CONSOLIDATED BIBLIOGRAPHY

- Abbott T, Argentati C 1995 015: A new component of public services. *Journal of Academic Librananshp* 21: 253
- Abel D J, Kilby P J, Davis J R 1994 The system integration problem. *International Journal of Geographical Information Systems* 8: 1–2
- Abel D J, Mark D M 1990 A comparative analysis of some 2-dimensional orderings. *International Journal of Geographicai Information Systems* 4: 21–31
- Abler R F 1993 Everything in its place: GPS, GIS, and geography in the 1990s. *The Professional Geographer* 45: 131–9
- Aboav D A 1970 The arrangement of grains in a polycrystal. *Metallography* 3: 383–90

Abrahams A D 1984 Channel networks: a geomorphological perspective. *Water Resources Research* 20: 161–88

- Abrahamson F 1994 'Uklarhet og noyaktighet i geografiske informasjonssystemer (flizziness and accuracy in geographical information systems)'. Unpublished Master's thesis, Division of Surveying and Mapping, University of Trondheim (Norway) and Norwegian Institute of Technology
- Abramowitz M, Stegun I A 1964 Handbook of mathematical functions. New York, Dover: 297–300, 228–31
- Ackermann F 1978 Experimental investigation into the accuracy of contouring from DTM. *Photogrammetric Engineering and Remote Sensing* 44: 1537–8
- Adams T, Corbley K P 1996 London Transport fine tunes transportation network. *Earth Observation Magazine* 5(7): 14–17
- Adams W M, Thomas D H L 1996 Conservation and sustainable resource use in the Radejia-Jama'are valley, Nigeria. *Oryx* 30: 131–42
- Addicott J F, Aho J M, Antolin M F, Padilla D K, Richardson J S, Soluk D A 1987 Ecological neighborhoods: scaling environmental patterns. *Oikos* 49: 340–6
- Agee J K, Stitt S C F, Nyquist M, Root R 1989 A geographical analysis of historical grizzly bear sightings in the North Cascades. *Photogrammetric Engineering and Remote Sensing* 55: 1637–42
- Agre P E 1994 Understanding the digital individual. *The Information Society* 10: 73–6
- Aguilar R 1996 Service pulls Social Security numbers. *ClNet* June 12 1996
- Agumya A, Hunter G J 1996 Assessing fitness for use of spatial information: information utilisation and decision uncertainty. *Proceedings GIS/LIS 96 Conference, Denver*: 359–70

- Ahearn S C, Smith J L D, Wee C 1990 Framework for a geographically referenced conservation database: case study Nepal. *Photogrammetric Engineering and Remote Sensing* 56: 1477–81
- Ahlberg C, Shneiderman B 1994 Visual information seeking: tight coupling of dynamic query filters with starfield displays. In Adelson B, Dumais S, Olson J (eds) *Human* factors in computing systems, CHI 94 conference proceedings. Boston, ACM Press: 313–17
- Ahmad S P, Deering D W 1992 A simple analytical function for bidirectional reflectance. *Journal of Geophysical Research* 97: 18 867–86
- Ahuja N 1983 On approaches to polygonal decomposition for hierarchical image representation. *Computer Vision, Graphics, and Image Processing* 24: 200–14
- Aitken S C, Michel S M 1995 Who contrives the 'real' in GIS? Geographic information, planning, and critical theory. *Cartography and Geographic Information Systems* 22: 17–29
- Akima H 1978 A method of bivariate interpolation and smooth surface fitting for irregularly spaced data points. *ACM Transactions on Mathematical Software* 4: 148–64
- Akom A A 1982 Information system for planning in Ghana. *Ekistics* 292: 73–7
- Aldrich R C 1979 *Remote sensing of wild land resources, a state of the art review.* General Technical Report RM 71. Fort Collins, GIS World Inc.
- Alexander D 1993 Natural disasters. New York, Chapman and Hall
- Alexander M 1995 Management planning in relation to protected areas. *Parks* 5: 2–11
- Alexander S, Waters N M 1996 Decision support methods for resolving land-use conflicts. *Proceedings GIS/LIS 96*. Falls Church, ACSM/ASPRS: 1152–68
- Alexandroff P 1961 *Elementary concepts of topology*. New York, Dover
- Allen J F 1984 Towards a general theory of action and time. *Artificial Intelligence* 23: 123–54
- Al-Taha K K 1992 'Temporal reasoning in cadastral systems'. Unpublished PhD dissertation, Department of Surveying Engineering, University of Maine
- Altman D 1994 Fuzzy set theoretic approaches for handling imprecision in spatial analysis. *International Journal of Geographical Information Systems* 8: 271–89
- Alvanides S 1995 'The investigation of a Zone Design System for reconstructing census geographies'. Unpublished dissertation 3031 available from School of Geography, University of Leeds

- American Library Association 1978 *Anglo-American cataloging rules*. Chicago, American Library Association: 201–16
- American Library Association 1988 *Anglo-American cataloging rules*. Chicago, American Library Association: 201–41
- American Society for Photogrammetry (Committee for Specifications and Standards, Professional Practice Division) 1985 Accuracy specification for large-scale line maps. *Photogrammetric Engineering and Remote Sensing* 51: 195–9
- American Society of Civil Engineers (Committee on Cartographic Surveying, Surveying, and Mapping Division) 1983 *Map users, scales, and accuracies for engineering and associated purposes.* New York, American Society of Civil Engineers
- Ammann R, Grunbaum B, Shephard G C 1992 Aperiodic tiles. *Discrete and Computational Geometry* 8: 1–27
- Amrhein C G, Reynolds H 1996 Using spatial statistics to assess aggregation effects. *Geographical Systems* 3: 143–58
- ANC 1994 *The reconstruction and development programme.* Johannesburg, Umanyano Publications
- Anderson J R, Hardy E F 1976 A land use and land cover classification system for use with remote sensor data. US *Geological Survey, Professional Paper 964*. Washington DC, USGS
- Anderson J R, Stewart A R 1995 Local government liability for erroneous data: law and policy in a changing environment. *Proceedings, Conference on Law and Information Policy for Spatial Databases.* Orono, University of Maine, NCGIA: 267–79
- Andes N, Davis J E 1995 Linking public health data using geographical information system techniques: Alaskan community characteristics and infant mortality. *Statistics in Medicine* 14: 481–90
- Andrewartha H G, Birch L C 1954 *The distribution and abundance of animals.* Chicago, University of Chicago Press
- Andrews D F, Fowlkes E B, Tukey P A 1988 Some approaches to interactive statistical graphics. In Cleveland W S, McGill M E (eds) *Dynamic graphics for statistics*. Pacific Grove, Wadsworth: 73–90
- Andrienko N, Andrienko G 1996 IRIS, a knowledge-based system for visual data exploration. See also *http: //allanon.gmd.delandljavaliris/Iris.html*
- Annitto R, Patterson B 1994 A new paradigm for GIS data communications. Journal of the Urban and Regional Information Systems Association 7: 64–7
- Anon 1996 Land for the accommodation of low-income people in the Western Cape Metropolitan Region: decision support system. *Report for the Provincial Administration of the Western Cape; Department of Planning, Local Government and Housing.* Stellenbosch, CSIR
- Anselin L 1986 Non-nested tests on the weight structure in spatial autoregressive models: some Monte Carlo results. *Journal of Regional Science* 26: 267–84

- Anselin L 1988 *Spatial econometrics: methods and models.* Dordrecht, Kluwer
- Anselin L 1989 What is special about spatial data? Alternative perspectives on spatial data analysis. Technical paper 89–4. Santa Barbara, NCGIA
- Anselin L 1990a What is special about spatial data? Alternative perspectives on spatial data analysis. In Griffith D A (ed.) *Statistics, past, present, and future.* Ann Arbor, Institute of Mathematical Geography: 63–77
- Anselin L 1990b Some robust approaches to testing and estimation in spatial econometrics. *Regional Science and Urban Economics* 20: 141–63
- Anselin L 1992 SpaceStat: a program for the analysis of spatial data. Santa Barbara, NCGIA, University of California
- Anselin L 1993 *Exploratory spatial data analysis and geographic information sysytems.* Research Paper 9329. West Virginia University, Regional Research Institute
- Anselin L 1994 Exploratory spatial data analysis and geographic information systems. In Painho M (ed.) *New tools for spatial analysis*. Luxembourg, Eurostat: 45–54
- Anselin L 1995a *SpaceStat version 1.80 user's guide.* Morgantown, Regional Research Institute, West Virginia University
- Anselin L 1995b Local indicators of spatial association LISA. *Geographical Analysis* 27: 93–115
- Anselin L 1997 The Moran scatterplot as an ESDA tool to assess local instability in spatial association. In Fischer M, Scholten H, Unwin D (eds) *Spatial analytical perspectives on GIS*. London, Taylor and Francis: 111–25
- Anselin L 1998 GIS research infrastructure for spatial analysis of real estate markets. *Journal of Housing Research* 8
- Anselin L, Bao S 1996 SpaceStat.apr user's guide. Morgantown, Regional Research Institute, West Virginia University
- Anselin L, Bao S 1997 Exploratory spatial data analysis: linking SpaceStat and ArcView. In Fischer M M, Getis A (eds) Recent developments in spatial analysis spatial statistics, behavioural modelling and computational intelligence. Berlin, Springer
- Anselin L, Florax R J G M (eds) 1995 New directions in spatial econometrics. Berlin, Springer
- Anselin L, Getis A 1992 Spatial statistics analysis and geographic information systems. *Annals of Regional Science* 26: 19–33
- Anselin L, Getis A 1993 Spatial data analysis and geographic information systems. In Fischer M M, Nijkamp P (eds) *Geographic information systems, spatial modelling, and policy evaluation.* Berlin, Springer: 35–49
- Anselin L, Griffith D A 1988 Do spatial effects really matter in regression analysis? *Papers of the Regional Science Association* 65: 11–34

Anselin L, Hudak S 1992 Spatial econometrics in practice: a review of software options. *Regional Science and Urban Economics* 22: 509–36

Anselin L, Rey S 1991 Properties of tests for spatial dependence in linear regression models. *Geographical Analysis* 23: 112–31

ANSI 1991 Object–Oriented Database Task Group final report. X3/SPARC/DBSSG OODBTG. American National Standards Institute

ANSI/NISO Z39.2–1994 1994 Information interchange format. New York, American National Standards Institute Inc.

ANSI/SPARC 1975 ANSI/X3/SPARC Study Group on data base management systems, interim report. *ACM SIGFIDET* 7: 3–139

Antenucci J, Brown K, Croswell P, Kevany M 1991 *Geographic information systems – a guide to the technology*. New York, Van Nostrand Reinhold

Anthes R A, Hsie E Y, Kuo Y H 1987 Description of the Penn State/NCAR Mesoscale Model version 4 (MM4). Report No. NCAR/TN-2282+STR. Boulder, National Center for Atmospheric Research

ANZLIC 1996 Land Information Management Training Needs Analysis: National Report. Canberra, ANZLIC Secretariat (PO Box 2 Belconnen ACT 2616)

Appleton J H 1975 *The experience of landscape*. Chichester, John Wiley & Sons

Arbia G 1989 Spatial data configuration in statistical analysis of regional economic and related problems. Dordrecht, Kluwer

Arbia G, Benedetti R, Espa G 1996 Effects of the MAUP on image classification. *Geographical Systems* 3: 159–180

 Archer H N 1995 Establishing a legal setting and organisational model for affordable access to governmentowned information management technology. In Onsrud H (ed.) *Law and information policy for spatial databases*. Orono, NCGIA: 13–24

ArcView 2.1 1996 The geographic information system for everyone. Redlands, ESRI

Ardanuy A, Han D, Salomonson V V 1991 The Moderate Resolution Imaging Spectrometer (MODIS) science and data system requirements. *IEEE Transactions on Geoscience and Remote Sensing* 29: 75–88

Arentze T A, Borgers W J, Timmermans H J P 1996 Design of a view-based DSS for location planning. *International Journal of Geographical Information Systems* 10: 219–36

Arlinghaus S L 1994 Practical handbook of digital mapping terms and concepts. Boca Raton, CRC Press

 Armstrong M P 1991 Knowledge classification and organization. In Buttenfield B P, McMaster R B (eds) *Map* generalisation: making rules for knowledge representation. Harlow, Longman: 86–102 Armstrong M P 1993 Perspectives on the development of group decision support systems for locational problemsolving. *Geographical Systems* 1: 69–81

Armstrong M P, Densham P J 1990 Database organisation strategies for spatial decision support systems. *International Journal of Geographical Information Systems* 4: 3–20

Armstrong M P, Densham P J, Lolonis P, Rushton G 1992 Cartographic displays to support locational decisionmaking. *Cartography and Geographic Information Systems* 19: 154–64

Armstrong M P, Densham P J, Rushton G 1986 Architecture for a microcomputer-based decision support system. *Proceedings, Second International Symposium on Spatial Data Handling.* Williamsville, International Geographical Union: 120–1

Armstrong M, Dowd P A (eds) 1993 *Geostatistical simulations*. Quantitative Geology and Geostatistics 7. Dordrecht, Kluwer Academic

Armstrong M P, Marciano R 1995 Massively parallel processing of spatial statistics. *International Journal of Geographical Information Systems* 9: 169–89

Aronoff S 1985 The minimum accuracy value as an index of classification accuracy. *Photogrammetric Engineering and Remote Sensing* 51: 99–111

Aronoff S 1989 Geographic information systems: a management perspective. Ottawa, WDL Publications

Arrow K 1986 The value of and demand for information. In McGuire C B, Radner R (eds) *Decision and organisation*. Minneapolis, University of Minneapolis Press

Arseneau B, Kearney A, Quek S, Coleman D 1997 Internet access to real property information. *Proceedings GIS 97 Conference, Vancouver*. Fort Collins, GIS World Inc.

Arthur R M 1996 'GIS analysis of speed related traffic collisions'. Unpublished MSc, Department of Geography, University of Calgary

Arthur R M, Waters N M 1995 GIS to maximize photo-radar deployment effectiveness. *Proceedings GIS/LIS 95*, Vol. 1. Falls Church, ACSM/ASPRS: 20–8

Arthur R M, Waters N M 1997 Formal scientific research of traffic collision data utilising GIS. *Transportation Planning and Technology* 21: 121–37

Ashkenazi V 1986 Coordinate systems: how to get your position very precise and completely wrong. *Journal of Navigation* 39: 269–78

Aspinall R J 1992 An inductive modelling procedure based on Bayes theorem for analysis of pattern in spatial data. *International Journal of Geographical Information Systems* 6: 105–21

Aspinall R J 1994a Exploratory spatial analysis in GIS: generating geographical hypotheses from spatial data. In Worboys W F (ed.) *Innovations in GIS 1*. London, Taylor and Francis: 139–47

Aspinall R J 1994b GIS and spatial analysis for ecological modelling. In Michener W K, Brunt J W, Stafford S G (eds) *Environmental information management and analysis: ecosystem to global scales.* London, Taylor and Francis: 377–96

Aspinall R J 1995 Redefining 'scale' for digital geographical data. In Folving S, Burril A, Meyer-Roux J (eds) Workshop on Scale and Extent: Proceedings of EuroCarto 13, Luxembourg, European Union: 69–79

Aspinall R J 1996 Spatial analysis in ecological and environmental modelling. *Aspects of Applied Biology* 46: 187–94

Aspinall R J, Pearson D M 1995 Describing and managing uncertainty of categorical maps in GIS. In Fisher P F (ed.) *Innovations in GIS 2*. London, Taylor and Francis: 71–83

Asrar G (ed.) 1989 *The theory and applications of optical remote sensing.* New York, John Wiley & Sons Inc.

Association of Research Libraries 1996 *Scholarship, research libraries, and global publishing.* Association of Research Libraries: 131

Astrahan M, Blasgen M, Chamberlin D, Eswaran K, Gray J, Griffiths P, King W, Lorie R, McJones P, Mehl J, Putzolu G, Traiger I, Wade B, Watson V 1976 System R: a relational approach to database management. *ACM Transactions on Database Systems* 1: 97–137

Atallah M 1983 Dynamic computational geometry. Proceedings, 24th IEEE Symposium on Foundations of Computer Science. IEEE Computer Society: 92–9

Atkinson M, Bancilhon F, DeWitt D, Dittnick K, Maier D, Zdonik S 1989 The object-oriented database system manifesto. *Proceedings, First International Conference on Deductive and Object-Oriented Databases, Kyoto, Japan.* Amsterdam, Elsevier Science

Audit Commission for Local Authorities and the National Health Service in England and Wales 1994 *High risk/high potential: a management handbook on information technology in local government.* London, Her Majesty's Stationery Office

Auerbach S, Schaeben H 1990 Surface representation reproducing given digitised contour lines. *Mathematical Geology* 22: 723–42

Aufhauser E, Fischer M M 1985 Log-linear modelling and spatial analysis. *Environment and Planning A* 17: 931–51

Aumann G, Ebner H, Tang L 1992 Automatic derivation of skeleton lines from digitised contours. *ISPRS Journal of Photogrammetry and Remote Sensing* 46: 259–68

Aurenhammer F 1991 Voronoi diagrams – a survey of fundamental geometric data structure. *ACM Computing Surveys* 23: 345–405

AUSLIG 1992 *Product Specification: Geodata Topo-250K.* Canberra, Australian Surveying and Land Information Group

Austin M P, Nicholls A O, Margules C R 1990 Measurement of the realised quantitative niche: environmental niche of five *Eucalyptus* species. *Ecological Monographs* 60: 161–77 Avery B W 1980 Soil classification for England and Wales (higher categories). Harpenden, Soil Survey Technical Monograph 14

Baeijs C, Demazeau Y, Alvares L 1996 SIGMA: application of multi-agent systems to cartographic generalisation. Seventh European Workshop on Modelling Autonomous Agents in a Multi-Agent World (MAAMAW96), Eindhoven, The Netherlands. Lecture Notes in Artificial Intelligence 1038. Springer

Baella B, Colomer J L, Pla M 1994 CHANGE. Technical report. Barcelona, Institut Cartogràfic de Catalunya: 1–16

Baier M 1967 Zip code – new tool for marketers. *Harvard* Business Review 45: 136–40

Bailey R G 1996 Ecosystem geography. New York, Springer

Bailey T C 1994 A review of statistical spatial analysis in geographical information systems. In Fotheringham S, Rogerson P (eds) Spatial analysis and GIS. London, Taylor and Francis: 13–44

Bailey T C, Gatrell A C 1995 Interactive spatial data analysis. Harlow, Longman/New York, John Wiley & Sons Inc.

