those readers who wish to read about certain topics and skip others. If one were looking for minor criticisms of this book, one might highlight that this attention to structure, although efficient, is pursued almost to the point of overkill. However, the progress from "Context and key ideas" (part 1) to "Policy and practice" (part 2) to "Comparisons and key issues" (part 3) is fluid and well polished and, although on occasion the two editors' different writing styles from chapter to chapter may become apparent, this does not detract from the book in any way—a successful transatlantic collaboration in itself.

Chapter 1 introduces the reader to the key relationships between crime, fear, and the built environment, offering useful definitions and a sound foundation to the key themes of the book. Chapter 2 then discusses trends in crime statistics in the USA and Britain. Here the authors also criticise the value of official police data records almost to the point of rendering them useless, despite a few brief statements to the contrary. Crime-survey data are evidently preferred for such studies. Many data are presented and discussed, but unfortunately the reader is subjected to twenty tables and no visual representations at this stage. Chapter 3 captivatingly takes the reader back in time to discuss the concept of defensible space, how this has developed, and how it still influences contemporary practice. We are taken from the beginning of humankind as a scavenger, through nomadic custom and the agricultural revolution, to Jericho as an example of urban target hardening, the Great Wall of China, Hadrian's Wall, The Walls of Theodosius, and The Maginot Line. Although of interest in their own right, discussions of these histories are carefully woven to enable simple comparisons with contemporary case studies such as Hulme Crescents in Manchester. Chapter 4 concludes part 1 with an excellent critical discussion of the relevant basic principles and theories such as defensible space and environmental criminology.

Chapter 5 looks at policy and practice in the USA, leading into more detailed case studies in chapter 6. This structure is then replicated for Britain in chapters 7 and 8, which completes part 2 of the book. The photographic evidence here is certainly noteworthy with the Hulme Photographic Essay being a particularly supportive feature of the book. The final part, chapters 9 and 10, draws comparisons and conclusions and effectively maps a direction for future research and practice in this field. This book is a welcome contribution to this field and good value for students or practitioners wishing to get a comprehensive foundation in the subject.

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**Java programming for spatial sciences** by J Wood; Taylor and Francis, London, 2002, 320 pages, £55.00 cloth, £24.99 paper (US \$88.00, \$39.95) ISBN 0 415 26097 1, 0 415 26098 3

Knowledge of a computer programming language is now an almost essential prerequisite for advanced research in many spatial science disciplines. Therefore, the question often faced by researchers and students is "which computer programming language should I learn?" Well if you decided to equip yourself with the Java programming language, for whatever reasons, and have some basic idea about the logic behind computer programming, then this is a suitable book for you to start your learning process. So what is special about this book amongst more than fifteen hundred other books on Java programming listed on the Amazon online bookstore website. Some aspects of the book stand out clearly after reading just the first few pages. It is a personal and informal introduction to Java programming, because a teacher rather than a professional

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programmer or software vendor has written the book. It is not a software manual and hence does not attempt to list Java methods and their syntax. Aside from being one of the few books on basic to intermediate level Java programming of less than 400 pages and under £25 in paperback (\$40), this book is also useful in its style of enticing the reader with coherent examples and clever tips. (The tips are given in brackets, and are the sort that only a concerned teacher would remember to divulge.)

