arbitrary selection of 13 articles and as a whole will not be very informative to anybody knowledgeable in GIS. The country profiles cover 14 European countries (with large countries as Germany and Spain missing), but again the information is not very systematic. There is a section on geographic information standards in 12 European countries which might have been informative if the space devoted to each country were larger.

In summary it is hard to imagine the kind of reader who might really benefit from these two volumes except for their extensive directory sections. Beginners in GIS would be better advised to read serious, coherent GIS textbooks, whereas GIS experts will be better served by advanced texts in GIS journals like the one in which this review appears. Seen as trade directories the two volumes might have a certain value for vendors and potential buyers of GIS, but hardly at the price. The promotional character of both volumes is underlined by the fact that neither of them contains any reference to problematic legal or societal aspects of GIS such as litigation, privacy or equity issues associated with the large-scale diffusion of GIS.

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Geographical Information Handling—Research and Applications. Edited by PAUL M. MATHER (Chichester: John Wiley and Sons, 1993) [Pp. 337 + index] Price: £35·00. ISSN 0-471-94060-7.

In 1989, the U.K.'s Economic and Social Research and Natural Environmental Research Councils (ESRC and NERC) initiated a joint programme of research training in geographic information handling. The programme lasted for three years, and funded projects on topics ranging from algorithm development to the impact of GIS on institutions. This volume contains the papers presented at the wrap-up meeting of the programme, which was held in London in February 1993, together with a number of short overview papers. The editor, Paul Mather, is to be congratulated on getting this volume out in good time, and on the high quality of the result.

The programme was in part a consequence of the Chorley Report (DoE, 1987), which urged the funding of exactly this type of research programme to foster a GIS research community, with the aim of removing some of the impediments it perceived to more effective use of digital geographic data within the U.K. Although many of Chorley's recommendations were specific to the U.K. context, the joint programme's research results travel well, and should be of international interest. Specifically, the objectives of the research programme were: 1. to carry out basic research into the handling of geographic information using newly developed geographical information systems (GIS) technology; 2. to develop and apply GIS methods to selected applications areas and to demonstrate their value; 3. to encourage the transfer of results from information technology (IT) programmes elsewhere; and 4. to generate additional training opportunities in GIS. This volume addresses primarily the first objective, and to a limited extent the second.

The book is organized into 22 chapters, of which the first five are short overviews by the editor, the chairs of ESRC and NERC (Howard Newby and John Knill, respectively), and representatives of the private sector (Mike Jackson of LaserScan) and the Ordnance Survey (Great Britain's national mapping agency, represented by David Rhind and Ian Logan). They provide a broad cross-sectional sampler of the state of GIS research, although given the current breadth of the field it is clearly impossible to cover all of its aspects in a volume of this size. It is also unreasonable to expect perfect evenness, and some chapters are inevitably more memorable than others. Among the highlights are a report of error simulation by Brunsdon and Openshaw, which throws interesting ideas around with the same abandon that Stan Openshaw has been observed to throw overhead projector transparencies; an innovative discussion of object-based modelling of geographic phenomena by Worboys, Mason and Dawson; a creditable effort to develop functionality for four-dimensional space-time GIS by O'Conaill, Mason, and Bell; a lengthy review of spatial query language and user interface research by Raper and Bundock; a report on the development of a combined image processing/GIS functionality for mapping land cover by Barnsley *et al.*; Masser and Campbell's report of survey research into the impact of GIS on local government in Great Britain; and the concluding chapter on the need for greater analytic power in GIS (Clarke *et al.*), with illustrations from three domain-specific applications of spatial decision support systems. As a research collection, the book offers

something for almost every area of research interest in GIS, from algorithms to institutional impacts.

As the outcome of a coordinated research programme, however, the book clearly offers something more, and there are insights here into the general state of GIS research, both in the U.K. and internationally. In his introductory chapter, Howard Newby, the then Chair of ESRC, notes that with the end of this programme, and the parallel ESRC-funded Regional Research Laboratory programme, 'GIS research has now come of age, and must compete openly for Research Council support with other programmes and initiatives' (p. 18). There is a sense both that the joint programme was a nursery, providing special protected funding for GIS research within the discipline of geography, and also that GIS has the potential to continue as a programme, or form the basis of a new initiative. But the statement leaves unresolved the question of whether a programme or initiative based around GIS, or spatial analysis, or geographic information is likely to be established in the near future, or whether GIS will continue to fall between the cracks of the traditional disciplines that are the basis of much research council funding. Unless we can convince the research councils that spatial analysis and modelling and the generic issues of geographic information handling involve problems of greater fundamental significance than is implied by the comment that 'GIS are *tools* (for scientific research)' (p. 18, original emphasis), then there is little prospect that GIS research can compete for funding with well established disciplines, programmes, and initiatives; instead, as Newby suggests, it will have to be extracted from 'the geography ghetto' and work for funding through its scientific users in other disciplines. It was disappointing for me to read these comments at the end of the joint programme, reflecting as they do a focus only on GIS as a tool for science, despite all of the other aspects of its role in society, and the importance of the concepts it implements, many of which are pressing topics for basic research.

The book leaves no doubt that the joint programme met at least the first two of its objectives. Although a parallel collection of papers from the RRL initiative was published three years ago (Masser and Blakemore 1991), this is the first volume devoted explicitly to basic research in GIS in the U.K. The organizers and investigators should be congratulated on a productive programme and effective administration, and some of the momentum the programme generated has emerged in the European Science Foundation GISDATA programme. As Jackson points out, the joint programme encountered the perennial problem of imperfect communication between academic research and industrial application, and the amount of funding was minuscule compared to that routinely invested in internal research by the private sector. At the end, I missed a sense of where we go from here, of what progress was made on the underlying GIS research agenda, what remains, and what new and important questions were raised by this research, and wondered whether the wrap-up meeting had included this type of discussion.

Although the programme seems unlikely to be repeated in this form, the book is clear evidence of the wisdom of ESRC and NERC in funding the programme. For continuing evidence, one has only to look at the success of the GISRUK series of meetings (see Worboys, 1993) and the Sixth International Symposium on Spatial Data Handling (Waugh & Healey, 1994) held recently in Edinburgh, as indications of the health of basic GIS research in the U.K. as a multidisciplinary enterprise. But the question of how that enterprise will continue to be funded remains, as it does in many other countries, despite the long term significance of GIS research to science, society, and industrial competitiveness.

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