Bain G D 1991 Lotus primes MarketPlace for desktop marketing. *MacWEEK* 5: 31ff

Baker J R, Mitchell P L, Cordey R A, Groom G B, Settle J J, Stileman M R 1994 Relationships between physical characteristics and polarimetric radar backscatter for Corsican pine stands in Thetford Forest, UK. *International Journal of Remote Sensing* 15: 2827–50

Baker W L 1989 A review of models of landscape change. Landscape Ecology 2: 111–33

Baker W L 1992 Effects of settlement and fire suppression on landscape structure. *Ecology* 73: 1879–87

Baker W L, Weisberg P J 1995 Landscape analysis of the forest-tundra ecotone in Rocky Mountain National Park, Colorado. *Professional Geographer* 47: 361–74

Ball J, Fisher P F 1994 Visualising stochastic catchments in geographical networks. *The Cartographic Journal* 31: 27–32

Band L E 1986a Analysis and representation of drainage basin structure with digital elevation data. *Proceedings, Second International Symposium on Spatial Data Handling, Seattle*: 437–50

Band L E 1986b Topographic partition of watersheds with digital elevation models. *Water Resources Research* 22: 15–24

Band L E 1989 A terrain-based watershed information system. *Hydrological Processes* 3: 151–62

Band L E 1993 Extraction of channel networks and topographic parameters from digital elevation data. In Kirkby M J, Beven K (eds) *Channel network hydrology*. Chichester, John Wiley & Sons: 13–42

Band L E, Patterson P, Nemani R, Running S W 1993 Forest ecosystem processes at the watershed scale: incorporating hillslope hydrology. *Agricultural and Forest Meteorology* 63: 93–126

Band L E, Peterson D L, Running S W, Coughlan J, Lammers R, Dungan J, Nemani R 1991 Forest ecosystem processes at

the watershed scale: basis for distributed simulation. *Ecological Modelling* 56: 171–96

Bao S, Henry M 1996 Heterogeneity issues in local measurements of spatial association. *Geographical Systems* 3: 1–13

Bao S, Henry M, Barkley D, Brooks K 1995 RAS: a regional analysis system integrated with ARC/INFO. *Computers, Environment and Urban Systems* 18: 37–56

Bär H R 1995 Interaktive bearbeitung von geländeoberflächen – konzepte, methoden, versuche. (PhD dissertation) Geoprocessing series. Department of Geography, University of Zurich Vol. 25: 1–140

Barata P 1996 Portugal Telecom: ready for the communications century. *GIS Europe* 5(3): 46–8

Bardon K S, Elliott C J, Stothers N 1984 *Computer applications in local authority planning departments 1984: a review.* Birmingham, Department of Planning and Landscape, City of Birmingham Polytechnic

Baret F, Guyot G 1991 Potentials and limits of vegetation indices for LAI and APAR assessment. *Remote Sensing of Environment* 35: 161–73

Barnes T J 1996 Logics of dislocation: model, metaphors, and meanings of economic space. New York, Guilford Press

Barnes T J, Duncan J S 1992 Introduction: writing worlds. In Barnes T J, Duncan J S (eds) *Writing worlds: discourse, text and metaphor in the representation of landscape*. London, Routledge: 1–17

Barnsley M J 1994 Environmental monitoring using multiple view angle (MVA) remotely-sensed images. In Curran P J, Foody G (eds) *Environmental remote sensing from regional to global scales*. London, Taylor and Francis: 181–201

Barnsley M J, Allison D, Lewis P 1997a On the information content of multiple view angle (MVA) images. *International Journal of Remote Sensing* 18: 1937–60

Barnsley M J, Barr S L 1996 Inferring urban land-use from satellite sensor images using kernel-based spatial reclassification. *Photogrammetric Engineering and Remote Sensing* 62: 949–58

Barnsley M J, Barr S L, Hamid A, Muller J-P A L, Sadler G J, Shepherd J W 1993 Analytical tools to monitor urban areas. In Mather P M (ed.) *Geographical information handling – research and applications*. Chichester, John Wiley & Sons: 147–84

Barnsley M J, Barr S L, Tsang T 1997b Scaling and generalization issues in land cover mapping. In Gardingen J van (ed.) *Scaling up*. Cambridge (UK), Cambridge University Press

Barnsley M J, Lewis P, Sutherland M, Muller J-P 1997c Estimating land surface albedo through inversion of two BRDF models against ASAS image data for HAPEX-Sahel. *Journal of Hydrology* 188–9; 749–78

Barnsley M J, Strahler A N, Morris K P, Muller J-P 1994 Sampling the surface BRDF: 1. Evaluation of current and future satellite sensors. *Remote Sensing Reviews* 8: 271–311

Barr R 1991 A federal approach to GIS. *Mapping Awareness* 5(6): 15–19

Barr R 1993 Mapping and spatial analysis. In Dale A, Marsh C (eds) *The 1991 Census user's guide*. London, Her Majesty's Stationery Office: 248–68

Barr R 1995 Excuse me, do you have a licence to drive that GIS? *GIS Europe* 4(1): 16–17

Barr R 1996 A comparison of aspects of the US and UK censuses of population. *Transactions in GIS* 1: 49–60

Barr R, Masser I 1997 Geographic information: a resource, a commodity, an asset or an infrastructure? In Kemp Z (ed.) *Innovations in GIS 4*. London, Taylor and Francis: 234–48

Barr S L, Barnsley M J 1995 A spatial modelling system to process, analyse, and interpret multi-class thematic maps derived from satellite sensor images. In Fisher P F (ed.) *Innovations in GIS 2.* London, Taylor and Francis: 53–5

Barr S L, Barnsley M J 1997 A region-based, graph-theoretic data model for the inference of second-order thematic information from remotely-sensed images. *International Journal of Geographical Information Science* 11: 555–76

Barrett G W 1992 Landscape ecology: designing sustainable agricultural landscapes. *Journal of Sustainable Agriculture* 2: 83–103

Barthel K M, Morgan G, Ventura S J 1992 Reliability of geographic information systems for environmental assessment in data poor regions. *Proceedings GIS 92 Symposium, Vancouver*: 1–7

Barton G S 1996 Multiple metadata formats from the NOAA Environmental Services Data Directory. *Proceedings, First IEEE Metadata Conference*. IEEE Computer Society Mass Storage Systems and Technology Technical Committee. *http: //www.computer.org/conferen/meta96/meta_home.html*

Bassoglu U, Morrison J L 1977 An efficient hierarchical data structure for the US Historical County Boundary Data File. *Proceedings*, 1977 ACSM Fall Technical Meeting: 31–53

Batey P, Brown P 1995 From human ecology to customer targeting: the evolution of geodemographics. In Longley P A, Clarke G (eds) GIS for business and service planning. Cambridge (UK), GeoInformation International: 77–103

Batini C, Ceri S, Navathe S B 1992 Conceptual database design, an entity-relationship approach. Redwood City, Benjamin Cummings

Battista C 1994 Chernobyl: GIS model aids nuclear disaster relief. GIS World 7(3): 32–5

Batty M 1990 Information systems and technology for urban and regional planning in developing countries: a review of UNCRD's research project, Vol. 1. Nagoya, Japan, United Nations Centre for Regional Development

Batty M 1992 Urban modeling in computer-graphic and geographic information system environments. *Environment and Planning B: Planning and Design* 19: 663–88

Batty M 1994 Using GIS for visual simulation modeling. GIS World 7(10): 46–8

Batty M 1995 Planning support systems and the new logic of computation. *Regional Development Dialogue* 16: 1–17

Batty M, Densham P 1996 Decision support, GIS and urban planning. *Sistema Terra* 5: 72–6

Batty M, Longley P 1994 Fractal cities: a geometry of form and function. London/San Diego, Academic Press

Batty M, Longley P 1996 Analytical GIS: the future. In Longley P, Batty M (eds) Spatial analysis: modelling in a GIS environment. Cambridge (UK), GeoInformation International: 345–52

Batty M, Xie Y 1994a Modelling inside GIS: part I. Model structures, exploratory spatial data analysis and aggregation. *International Journal of Geographical Information Systems* 8: 291–307

Batty M, Xie Y 1994b Modelling inside GIS: part II. Selecting and calibrating urban models using ARC/INFO. *International Journal of Geographical Information Systems* 8: 451–70

Batty M, Xie Y 1994c Urban analysis in a GIS environment: population density modelling using ARC/INFO. In Fotheringham A S, Rogerson P A (eds) *Spatial analysis and GIS*. London, Taylor and Francis: 189–219

Baumann J 1995 Making connections: GIS helps to link Europeans. *GIS Europe* 4(3): 32–3

Bayer R, McCreight E 1973 Organization and maintenance of large ordered indexes. *Acta Informatica* 1: 173–89

BCS/British Computer Society 1991 Industry structure model: a set of performance standards covering all functional areas of work carried out by professionals both in and allied to the field of information systems engineering. Release 2. Swindon, British Computer Society. (Note that a new version of ISM was launched in 1996.)

BCS with Survey and Mapping Alliance 1992 Survey and mapping qualifications for the 1990s. London, Special Publication British Cartographic Society with Survey and Mapping Alliance

Beard M K 1989a Designing GIS to control misuse of spatial information *Proceedings URISA 89 Conference, Boston* 4: 245–55

Beard M K 1989b Use error: the neglected error component. Proceedings, AutoCarto 9: 808–17

Beard M K 1991 Constraints on rule formation. In Buttenfield B P, McMaster R B (eds) *Map generalisation: making rules for knowledge representation*. Harlow, Longman: 121–35

Beard M K 1996 A structure for organising metadata collection. Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modeling, Santa Fe. Santa Barbara, NCGIA. CD and http://ncgia.ucsb.edu

Beard M K, Buttenfield B P, Clapham S B (eds) 1991 Executive summary. Scientific report of the specialist meeting on NCGM Research Initiative 7: visualisation of spatial data quality. Technical Paper 91–26. Santa Barbara, NCGIA: iv–v

Beard M K, Mackaness W A 1991 Generalisation operators and supporting structures. *Technical Papers*, ACSM/ASPRS Annual Convention 6 (Proceedings AutoCarto 10): 29–45

Beasley J 1993 Lagrangian heuristics for location problems. European Journal of Operations Research 65: 383–99 Beaumont J R 1981 Location–allocation problems in the plane: a review of some models. *Socioeconomic Planning Sciences* 15: 217–29

Beaumont J R 1991a GIS and market analysis. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, LongmanlNew York, John Wiley & Sons Inc. Vol. 2: 139–51

Beaumont J R 199lb An introduction to market analysis. Concepts and Techniques in Modern Geography 53. Norwich, GeoBooks

Becker R A, Cleveland W S 1987 Brushing scatterplots. *Technometrics* 29: 127–42

Becker R A, Cleveland W S, Shyu M-J 1996 The visual design and control of Trellis display. *Journal of Computational and Graphical Statistics* 5: 123–55

Becker R A, Cleveland W S, Wilks A R 1987 Dynamic graphics for data analysis. *Statistical Science* 2: 355–95

Beckmann N, Kriegel H-P, Schneider R, Seeger B 1990 The Rtree: an efficient and robust access method for points and rectangles. *Proceedings ACM/SIGMOD, Atlantic City*. New York, ACM: 322–31

Bédard Y 1987 Uncertainties in land information systems databases. *Proceedings, Eighth International Symposium on Computer Assisted Cartography (AutoCarto 8):* 175–84

Bédard Y, Caron C, Maamar Z, Moulin B, Vallière D 1996 Adapting data models for the design of spatio-temporal databases. *Computers, Environment and Urban Systems* 20: 19–41

Bédard Y, Larrivée S 1992 Développement des systèmes d'information à référence spatiale: vers l'utilisation d'ateliers de génie logiciel. *Journal of the Canadian Institute of Surveying and Mapping* 46: 423–33

Bédard Y, Sondheim M 1996 Road Network System data model Technical report. Geographic Data. http://www. env.gov.bc.ca/gdbc/rns/

Bednarz S W, Ludwig G 1997 Curricular connections: geography and geographic information systems. *Transactions in GIS*

Bell D, Morrey K, Pugh J 1992 Software engineering: a programming approach, 2nd edition. New York, Prentice-Hall

Bell J C, Cunningham R L, Havens M W 1992 Calibration and validation of a soil-landscape model for predicting soil drainage class. *Soil Science Society of America Journal* 56: 1860–6

Bell J C, Cunningham R L, Havens M W 1994 Soil drainage class probability using a soil-landscape model. *Soil Science Society of America Journal* 58: 464–70

Bell S B M, Diaz B M, Holroyd F C 1989 The HOR quadtree: an optimal structure based on a non-square 4-shape. In Brooks S R (ed.) *Mathematics in remote sensing*. Oxford, Clarendon Press: 315–43

Bell S B M, Diaz B M, Holroyd F C, Jackson M J 1983 Spatially referenced methods of processing raster and vector data. *Image and Vision Computing* 1: 211–20

Bell S B M, Holroyd F C 1991 Tesseral amalgamators and hierarchical tessellations. *Image and Vision Computing* 9: 313–28 Ben Akiva M, Lerman S 1985 Discrete choice analysis: theory and application to travel demand. Cambridge (USA), MIT Press

Beniger J R 1986 *The control revolution: technological and economic origins of the information society.* Cambridge (USA), Harvard University Press

Bennett C J 1992 *Regulating privacy: data protection and public policy in Europe and the United States.* Ithaca, Cornell University Press

Bennett K B, Toms M L, Woods D D 1993 Emergent features and graphical elements: designing more effective configurational displays. *Human Factors* 35: 71–97

Bennett R J 1989 Whither models and geography in a postwelfarist world. In MacMillan W (ed.) *Remodelling geography*. Oxford, Basil Blackwell: 373–90

Bennett R J, Chorley R J 1978 Environmental systems: philosophy analysis and control. London, Methuen

Benoit D, Clarke G P 1997 Assessing retail location planning using GIS. Journal of Retailing and Consumer Services 4: 239–58

Bentley J L 1975 Multi-dimensional binary search trees used for associative searching. *Communications of the ACM* 18: 509–17

Bentley J L, Friedman J H 1979 Data structures for range searching. *Computing Surveys* 11: 397–409

Bentley J L, Ottmann T A 1979 Algorithm for reporting and counting geometric intersections. *IEEE Transactions on Computers* 28: 643–7

Berg M de, Dobrindt K T G 1995 On levels of detail in terrains. Proceedings, Eleventh Annual ACM Symposium on Computational Geometry: C26–C27

Berg M de, Kreveld M van, Schirra S 1995 A new approach to sub-division simplification. ACSM/ASPRS Annual Convention and Exposition 4 (Proceedings AutoCarto 12): 79–88

Bern M, Dobkin D, Epstein D, Grossman R 1994 Visibility with a moving point of view. *Algorithmica* 11: 360–78

Bernard M, Miellet P 1996 *GeoCube Version 1.5.* Cambridge (UK), GeoInformation International. CD-ROM

Bernhardsen T 1992 *Geographic information systems*. Arendal, Norway, Viak IT and Norwegian Mapping Authority/ Cambridge (UK), GeoInformation International

Bernknopf R L, Brookshire D L, Soller D R, McKee M J, Sutter J F, Matti J C, Campbell R H 1993 Societal value of geological maps. Washington DC, US Geological Survey

Berry B 1964 Approaches to regional analysis: a synthesis. Annals of the Association of American Geographers 54: 2–11

Berry B J L, Baker A M 1968 Geographic sampling. In Berry B J L, Marble D F (ed.) *Spatial analysis: a reader in statistical geography.* Englewood Cliffs, Prentice-Hall: 91–100

Berry B J L, Marble D F (eds) 1968 Spatial analysis: a reader in statistical geography. Englewood Cliffs, Prentice-Hall

Berry J K 1987 Fundamental operations in computer-assisted map analysis. *International Journal of Geographical Information Systems* 1: 119–36

Berry J K 1996 GIS concepts gCON digital slide show.

Cambridge (UK), GeoInformation International. CD-ROM

Bertalanffy L von 1969 General systems theory: foundations, development and applications. New York, Braziller

Bertazzon S, Crouch G, Draper D, Waters N 1997 GIS applications in tourism marketing: current uses, an experimental application and future prospects. *Journal of Travel and Tourism Marketing* 6: 35–59

Bertazzon S, Waters N M 1996 The use of GIS applications on the Internet for marketing tourist destinations. *Proceedings GIS/LIS* 96. Falls Church, ACSM/ASPRS: 870–81

Bertin J 1983 Semiology of graphics: diagrams, networks, maps. Madison, University of Wisconsin Press

Bertuglia C S, Clarke G P, Wilson A G 1994 (eds) *Modelling* the city: planning performance and policy. London, Routledge

Besag J 1974 Spatial interaction and the statistical analysis of lattice systems (with discussion). *Journal of the Royal Statistical Society*, Series B 36: 192–236

Besag J 1975 Statistical analysis of non-lattice data. *The Statistician* 24: 179–96

Besag J 1977 Discussion following Ripley. *Journal of the Royal Statistical Society B* 39: 193–5

Besag J E, Newell J 1991 The detection of clusters in rare diseases. *Journal of the Royal Statistical Society A* 154: 143–55

Best R H 1981 Land use and living space. London, Methuen

BEV 1991 Databases of real estates. Vienna, Bundesamt für Eich- und Vermessungswesen: 1–26

Beven K 1989 Changing ideas in hydrology – the case of physically-based models. *Journal of Hydrology* 105: 157–72

Bezdek J C 1981 Pattern recognition with fuzzy objective function algorithms. New York, Plenum Press

Bezdek J C 1994 What is computational intelligence? In Zurada J M, Marks R J R, Robinson C J (eds) Computational intelligence: imitating life. New York, IEEE: 1–12

Bezdek J C, Ehrlich R, Full W 1984 FCM: the fuzzy *c*-means algorithm. *Computers and Geosciences* 10: 191–203

Bhaskar R 1978 A realist theory of science. Brighton, Harvester

Bhopal R, Diggle P J, Rowlingson B S 1992 Pinpointing clusters of apparently sporadic Legionnaire's disease. *British Medical Journal* 304: 1022–7

Bibby P R 1992 Postcodes in town planning. In Raper J, Rhind D W, Shepherd J W (eds) *Postcodes the new geography*. Harlow, Longman: 230–3

Bibby P R, Coppin P 1994 Analyses of land use change statistics. *SERRL Occasional Monographs No. 1*. London, Birkbeck College Department of Geography

Bibby P R, Shepherd J W 1990 Rates of urbanisation in England 1991–2001. London, Her Majesty's Stationery Office

Bibby P R, Shepherd J W 1992 GIS: strategic choice or laundry list? Proceedings Association for Geographic Information Annual Conference Birmingham, England: 2.31.1–2.31.7

Bibby P R, Shepherd J W 1996 Urbanisation in England: projections 1991–2016. London, Her Majesty's Stationery Office

Bibby P R, Shepherd J W 1997 Projecting rates of urbanisation in England 1991–2016: method, policy applications and results. *Town Planning Review* 68: 93–124

Bicking B, Beard M K 1995 Toward implementing a formal approach to automate thematic accuracy checking for digital cartographic datasets. *Proceedings AutoCarto 12*: 355–62

Binley A, Beven K 1992 Three-dimensional modelling of hillslope hydrology. *Hydrological Processes 6*: 347–59

Birkin M 1994 Understanding retail interaction patterns: the case of the missing performance indicators. In Bertuglia C S, Clarke G P, Wilson A G (eds) *Modelling the city*. London, Routledge: 105–20

Birkin M 1995 Customer targeting, geodemographics and lifestyle approaches. In Longley P, Clarke G (eds) GIS for business and service planning. Cambridge (UK), GeoInformation International: 104–49

Birkin M 1996 Retail location modelling in GIS. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 207–26

Birkin M, Clarke G P, Clarke M, Wilson A G 1987 GIS and spatial modelling: ships in the night, or the beginnings of a relationship? *Working Paper 498*. School of Geography, University of Leeds

Birkin M, Clarke G, Clarke M, Wilson A 1996 *Intelligent GIS: location decisions and strategic planning.* Cambridge (UK), GeoInformation International

Birkin M, Clarke M, George F 1995 The use of parallel computers to solve non-linear spatial optimisation problems: an application to network planning. *Environment and Planning A* 27: 1049–68

Birkin M, Foulger F 1992 Sales performance and sales forecasting using spatial interaction modelling: the W H Smith approach. *Working Paper 92/21*. School of Geography, University of Leeds

Birnie R 1996 *Methodologies for detecting national land cover changes in Scotland.* Report on behalf of the Scottish Office Agriculture, Environment and Fisheries Department

Bithell J 1990 An application of density estimation to geographical epidemiology. *Statistics in Medicine* 9: 691–701

Blais A, Massicotte L 1996 Electoral systems. In LeDuc L, Niemi R G, Norris P (eds) Comparing democracies: elections and voting in global perspective. Thousand Oaks, Sage Publications: 49–82

Blakemore M 1983 Generalisation and error in spatial databases. *Cartographica* 21: 131–9

Blakemore M 1985 High or low resolution? Conflicts of accuracy, cost, quality and application in computer mapping. *Computers and Geosciences* 11: 345–8

Blalock M 1964 *Causal inferences in nonexperimental research.* Chapel Hill, University of North Carolina

Blanchard G 1996 Intelligent transportation systems and

highway infrastructure. Report TP12836E, Special Infrastructure Report, Economic Analysis, Transport Canada, Ottawa

Blelloch G E 1990 Vector models for data-parallel computing. Cambridge (USA), MIT Press

Bliss N B 1990 A hierarchy of soil databases for calibrating models of global climate change. In Bouwman W (ed.) *Soils and the Greenhouse Effect*. New York, John Wiley & Sons Inc.: 529–33

Bliss N B, Reybold W U 1989 Small-scale digital soil maps for interpreting natural resources. *Journal of Soil and Water Conservation* 44: 30–4

Blöschl G, Sivaplan M 1995 Scale issues in hydrological modelling: a review. *Hydrological Processes* 9: 313–30

Board C 1993 Spatial processes. In Kanakubo T (ed.) *The* selected main theoretical issues facing cartography: report of the ICA Working Group to Define the Main Theoretical Issues in Cartography. Cologne, International Cartographic Association: 21–4

Bober M L, Wood D, McBride R A 1996 Use of digital image analysis and GIS to assess regional soil compaction risk. *Photogrammetric Engineering and Remote Sensing* 62: 1397–404

Bocco G, Sanchez R, Riemann H 1995 GIS affects flood planning efforts. *GIS World* 8(2): 58–60

Bogaert P 1996 Comparison of Kriging techniques in a spacetime context. *Mathematical Geology* 28: 73–83

Bohme R 1989 Inventory of world topographic mapping. Vols I-III. London, Elsevier Applied Science