The chapter layout of the book is similar to other programming books, that is, each of the nine chapters deals with a different topic. The book makes it clear from the beginning that Java language is essentially about object-oriented programming (OOP). The author takes his experience of watching ants feeding in his garden and nicely builds up the rather difficult OOP topics of objects, classes, abstraction, encapsulation, and inheritance around it, with an almost story-like discussion. As a result, example source codes become bigger as we progress to later chapters in the book. The ants in the garden context is also used to demonstrate the application of Java for spatial analyses: for example, in georeferencing, performance of geometrical operations (overlay, intersection), and spatial transformation. The overall structure of this particular example serves as an excellent framework within which to implement agent-based simulation modelling. After familiarising the reader with the basics of classes and objects in the first three chapters, the spatial sciences focus of the book is first manifest in chapter 4 with an example of reading raster (spatial) data. This chapter also briefly mentions the use of parallel processing using Threads, which makes Java ideal for programming applications such as cellular automata and agent-based models. Chapters 5–7 demonstrate how the arrays, abstraction, and inheritance functions can be used to store vector spatial data and their topological relationships. Chapter 8 is about handling input and output streams and object serialization. The last chapter covers the topics of increasingly popular XML parsing and, every Java programmers' old favourite, Applet programming. Throughout the entire book, the author emphasises the need to document the code properly and promptly, a practice which is central to good programming.

To my knowledge, this book is one of the few attempts for a long time to promote a computer programming language in spatial sciences, and this in itself is a very worthy objective. One omission, however, is that, although Java is not unknown to spatial sciences, this book fails to cite some popular applications—such as GeoTools (<http://geotools.sourceforge.net/>)—a Java-based mapping toolkit. As a result, some parts of the book appear a little self-centred. Although the author suggests that the novice could read the book, presumptuous statements such as one in the summary of chapter 1 “By the end of this chapter, you should be able to ... create, compile and run a simple Java program” give the impression that at least some familiarity with computer programming is implicitly anticipated as a prerequisite. Based on my personal experience, I would doubt if a novice would be able to start creating even a simple program after just the first lesson. Therefore, I am not sure if the statement on the book's website (<http://www.soi.city.ac.uk/jpps>) that the book is “suitable for self-paced learning” is appropriate. Further, the source code available at the book's website is accompanied by only minimal guidelines on how to start using it, which could be quite daunting for an unassisted novice. The presence of the book's website, however, definitely adds to the value of the book and I eagerly look forward to the second edition of the book.

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**Geographical data: characteristics and sources** by N Walford; John Wiley, Chichester, Sussex, 2002, 272 pages, £65.00 (US \$120.00, €107.30) ISBN 00471 97085 9

*Geographical Data: Characteristics and Sources* aims to provide an introduction to the nature and availability of contemporary geographical digital data. Its avowed target audience comprises complete novices and experienced users of geographic information systems intending to engage with unfamiliar data sources. To this end, the book is laid out in three main sections. The first section, chapters 1 to 3, provides an introduction to the nature of geographical data. In the second

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section, chapters 4 to 7 provide more focused introductions to four categories of geographical data: remotely sensed, cartographic, census and survey, and administrative and statutory. Chapter 8 provides an overview of the international availability of these types of data. The final section provides some examples of the problems and pitfalls of geographical data analysis, and some concluding thoughts on possible future developments in the collection and availability of geographical data.

Of the three sections in the book it is the second, with its focus on data sources, that is most distinctive. Indeed, it would perhaps not be unfair to say that the contents of the first, and certainly the third, section of the book have been treated as well, if not better, elsewhere (for example, Burrough and McDonnell, 1998; Longley et al, 2001). A similar argument could be extended to the first chapter of section 2, which focuses on the capture and analysis of remotely sensed data only in a generic sense. However, the remaining four chapters in the section, comprising just under half of the overall book content, provide an ambitious survey of subnational geographical data sources and their availability unequalled elsewhere in print. UK-based data sources reviewed include a detailed look at Ordnance Survey, map products, the Census of Population, the Agricultural Census, the Farm Business Survey, and the National Land Use Database. Briefer overviews are given for the Breeding Bird Census, the Countryside Survey, two government social surveys (the General Household and Labour Force surveys), administrative data on planning applications, the Electoral Roll, counts of state benefit claimants, and environmental data on the weather and air and river quality. For many of these data sources at least one international comparator is given (normally drawn from the USA, Australia, or New Zealand). Finally, a wider range of international comparisons is provided for cartographic and population census data, although mainly confined to consideration of Anglophone countries plus France and India.