Boissonnat J D, Dobrindt K 1992 On-line construction of the upper envelope of triangles in R³. In Wang C A (ed.) Proceedings, Fourth Canadian Conference on Computational Geometry: 311–15

Bolstad P V, Stowe T 1994 An evaluation of DEM accuracy: elevation, slope, and aspect. *Photogrammetric Engineering and Remote Sensing* 60: 1327–32

Bomford G 1980 Geodesy, 4th edition. Oxford, Clarendon Press

Bonham-Carter G F 1994 Geographical information systems for geo-scientists: modelling with GIS. New York, Pergamon Press

Bonham-Carter G F, Agterberg F P, Wright D F 1988 Integration of geological datasets for gold exploration in Nova Scotia. *Photogrammetric Engineering and Remote Sensing* 54: 1585–92

Bonissone P P, Decker K 1986 Selecting uncertainty calculi and granularity: an experiment in trading-off precision and complexity. In Kanal L N, Lemmer J F (eds) *Uncertainty in artificial intelligence*. Amsterdam, Elsevier Science

Bonsall P, Bell M (eds) 1987 Information technology applications in transport. Utrecht, VNU Science Press

Booch G 1994 *Object-oriented analysis and design with applications*, 2nd edition. Redwood City, Benjamin Cummings

Booch G, Rumbaugh J, Jacobson I 1996 The Unified Modeling Language for object-oriented development. Documentation set Version 0.9 addendum. Santa-Clara, Rational Software Corporation. http://www.rational.com/ot/uml.html Boochs F, Kupfer G, Dockter K, Kuhbauch W 1990 Shape of the red-edge as a vitality indicator for plants. *International Journal of Remote Sensing* 11: 1741–53

Boots B N 1979 The topological structure of area patterns: Indian administrative divisions. *The National Geographical Journal of India* 25: 149–53

Boots B N 1980 Packing polygons: some empirical evidence. The Canadian Geographer 24: 406–11

Boots B N 1986 Voronoi (Thiessen) polygons. Concepts and Techniques in Modern Geography 45. Norwich, GeoBooks

Boots B N, Getis A 1988 *Point pattern analysis*. Newbury Park, Sage Publications

Boots B N, Kanaroglou P S 1988 Incorporating the effect of spatial structure in discrete choice models of migration. *Journal of Regional Science* 28: 495–507

Borning A 1986 Defining constraints graphically. In Mantei M, Orbeton P (eds) *Human factors in computing systems*, CHI 86 conference proceedings. Boston, ACM Press: 137–43

Bose P, Kirkpatrick D, Li Z 1996 Efficient algorithms for guarding or illuminating the surface of a polyhedral terrain. In Fiala F, Kranakis E, Sack J R (eds) *Proceedings, Canadian Conference on Computational Geometry*: 217–22

Bouma J 1995 Methods to characterize soil resource variability in space and time. In Robert P C, Rust R H (eds) *Site-specific management for agricultural systems.* Madison, American Society of Agronomy: 251–71

Bovy P H L, Stern E 1990 Route choice: wayfinding in transport networks. Dordrecht, Kluwer

Boyle P J, Dunn C E 1991 Redefinition of enumeration district centroids: a test of their accuracy using Thiessen polygons. *Environment and Planning A* 23: 1111–19

Bracken I, Martin D 1995 Linkage of the 1981 and 1991 censuses using surface modelling concepts. *Environment and Planning A* 27: 379–90

Bradley R, Haslett J 1992 High interaction diagnostics for geostatistical models of spatially referenced data. *The Statistician* 41: 371–80

Braga M, Cislaghi C, Luppi G, Tasco C 1998 A multipurpose, interactive mortality atlas of Italy. In Gatrell A C, Löytönen M (eds) GIS and health. London, Taylor and Francis

Brainard J, Lovett A, Parfitt J 1996 Assessing hazardous waste transport risks using a GIS. *International Journal of Geographical Information Systems* 10: 831–49

Brand M, Burrough P, Salgé F, Schüller K 1993 Report of the committee for investigating the feasibility of creating a European Umbrella Organisation for Geographic Information – Phase II. Proposals for setting up EUROGI. Luxembourg, Commission of the European Communities DG XIII-E2 (Information Technology)

Brand S 1987 The media lab. New York, Viking

Brandeau M L, Chiu S S 1989 An overview of representative problems in location research. *Management Science* 35: 645–74 Brandenberger A J, Ghosh S K 1990 Status of world topographic and cadastral mapping. *World Cartography*. New York, United Nations Vol. XX: 1–102

Brandenberger C 1995 From digital cadastral data to large-scale topographic maps. Cartography crossing borders (Proceedings, Seventeenth International Cartographic Conference). Barcelona. Institut Cartografic de Catalunva: 1771–80

Branscomb A W 1994 *Who owns information?* New York, Basic Books

Brassel K, Bucher F, Stephan E-M, Vckovski A 1995 Completeness. In Guptill S C, Morrison J L (eds) *Elements* of spatial data quality. Oxford, Elsevier Science: 81–108

Brassel K, Weibel R 1988 A review and framework of automated map generalisation. *International Journal of Geographical Information Systems* 2: 229–44

Breckling B, Müller F 1994 Current trends in ecological modelling and the Eighth ISEM conference on the state-ofthe-art. *Ecological Modelling* 75/76: 667–75

Breheny M (ed.) 1992 Sustainability and urban form. London, Pion

Breininger D R, Provancha M J, Smith R B 1991 Mapping Florida's shrub jay habitat for purposes of land management. *Photogrammetric Engineering and Remote Sensing* 57: 1467–74

Brewer C A 1994 Colour use guidelines for mapping and visualisation. In MacEachren A, Taylor D R F (eds) 1994 Visualisation in modern cartography. Oxford, Elsevier Science: 123–8

Bridgewater P B 1993 Landscape ecology, geographical information systems and nature conservation. In Haines-Young R, Green D R, Cousins S (eds) *Landscape ecology and geographical information systems*. London, Taylor and Francis: 23–36

Briggs I C 1974 Machine contouring using minimum curvature. *Geophysics* 39: 39–48

Brill E D Jr 1979 The use of optimisation in public sector planning. *Management Science* 25: 413–21

Brody H 1981 Maps and dreams; Indians and the British Columbia frontier. Harmondsworth, Penguin

Bromley R, Coulson M 1989 The value of corporate GIS to local authorities: evidence of a needs study in Swansea City Council. *Mapping Awareness* 3(5): 32–5

Brooks F 1995 The mythical man month. Essays on software engineering. Reading (USA), Addison-Wesley

Broome F R, Meixler D B 1990 The TIGER database structure. In Marx R W (ed.) *The Census Bureau's TIGER* system. Bethesda, ACSM: 39–47

Brown J F, Loveland T R, Merchant J W, Reed B C, Ohlen D O 1993 Using multisource data in global land-cover characterization: concepts, requirements, and methods. *Photogrammetric Engineering and Remote Sensing* 59: 977–87

Brown P J B, Hirschfield A F G, Batey P W J 1991 Applications of geodemographic methods in the analysis of health condition

incidence data. Papers in Regional Science 70: 329-44

Brown P J B, Todd P, Bundred P 1995 Geodemographics and GIS in small area demographic analysis: applying Super Profiles in district health care planning. *GIS Case Study Briefing Note 5*. Warrington, North West Regional Health Authority

Brown R 1993 Market focus: achieving and sustaining market effectiveness. Oxford, Butterworth-Heinemann

Brown R B, Steckler G A, Anderson G W 1994 Remote sensing for identification of weeds in no-till corn. *Transactions of the American Society of Agricultural Engineers* 37: 297–302

Brown W M, Astley M, Baker T, Mitasova H 1995 GRASS as an integrated GIS and visualization environment for spatiotemporal modeling. *Proceedings AutoCarto 12, Charlotte*. ACSM/ASPRS: 89–99

Bruns T, Egenhofer M 1997 User interfaces for map algebra. Journal of the Urban and Regional Information Systems Association 9: 44–54

Brunsdon C, Charlton M 1996 Developing an exploratory spatial analysis system in Xlisp-Stat. In Parker D (ed.) *Innovation in GIS 3*. London, Taylor and Francis: 135–45

Brussard P F 1991 The role of ecology in biological conservation. *Ecological Applications* 1: 6–12

Bruzewicz A J 1994 Remote sensing and GIS for emergency management. *Proceedings, First Federal Geographic Technology Conference*. Washington DC, GIS World Inc. 1: 161–4

Bruzzone E, De Floriani L, Magillo P 1995 Updating visibility information on multi-resolution terrain models. In Frank A U, Kuhn W (eds) *Proceedings, Conference on Spatial Information Theory (COSIT 95)*. Lecture Notes in Computer Science 988. Berlin, Springer: 279–96

Buckland S T, Elston D A 1993 Empirical models for the spatial distribution of wildlife. *Journal of Applied Ecology* 30: 478–95

Buehler K, McKee L 1996 The Open GI guide: introduction to interoperable geoprocessing. The Open GIS Consortium Inc.: 96–101

Buja A, Cook D, Swayne D F 1996 Interactive highdimensional data visualization. *Journal of Computational* and Graphical Statistics 5: 78–99

Buja A, McDonald J A, Michalak J, Stuetzle W 1991 Interactive data visualization using focusing and linking. In Nielson G M, Rosenblum L (eds) *Proceedings of Visualization 91*. Los Alamitos, IEEE Computer Society Press: 155–62

Bullen N, Moon G, Jones K 1996 Defining localities for health planning: a GIS approach. *Social Science and Medicine* 42: 801–16

Bunce R G H, Barr C J, Fuller R M 1992 Integration of methods for detecting land use change, with special reference to Countryside Survey 1990. In Whitby M C (ed.) Land use change: the causes and consequences. London, Her Majesty's Stationery Office: 69–78

Bundy G L, Jones C B, Furse E 1995 Holistic generalisation of large-scale cartographic data. In Müller J-C, Lagrange J-P, Weibel R (eds) *GIS and generalisation: methodological and*

practical issues. London, Taylor and Francis: 106-19

Burdea G, Coiffet P 1994 Virtual reality technology. New York, John Wiley & Sons Inc.

Bureau of the Census 1982 *Census of Population and Housing*. Washington DC, US Department of Commerce

Burke I C, Schimel D S, Yonker C M, Parton W J, Joyce L A, Lauenroth W K 1990 Regional modelling of grassland biogeochemistry using GIS. *Landscape Ecology* 4: 45–54

Burke L M 1993 Race and environmental equity: a geographical analysis of Los Angeles. Geo Info Systems 3(9): 44–50

Burley T M 1961 Land use or land utilisation? *Professional* Geographer 13: 18–20

Burns T, Hendersen J 1989 Education and training in GIS: the view from ESRI. *Proceedings AutoCarto* 9: 31–7

Burrough P A 1981 Fractal dimensions of landscapes and other environmental data. *Nature* 294: 240–2

Burrough P A 1986 Principles of geographical information systems for land resources assessment. Oxford, Clarendon Press

Burrough P A 1989 Fuzzy mathematical methods for soil survey and land evaluation. *Journal of Soils Science* 40: 477–92

Burrough P A 1991 Soil information systems. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 153–64

Burrough P A 1992a Are GIS data structures too simple minded? *Computers and Geosciences* 18: 395–400

Burrough P A 1992b Development of intelligent geographical information systems. *International Journal of Geographical Information Systems* 6: 1–11

Burrough P A 1992c The development of intelligent geographical information systems. *Proceedings, Second European Conference on GIS (EGIS 91), Brussels* 1: 165–74

Burrough P A 1996 Natural objects with indeterminate boundaries. In Burrough P A, Frank A U (eds) *Geographic* objects with indeterminate boundaries. London, Taylor and Francis: 3–28

Burrough P A, Craglia M, Masser I, Rhind D 1997 Decisionmakers' perspectives on European geographic information policy issues. *Transactions in GIS* 2: 61–71

Burrough P A, Craglia M, Masser I, Salgé F 1997 Geographic information: the European dimension. GIS Data Newsletter 8: 6–16. Strasbourg, European Science Foundation (see also http://www.sheff.ac.uk/unil/academic/D–H/gis/gisdata.html)

Burrough P A, Frank A U 1995 Concepts and paradigms in spatial information: are current geographical information systems truly generic? *International Journal of Geographical Information Systems* 9: 101–16

Burrough P A, Frank A U (eds) 1996 *Geographic objects with indeterminate boundaries*. London, Taylor and Francis

Burrough P A, MacMillan R A, Deursen W van 1992 Fuzzy classification methods for determining land suitability from soil profile observations and topography. *Journal of Soil*

Science 43: 193-210

- Burrough P A, McDonnell R A 1998 *Principles of* geographical information systems, 2nd edition. Oxford, Oxford University Press
- Burton I, Kates R W, White G F 1993 *The environment as hazard.* New York, Guilford Press
- Burton L L 1989 Analysis of the county level land information system in the State of Florida: user trends and perceived accuracy requirements. *Proceedings GIS/LIS 89 Conference* 1: 348–65

Burton P J, Balisky A C, Coward L P, Cumming S G, Kneeshaw D D 1992 The value of managing for biodiversity. *The Forestry Chronicle* 68: 225–37

Butler D, McLean 1996 The redrawing of political boundaries in Britain. In McLean I, Butler D (eds) *Fixing the boundaries: defining and redefining single-member electoral districts*. Aldershot, Dartmouth Publishing: 1–38

Buttenfield B P 1985 Treatment of the cartographic line. *Cartographica* 22: 1–26

Buttenfield B P, Beard M K 1994 Graphical and geographical components of data quality. In Hearnshaw H, Unwin D J (eds) Visualisation in geographical information systems. Chichester, John Wiley & Sons: 150–7

- Buttenfield B P, DeLotto J S 1989 Multiple representations: scientific report for the specialist meeting. *NCGIA Technical Report 89–3*. Santa Barbara, NCGIA
- Buttenfield, B P, McMaster R B (eds) 1991 *Map* generalisation: making rules for knowledge representation. Harlow, Longman
- Buttimer A 1993 *Geography and the human spirit*. Baltimore, Johns Hopkins University Press

Buxton W, Gaver W, Bly S 1993 Auditory interfaces: the use of non-speech audio at the interface. Cambridge (UK), Cambridge University Press

- Bydler R, Nilsson A 1977 The Swedish road data bank and its use in road planning. *Cartographica*, Monograph 20: 68–84
- Cahn M D, Hummel J W, Brouer B H 1994 Spatial analysis of soil fertility for site-specific management. *Soil Science Society of America Journal* 58: 1240–8

Cain B E 1984 *The reapportionment puzzle*. Berkeley, University of California Press

Calhoun C, Drummond W, Whittington D 1987 Computerised information management in a system-poor environment: lessons from the design and implementation of a computer system for the Sudanese Planning Ministry. *Third World Planning Review* 9: 361–79

Caliper Corporation 1996a Routing and Logistics with TransCAD 3.0. Newton, Caliper Corporation

Caliper Corporation 1996b *Travel demand modeling with TransCAD 3.0.* Newton, Caliper Corporation

Calvert C, Murray K, Smith N S 1997 New technology and its impact on the framework for the world. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 133–59 Câmara A, Gomes A L, Fonseca A, Lucena e Vale M J 1991 Hypersnige – a navigation system for geographic information. *Proceedings, European GIS Conference*, Brussels, April: 175–9

Campbell C S, Egbert S L 1990 Animated cartography: 30 years of scratching the surface. *Cartographica* 27: 24–46

Campbell H J 1992 Organisational issues in the implementation of GIS in Massachusetts and Vermont: some lessons for the UK. *Environment and Planning B: Planning and Design* 19: 85–95

Campbell H J 1994 How effective are GIS in practice? A case study of British local government. *International Journal of Geographical Information Systems* 8: 309–25

Campbell H J 1996 Theoretical perspectives on the diffusion of GIS technologies. In Masser I, Campbell H, Craglia M (eds) GIS diffusion: the adoption and use of geographic information systems in local government in Europe. London, Taylor and Francis: 23–45

Campbell H J, Masser I 1995 GIS and organisations: how effective are GIS in practice? London, Taylor and Francis

Campbell H J, Masser I, Poxon J, Sharp E 1993 Monitoring the take up of GIS in British local government. London, Local Government Management Board

Campbell J B 1984 *Introductory cartography*. Englewood Cliffs, Prentice-Hall

Campbell J B 1987 Introduction to remote sensing. New York, Guilford Press

Campbell J C, Radke J, Gless J T, Wirtshafter R M 1992 An application of linear programming and geographic information systems: cropland allocation in Antigua. *Environment and Planning A* 24: 535–49

Campbell W G, Church M R, Bishop G D, Mortenson D C, Pierson S M 1989 The role for a geographical information system in a large environmental project. *International Journal* of Geographical Information Systems 3: 349–62

Camus J-P, Fortin M 1995 *Road transport informatics: institutional and legal issues.* Paris, European Conference of Ministers of Transport

Carbone G J, Narumalani S, King M 1996 Application of remote sensing and GIS technologies with physiological crop models. *Photogrammetric Engineering and Remote Sensing* 62: 171–9

Carbonell J G 1990 Introduction: paradigms for machine learning. In Carbonell J (ed.) *Machine learning: paradigms and methods*. Cambridge (USA), MIT Press

Carey H C 1858 *Principles of social science*. Philadelphia, Lippincott

Carmichael A (ed.) 1995 *Object development methods*. New York, SIGS Books

Caron C, Bédard Y 1993 Extending the individual formalism for a more complete modeling of urban spatially referenced data. *Computers, Environment and Urban Systems* 17: 337–46

Carr P M, Carlson G R, Jacobsen J S, Nielsen G A, Scogley E O

1991 Farming soils, not fields: a strategy for increasing fertilizer profitability. *Journal of Production Agriculture* 4: 57–61

- Carstairs A McL 1980 A short history of electoral systems in Western Europe. London, Allen and Unwin
- Carstairs V, Morris R 1991 *Deprivation and health in Scotland*. Aberdeen, Aberdeen University Press
- Carter J R 1988 Digital representations of topographic surfaces. *Photogrammetric Engineering and Remote Sensing* 54: 1577–80
- Carter J R 1992 The effect of data precision on the calculation of slope and aspect using gridded DEMs. *Cartographica* 29: 22–34
- Cartwright J 1990 CAMEO present and future. GIS World December: 78–80
- Carver S J 1991 Integrating multi-criteria evaluation with geographical information systems. *International Journal of Geographical Information Systems* 5: 321–39
- Casetti E 1972 Generating models by the expansion method: applications to geographic research. *Geographical Analysis* 4: 81–91
- Casetti E, Poon J 1995 Econometric models and spatial parametric instability: relevant concepts and an instability index. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics*. Berlin, Springer: 301–21
- Caspary W, Scheuring R 1993 Positional accuracy in spatial databases. *Computers, Environment and Urban Systems* 17: 103–10
- Cassettari S 1993 Introduction to integrated geoinformation management. London, Chapman and Hall
- Casti J L 1989 Alternative realities: mathematical models of nature and man. Chichester, John Wiley & Sons
- Casti J L 1997 Would-be worlds. Chichester, John Wiley & Sons
- Catling I (ed.) 1994 Advanced technology for road transport: IVHS and ATT. Boston (USA), Artech House
- CBRED 1995 *The Swedish Land Data Bank System*. Gävle Sweden, Central Board for Real Estate Data
- CCGISE/IGISE 1991 GIS curriculum development toolkit. Ottawa, Centre for GIS in Education
- CEN/TC 287 Secretariat 1996 CEN/TC 287 Geographic Information. http://www.statkart.no/sk/standard/cen/
- CEN (Comité Européen de Normalisation) 1995 *Geographic information – data description – quality* (draft). Brussels, CEN Central Secretariat
- Centro Nacional de Epidemiologia 1995 Mortalidad por cancer, Espana 1992. http://www.isciii.es/cancer/mort92.txt
- Ceri S, Gottlob G, Tanca L 1990 Logic programming and databases. Berlin, Springer
- Chakraborty J, Armstrong M P 1996 Using geographic plume analysis to assess community vulnerability to hazardous accidents. *Computers, Environment and Urban Systems* 19: 341–56
- Chamberlin D, Boyce R 1974 SEQUEL: a structured English

query language. Proceedings ACM SIGFIDET Workshop Conference, New York. ACM Press: 249–64

- Chambers J M, Cleveland W S, Kleiner B, Tukey P 1983 Graphical methods for data analysis. Boston, Duxbury Press
- Chamoux J P, Ronai M 1996 Exploiter les données publiques. Paris, A Jour
- Champine G A, Coop R D, Heinselman R C 1980 Distributed computer systems. Amsterdam, Elsevier Science
- Chang H, McMaster R B 1993 Interface design and knowledge acquisition for cartographic generalisation. *Proceedings AutoCarto 9.* Bethesda, ACSM/ASPRS: 187–96
- Chapal S E, Edwards D 1994 Techniques for visualisation and quality control. In Michener W K, Brunt J W, Stafford S G (eds) *Environmental information management and analysis: ecosystem to global scales.* London, Taylor and Francis: 141–59
- Chazelle B, Edelsbrunner H 1992 An optimal algorithm for intersecting line segments in the plane. *Journal of the Association for Computing Machinery* 39: 1–54
- Checkland P 1981 Systems thinking, systems practice. Chichester, John Wiley & Sons
- Chen P P-S 1976 The entity-relationship model toward a unified view of data. ACM Transactions on Database Systems 1: 9–36
- Chen Z T, Tobler W R 1986 Quadtree representation of digital terrain. *Proceedings AutoCarto*: 475–84
- Chisholm G, Lenthall P 1991 Combining GPS and echo sounders to monitor river siltation. GISWorld 5(2): 46-8
- Chiu S N 1995 A comment on Rivier's maximum entropy method of statistical crystallography. *Journal of Physics A: Mathematical and General* 28: 607–15
- Choo Y K 1996 'Interactive distributed geographical information systems (IDGIS)'. Unpublished Master's Research Project, Department of Rangeland Ecology and Management, Texas A&M University. *http://starr-www. tamu.edu/choolidgis/intro.html*
- Chorafas D 1980 Computer networls for distributed information systems. New York, Petrocelli Books
- Chorley R J, Haggett P 1965 Trend surface models in geographical research. *Transactions of the Institute of British Geographers* 37: 47–67
- Chorley R J, Kennedy B A 1971 *Physical geography: a systems approach.* London, Prentice-Hall
- Chou Y H 1992 Management of wildfires with a geographical information system. *International Journal of Geographical Information Systems* 6: 123–40
- Chrisman N R 1982 A theory of cartographic error and its measurement in digital databases. *Proceedings AutoCarto 5*: 159–68
- Chrisman N R 1987a Directions for research in GIS. Proceedings IGIS Symposium 1: 101–12
- Chrisman N R 1987b The accuracy of map overlays: a reassessment. *Landscape and Urban Planning* 14: 427–39

Chrisman N R 1988 The risk of software innovation: a case study of the Harvard lab. *American Cartographer* 15: 291–300

Chrisman N R 1991a A geography of geographic information: placing GIS in cultural and historical context. *Mimeo*

Chrisman N R 1991b The error component in spatial data. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications.* Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 165–74

Chrisman N R 1994 'Beyond the snapshot: changing the approach to change, error, and process'. Unpublished manuscript

Chrisman N R 1997 *Exploring geographic information Systems*. New York, John Wiley & Sons Inc.

Christaller W 1935 Die zentralen Orte in Suddeutschland. Jena, G Fischer

Christian E 1996 GILS. What is it? Where is it going? *D-Lib* Magazine. December 1996. http://www.dlib.org/dlib/ december96/12christian.html

Chui C K 1988 *Multivariate splines*. Philadelphia, Society for Industrial and Applied Mathematics

Chui C K 1992 An introduction to wavelets. San Diego, Academic Press

Church R L, Loban S R, Lombard K 1992 An interface for exploring spatial alternatives for a corridor location problem. *Computers and Geosciences* 18: 1095–1105

Church R L, ReVelle C S 1974 The maximal covering location problem. *Papers of the Regional Science Association* 32: 101–18

Church R L, ReVelle C S 1976 Theoretical and computation links between the *p*-median, location set covering, and the maximal covering location problems. *Geographical Analysis* 8: 406–15

Church R L, Sorensen P 1996a Integrating normative location models into GIS: problems and prospects with the p-median model. Technical Report 94–5. Santa Barbara, NCGIA

Church R L, Sorensen P 1996b Integrating normative location models into GIS: problems and prospects with the *p*-median model. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 167–83

Church R L, Stoms D M, Davis F W 1996 Reserve selection as a maximal covering location problem. *Biological Conservation* 76: 105–12

Church R L, Weaver J R 1986 Theoretical links between median and coverage location problems. *Annals of Operations Research* 6: 1–19

Churcher M, Churcher C 1996 GROUPARC: a collaborative approach to GIS. In Pascoe R T (ed.) *Proceedings, Eighth Annual Colloquium of the Spatial Information Research Centre*. Dunedin, University of Otago: 156–63

Chuvieco E 1993 Integration of linear programming and GIS for land-use modelling. *International Journal of Geographical Information Systems* 7: 71–83 Cignoni P, Puppo E, Scopigno R 1995 Representation and visualization of terrain surfaces at variable resolution. In Scateni R (ed.) *Proceedings, International Symposium on Scientific Visualization.* Singapore, World Scientific. *http: //www.disi.unige.it/person/PuppoE*

Cislaghi C, Biggeri A, Braga M, Lagazio C, Marchi M 1995 Exploratory tools for disease mapping in geographical epidemiology. *Statistics in Medicine* 14: 2663–82

Clark J D, Dunn J E, Smith K G 1993 A multivariate model of female black bear habitat use for a geographical information system. *Journal of Wildlife Management* 57: 519–26

Clark P J, Evans F C 1954 Distances to nearest neighbour as a measure of spatial relationships in populations. *Science* 121: 397–8

Clark S C, Starr J, Acevedo W, Solomon C 1996 Development of the temporal transportation database for the analysis of urban development in the Baltimore–Washington region. *Proceedings Annual ACSM/ASPRS Conference*. Falls Church, ACSM/ASPRS 3: 77–88

Clark W A V 1969 Applications of spacing models in intracity studies. *Geographical Analysis* 1: 391–9

Clarke A L, Grün A, Loon J C 1982 The application of contour data for generating high fidelity grid digital elevation models. *Proceedings AutoCarto 5*. Falls Church, ACSM/ASPRS: 213–22

Clarke G P, Clarke M 1995 The development and benefits of customised spatial decision support systems. In Longley P, Clarke G P (eds) GIS for business and service planning. Cambridge (UK), GeoInformation International: 227–45

Clarke G P, Longley P, Masser I 1995 Business, geography and academia in the UK. In Longley P, Clarke G P (eds) *GIS for business and service planning*. Cambridge (UK), GeoInformation International: 272–81

Clarke G P, Wilson A G 1994 A new geography of performance indicators. In Bertuglia C S, Clarke G P, Wilson A G (eds) *Modelling the city*. London, Routledge: 55–81

Clarke G P, Beckett P 1971 *The study of soils in the field*, 5th edition. Oxford, Clarendon Press

Clarke K C 1995 Analytical and computer cartography, 2nd edition. Englewood Cliffs, Prentice-Hall

Clarke K C 1997 *Getting started with geographic information* systems. Upper Saddle River, Prentice-Hall

 Clarke M, Clarke G 1995 The development and benefits of customised spatial decision support systems. In Longley P A, Clarke G (eds) *GIS for business and service planning*.
 Cambridge (UK), GeoInformation International: 227–46

Clarke M, Wilson A G 1987 Towards an applicable human geography: some developments and observations. *Environment and Planning A* 19: 1525–42

Clarke R 1994 The digital persona and its application to data surveillance. *The Information Society* 10: 77–94

Clarkson K L, Shor P W 1989 Application of random sampling in computer geometry. *Discrete and Computational Geometry* 4: 387–421

Clayton A M H, Radcliffe N J 1996 Sustainability: a systems approach. London, Earthscan Publications

Cleveland W S 1979 Robust locally weighted regression and smoothing scatter plots. *Journal of the American Statistical Association* 74: 829–36

Cleveland W S 1993 Visualising data. Murray Hill, AT&T Bell Laboratories

Cleveland W S, McGill M E (eds) 1988 *Dynamic graphics for statistics*. Pacific Grove, Wadsworth

Cleveland W S, McGill R 1984 Graphical perception: theory, experimentation and application to the development of graphical methods. *Journal of the American Statistical Association* 79: 531–53

Cliff A D, Haggett P 1988 Atlas of disease distributions: analytic approaches to epidemiological data. Oxford, Blackwell

Cliff A D, Ord J K 1973 Spatial autocorrelation. London, Pion

Cliff AD, Ord J K 1981a Spatial and temporal analysis: autocorrelation in space and time. In Wrigley N, Bennett R J (eds) *Quantitative geography: a British view*. London, Routledge: 104–10

Cliff A, Ord J K 1981b Spatial processes: models and applications. London, Pion

Clifford E 1996 Electoral Distribution and Mapping System (EDAMS). Mapping Sciences Institute of Australia, *Technical Papers of the Mapping Sciences 96 Conference*: 360–6

Clifford J, Tuzhilin A 1995 Recent advances in temporal databases. *Proceedings, International Workshop on Temporal Databases, Zurich, Switzerland.* Berlin, Springer

Cline N, Adler P 1995 GIS and research libraries: one perspective. *Information Technology and Libraries* 14: 114

Clinton W J 1994 Executive Order 12906. *Coordinating* geographic data acquisition and access: the National Spatial Data Infrastructure. Washington DC: 2 pp

ClockWork Software 1995 *Centennia*. PO Box 148036, Chicago 60614, USA

Clogg R 1983 Greece. In Bogdanor V, Butler D (eds) Democracy and elections. Cambridge (UK), Cambridge University Press: 190–208

Coad P, Yourdon E 1991a *Object-oriented analysis*, 2nd edition. Englewood Cliffs, Prentice-Hall

Coad P, Yourdon E 1991b *Object-oriented design*. Englewood Cliffs, Prentice-Hall

Codd E 1970 A relational model for large shared data banks. Communications of the ACM 13: 377–87

Codd E 1979 Extending the relational database model to capture more meaning. *ACM Transactions on Database Systems* 4: 397–434

Cohen R B 1992 *The impact of broadband communications on the US economy and on competitiveness.* Washington DC, Economic Strategy Institute

Cohn A G 1995 The challenge of qualitative spatial reasoning. Computing Surveys 273: 323–7 Cole G, MacInnes S, Miller J 1990 Conversion of contoured topography to digital terrain data. *Computers and Geosciences* 16: 101–9

Cole R, Sharir M 1989 Visibility problems for polyhedral terrains. *Journal of Symbolic Computation* 17: 11–30

Coleman A 1962 The Second Land Use Survey: progress and prospect. *Geographical Journal* 127: 168–86

Coleman D J 1994 'Geographic information systems performance in a broadband communications environment'. Unpublished PhD dissertation, Department of Surveying and Spatial Information Science, University of Tasmania

Coleman D J 1995 An overview of groupware. In Coleman D J, Khanna R (eds) *Groupware technology and applications*. Englewood Cliffs, Prentice-Hall

Coleman D J, Brooks R 1995 Applying collaborative production approaches to GIS data collection and electronic chart production. Santa Barbara NCGIA http://www.ncgia.ucsb.edu/research/il7/il7papers.html

Coleman D J, McLoughlin J D 1997a Information access and network usage in the emerging spatial information marketplace. *Journal of Urban and Regional Information Systems* 9(1)

Coleman D J, McLoughlin J D 1997b Towards a global geospatial data infrastructure. *Proceedings, Second GSDI Conference, University of North Carolina, 19–22 October*

Collar N J 1996 The reasons for Red Data Books. *Oryx* 30: 121–30

Collier A 1994 Critical realism. London, Verso

Collins M, Rhind D 1997 Developing global environmental databases: lessons learned about framework information. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 120–9

Collins S, Smallbone K, Briggs D 1995 A GIS approach to modelling small area variations in air pollution within a complex urban environment. In Fisher P (ed.) *Innovations in GIS 2*. London, Taylor and Francis

Columbia Human Rights Law Review 1973 Surveillance, dataveillance, and personal freedoms. Fair Lawn, R E Burdick

Commission of the European Communities 1980 Commission communication on the protection of individuals in relation to the processing of personal data in the Community and information security. Brussels, European Community

Commission of the European Communities 1991 Opinion on the proposal for a Council Directive concerning the protection of individuals in relation to the processing of personal data. Brussels, European Community

Congalton R G 1988 A comparison of sampling schemes used in generating error matrices for accessing the accuracy of maps generated from remotely-sensed data. *Photogrammetric Engineering and Remote Sensing* 54: 593–600

Congalton R G, Mead R A 1983 A quantitative method to test for consistency and correctness in photointerpretation. *Photogrammetric Engineering and Remote Sensing* 49: 69–74

Connor P 1997 Assisting Bell Canada's business

transformation by implementing a world class access network facilities management system. *Paper presented at 'Becoming a Lean Communications Provider, Managing Network Infrastructure'*. Saint-Paul-de-Vence, Unisys International Industry Forum, France, 11–13 June

Conquest J, Speer E 1996 Dissenunating ARC/INFO dataset documentation in a distributed computing environment. Proceedings 1996 ESRI User Conference. Redlands, ESRI. http://www.esri.com/resources/userconfproc96/T0200/PAP1 65/P165.HTM

Conry T, Goldberg J 1994 Integrating facility, comprehensive planning, and environmental management at a large Air Force Base using GIS. *URISA Proceedings*. Washington DC, URISA: 542–53

Cook D, Buja A, Cabrera J, Hurley C 1995 Grand tour and projection pursuit. *Journal of Computational and Graphical Statistics* 4: 155–72

Cook D, Majure J, Symanzik J, Cressie N 1996 Dynamic graphics in a GIS: a platform for analysing and exploring multivariate spatial data. *Computational Statistics* 11: 467–80

Cook S, Daniels J 1994a *Designing object systems: objectoriented modelling with Syntropy.* Englewood Cliffs, Prentice-Hall

Cook S, Daniels J 1994b Software isn't the real world. *Journal* of Object-Oriented Programming (May): 2–28

Coombes M 1995 Dealing with census geography: principles, practice and possibilities. In Openshaw S (ed.) *Census users' handbook*. Cambridge (UK), GeoInformation International

Cooper L 1963 Location–allocation problems. *Operations Research* 11: 331–3

Coopers and Lybrand 1996 Economic aspects of the collection, dissemination and integration of government's geospatial information. Southampton, Ordnance Survey

Copeland G 1982 What if mass storage were free? *Computer* 15: 27–35

Coplien J O 1996 Software patterns. New York, SIGS Books

Coppock J T 1962 Electronic data processing in geographical research. *Professional Geographer* 14: 1–4

Coppock J T 1995 GIS and natural hazards: an overview from a GIS perspective. In Carrara A, Guzzetti F (eds) *Geographical information systems in assessing natural hazards*. Dordrecht, Kluwer: 21–34

Coppock J T, Kirby R P 1987 *Review of approaches and sources for monitoring changes in land cover*. Edinburgh, Scottish Development Office

Coppock J T, Rhind D W 1991 The history of GIS. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 21–43

Corbett J D, Carter S E 1996 Using GIS to enhance agricultural planning: the example of inter-seasonal rainfall variability in Zimbabwe. *Transactions in GIS* 1: 207–18 Corbley K P 1995 South Florida fine-tunes GIS in hurricane's aftermath. GIS World 8(9): 40–3

Cortese A, Verity J, Rebello K, Hof R 1995 The software revolution: the Internet changes everything. *Business Week* 3453, 4 Dec.: 78–90

Costa-Cabral M, Burges S J 1994 Digital elevation model networks (DEMON): a model of flow over hillslopes for computation of contributing and dispersal areas. *Water Resources Research* 30: 1681–92

Costello B 1996 Trends in client-server architecture in GIS. Slide from invited presentation at 1996 Geomatics Atlantic Conference, Fredericton, New Brunswick, Canada

Cotting C C, Daniels M J 1994 Boston Gas Company – AMMS project. In Kunze A E (ed.) *The best of AM/FM/GIS: a special collection of past conference proceedings for the gas industry*. Aurora, AM/FM International

Couclelis H 1985 Cellular worlds: a framework for modeling micro-macro dynamics. *Environment and Planning A* 17: 585–96

Couclelis H 1988 The truth seekers: geographers in search of the human world. In Golledge R, Couclelis H, Gould P (eds) *A ground for common search*. Santa Barbara, The Santa Barbara Geographical Press: 148–55

Couclelis H 1991 Requirements for a planning-relevant GIS: a spatial perspective. *Papers in Regional Science* 70: 9–19

Couclelis H 1992 People manipulate objects (but cultivate fields): beyond the raster-vector debate in GIS. In Frank A U, Campari I, Formentini U (eds) *Theories and methods of spatio-temporal reasoning in geographic space*. Berlin, Springer: 65–77

Couclelis H 1996 Towards an operational typology of geographic entities with ill-defined boundaries. In Burrough P A, Frank A U (eds) *Geographic objects with indeterminate boundaries*. London, Taylor and Francis: 45–55

Couclelis H 1997 GIS without computers: building geographic information science from the ground up. In Kemp Z (ed.) Innovations in GIS 4: selected papers from the Fourth National Conference on GIS Research UK. London, Taylor and Francis: 219–26

Coulson M R C, Waters N M 1992 Teaching the NCGIA curriculum in practice: assessment and evaluation. *Cartographica* 28: 94–102

Council of Europe 1973 Protection of the privacy of individuals vis-à-vis electronic data banks in the private sector. Strasbourg, Council of Europe

Council of Europe 1981a Convention for the protection of individuals with regard to automatic processing of personal data. Strasbourg, Council of Europe

Council of Europe 198lb *Regulations for automated medical data banks*. Strasbourg, Council of Europe

Council of Europe 1984 Protection of personal data used for scientific research and statistics. Strasbourg, Council of Europe

Council of Europe 1986 Protection of personal data used for the purposes of direct marketing. Strasbourg, Council of Europe

Council of Europe 1989 Protection of personal data used for employment purposes. Strasbourg, Council of Europe

Council of Europe 1990 On the protection of personal data used for payment and other related operations. Strasbourg, Council of Europe

Cova T J, Church R L 1997 Modeling community evacuation using GIS. International Journal of Geographical Information Science 11: 763–84

Cowen D J 1988 GIS versus CAD versus DBMS: what are the differences? *Photogrammetric Engineering and Remote Sensing* 54: 1551–4

Cowen D J 1995 The importance of GIS for the average person. *GIS in government: the federal perspective 1994*. Proceedings First Federal Geographic Technology Conference, 26–28 September 1994. Washington DC, GIS World Inc.: 7–11

Cox D R 1978 Some remarks on the role in statistics of graphical methods. *Applied Statistics* 27: 9

Cox S J D, Kohn B P, Gleadow A J W 1994 Toward a fission track tectonic image of Australia: model based interpolation in the Snowy Mountains using a GIS. Presented at the *Twelth Australian Geological Convention, Perth, W Australia. http: //www.ned.dem.csiro.aul AGCRC/papers/snowys/12agc.cox.html*

Coyne R D, Sudweeks F, Haynes D 1996 Who needs the Internet? Computer-mediated communication in design firms. *Environment and Planning B: Planning and Design* 23: 749–70

Craglia M 1994 GIS in Italian municipalities. Computers, Environment and Urban Systems 18: 381–475

Craig W J 1989 URISA's research agenda and the NCGIA. Journal of the Urban and Regional Information Systems Association 1: 7–16

Craig W J, Tessar P, Ali Khan N 1991 Sharing graphic data files in an open system environment. *Journal of the Urban and Regional Information Systems Association* 3: 20–32

Crang P 1992 The politics of polyphony: reconfigurations in geographical authority. *Environment and Planning D: Society and Space* 10: 527–59

Crawford-Tilley J, Acevedo W, Foresman T, Prince W 1996 Developing a temporal database of urban development for the Baltimore–Washington region. *Proceedings Annual ACSM/ASPRS Conference*. Falls Church, ACSM/ASPRS 3: 101–10

Cressie N A C 1993 *Statistics for spatial data*, revised edition. New York, John Wiley & Sons Inc.