A central dilemma for a book of this type is the appropriate range and level of coverage to provide. As the author himself acknowledges, "...it would be pointless to attempt a comprehensive and exhaustive list of...sources [of digital geographical data] on a national scale and at a global one it would be utterly futile". Consequently the review of data sources provided in chapters 5 to 8 necessarily omits coverage of data sources (and countries) that might be of interest to the reader. For example, the online availability of births and deaths data in the United Kingdom is not mentioned. Nor is reference made to the annual publication *Regional Trends* (ONS, 2002), itself a collation of official UK government data from a range of sources. Instead, this book is clearly intended as a teaching aid, exposing the reader to the diversity of available geographical data and the types of organisation that act as potential sources for such information. For this reason it is disappointing that the comparisons furnished throughout the book were not more obviously didactic in purpose. For example, despite the range of sources and countries reviewed, barely a comment is passed on whether one system of data collection or provision is better than another. In this context the failure to discuss the Scandinavian register-based approach to population data collection is particularly disappointing. A more minor disappointment is the lack of a dedicated book-related website to provide a gateway to the various resources listed in the book. That this is necessary for a book of this type is demonstrated by the fact that at least two of the website addresses provided in chapter 8 are already out-of-date. But these are perhaps minor gripes. By way of compensation much of the material is fully up-to-date. For example, the recent change in UK copyright law arrangements for access to government data (the HMSO 'click-use' licence) is covered. And, as shown above, the range of data sources covered is truly impressive.

*Geographical Data: Characteristics and Sources* attempts to provide both an undergraduate primer to GIS and a published guide to the nature and availability of contemporary subnational digital geographical data. For the former task there are arguably better alternatives. For the latter task it is unequalled, although more suited to readers with previous experience of geographical data analysis than to the stated target audience of 'complete novices'.

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**A new kind of science** by S Wolfram; Wolfram Media, Champaign, IL, 2002, 1197 pages, \$44.95 (Can \$69.95) ISBN 1 57955 008 8

This is an enormous and very well-made book, with about 850 pages of text and 350 pages of notes in fine print, illustrated with hundreds of computer printouts and diagrams. The author is a very successful entrepreneur in mathematical computer software, and holds a PhD in Physics.

At the outset we must note that there are features of this investigation that could well be translated to urban research. In any basic research project there is a pressing need for talented and broadly educated leadership and staff. (Wolfram was supported by his corporate researchers.) Hundreds of computer-years must be invested in explorations, together with excellent visual interpretations. The research must be energized and guided by a small cluster of powerful ideas. Finally, at least in principle, the developing concepts must be tested against real-world phenomena and their analytic interpretation. In our investigation we will see how Wolfram unfortunately fails to follow this last injunction.

The claim to present a new kind of science rests on an intensive and extensive examination of a dozen or so different types of cellular automata. These are far from the types that have been used in some efforts to simulate urban growth and development. The author shows how most such automata are equivalent to their simplest possible type and to universal computers such as Turing machines, at least in principle. Selected automata (perhaps four out of the 256 simplest possible) seem to generate endless sequences of various types of random output, which the author in some sense equates with complexity. The universal applicability of these sequences arises out of the choice of different starting configurations.

The main and most interesting principle the author derives from these studies is that the underlying basis of science is the concept of processes programmed in discrete steps, rather than flowing in smooth continuity over space, time, and system development. Concomitantly, very complex results can stem from the operation of very simple programs. These are attractive ideas, already applied in several contexts, and well suited to the subject matter of chemistry, biology, and urbanism, which are neglected in this work in favor of physics and mathematics. The principle that simple rules can generate complexity contradicts the operations research idea (also commonly held in politics) that a complex system requires equally complex controls, as suggested by W Ross Ashby's 'law of requisite variety'.