Crockett M 1997 GIS companies race for market share. *GIS World* 10(4): 54–7

Cromley R G 1991 Hierarchical methods of line simplification. *Cartography and Geographic Information Systems* 18: 125–31

Crossley D 1994 WAIS through the Web: discovering environmental information. Paper presented at Second International WWW Conference Mosaic and the Web, Chicago, 17–20 October Crosswell P L 1991 Obstacles to GIS implementation and guidelines to increase the opportunities for success. *Urban and Regional Information Systems Association Journal* 3: 43–56

CRU/OPCS/GRO(S) 1980 *People in Britain: a census atlas.* London, Her Majesty's Stationery Office

CSDC 1994 Commonwealth Spatial Data Committee Annual Report 1993–94. Canberra, Australian Government Printing Service

Cullinan V I, Thomas J M 1992 A comparison of quantitative methods for examining landscape pattern and scale. *Landscape Ecology* 7: 211–27

Cullingworth J B, Nadin V 1994 *Town and country planning in Britain*, 11th edition. London, Routledge

Cullis B J 1996 Clarifying the value of the human context to GIS adoption. *Proceedings GIS/LIS 96 Conference*

Culnan M J 1991 The lessons of the Lotus MarketPlace: implications for consumer privacy in the 1990s. Paper read at The First Conference on Computers, Freedom and Privacy

Curran P J, Windham W R, Gholz H L 1995 Exploring the relationship between reflectance red-edge and chlorophyll concentration in slash pine leaves. *Tree Physiology* 15: 203–6

Current J R, Schilling D A 1987 Elimination of source A and B errors in *p*-median location problems. *Geographical Analysis* 19: 95–110

Current J R, Schilling D A 1990 Analysis of errors due to demand aggregation in the set covering and maximal covering location problems. *Geographical Analysis* 22: 116–26

Curry D J 1992 The new marketing research systems: how to use strategic database information for better marketing decisions. New York, John Wiley & Sons Inc.

Curry M R 1994 Images, practice, and the hidden impacts of GIS. *Progress in Human Geography* 18: 441–59

Curry M R 1995a GIS and the inevitability of ethical inconsistency. In Pickles J (ed.) *Ground truth: the social implications of geographic information systems*. New York, Guilford Press

Curry M R 1995b Rethinking rights and responsibilities in GIS: beyond the power of the image. *Cartography and Geographic Information Systems* 22: 58–9

Curry M R 1996a Data protection and intellectual property: information systems and the Americanisation of the new Europe. *Environment and Planning A* 28: 891–908

Curry M R 1996b Digital people, digital places: rethinking privacy in a world of geographic information. Paper presented at the conference on Technological Assaults on Privacy, Rochester Institute of Technology, Rochester (USA), 18–19 April

Curry M R 1997a Geodemographics and the end of the private realm. *Annals of the Association of American Geographers* 87: 681–99

Curry M R 1997b The digital individual and the private realm. Annals of the Association of American Geographers 87: 681–99

Curry R B, Peart R M, Jones J W, Boote K J, Allen L H Jr

1990 Response of crop yield to predicted changes in climate and atmospheric CO₂ using simulation. *Transactions of the American Society of Agricultural Engineers* 33: 1383–90

Cushnie J 1994 A British Standard is published. *Mapping Awareness* 8: 40–3

Custer S G, Farnes P, Wilson J P, Snyder R D 1996 A comparison of hand- and spline-drawn precipitation maps for mountainous Montana. *Water Resources Bulletin* 32: 393–405

Cutter S L 1996 Vulnerability to environmental hazards. Progress in Human Geography 20: 429–39

Cuzick J, Edwards R 1990 Spatial clustering for inhomogeneous populations. *Journal of the Royal Statistical Society B* 52: 73–104

Cyert R M, March J G 1963 *A behavioral theory of the firm.* Englewood Cliffs, Prentice-Hall

Dacey M F 1960 A note on the derivation of nearest neighbour distances. *Journal of Regional Science* 2: 81–7

Dacey M F 1963 Order neighbor statistics for a class of random patterns in multidimensional space. *Annals of the Association of American Geographers* 53: 505–15

Dacey M F 1965 A review of measures of contiguity for two and k-color maps. In Berry B J L, Marble D F (eds) Spatial analyses: a reader in statistical geography. Englewood Cliffs, Prentice-Hall: 479–95

Dair B, Oldfield B 1996 Cellular radio: planning and analysis using GIS. *GIS Europe* 5(3): 40–2

Dale P F 1991 Land information systems. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 85–99

Dale P F 1992 Education in land information management. *Cartographica* 28: 23–30

Dale P F 1994 *Professionalism and ethics in GIS*. London, Association for Geographic Information

Dale P F, McLaughlin J D 1988 Land information management. Oxford, Clarendon Press

Dale P F, McLaughlin J D 1989 Land information management: an introduction. Oxford, Oxford University Press

Dale V H, Rauscher H M 1994 Assessing the impacts of climate change on forests: the state of biological modelling. *Climate Change* 28: 65–90

Daly C, Neilson R P, Phillips D L 1994 A statisticaltopography model for mapping climatological precipitation over mountainous terrain. *Journal of Applied Meteorology* 33: 140–58

Daly C, Taylor G H 1996 Development of a new Oregon precipitation map using the PRISM model. In Goodchild M F, Steyaert L T, Parks B O, Johnston C, Maidment D, Crane M, Glendinning S (eds) GIS and environmental modeling: progress and research issues. Fort Collins, GIS World Inc.: 91–2

Dando L P 1995 A case for the commercialisation of public information. In Onsrud H (ed.) *Law and information policy for spatial databases*. Orono, NCGIA: 32–6 Dangermond J 1991 Applications of GIS to the international decade for natural hazards reduction. *Proceedings, Fourth International Conference on Seismic Zonation*. Oakland, Stanford University, Earthquake Engineering Research Institute 3: 445–68

Danko D 1997 Perspectives in the development of ISO metadata standards. Proceedings, Earth Observation (EO)/GEO World Wide Web Workshop 97. February 4–6, Washington DC. http://www.fgdc.gov/clearinghouse /pubs/nima/nimapaperhtml

Dansby B 1991 Recovering GIS development costs by copyright use. GIS World 4(2): 100–1

Dansby H B 1992 Public records and governmental liability. GIS Law 1(2): 8–13

Danson F M, Steven M D, Malthus T J, Clark J A 1992 Highspectral resolution data for determining leaf water content. *International Journal of Remote Sensing* 13: 461–70

Date C J 1995 Introduction to database systems, 6th edition. Reading (USA), Addison-Wesley

Davey S M, Stockwell D R B 1991 Incorporating wildlife habitat into an A1 environment: concepts, theory and practicalities. *A1 Applications* 5: 59–104

Davidson D A, Theocharopoulos S P, Bloksma R J 1994 A land evaluation project in Greece using GIS and based on Boolean fuzzy set methodologies. *International Journal of Geographical Information Systems* 8: 369–84

Davidson D A, Watson A I, Selman P H 1993 An evaluation of GIS as an aid to the planning of proposed developments in rural areas. In Mather P M (ed.) *Geographical information handling: research and applications*. Chichester, John Wiley & Sons: 251–9

Davies C, Medyckyj-Scott D 1995 Feet on the ground: studying user–GIS interaction in the workplace. In Nyerges T L, Mark D M, Laurini R, Egenhofer M J (eds) Cognitive aspects of human–computer interaction for GIS. Dordrecht, Kluwer: 123–41

Davies C, Medyckyj-Scott D 1996 GIS users observed. International Journal of Geographical Information Systems 10: 363–84

Davies R L, Rogers D S 1984 Store location and store assessment research. Chichester, John Wiley & Sons

Davis B E 1996 GIS: a visual approach. Santa Fe, Onword Press

Davis E 1990 Representations of commonsense knowledge. San Mateo, Morgan Kaufmann

Davis F W, Dozier J 1990 Information analysis of a spatial database for ecological land classification. *Photogrammetric Engineering and Remote Sensing* 56: 605–13

Davis F W, Simonett D S 1991 GIS and remote sensing. In Maguire D J, Goodchild M F, Rhind D W (eds) Geographical information systems: principles and applications. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 191–213

Davis S L, Prescott J R V 1992 Aboriginal frontiers and boundaries in Australia. Melbourne, Melbourne University

Press

Dawe P 1996 'An investigation of the Internet for spatial data distribution'. Unpublished Master of Engineering report, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Canada

Dawes W, Short D 1994 The significance of topology for modelling the surface hydrology of fluvial landscapes. *Water Resources Research* 30: 1045–55

Day A 1994 From map to model. Design Studies 15: 366-84

Day T, Muller J-P 1988 Quality assessment of digital elevation models produced by automatic stereo matchers from SPOT image pair. *International Archives of Photogrammetry and Remote Sensing* 27: 148–59

De Floriani L 1989 A pyramidal data structure for trianglebased surface description. *IEEE Computer Graphics and Applications* 9: 67–78

De Floriani L, Falcidieno B, Nagy G, Pienovi C 1984 A hierarchical structure for surface approximation. *Computer Graphics (Proceedings SIGGRAPH 84)*18: 183–93

De Floriani L, Falcidieno B, Nagy G, Pienovi C 1989 *Polyhedral terrain description using visibility criteria*. Technical Report 17. Genova, Institute for Applied Mathematics, National Research Council

De Floriani L, Falcidieno B, Nagy G, Pienovi C 1991 On sorting triangles in a Delaunay tessellation. *Algorithmica* 6: 522–32

De Floriani L, Falcidieno B, Pienovi C, Allen D, Nagy G 1986 A visibility-based model for terrain features. *Proceedings, Second International Symposium on Spatial Data Handling.* Columbus, International Geographical Union: 235–50

De Floriani L, Magillo P 1995 Horizon computation on a hierarchical terrain model. *The Visual Computer* 11: 134-49

De Floriani L, Magillo P 1996 A comprehensive framework for spatial operations on hierarchical terrain models. Technical Report DISI-TR-96–15. University of Genova, Department of Computer and Information Sciences

De Floriani L, Marzano P, Puppo E 1994a Line-of-sight communication on terrain models. *International Journal of Geographical Information Systems* 8: 329–42

De Floriani L, Montani C, Scopigno R 1994b Parallelizing visibility computations on triangulated terrains. *International Journal of Geographical Information Systems* 8: 515–32

De Floriani L, Puppo E 1995 Hierarchical triangulation for multi-resolution surface description. ACM Transactions on Graphics 14: 363–11. http://www.disi.unige.it/person/PuppoE

De Ploey J, Kirkby M J, Ahnert F 1991 Hillslope erosion by rainstorms: a magnitude-frequency analysis. *Earth Surface Processes and Landforms* 16: 399–409

De Roo A P J, Hazelhoff L, Burrough P A 1989 Soil erosion modelling: using ANSWERS and geographical information systems. *Earth Surface Processes and Landforms* 14: 517–32

De Roo A P J, Hazelhoff L, Heuvelink G B M 1992 Estimating the effects of spatial variability of infiltration on the output of a distributed runoff and soil erosion model using Monte Carlo methods. Hydrological Processes 6: 127-43

Deal T E, Kennedy A A 1982 Corporate cultures: the rites and rituals of corporate life. Reading (USA), Addison-Wesley

Deichmann U 1994 A medium resolution population database for Africa. Santa Barbara, NCGIA

Delcourt H R, Delcourt P A 1988 Quaternary landscape ecology: relevant scales in space and time. *Landscape Ecology* 2: 23–44

Delcourt H R, Delcourt P A, Webb T A III 1983 Dynamic plant ecology: the spectrum of vegetation change in space and time. *Quaternary Science Reviews* 1: 153–75

DeMers M N 1996 Fundamentals of geographic information systems. New York, John Wiley & Sons Inc.

Densham P J 1991 Spatial decision support systems. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 403–12

Densham P J 1994 Integrating GIS and spatial modeling: visual interactive modelling and location selection. *Geographical Systems* 1: 203–19

Densham P J 1996 Visual interactive locational analysis. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 185–205

Densham P J, Rushton G 1988 Decision support system for location planning. In Golledge R G, Timmermans H (eds) *Behavioural modelling in geography and planning*. London, Croom Helm: 56–90

Densham P J, Rushton G 1991 Designing and implementing strategies for solving large location–allocation problems with heuristic methods. Technical Report 91–10. Santa Barbara, NCGIA

Densham P J, Rushton G 1992 A more efficient heuristic for solving large *p*-median problems. *Papers in Regional Science* 71: 307–29

Department of Land Affairs 1995 Annual report 1995. Pretoria, Department of Land Affairs

Department of National Health and Population Development 1993 The squatters. *Epidemiological Comment* 20(8): 123–6

Department of the Environment 1972 General information system for planning. London, Her Majesty's Stationery Office

Department of the Environment 1975 National Land Use Classification. London, Her Majesty's Stationery Office

Department of the Environment 1988a Vacant urban land, a literature review 1976–1986. Cambridge (UK), University of Cambridge, Department of Land Economy

Department of the Environment 1988b Planning Policy Guidance Note 6: *Major retail development*. London, Her Majesty's Stationery Office

Department of the Environment 1994a Countryside information system, user guide 5. London, DOE

Department of the Environment 1994b Countryside information system, dataset guide. London, DOE

Department of the Environment 1994c *Planning Policy Guidance Note 13: Transport.* London, Her Majesty's Stationery Office

Department of the Environment 1996 Household growth – where shall we live? London, Her Majesty's Stationery Office

Deschamps P Y, Herman M, Podaire A, Leroy M, Laporte M, Vermande P 1990 A spatial instrument for the observation of polarisation and directionality of Earth reflectances:
POLDER. Proceedings International Geoscience and Remote Sensing Symposium (IGARSS 90). Washington DC, IEEE Publications: 1769–74

Desmet P J J, Govers G 1995 GIS-based simulation of erosion and deposition patterns in an agricultural landscape: a comparison of model results with soil map information. *Catena* 25: 389–401

Desmet P J J, Govers G 1996a Comparison of routing algorithms for digital elevation models and their implications for predicting ephemeral gullies. *International Journal of Geographical Information Systems* 10: 311–31

Desmet P J J, Govers G 1996b A GIS procedure for automatically calculating the USLE LS factor on topographically complex landscape units. *Journal of Soil and Water Conservation* 51: 427–33

Despotakis V K, Giaoutzi M, Nijkamp P 1993 Dynamic GIS models for regional sustainable development. In Fisher M M, Nijkamp P (eds) *Geographic information systems, spatial modelling, and policy evaluation.* Berlin, Springer: 235–61

Deutsch C V, Journel A G 1992 GSLIB: geostatistical software library and user's guide. New York, Oxford University Press

Deux O 1990 The story of 0₂. *IEEE Transactions on Knowledge and Data Engineering* 2: 91–108

Devogele T, Trevisan J, Raynal L 1997 Building a multi-scale database with scale-transition relationships. In Kraak M-J, Molenaar M (eds) *Advances in GIS research II (Proceedings Seventh International Symposium on Spatial Data Handling)*. London, Taylor and Francis: 337–52

Dewdney J G 1983 Census past and present. In Rhind D W (ed.) *A census user's handbook* Methuen, London: 1–15

DeWitt W J, Ralston B A 1996 GIS: existing and potential applications for logistics and transportation. *Proceedings, Business Geographics for Educators and Researchers Conference.* Fort Collins, GIS World Inc.: 59–68

Dias A E, Silva J P, Câmara A S 1995 BITS: browsing in time and space. *Conference Companion CHI* 1995: 248–9

Diaz B M 1986 Tesseral addressing and arithmetic – overview and theory. In Diaz B, Bell S (eds) *Spatial data processing using tesseral methods.* Swindon, National Environment Research Council: 1–10

DiBiase D 1990 Visualization in earth sciences. *Earth and Mineral Sciences*, Bulletin of the College of Earth and Mineral Sciences, Pennsylvania State University 59: 13–18

Dibiase D, MacEachren A M, Krygier J, Reeves C 1992 Animation and the role of map design in scientific visualisation. *Cartography and Geographic Information* Systems 19: 201-14, 265-6

Dickinson G C, Shaw M A 1977 What is land use? Area 9: 38-42

- Dickinson H J, Calkins H W 1988 The economic evaluation of implementing a GIS. *International Journal of Geographical Information Systems* 2: 307–27
- Dickinson H J, Calkins H W 1990 Concerning the economic evaluation of implementing a GIS. *International Journal of Geographical Information Systems* 4: 211–12

Didier M 1990 Utilité et valeur de l'information géographique. Paris, Economica

Difani C, Dolton L 1992 Battling the Oakland fire with GIS. GIS World 5(1): 43–5

Diggle P J 1979 Statistical methods for spatial point patterns in ecology. In Cormack R M, Ord J K *Spatial and temporal analysis in ecology*. Fairland, International Cooperative Publishing House: 95–150

Diggle P J 1983 Statistical analysis of spatial point patterns. London, Academic Press

Diggle P J 1993 Point process modelling in environmental epidemiology. In Barnett V, Turkman K (eds) *Statistics for the environment*. Chichester, John Wiley & Sons: 89–110

Diggle P J, Chetwynd A D 1991 Second-order analysis of spatial clustering for inhomogeneous populations. *Biometrics* 47: 1155–63

Diggle P J, Gatrell A C, Lovett A A 1990 Modelling the prevalence of cancer of the larynx in part of Lancashire: a new methodology for spatial epidemiology. In Thomas R (ed.) *Spatial epidemiology*. London, Pion: 35–47

Diggle P J, Rowlingson B S 1994 A conditional approach to point process modelling of elevated risk. *Journal of the Royal Statistical Society A* 157: 433–40

Digital Geographic Information Working Group 1995a Digital geographic information exchange standard. Version 1.2a. http://132.J56.33.161/Engineer/DIGEST_1.2a/cover. htm

Digital Geographic Information Working Group 1995b Feature attribute and coding catalogue. Version 1.2a. http: //132.156.33.161/Engineer/DIGEST_1. 2a/covers/part4.htm

Dikau R 1988 Case studies in the development of derived geomorphic maps. *Geologische Jahrbuch A* 104: 329–38

Dikau R 1990 Geomorphic landform modelling based on hierarchy theory. *Proceedings, Fourth International Symposium on Spatial Data Handling, Zurich*: 230–39

Dikau R 1992 Aspects of constructing a digital geomorphological base-map. *Geologische Jahrbuch A* 122: 357–70

Dikau R, Brabb E E, Mark R K, Pike R J 1995 Morphometric landform analysis of New Mexico. *Zeitschrift für Geomorphologie* suppl. 101: 109–26

Dillard A 1974 Pilgrim at Tinker Creek: a mystical excursion into the natural world. New York, Bantam

Diner D J, Bruegge C J, Martonchik J V, Bothwell G W, Danielson E D, Ford V G, Hovland L E, Jones K L K, White

M L 1991 A multi-angle image spectroradiometer for terrestrial remote sensing with the Earth Observing System. *International Journal of Imaging Systems and Technology* 3: 92–107

Diner D J, Martonchik J V 1985 Atmospheric transmittance from spacecraft using multiple view angle imagery. *Applied Optics* 24: 3503–11

Ding Y, Fotheringham A S 1992 The integration of spatial analysis and GIS. *Computers, Environment, and Urban Systems* 16: 3–19

Diepen C A van, Wolf J, Keulen H van, Rappoldt C 1989 WOFOST: a simulation model of crop production. *Soil Use and Management* 5: 16–24

Dixon R G 1982 Fair criteria and procedures for establishing legislative districts. In Grofman B, Lijphart A, McKay R B, Scarrow H A (eds) *Representation and redistricting issues*. Lexington, Lexington Press: 7–19

Dixon T H 1991 An introduction to the global positioning system and some geological applications. *Reviews of Geophysics* 29: 249–76

Dixon T H (ed.) 1995 SAR interferometry and surface change detection. RSMAS Technical Report TR 95–003, University of Miami

Dobrindt K, Yvinec M 1993 Remembering conflicts in history yields dynamic algorithms. In Ng K W, Raghavan P, Balasubramanian N V, Chin F Y L (eds) *Algorithms and computation. Lecture notes in computer science 762*. Hong Kong, Springer: 21–30

Dobson J E 1979 A regional screening procedure for land use suitability analysis. *Geographical Review* 69: 224–34

Dobson J E 1992 Spatial logic in palaeogeography and the explanation of continental drift. *Annals of the Association of American Geographers* 82: 187–206

Dobson J E, Rush R M, Peplies R W 1990 Forest blow-down and lake acidification. *Annals of the Association of American Geographers* 80: 343–61

Docherty M, Scovell L M, Dunbar W S 1997a Logistics and distribution system planning using GIS: three GIS case studies. *Proceedings GIS 97: Integrating spatial information technologies* for tomorrow. Fort Collins, GIS World Inc.: 477–80

Docherty M, Scovell L M, Dunbar W S 1997b Site location modeling: continuous space models in GIS. *Proceedings GIS* 97: Integrating spatial information technologies for tomorrow. Fort Collins, GIS World Inc.: 481–4

Dodson R T 1991 VT/GIS *The von Thünen GIS Package*. National Center for Geographic Information and Analysis Technical Paper 91–27. Santa Barbara, NCGIA. 57 pages and CD-ROM

Donnelly K P 1978 Simulations to determine the variance and edge effect of total nearest neighbor distance. In Hodder I (ed.) *Simulation methods in archaeology*. Cambridge (UK), Cambridge University Press: 91–5

Dorling D 1992 Visualising people in time and space. Environment and Planning B: Planning and Design 19: 613–37 Dorling D 1994a Cartograms for visualising human geography. In Hearnshaw H M, Unwin D J (eds) *Visualisation in geographical information systems*. Chichester, John Wiley & Sons: 85–102

Dorling D 1994b *A new social atlas of the UK.* Chichester, John Wiley & Sons

Dorling D, Openshaw S 1992 Using computer animation to visualise space-time patterns. *Environment and Planning B: Planning and Design* 19: 639–50

Douglas D H 1986 Experiments to locate ridges and channels and create a new type of digital elevation model. *Cartographica* 23: 29–61

Douglas D H 1988 Hardball and softball in geographic information systems. *The Operational Geographer* 6: 42–111

Douglas D H, Peucker T K 1973 Algorithms for the reduction of points required to represent a digitized line or its caricature. *Canadian Cartographer* 10: 112–22

Douglas M 1986 *How institutions think*. Syracuse, Syracuse University Press

Douglas R 1994 Unfinished business. London, Penguin

Douven W, Grothe M, Nijkamp P, Scholten H 1993 Urban and regional planning models and GIS. In Masser I, Onsrud H (eds) *Diffusion and use of geographic information technologies*. Dordrecht, Kluwer: 317–37

Dowman I J, Ebner H, Heipke C 1992 Overview of European developments in digital photogrammetric workstations. *Photogrammetric Engineering and Remote Sensing* 58: 51–6

Downs A 1967 *Inside bureaucracy*. Boston, Little Brown & Co. Inc.

Drabek T E, Hoetmer G J (eds) 1991 *Emergency management:* principles and practice for local government. Washington DC, International City Management Association

Draeger W C, Holm T M, Lauer D T, Thompson R J 1997 The availability of LANDSAT data: past, present and future. *Photogrammetric Engineering and Remote Sensing* 63: 869–75

Dresner Z (ed.) 1995 Facility location: a survey of applications and methods. New York, Springer

Drummond W J 1995 Extending the revolution: teaching land use planning in a GIS environment. *Journal of Planning Education and Research* 14: 280–91

 Dubbink D 1989 Use of acoustic examples in airport noise planning and decision-making. *Airport landside planning techniques: Transportation Research Record 1199.* Washington DC, National Research Council

Dubin R 1995 Estimating logit models with spatial dependence. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics.* Berlin, Springer: 229–42

Dubois D, Prade H 1982 A class of fuzzy measures based on triangular norms. *International Journal of General Systems* 8: 43–61

Dubrule O 1984 Comparing splines and Kriging. Computers and Geosciences 10: 327–38 Duchon J 1976 Interpolation des fonctions de deux variables suivant le principle de la flexion des plaques minces. *RAIRO Annales Numeriques* 10: 5–12

Duggin M J 1985 Factors limiting the discrimination and quantification of terrestrial features using remotely-sensed radiance. *International Journal of Remote Sensing* 6: 3–27

Dunlop C, Kling R (eds) 1991 Computerization and controversy: value conflicts and social choices. San Diego, Academic Press

Dunn C E 1992 Optimal routes in GIS and emergency planning applications. *Area* 24: 259–67

Dunn C E, Kingham S 1996 Modelling air quality and the effect on health in a GIS framework. In Parker D (ed.) *Innovations in GIS 3*. London, Taylor and Francis: 205–14

Dunn C E, Woodhouse J, Bhopal R S, Acquilla S D 1995 Asthma and factory emissions in northern England: addressing public concern by combining geographical and epidemiological methods. *Journal of Epidemiology and Community Health* 49: 395–400

Dunn R, Harrison A 1994 Feasibility study for deriving information about land use stocks. London, DOE

Dunn R, Swanwick C, Harrison A 1995 Evaluation of the Land Cover of Scotland 1988 Project. Final Report. Edinburgh, Scottish Office Environment Department

Durlach N, Mavor A S (eds) 1994 Virtual reality: scientific and technological challenges. National Research Council, National Academy Press

Dutton G 1984 Truth and its consequences in digital cartography. *Proceedings ASP/ACSM 44th Annual Meeting*. Falls Church, ACSM: 273–81

Dutton, G 1989 Modelling locational uncertainty via hierarchical tessellation. In Goodchild M F, Gopal S (eds) *Accuracy of spatial databases*. London, Taylor and Francis: 125–40

Dutton G 1997 Encoding and handling geospatial data with hierarchical triangular meshes. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 505–18

Dutton G, Buttenfield B P 1993 Scale change via hierarchical coarsening: cartographic properties of quaternary triangular meshes. *Proceedings, Sixteenth International Cartographic Conference*. Bielefeld, German Society of Cartography: 847–62

Dykes J 1995 Cartographic visualisation for spatial analysis. Proceedings, Seventeenth International Cartographic Conference, Barcelona: 1365–70

Dymon U J 1990 The role of emergency mapping in disaster response. *Quick Response Research Report #42*. Colorado, Natural Hazards Research and Applications Information Center

Dymon U J, Platt R H 1995 Mapping the geographic distributions of disasters. *Proceedings GIS/LIS 95*. ACSM/ASPRS 1: 297–301

Dymond J R, Derose R C, Harmsworth G R 1995 Automated mapping of land components from digital elevation data. *Earth Surface Processes and Landforms* 20: 131–7

Dyn N, Levin D, Rippa S 1990 Data-dependent triangulations for piecewise linear interpolation. *IMA Journal of Numerical Analysis* 10: 137–54

Dyn N, Wahba G 1982 On the estimation of functions of several variables from aggregated data. *SIAM Journal of Mathematical Analysis* 13: 134–52

Eason K D 1988 Information technology and organisation change. London, Taylor and Francis

Eastman J R 1993 *Idrisi: a geographical information system. Version 4.1.* Worcester (USA), Clark University

Eastman J R 1995 Idrisi for Windows: user's guide, version 1.0. Worcester (USA), Clark Labs, The Idrisi Project

Eastman J R 1996 Uncertainty and decision risk in multicriteria evaluation: implications for GIS software design. Proceedings, International Institute for Software Technology Expert Group Workshop on Software Technology for Agenda 21: Decision Support Systems. Section 8

Eastman J R, Jiang H 1996 Fuzzy measures in multi-criteria evaluation. Proceedings, Second International Symposium on Spatial Accuracy Assessment in Natural Resources and Environmental Studies. Fort Collins, GIS World Inc.: 527–34

Eastman J R, Jin W, Kyem P A K, Toledano J 1995 Raster procedures for multi-criteria/multi-objective decisions. *Photogrammetric Engineering and Remote Sensing* 61: 539–47

Eastman J R, Kyem P A K, Toledano J, Jin W G 1993 GIS and decision-making. Worcester (USA), Clark Labs for Cartographic Technology and Geographic Analysis

Eastman J R, McKendry J E 1991 *Change and Time Series Analysis Explorations in Geographic Information Systems Technology*. Vol. 1. Geneva, UN Institute for Training and Research/UN Environment Programme. (There are seven other books in the series.)

Ebner H, Reinhardt W, Hössler R 1988 Generation, management and utilisation of high-fidelity digital terrain models. *International Archives of Photogrammetry and Remote Sensing* 27: 556–65

Echoud M van, Hugenholtz P B 1997 Legal protection of geographical information: copyright and related rights. Bottlenecks and recommendations. Amersfoort, EUROGI

Edelsbrunner H, Guibas L J, Sharir M 1989 The upper envelope of piecewise linear functions: algorithms and applications. *Discrete and Computational Geometry* 4: 311–36

Edwards G 1993 The Voronoi model and cultural space: applications to the social sciences and humanities. In Frank A U, Campari I (eds) *Spatial information theory – a theoretical basis for GIS.* Berlin, Springer: 202–14

Edwards G 1994 Characteristics and maintaining polygons with fuzzy boundaries in geographic information systems. In Waugh T C, Healey R G (eds) *Advances in GIS research: Proceedings, Sixth International Symposium on Spatial Data Handling.* London, Taylor and Francis: 223–39

Edwards G, Lowell K E 1996 Modeling uncertainty in

photointerpreted boundaries. *Photogrammetric Engineering* and Remote Sensing 62: 377–91

Edwards G, Moulin B 1995 Towards the simulation of spatial mental images using the Voronoi model. *Proceedings, International Joint Conference on Artificial Intelligence* (*IJCAI-95*), *Montreal, Canada, 19–26 August:* 63–73

Edwards T M 1992 Virtual worlds technology as a means for human interaction with spatial problems. *Proceedings of GIS/LIS San José*, 10–12 November: 208–20

Egbert S L, Slocum T A 1992 EXPLOREMAP: an exploration system for choropleth maps. *Annals of the Association of American Geographers* 82: 275–88

Egenhofer M J 1992 Why not SQL! International Journal of Geographical Information Systems 6: 71–85

Egenhofer M J 1994 Spatial SQL: a query and presentation language. *IEEE Transactions on Knowledge and Data Engineering* 6: 86–95

Egenhofer M J 1996a Multi-modal spatial querying. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 785–99

Egenhofer M J 1996b Spatial query-by-sketch. In VL 96: IEEE Symposium on Visual Languages. IEEE Computer Society: 60–7

Egenhofer M J, Frank A U 1992 Object-oriented modeling for GIS. Journal of the Urban and Regional Information Systems Association: 4: 3–19

Egenhofer M J, Franzosa R D 1995 On the equivalence of topological relations. *International Journal of Geographical Information Systems* 9: 133–52

Egenhofer M J, Herring J 1993 Querying a geographical information system. In Medyckyj-Scott D, Hearnshaw H (eds) *Human factors in geographical information systems*. London, Belhaven Press: 124–36

Egenhofer M J, Herring J 1994 Categorising topological spatial relations between point, line, and area objects. In Egenhofer M J, Mark D M, Herring J R (eds) *The 9–Intersection: formalism and its use for natural-language spatial predicates.* Technical Report 94–1. Santa Barbara, NCGIA

Egenhofer M J, Kuhn W 1991 Visualising spatial query results: the limitations of SQL. In Knuth E, Wegner L (eds) *IFIP Transactions A-7: Visual Database Systems, II, Proceedings* of *IFIP TC2/WG2.6 Second Working Conference on Visual Database Systems, Budapest, Hungary.* Amsterdam, North-Holland: 5–18

Egenhofer M J, Mark D M 1995 Modelling conceptual neighbourhoods of topological line-region relations. *International Journal of Geographical Information Systems* 9: 555–65

Ehlers M, Edwards G, Bédard Y 1989 Integration of remote sensing with geographical information systems: a necessary evolution. *Photogrammetric Engineering and Remote Sensing* 55: 1619–27

Ehlers M, Greenlee D, Smith T, Star T 1991 Integration of remote sensing and GIS: data and data access.

Photogrammetric Engineering and Remote Sensing 57: 669–75

Ehlschlaeger C 1990 r.watershed manual entry. *GRASS3. 1 User's Manual.* Champaign-Urbana, US Army Corps of Engineers, Construction Engineering Research Laboratory

Ehrliholzer R 1995 Quality assessment in generalisation: integrating quantitative and qualitative methods. *Cartography crossing borders (Proceedings, Seventeenth International Cartographic Conference)*. Barcelona, Institut Cartogràfic de Catalunya: 2241–50

Ehrliholzer R 1996 'Methoden für die Bewertung der Qualität von Generalisierungslösungen'. Unpublished MSc thesis. Department of Geography, University of Zurich

Einstein A 1920 Relativity. London, Methuen

Eiselt H A 1992 Location modelling in practice. *American* Journal of Mathematical and Management Sciences 12: 3–18

Ekstrund S 1996 LANDSAT TM-based forest damage assessment: correction for topographic effects. *Photogrammetric Engineering and Remote Sensing* 62: 151–61

Elliot S 1994 Real-time GIS in today's world. *Proceedings, First Federal Geographic Technology Conference*. Washington DC, GIS World Inc. 1: 201–5

Elliot W 1994 Moving AM/FM to the field: technology, trends and success stories. *Proceedings of 1994 AM/FM International Conference*: 845–57

Elliott C 1991 Store planning with GIS. In Cadoux-Hudson J, Heywood D I (eds) *Geographic Information 1991*. The Yearbook of the Association for Geographic Information. London, Taylor and Francis: 169–72

Elliott P, Cuzick J, Stern R, English R (eds) 1992 *Geographical* and environmental epidemiology. Oxford, Oxford University Press

Elliott P, Hills M, Beresford J, Kleinschmidt I, Jolley D, Pattenden S, Rodrigues L, Westlake A, Rose G 1992 Incidence of cancer of the larynx and lung near incinerators of waste solvents and oils. *Lancet* 339: 854–8

Elmes G A, Cai G 1992 Data quality issues in user interface design for a knowledge-based decision support system. *Proceedings, Fifth International Symposium on Spatial Data Handling, Charleston* 2: 303–12

Elshaw Thrall S 1997 MapViewer: first impressions software review. *Geo Info Systems* 7 (November)

Elzinga J, Hearn D W 1972 Geometrical solutions for some minimax location problems. *Transportation Science* 6: 379–94

Emani S 1996 Applications in hazard assessment and management. Explorations in Geographic Information Systems Technology, Vol. 6. Worcester (USA), United Nations Institute for Training and Research (UNITAR)

Emani S, Ratick S J, Clark G E, Dow K 1993 Assessing vulnerability to extreme storm events and sea-level rise using geographical information systems (GIS). *Proceedings GIS/LIS 93*. Bethesda, ACSM/ASPRS 1: 201–9

Emmi P C, Horton C A 1995 A Monte Carlo simulation of error propagation in a GIS-based assessment of seismic risk. *International Journal of Geographical Information Systems* 9:

447-61

Engel B A, Srinivasan R, Rewerts C 1993 A spatial decision support system for modeling and managing agricultural nonpoint source pollution. In Goodchild M F, Parks B O, Steyaert L T (ed.) *Environmental Modeling with GIS*. New York, Oxford University Press: 231–7

England J, Hudson K, Masters R, Powell K, Shortridge J (eds) 1985 *Information systems for policy planning in local government.* Harlow, Longman

Englebart D 1963 A conceptual framework for the augmentation of man's intellect. In Howerton P (ed.) *Vistas in information handling*. Washington DC, Spartan Books 1: 1–29

Englund E J 1993 Spatial simulation: environmental applications. In Goodchild M F, Steyaert L T, Parks B O (eds) *Environmental modeling with GIS*. New York, Oxford University Press: 432–7

ENV 12160 1997 *Geographic information – spatial schema*. Paris, AFNOR (French Standardisation Organisation)

Epstein E, Hunter G J, Agumya A 1996 Liability and insurance for use of geographic information. *Proceedings* URISA 96 Conference, Salt Lake City 1: 294–301

ESRI 1990 ARC/INFO Maps 1990. Redlands, ESRI

ESRI 1995a *ESRI map book, volume 10: creating a new world.* Redlands, ESRI

ESRI 1995b ArcView 2.1, the geographic information system for everyone. Redlands, ESRI

ESRI 1995c Understanding GIS: the ARC/INFO method. Redlands, ESRI

ESRI 1996a ArcView GIS Extensions (ArcView Network Analyst; ArcView Spatial Analyst). White Paper. Redlands, ESRI

ESRI 1996b Automation of map generalisation – the cuttingedge technology. White Paper. Redlands, ESRI Inc.

ESRI 1996c *Getting to know ArcView*. Redlands, ESRI. CD and book

Estes J E, Lawless J, Mooneyhan D W (eds) 1995 Report on the International Symposium on Core Data Needs for Environmental Assessment and Sustainable Development Strategies. New York, United Nations Development Programme

Estes J E, McGwire K C, Fletcher G A, Foresman T W 1987 Coordinating hazardous waste management activities using geographical information systems. *International Journal of Geographical Information Systems* 1: 359–86

EUROGI 1994 EUROGI's work programme for standardisation. Paper presented at the first General Assembly of EUROGI

European Commission DGXIII 1996 GDF home page. http://205.139.128.5/ehq/gdf

European Commission 1997 Towards a European policy framework for geographic information: a working document. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 202–5

European Conference of Ministers of Transport 1995 New

information technologies in the road transport sector: policy issues, ergonomics and safety. Paris, European Conference of Ministers of Transport

European Parliament and Council Directive 96/9/EC of 11 March 1996 on the Legal Protection of Databases, 1996. *Official Journal of the European Communities* No. L 77/20–28

European Space Agency 1995 Coordination for the next decade: 1995 Committee on Earth Observation Satellites (CEOS) yearbook. UK, Smith Engineering Systems Ltd: 7–8

Everitt J H, Escobar D E, Alaniz M A, Davis M R 1989 Using multi-spectral video imagery for detecting soil surface conditions. *Photogrammetric Engineering and Remote Sensing* 55: 467–71

Everitt J H, Escobar D E, Sunny K R, Davis M R 1994 Using airborne video, global positioning system and geographical information system technology for detecting and mapping citrus blackfly infestations. *Southwestern Entomologist* 19: 129–38

Ezigbalike I, Coleman D, Cooper R H, McLaughlin J D 1988 A land information system development methodology. *Proceedings, Urban and Regional Information Systems Association Conference* 3: 282–96

Ezigbalike I, Cooper R, McLaughlin J 1987 A query management strategy for land information network implementation. *Proceedings, 1987 Annual Meeting of the Urban and Regional Information Systems Association* (*URISA*) 3: 105–12

Faber B G, Wallace W, Cuthbertson J 1995 Advances in collaborative GIS for land-resource negotiation. *Proceedings*, GIS 95 Ninth Annual Symposium on Geographic Information Systems. Fort Collins, GIS World Inc.: 183–9

Fahrig L, Paloheimo J 1988 Effect of spatial arrangement of habitat patches on local population size. *Ecology* 69: 468–75

Fairfield J, Leymarie P 1991 Drainage networks from grid digital elevation models. *Water Resources Research* 27: 709–17

Faloutsos C 1988 Gray codes for partial match and range queries. *IEEE Transactions on Software Engineering* SE-14(10): 1381–93

Faloutsos C, Roseman S 1989 Fractals for secondary key retrieval. *Eighth ACM SIGACT-SIGMOD-SIGART Symposium on Principles of Database Systems (PODS)*: 247–52

Faloutsos C, Sellis T, Roussopoulos N 1987 Analysis of object-oriented spatial access methods. *ACM SIGMOD* 16: 426–39

FAO/UNESCO 1990 Soil map of the world: revised legend. FAO, Rome, World Soil Resources Report 60

Farley J A, Limp W F, Lockhart J 1990 The archeologist's workbench: integrating GIS, remote sensing, EDA and database management. In Allen K, Green F, Zubrow E (eds) *Interpreting space: GIS and archaeology*. London, Taylor and Francis: 141–64

Farrell D M 1997 *Comparing electoral systems*. Hemel Hempstead, Prentice-Hall

Faulhaber G R 1967 Cross-subsidisation: pricing in public

enterprises. American Economic Review 65: 966-77

- Faulkenberry G D, Garoui A 1991 Estimating a population total using an area frame. *Journal of the American Statistical Association* 86: 445–9
- Faust N L 1995 The virtual reality of GIS. *Environment and Planning B: Planning and Design* 22: 257–68
- Fayyad U, Haussler D, Stolorz P 1996 Mining scientific data. Communications of the ACM 39: 51–7
- Federa K, Kubat M 1992 Hybrid Geographical Information Systems. *EARSel Advances in Remote Sensing* 1: 89–100
- Fegeas R G, Cascio J L, Lazar R A 1992 An overview of FIPS 173, the Spatial Data Transfer Standard. *Cartography and Geographic Information Systems* 19: 278–93
- Feigenbaum E, McCorduck P 1991 Excerpts from 'The fifth generation: artificial intelligence and Japan's computer challenge to the world'. In Dunlop C, Kling R (eds) *Computerization and controversy: value conflicts and social choices.* San Diego, Academic Press: 31–54
- Fekete G 1990 Rendering and managing spherical data with sphere quadtree. *Proceedings Visualisation 90 (first IEEE conference on visualisation, San Francisco, 23–26 October)*. Los Alamitos, IEEE Computer Society Press
- Felleman J P, Griffin C 1990 *The role of error in GIS-based* viewshed determination – a problem analysis. Technical Report EIPP-90–2. State University of New York, Institute for Environmental Policy and Planning
- Fels J E, Matson K C 1996 A cognitively based approach for hydrogeomorphic land classification using digital terrain models. Proceedings, Third International Conference on Integrating GIS and Environmental Modeling, Santa Fe, 21–26 January. Santa Barbara, NCGIA. CD
- Ferrari D, Serazzi G, Zeigner A 1983 Measurement and tuning of computer systems. Englewood Cliffs, Prentice-Hall
- Ferraz de Abreu P 1995 'Intelligent multimedia in public participation'. Unpublished PhD thesis proposal. Cambridge (USA), MIT, Department of Urban Studies and Planning
- Fetterer A, Goyal B, Agarwal N 1996 Background: Java interactive routing for Minneapolis – explanation of WebRoute project. Spatial Database Laboratory, Department of Computer Science, University of Minnesota. http://www.ggrweb.com/geojaval
- Feyerabend P K 1975 Against method. London, Verso
- FGDC 1994 Content standards for digital geospatial metadata. Washington DC, Federal Geographic Data Committee. http: //www.fgdc.gov/metadata
- FGDC 1995a *Development of a national digital geospatial data framework*. Washington DC, Federal Geographic Data Committee
- FGDC 1995b The national geospatial data clearinghouse. Washington DC, Federal Geographic Data Committee
- FGDC 1996 National Spatial Data Infrastructure. Washington DC, Federal Geographic Data Committee. http://www.fgdc. gov/nsdi2.html
- FGDC 1997 A strategy for the National Spatial Data