We will look at the application of these ideas to exploring the way such programs operate and how they change in the fields of biology and urbanism—this knowledge being a proper object of science and a necessity for understanding the professional promotion of health and the allocation of power and resources in urban development and planning. Even in his own field, Wolfram discusses his principles at a very general level, without showing clearly how they would operate. There is evidence that he knows much more about chemistry and biology than he sets out in the main argument, and thus that he could mount an able attack against questions as to his view of complexity in such fields.

Complexity is now widely considered to be the applicable term for the emergence of new patterns of function and development for systems. Thus chemistry has patterns which render it more complex than physics, as biology is more complex than chemistry, and ecology or social science is more complex than biology. At each level the rules for the less complex levels still apply, but to assume, for instance, that all of biology can be directly explained by the rules of chemistry and physics is counterproductive. To believe that physics *explains* DNA and other aspects of biology is called *reductionism* and is widely held to be incorrect.

Let us explore the application of Wolfram's paradigm to biology, to evolution, and by analogy to urbanism. This is today an attractive approach because biologists now understand

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(if imperfectly) that for each species there is a set of programs in DNA which controls the development and function of living matter. These programs, called genes, are indeed simpler than the processes which they specify, which are intrinsically complex and even more so considering the interaction of processes within and between organisms. Similar programs of urban development and evolution are understood in a fragmentary way.

The most striking divergence of such systems of programs from Wolfram's views is the fact that they generate not randomness but repetition. He repeatedly sets aside automata which generate repeated or nested patterns. The body plan, cell types, and chemistry of the invertebrates, or the general structure and institutions of the nation-state, for instance, have been invariant for long periods of time and across many otherwise diverse exemplars in each category. In other words, the sciences of biology and of social affairs must try to identify the programs which maintain and replicate a certain underlying stability and persistence, and not focus on superficial and random variation.

The genetic programs of organisms pay a good deal of attention to preserving stability and to editing the transmission of the body of programs, but changes do occur, usually rather slowly in a process of evolution. We are beginning to understand that there are in biology other internal programs which influence this process. These seem to work by permitting more random variation when a population of organisms is stressed, by amplifying and improving supports for favorable variations within limits, and by coordinating the rest of the organism with the resulting changes. Wolfram is deeply concerned with such evolution, but appears unable to adapt his paradigm to understanding it. He argues against the idea that evolution seeks to optimize a species for survival, incorrectly imputing a purpose to the process, and failing to credit the ability of supporters of natural selection to distinguish between global and local optima. He thus develops an elaborate example to prove the extreme difficulty of optimizing under constraints, supporting the argument by selecting an inappropriate method of optimization.

Wolfram correctly concludes that evolution depends on random events, but wrongly adds that natural selection cannot support it. Even at this early date, mechanisms have been identified which appear programmed to support evolution. Real science in biological and social systems, even accepting Wolfram's hypotheses, needs to explore what types of simple rules produce known results, including both system constancy and system diversity and change, while preserving an appropriate role for randomness.

To complicate this agenda, simple cellular automata have two limitations which do not operate in many circumstances in the more complex of real-world systems. A current event in a given cell can be affected only by cells in some close neighborhood of it, and only by conditions which are recent in time. These restrictions are not serious in physics, and they can be removed by expanding the model being used. The research problem of dealing with the real world is to find the model which reproduces its relevant features. In terms of cellular automata, this means finding which type of automaton is operative, and how distant in space or time relevant events or conditions inside the system may be. In organisms, the spatial problem is managed by electrical and chemical means, and a much wider 'geography' is relevant—but still only within the organism. In cities, the complexity of space is even greater. The influence of time is frequently regarded as embedded in the current state of the system and its parts. For organisms this may be more valid than for cities, where the living parts of the system (at least the people) have memories which are not usually fully recorded in the system states.

These comments begin to show how Wolfram's proposal falls short of meeting our need for new steps toward the scientific understanding of biology, social organizations (especially in cities), and the evolution of organisms and social systems.

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### Books received

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