Infrastructure. Washington DC, Federal Geographic Data Committee

- Field B C 1994 Environmental economics: an introduction. New York, McGraw-Hill: 119–23
- FieldWorks Inc. 1996 Eden Prairie. http://www.canaska. com/fw.htm
- FIG 1995a *Statement on the cadastre*. Belconnen, Australia, International Federation of Surveyors, Publication No.11: 1–22
- FIG 1995b Land tenure, land management and land information systems. London, International Federation of Surveyors, Publication No.13: 1–23
- Filella I, Peñuelas J 1994 The red-edge position and shape as indicators of plant chlorophyll content, biomass, and hydric status. *International Journal of Remote Sensing* 15: 1459–70
- Fincham R, MacDevette D, Piper S 1993 International GIS: Southern Africa. *International GIS Sourcebook 1993*. Fort Collins, GIS World Inc.: 306–8
- Finke P A, Wösten J H M, Jansen M J W 1996a Effects of uncertainty in major input variables on simulated functional soil behaviour. *Hydrological Processes* 10: 661–9
- Finke P A, Wösten J H M, Kroes J G 1996b Comparing two approaches of characterizing soil map unit behavior in solute transport. *Soil Science Society of America Journal* 60: 200–5
- Fischer M M 1994 Expert systems and artificial neural networks for spatial analysis and modelling: essential components for knowledge-based geographical information systems. *Geographical Systems* 1: 221–35
- Fischer M M 1995 Fundamentals in neurocomputing. In Fischer M M, Sikos T T, Bassa L (eds) *Recent developments in spatial information, modelling and processing.* Budapest, Geomarket Co.: 31–41
- Fischer M M 1997 Computional neural networks a new paradigm for spatial analysis. *Environment and Planning A* 29
- Fischer M M, Getis A (eds) 1997 Recent developments in spatial analysis: spatial statistics, behavioural modelling, and computational intelligence. Berlin, Springer
- Fischer M M, Gopal S 1993 Neurocomputing a new paradigm for geographic information processing. *Environment and Planning A* 25: 757–60
- Fischer M M, Gopal S 1994a Artificial neural networks. A new approach to modelling interregional telecommunication flows. *Journal of Regional Science* 34: 503–27
- Fischer M M, Gopal S 1994b Neurocomputing and spatial information processing. From general considerations to a low dimensional real-world application. *New Tools for Spatial Analysis*. Luxembourg, EUROSTAT: 55–68
- Fischer M M, Gopal S 1996 Spectral pattern recognition and fuzzy ARTMAP classification. In Zimmermann H-J (ed.) *Proceedings, Fourth European Congress on Intelligent Techniques and Soft Computing*, Vol. 3: Aachen, Verlag Mainz: 1664–8
- Fischer M M, Gopal S, Staufer P, Steinnocher K 1997 Evaluation of neural pattern classifiers for a remote sensing application. *Geographical Systems* 4: 195–223, 231–2

Fischer M M, Nijkamp P 1992 Geographic information systems and spatial analysis. *The Annals of Regional Science* 26: 3–12

Fischer M M, Nijkamp P (eds) 1993 Geographic information systems, spatial modelling, and policy evaluation. Berlin, Springer

Fischer M M, Scholten H, Unwin D (eds) 1996 Spatial analytical perspectives on GIS in environmental and socioeconomic sciences. London, Taylor and Francis

Fisher P F 1989 Geographical information system software for university education and research. *Journal of Geography in Higher Education* 13: 69–78

Fisher P F 1991a First experiments in viewshed uncertainty: the accuracy of the viewshed area. *Photogrammetric Engineering and Remote Sensing* 57: 1321–7

Fisher P F 199lb Data sources and data problems. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 175–89

Fisher P F 1992 First experiments in viewshed uncertainty: simulating the fuzzy viewshed. *Photogrammetric Engineering and Remote Sensing* 58: 345–52

Fisher P F 1993 Algorithm and implementation uncertainty in the viewshed function. *International Journal of Geographical Information Systems* 7: 331–47

Fisher P F 1994a Probable and fuzzy models of the viewshed operation. In Worboys M (ed.) *Innovations in GIS 1*. London, Taylor and Francis: 161–75

Fisher P F 1994b Randomisation and sound for the visualisation of uncertain spatial information. In Hearnshaw H, Unwin D J (eds) *Visualisation in geographical information Systems*. Chichester, John Wiley & Sons: 181–5

Fisher P F 1994c Visualisation of the reliability in classified remotely-sensed images. *Photogrammetric Engineering and Remote Sensing* 60: 905–10

Fisher P F 1994d Visualising the uncertainty of soil maps by animation. *Cartographica* 30: 20–7

Fisher P F 1996a Concepts and paradigms of spatial data. In Craglia M, Coucelis H (eds) *Geographic information research: bridging the Atlantic.* London, Taylor and Francis: 297–307

Fisher P F 1996b Reconsideration of the viewshed function in terrain modelling. *Geographical Systems* 3: 33–58

Fisher P F, Dykes J, Wood J 1993 Map design and visualisation. *The Cartographic Journal* 30: 136–42

Fisher P F, Mackaness W A 1987 Are cartographic expert systems possible? *Proceedings AutoCarto 8 (Eighth International Symposium on Computer-Assisted Cartography)*. Falls Church, ACSM: 530–34

Fisher P F, Pathirana S 1991 The evaluation of fuzzy membership of land cover classes in the suburban zone. *Remote Sensing of Environment* 34: 121–32

Fites D V 1996 Making your dealers your partners. *Harvard Business Review* March-April: 84–95

Fitzgibbon M 1993 A real-time display interface for emergency management using ARC/INFO. *Proceedings, Thirteenth* Annual ESRI User Conference. Redlands, ESRI 3: 185-92

Flaatten P O, McCubbrey D J, O'Riordan P D, Burgess K 1992 *Foundations of business systems*, 2nd edition. Orlando, The Dryden Press

Flaherty D H 1989 Protecting privacy in surveillance societies: the Federal Republic of Germany, Sweden, France, Canada, and the United States. Chapel Hill, The University of North Carolina Press

Flamm R O, Turner M G 1994 Alternative model formulations for a stochastic simulation of landscape change. *Lanascape Ecology* 9: 37–46

Flanagan N, Jennings C, Flanagan C 1994 Automatic GIS data capture and conversion. In Worboys M F (ed.) *Innovations in GIS*. London, Taylor and Francis: 25–38

Flather C H, Brady S J, Inkley D B 1992 Regional habitat appraisals of wildlife communities: a landscape-level evaluation of a resource planning model using avian distribution data. *Landscape Ecology* 7: 137–47

Flather C H, King R M 1992 Evaluating performance of regional wildlife habitat models: implications to resource planning. *Journal of Environmental Management* 34: 31–46

Fletcher D 1987 Modeling GIS transportation networks. Proceedings of UMSA, Vol. 2. Washington DC: 84–92

Fletcher R 1987 Practical methods of optimisation. Chichester, John Wiley & Sons

Florax R J G M, Folmer H 1992 Specification and estimation of spatial linear regression models: Monte Carlo evaluation of pre-test estimators. *Regional Science and Urban Economics* 22: 405–32

Florax R J G M, Rey S 1995 The impacts of misspecified spatial interaction in linear regression models. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics*. Berlin, Springer: 111–35

Florence J, Hornsby K, Egenhofer M 1996 The GIS WallBoard: interactions with spatial information on largescale displays. In Kraak M-J, Molenaar M (eds) *Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling)*. London, Taylor and Francis: 449–63

Florencio C A 1996 Human rights in nutrition and nutrition in human rights. *Food Policy* 21: 17–21

Flowerdew R, Green M 1991 Data integration: statistical methods for transferring data between zonal systems. In Masser I, Blakemore M (eds) *Handling geographic information: methodology and potential applications.* Harlow, Longman/New York, John Wiley & Sons Inc.: 38–54

Flowerdew R, Green M 1992 Developments in areal interpolation methods and GIS. *Annals of Regional Science* 26: 67–78

Flynn L J 1996a Company stops providing access to social security numbers. *New York Times* June 13 1996

Flynn L J 1996b Lexis-Nexis flap prompts push for privacy rights. *New York Times* October 13 Cyber Times Extra

Fochler-Hauke O (ed.) 1959 Geographie. Frankfurt, Das

FischerLexikon

Fogel D N 1996 Image rectification with radial basis functions: application to RS/GIS data integration. *Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modeling, Santa Fe, 21–25 January.* Santa Barbara, NCGIA. CD-ROM

Foley T 1987 Interpolation and approximation of 3-D and 4-D scattered data. *Computers and Mathematics with Applications* 13: 711–40

Folse L J, Packard J M, Grant W E 1989 AI modelling of animal movements in a heterogeneous habitat. *Ecological Modelling* 46: 57–72

Fonseca A, Gouveia C, Câmara A, Silva J P 1995 Environmental impact assessment with multimedia spatial information system. *Environment and Planning B: Planning and Design* 22: 637–48

Fonseca A, Gouveia C, Ferreira F C, Raper J, Câmara A 1993 Adding video and sound into GIS. *Proceedings, EGIS 93 Conference, Genoa, Italy*, April: 176–87

Food and Agriculture Organisation 1974–78 Soil map of the world: volumes 1–10. Paris, Food and Agriculture Organisation/United Nations Educational, Scientific, and Cultural Organisation

Food and Agriculture Organisation 1978 *Report on the Agroecological Zones Project*. Rome, Food and Agriculture Organisation/United Nations Educational, Scientific, and Cultural Organisation Soil Resource Report No. 48

Foody G M 1992 A fuzzy sets approach to the representation of vegetation continua from remotely-sensed data: an example from lowland heath. *Photogrammetric Engineering and Remote Sensing* 58: 221–5

Foody G M 1996 Approaches to the production and evaluation of fuzzy land cover classification from remotely-sensed data. *International Journal of Remote Sensing* 17: 1317–40

Foote K 1994 The Geographer's craft: a new approach to teaching geographical methods in the liberal arts curriculum. *The Pennsylvanian Geographer* 32: 3–25. See also *http: //www.utexas edu/depts/grg/gcraft*

Forbes H, Todd P 1995 *Review of cancer services: North West Regional Health Authority.* Urban Research and Policy Evaluation Regional Research Laboratory, University of Liverpool

Forer P 1989 GIS and geographic education: design parameters for a spatio-temporal database. In Welch R (ed.) *Geography in action: Proceedings, Fifteenth New Zealand Geography Conference, Dunedin.* New Zealand Geographical Society: 169–74

Foresman T W 1998 *The history of geographic information* systems: perspectives from the pioneers. Upper Saddle River, Prentice-Hall

Forester J 1982 Planning in the face of power. *Journal of the American Planning Association* 48: 67–80

Forier F, Canters F 1996 A user-friendly tool for error modelling and error propagation in a GIS environment. In Mowrer H T, Czaplewski R L, Hamre R H (eds) *Spatial* accuracy assessment in natural resources and environmental sciences. Fort Collins, USDA Forest Service General Technical Report RM GTR-277: 25–34

Forman R T T, Godron M 1986 *Landscape ecology*. New York, John Wiley & Sons Inc.

Forrester Research Inc. 1996 Teams on the Internet. *The Forrester report* 7(6): 2–8. Cambridge (USA), Forrester Research Inc. *http://www.forrester.com*

Forshaw M R B, Haskell A, Miller P F, Stanley D J, Townshend J R G 1983 Spatial resolution of remotelysensed imagery: a review paper. *International Journal of Remote Sensing* 4: 497–520

Foster C D, Plowden F J 1996 *The state under stress*. Buckingham, Open University Press

Foster S A, Gorr W L 1986 An adaptive filter for estimating spatially varying parameters: application to modeling police hours in response to calls for service. *Management Science* 32: 878–89

Fotheringham A S 1997 Trends in quantitative methods 1: stressing the local. *Progress in Human Geography* 21: 88–96

Fotheringham A S, Charlton M 1994 GIS and exploratory spatial data analysis: an overview of some research issues. *Geographical Systems* 1: 315–27

Fotheringham A S, Densham P J, Curtis A 1995 The zone definition problem in location–allocation modeling. *Geographical Analysis* 27: 60–77

Fotheringham A S, Rogerson P A 1993 GIS and spatial analytical problems. *International Journal of Geographical Information Systems* 7: 3–19

Fotheringham A S, Rogerson P A (eds) 1994 Spatial analysis and GIS. London, Taylor and Francis

Fotheringham A S, Wong D W S 1991 The modifiable areal unit problem in multivariate statistical analysis. *Environment and Planning A* 23: 1025–44

Fotheringham A S, Zhan F B 1996 A comparison of three exploratory methods for cluster detection in spatial point patterns. *Geographical Analysis* 28: 200–18

Foucault M 1972 *The archaeology of knowledge*. London, Tavistock

Foulon F, Breemersch H, Pallage M 1996 The art of networking. *GIS Europe* 5(9): 36–7

Foussereau X, Hornsby A G, Brown R B 1993 Accounting for the variability within map units when linking a pesticide fate model to soil survey. *Geoderma* 60: 257–76

Fowler M 1995 *Analysis patterns: reusable object models.* Reading (USA), Addison-Wesley

Fox C J, Miller H T 1995 Postmodern public administration: toward discourse. Thousand Oaks, Sage Publications

Frank A U 1982 MAPQUERY: database query language for retrieval of geometric data and its graphical representation. *ACM SIGGRAPH* 16: 199–207 Frank A U 1983 Storage methods for space-related data: the field-tree. Technische Bericht no.71. Zurich, Eidgenössische Technische Hochschule

Frank A U 1992a Qualitative spatial reasoning about distances and directions in geographic space. *Journal of Visual Languages and Computing* 3: 343–71

Frank A U 1992b Spatial concept, geometric data models, and geometric data structures. *Computers and Geosciences* 18: 409–17

Frank A U 1993 The user interface is the GIS. In Medyckyj-Scott D, Hearnshaw H (eds) *Human computer interaction and* geographic information systems. London, Belhaven Press: 3–14

Frank A U 1994 Qualitative temporal reasoning in GIS ordered timescales. *Sixth International Symposium on Spatial Data Handling, Edinburgh, Scotland.* International Geographical Union: 410–30

Frank A U, Barrera R 1989 The field-tree: a data structure for geographic information systems. *Symposium on the Design and Implementation of Large Spatial Databases, Santa Barbara, California.* Berlin, Springer: 29–44

Frank A U, Campari I (eds) 1993 Spatial information theory: a theoretical basis for GIS. Berlin, Springer

Frank A U, Mark D M 1991 Language issues for GIS. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1:147–63

Frank A U, Palmer B, Robinson V B 1986 Formal methods for the accurate definition of some fundamental terms in physical geography. *Proceedings, Second International Symposium on Spatial Data Handling*: 583–99

Frank S 1994 Cataloging digital geographic data in the information infrastructure: a literature and technology review. *Information Processing and Management* 30: 587–606

Frank T D 1988 Mapping dominant vegetation communities in the Colorado Rocky Mountain Front Range with LANDSAT Thematic Mapper and digital terrain data. *Photogrammetric Engineering and Remote Sensing* 54: 1727–34

Franke R 1982a Scattered data interpolation: tests of some methods. *Mathematics and Computation* 38: 181–200

Franke R 1982b Smooth interpolation of scattered data by local thin plate splines. *Computers and Mathematics with Applications* 8: 273–81

Franke R 1985 Thin plate spline with tension. *Computer Aided Geometrical Design* 2: 87–95

Franke R, Nielson G 1991 Scattered data interpolation and applications: a tutorial and survey. In Hagen H, Roller D (eds) *Geometric modelling: methods and applications*. Berlin, Springer: 131–60

Franklin J 1995 Predictive vegetation mapping: geographic modelling of biospatial patterns in relation to environmental gradients. *Progress in Physical Geography* 19: 474–99

Frederiksen P, Jacobi O, Kubik K 1985 A review of current trends in terrain modelling. *ITC Journal* 1985: 101–6

Freeman G T 1991 Calculating catchment area with divergent flow based on a regular grid. *Computers and Geosciences* 17: 413–22

French S P, Wiggins L L 1990 California planning agency experiences with automated mapping and geographic information systems. *Environment and Planning B: Planning and Design* 17: 441–50

Friedrich C J 1977 *The philosophy of Kant*. New York, The Modern Library

Friel C, Leary T, Norris H, Sargent B, Warford R 1993 GIS tackles oil spill in Tampa Bay. GIS World 6(11): 30–3

Fritsch E, Lagrange J-P 1995 Spectral representations of linear features for generalisation. In Frank A U, Kuhn W (eds) Spatial information theory – a theoretical basis for GIS (Proceedings COSIT 95). Lecture Notes in Computer Science 988. Berlin, Springer: 157–71

Fritz L W 1996 The era of commercial earth observation satellites. *Photogrammetric Engineering and Remote Sensing* 62: 39–45

Fuchs H, Abram GD, Grant E D 1983 Near real-time shaded display of rigid objects. ACM Computer Graphics 17: 65–72

Fuchs H, Kedem Z M, Naylor B F 1980 On visible surface generation by a priori tree structures. ACM Computer Graphics 14: 124–33

Fujimoto R M 1990 Parallel discrete event simulation. Communications of the ACM 33: 30–53

Fulcher C, Prato T, Vance S, Zhou Y, Barnett C 1995 Flood impact decision support system for St Charles, Missouri, USA. Proceedings, Fifteenth Annual ESRI User Conference. Redlands, ESRI

Fuller N 1995 Sell as you build: GIS helps cable companies build viable networks. *GIS Europe* 4(3): 42–3

Fuller R, Groom G B 1993 The Land Cover Map of Great Britain. *Mapping Awareness* 7(9): 18–20

Fuller R, Groom G B, Jones A R 1994 The Land Cover Map of Great Britain: an automated classification of LANDSAT Thematic Mapper data. *Photogrammetric Engineering and Remote Sensing* 60: 553–62

Gallant J C, Hutchinson M F 1996 Towards an understanding of landscape scale and structure. *Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modeling.* Santa Barbara, NCGIA. CD

Gallant J C, Hutchinson M F, Moore I D, Gessler P E 1994 Estimating fractal dimensions: an empirical approach. *Mathematical Geology* 26: 455–81

Gallant J C, Wilson J P 1996 TAPES-G: a terrain analysis program for the environmental sciences. *Computers and Geosciences* 22: 713–22

Gamma E, Helm R, Johnson R, Vlissides J 1995 Design patterns: elements of reusable object-oriented software. Reading (USA), Addison-Wesley

Ganter J, Cashwell J W 1994 Display techniques for dynamic network data in transportation GIS. Seventh Symposium on

GIS for Transportation, Norfolk, Virginia: 42-53

Garbrecht J, Martz L W 1996 Digital landscape parameterization for hydrological applications. *HydroGIS* 96: Application of Geographic Information Systems in Hydrology and Water Resources Management. IAHS Publ. no. 235: 169–73

Garbrecht J, Starks P 1995 Note on the use of USGS level 1 7.5-minute DEM coverages for landscape drainage analyses. *Photogrammetric Engineering and Remote Sensing* 61: 519–22

Garey M R, Johnson D S 1979 *Computers and intractability: a guide to the theory of NP-completeness.* New York, W H Freeman and Co.

Gargantini 1992 Modelling natural objects via octrees. In Turner K (ed.) *Three-dimensional modelling with geoscientific information systems*. Dordrecht, Kluwer: 145–58

Gaston K J 1991 How large is a species' geographical range? Oikos 61: 434–8

Gaston K J 1994 Spatial patterns of species description: how is our knowledge of the global insect fauna growing? *Biological Conservation* 67: 37–40

Gatrell A C 1991 Concepts of space and geographical data. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications.* Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 119–34

 Gatrell A C 1994 Density estimation and the visualisation of point patters. In Hearnshaw H M, Unwin D J (eds) *Visualisation in geographical information systems*. Chichester, John Wiley & Sons: 65–75

Gatrell A C, Bailey T C, Diggle P J, Rowlingson B S 1996 Spatial point pattern analysis and its application in geographical epidemiology. *Transactions, Institute of British Geographers* 21: 256–74

Gatrell A C, Löytönen M 1997 (eds) GIS and health. London, Taylor and Francis

Gatrell A C, Maddocks A, Kirwan M, Garnett S 1995 Making GIS sing and dance to a purchaser's tune. *Proceedings AGI* 95: 3.4.1–3.4.4

Gatrell A C, Rowlingson B S 1994 Spatial point process modelling in a GIS environment. In Fotheringham A S, Rogerson P (eds) *Spatial analysis and GIS*. London, Taylor and Francis: 147–64

Gatrell A C, Vincent P 1991 Managing natural and technological hazards. In Masser I, Blakemore M (eds) *Handling geographical information: methodology and potential applications.* Harlow, Longman/New York, John Wiley & Sons Inc.: 148–80

Gault I, Peutherer D 1989 Developing GIS for local government in the UK. Presentation at the European Regional Science Association Congress, Cambridge

Geary R 1954 The contiguity ratio and statistical mapping. *The Incorporated Statistician* 5: 115–45

Geiger C, Barnes K B 1994 Indoor radon hazard: a

geographical assessment and case study. *Applied Geography* 14: 350–71

Geleta S, Sabbagh G J, Stone J F, Elliot R L, Mapp H P, Bernado D J, Watkins K B 1994 Importance of soil and cropping systems in the development of regional water quality policies. *Journal of Environmental Quality* 23: 36–42

Genderen J L van, Lock B F 1977 Testing land-use map accuracy. *Photogrammetric Engineering and Remote Sensing* 43: 1135–7

GeoData Institute 1992 *GIS Awareness*. Southampton, GeoData Institute. Booklet and disks

GEO-EAS 1988, Las Vegas, United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory

Geographic Data BC 1995 Spatial archive and interchange format: formal definition. Release 3.2. http://www.env.gov. bc.ca/gdbc/saif32/toc.htm

Geographic Data BC 1996 Feature manipulation engine BC. http://www.env.gov.bc.ca/gdbc/fmebc

GEOHUB 1996 INTERLIS. http://www.geo.unizh. ch/~keller/geohub.html#tagOO2

Gerrard R A, Stoms D A, Church R L, Davis F W 1996 Using GIS models for reserve site selection. *Transactions in GIS*

Gershon N, Brown J R 1996 The role of computer graphics and visualisation in the global information infrastructure. *IEEE Computer Graphics and Applications* 16: 60

Gessler P E, McKenzie N J, Hutchinson M F 1996 Progress in soil-landscape modelling and spatial prediction of soil attributes for environmental models. *Proceedings, Third International ConferencelWorkshop on Integrating GIS and Environmental Modeling*. Santa Barbara, NCGIA. CD

Gessler P E, Moore I D, McKenzie N H, Ryan P J 1995 Soillandscape modelling and spatial prediction of soil attributes. *International Journal of Geographical Information Systems* 9: 421–32

Getis A 1964 Temporal land-use pattern analyses with the use of nearest neighbor and quadrat methods. *Annals of the Association of American Geographers* 54: 391–9

Getis A 1983 Second-order analysis of point patterns: the case of Chicago as a multi-center urban region. *Professional Geographer* 35: 73–80

Getis A 1984 Interaction modeling using second-order analysis. *Environment and Planning A* 16: 173–83

Getis A 1990 Screening for spatial dependence in regression analysis. *Papers of the Regional Science Association* 69: 69–81

Getis A 1991 Spatial interaction and spatial autocorrelation: a cross-product approach. *Environment and Planning A* 23: 1269–77

Getis A 1992 *Spatial dependence and proximal databases.* Paper presented at 39th North American Meeting of the RSAI, Chicago, 14 November 1991

Getis A 1993 GIS and modeling prerequisites. In Frank A U, Campari I (eds) *Spatial information theory: a theoretical basis for GIS.* Berlin, Springer: 322–40 Getis A 1994 Spatial dependence and heterogeneity and proximal databases. In Fotheringham S, Rogerson P (eds) *Spatial analysis and GIS* London, Taylor and Francis: 105–20

Getis A 1995 Spatial filtering in a regression framework: experiments on regional inequality, government expenditures, and urban crime. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics*. Berlin, Springer: 172–88

Getis A, Boots B 1978 *Models of spatial processes.* Cambridge (UK), Cambridge University Press

Getis A, Ord J K 1992 The analysis of spatial association by use of distance statistics. *Geographical Analysis* 24: 189–206

Getis A, Ord J K 1996 Local spatial statistics: an overview. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 269–85

Ghosh A, Craig C S 1984 A location–allocation model for facility planning in competitive environments. *Geographical Analysis* 16: 39–56

Ghosh A, Harche F 1993 Location–allocation models in the private sector: progress, problems and prospects. *Locational Science* 1: 81–106

Ghosh R, Sridhar V, Venkatesh H, Mehta A, Patel K 1993 Linear polarisation measurements of a wheat canopy. *International Journal of Remote Sensing* 14: 2501–8

GI2000 1996 Towards a European policy framework for geographic information. Luxembourg, European Commission – DG XIII

Gibbons G 1996 Intelligent transportation. GPS World 6(11): 10

Giddens A 1979 Central problems in social theory: action structure and contradiction in social analysis. London, Macmillan

Giddens A 1984 *The constitution of society*. Cambridge (UK), Polity Press

Giffin T L C 1983 Problem solving on maps – the importance of user strategies. *The Cartographic Journal* 20: 101–9

Gilb T 1996 *Principles of software engineering management*, 2nd edition. Reading (USA), Addison-Wesley

Gilbert C 1994a Attribute collection with GPS part 1: variety is the spice of attributes. *Mapping Awareness* 8(9): 28–30

Gilbert C 1994b Attribute collection with GPS part 2: assessing ease of use in the field. *Mapping Awareness* 8(10): 30–2

Gilbert C 1996 The software with your GPS part 1 – data export. *Mapping Awareness* 10(8): 32–4

Gilbert D 1995 Between two cultures: geography, computing, and the humanities. *Ecumene* 2: 1–13

Giles P T, Franklin S E 1996 Comparison of derivative topographic surfaces of a DEM generated from stereographic SPOT images with field measurements. *Photogrammetric Engineering and Remote Sensing* 62: 1165–71

Gittings B M, Sloan T M, Healey R G, Dowers S, Waugh T C 1993 Meeting expectations: a review of GIS performance issues. In Mather P M (ed.) *Geographical information handling*. Chichester/New York, John Wiley & Sons: 33–45

Glanz J 1994 New soil erosion erodes farmers' confidence.

Science 264: 1661-2

Gober P A, Glasmeier A K, Goodman J M, Plane D A, Stafford H A, Wood J S 1995 Employment trends in geography. *The Professional Geographer* 47: 317–46

Godschalk D R 1991 Disaster mitigation and hazard management. In Drabek T E, Hoetmer G J (eds) *Emergency management: principles and practice for local government*.
Washington DC, International City Management Association: 131–60

Goel N S 1989 Inversion of canopy reflectance models for estimation of biophysical parameters from reflectance data. In Asrar G (ed.) *Theory and applications of optical remote sensing*. New York, John Wiley & Sons Inc.: 205–51

Goetz A F H, Herring M 1989 The High Resolution Imaging Spectrometer (HIRIS) for EOS. *IEEE Transactions on Geoscience and Remote Sensing* 27: 136–44

Golay F 1992 'Modélisation des systèmes d'information à réfèrence spatiale et de leurs domaines d'utilisation spécialisés, aspects méthodologiques, organisatiounels et technologiques'. PhD thesis, École Polytechnique Fédérale de Lausanne, Switzerland

Gold C M 1989 Breadth vs depth: the dilemma of GIS education. Paper presented to the Conference 'GIS in the 90s', Ottawa, Feb. 1989 cited with the author's permission

Gold C M 1990 Spatial data structures – the extension from one to two dimensions. In Pau L F (ed.) *Mapping and spatial modelling for navigation*. Berlin, Springer: 11–39

Gold C M 1991 Problems with handling spatial data – the Voronoi approach. *CISM Journal* 45: 65–80

Gold C M 1992 The meaning of 'neighbour'. In Frank A U, Campari I, Formentini U (eds) *Theories and methods of spatio-temporal reasoning in geographic space*. Berlin, Springer: 221–35

Gold J R, Jenkins A, Lee R, Monk J, Riley J, Shepherd I, Unwin D 1990 *Teaching geography in higher education: a manual of good practice.* Oxford, Blackwell

Gomez D, Guzman A 1979 Digital model for 3-dimensional surface representation. *Geoprocessing* 1: 53–70

Gonçalves P, Diogo P 1994 Geographic information systems and cellular automata: a new approach to forest frre simulation. *Proceedings, European Conference on Geographical Information Systems, Paris*

Gong P, Howarth P J 1990 An assessment of some factors influencing multispectral land cover classification. *Photogrammetric Engineering and Remote Sensing* 56: 597–603

Good I J 1983 The philosophy of exploratory data analysis. *Philosophy of Science* 50: 283–95

Goodchild M F 1977 An evaluation of lattice solutions to the problem of corridor location. *Environment and Planning A* 9: 727–38

Goodchild M F 1979 The aggregation problem in location–allocation. *Geographical Analysis* 11: 240–55

Goodchild M F 1985 Geographical information systems in undergraduate geography: a contemporary dilemma. *The Operational Geographer* 8: 34–8

Goodchild M F 1987 A spatial analytical perspective on geographical information systems. *International Journal of Geographical Information Systems* 1: 327–34

Goodchild M F 1988a Stepping over the line: technological constraints and the new cartography. *The American Cartographer* (special issue on the history of GIS) 15: 311–22

Goodchild M F 1988b The issue of accuracy in global databases. In Mounsey H (ed.) *Building databases for global science*. London, Taylor and Francis: 31–48

Goodchild M F 1989 Tiling large geographical databases. Symposium on the Design and Implementation of Large Spatial Databases, Santa Barbara, California. Berlin, Springer: 137–46

Goodchild M F 1990 Keynote address: spatial information science. *Proceedings, Fourth International Conference on Spatial Data Handling, Zurich* Vol. 1: 3–14

Goodchild M F 1991a Issues of quality and uncertainty. In Müller J C (ed.) *Advances in cartography*. Oxford, Elsevier Science: 111–39

Goodchild M F 1991b Just the facts. *Political Geography Quarterly* 10: 192–3

Goodchild M F 1991c Keynote address. Proceedings, Symposium on Spatial Database Accuracy: 1–16

Goodchild M F 1991d Towards a science of geographic information. In Cadoux-Hudson J, Heywood I (eds) *Geographic Information 1991: the yearbook of the Association for Geographic Information:* 212–18

Goodchild M F 1992a Geographical data modeling. Computers and Geosciences 18: 401–8

Goodchild M F 1992b Geographical information science. International Journal of Geographical Information Systems 6: 31–45

Goodchild M F 1993 Ten years ahead: Dobson's automated geography in 1993. *The Professional Geographer* 45: 444–5

Goodchild M F 1995a GIS and geographical research. In Pickles J (ed.) *Ground truth: the social implications of GIS*. New York, Guilford Press: 31–50

Goodchild M F 1995b Sharing imperfect data. In Onsrud H J, Rushton G (eds) *Sharing geographic information*. New Brunswick, Center for Urban Policy Research: 413–25

Goodchild M F 1996 Multiple roles for GIS in global change research. Paper presented at the second NSF/ESF Young Scholars International Institute in Geographic Information, Berlin, July

Goodchild M F, Anselin L, Deichmann U 1993 A framework for the areal interpolation of socioeconomic data. *Environment and Planning A* 25: 383–97

Goodchild M F, Buttenfield B, Wood J 1994 Introduction to visualising data validity. In Hearnshaw H, Unwin D (eds) *Visualisation in geographical information systems*. Chichester, John Wiley & Sons: 141-9

Goodchild M F, Chi-Chang L, Leung Y 1994 Visualising fuzzy maps. In Hearnshaw H M, Unwin D J (eds) *Visualisation in geographical information systems*. Chichester, John Wiley & Sons: 158–67

Goodchild M F, Gopal S 1989 Accuracy of spatial databases. London, Taylor and Francis

Goodchild M F, Grandfield A W 1983 Optimizing raster storage: an examination of four alternatives. *Proceedings AutoCarto* 6: 400–7

Goodchild M F, Haining R P, Wise S 1992 Integrating GIS and spatial analysis: problems and possibilities. *International Journal of Geographical Information Systems* 6: 407–23

Goodchild M F, Lam N S-N 1980 Areal interpolation: a variant of the traditional spatial problem. *Geoprocessing* 1: 297–312

Goodchild M F, Mark D M 1987 The fractal nature of geographic phenomena. *Annals of the Association of American Geographers* 77: 265–78

Goodchild M F, Parks B O, Steyaert L T (eds) 1993 *Environmental modeling with GIS*. Oxford, Oxford University Press

Goodchild M F, Rizzo B 1986 Performance evaluation and workload estimation for geographic information systems. *Proceedings, Second International Symposium on Spatial Data Handling*: 497–509

Goodchild M F, Steyaert L, Parks B O, Johnston C O, Maidment D R, Crane M P, Glendinning S 1996 *GIS and environmental modelling: progress and research issues.* Fort Collins, GIS World Inc.

Goodchild M F, Sun G, Yang S 1992 Development and test of an error model for categorical data. *International Journal of Geographical Information Systems* 6: 87–104

Goodchild M F, Yang S 1992 A hierarchical data structure for global geographic information systems. *Computer Vision, Graphics, and Image Processing* 54: 3144

Goodwin C W H 1994 Towards a common language for IVHS databases. *Proceedings GIS/LIS 94*. Falls Church, ACSM/ASPRS: 351–60

Goodwin C W H, Gordon S R, Siegel D 1995 Reinterpreting the location referencing problem: a protocol approach. *Proceedings GIS-T 95, Geographic Information Systems for Transportation Symposium.* Washington DC, American Association of State Highway and Transportation Officials: 76–88

Gopal S, Fischer M M 1996 Learning in single hidden-layer feedforward network models. *Geographical Analysis* 28: 38–55

Gopal S, Fischer M M 1997 Fuzzy ARTMAP – a neural classifier for multispectral image classification. In Fischer M M, Getis A (eds) *Recent developments in spatial analysis* – *spatial statistics, behavioural modelling and neurocomputing.* Berlin, Springer

Gordon T, Karacapilidis N, Voss H 1996 Zeno: a mediation system for spatial planning. *Proceedings ERCIM workshop on CSCW and the Web, Sankt Augustin, Germany, 7–9 February* and *http: //orgwis.gmd.de/W4G/proceedings/zeno.html* Gore A 1993 From red tape to results: creating a government that works better and costs less. Report of the National Performance Review. Washington DC, US Government Printing Office

Goss J 1995a Marketing the new marketing: the strategic discourse of geodemographic information systems. In Pickles J (ed.) *Ground truth: the social implications of GIS.* New York, Guilford Press: 130–70

Goss J 1995b 'We know who you are and we know where you live': the instrumental rationality of geodemographic information systems. *Economic Geography* 71: 171–98

Gotelli N J, Simberloff D 1987 The distribution and abundance of tallgrass prairie plants: a test of the coresatellite hypothesis. *The American Naturalist* 130: 18–35

Gotway C A, Ferguson R B, Hergert G W, Peterson T A 1996 Comparison of Kriging and inverse-distance methods for mapping soil parameters. *Soil Science Society of America Journal* 60: 1237–47

Gould P 1993a *The slow plague: a geography of the AIDS pandemic.* Cambridge (USA), Blackwell

Gould P 1993b Why not? The search for spatio-temporal structure. *Environment and Planning A* (Anniversary issue): 48–55

Gould P 1994 Neural computing and the AIDS pandemic: the case of Ohio. In Hewitson B, Crane R (eds) *Neural nets, applications in geography*. Boston (USA), Kluwer Academic

Goulstone-Grunland A G, Wei-Ning X, Sox J 1994 GIS, expert system technologies improve forest fire management techniques. *GIS World* 7(2): 32–6

Gouveia M C 1996 'Augmenting public participation with information technology in a Portuguese environmental assessment context'. Unpublished master's thesis. Cambridge (USA), MIT, Department of Urban Studies and Planning

Graff L H, Usery E L 1993 Automated classification of generic terrain features in digital elevation models. *Photogrammetric Engineering and Remote Sensing* 59: 1409–17

Graff L H, Visone D L 1996 The seamless integration of commercial-off-the-shelf (COTS) and government-off-theshelf (GOTS) products to meet the Army's terrain analysis requirements. *Proceedings, Sixteenth Annual ESRI User Conference.* Redlands, ESRI: 4pp

Graham L A, Gallion C 1996 Image processing under Windows NT – a comparative review. GIS World 9(9): 36–44

Graham S 1997 Surveillant simulation and the city: telematics and the new urban control revolution. *Environment and Planning D: Society and Space*

Graham S, Marvin S 1996 *Telecommunications and the city: electronic spaces, urban places.* London, Routledge

Grandi G de, Lemoine G G, Groof H de, Lavalle C, Siebert A J 1994 Fully polarimetric classification of the Black Forest MAESTRO 1 AIRSAR data. *International Journal of Remote Sensing* 15: 2755–76

Granger K 1995 Dimensions of vulnerability: the human aspects of disaster. URISA Proceedings 1: 238–48

Grayson R B, Blöschl G, Moore I D 1995 Distributed parameter hydrologic modelling using vector elevation data: Thales and TAPES-C. In Singh V P (ed.) *Computer models of watershed hydrology*. Highland Ranch, Water Resources Publications: 669–96

Grayson R B, Moore I D, McMahon T A 1992 Physically based hydrologic modelling: 2. is the concept realistic? *Water Resources Research* 28: 2659–66

Grayson T H 1991 Expanding GIS functionality using DBMS tools: a network analysis prototype based on SQL. *Proceedings* URISA Annual Conference, San Francisco Vol. 1: 145–55

Green M, Flowerdew R 1996 New evidence on the modifiable areal unit problem. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International

Gregory D 1978 *Ideology, science, and human geography*. London, Hutchinson

Gregory D 1989 Areal differentiation and postmodern human geography. In Gregory D, Walford R (eds) *Horizons in human geography*. London, Macmillan: 67–96

Gregory D 1994 *Geographical imaginations*. Cambridge (USA), Blackwell

Gregory K J 1985 *The nature of physical geography*. London, Edward Arnold

Grehan J R 1993 Conservation biogeography and the biodiversity crisis: a global problem in space/time. *Biodiversity Letters* 1: 134–40

Grelot J-P 1997 The French approach. In Rhind D W (ed.), *Framework for the world*. Cambridge (UK), GeoInformation International: 226–34

Greysukh V L 1967 The possibility of studying landforms by means of digital computer. *Soviet Geography Review, and Translations*: 137–49

Griffith D A 1982 Dynamic characteristics of spatial economic systems. *Economic Geography* 58: 177–96

Griffith D A 1986 Hurricane emergency management applications of the SLOSH numerical storm surge prediction model. In Marston S A (ed.) *Terminal disasters: computer applications in emergency management*. Boulder, Boulder Institute of Behavioral Science

Griffith D A 1988 Advanced spatial statistics: special topics in the exploration of quantitative spatial data series. Dordrecht, Kluwer

Griffith D A 1989 Distance calculations and errors in geographic databases. In Goodchild M F, Gopal S (eds) *Accuracy of spatial databases*. London, Taylor and Francis: 81–90

Griffith D A 1992 What is spatial autocorrelation? Reflections on the past 25 years of spatial statistics. *L'Espace Geographique* 21: 265–80

Griffith D A 1993 Which spatial statistics techniques should be converted to GIS functions? In Fischer M M, Nijkamp P (eds) *Geographic information systems, spatial modelling, and policy evaluation.* Berlin, Springer: 101–14

Griffith D A 1995 The general linear model and spatial autoregressive models. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics.* Berlin, Springer: 273–300

Griffith D A 1996a Computational simplifications for spacetime forecasting within GIS: the neighbourhood spatial forecasting model. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International

Griffith D A 1996b Spatial autocorrelation and eigenfunctions of the geographic weights matrix accompanying georeferenced data. *The Canadian Geographer* 40: 351–67

Griffith D A, Haining R, Arbia G 1994 Heterogeneity of attribute sampling error in spatial datasets. *Geographical Analysis* 26: 300–20

Grimshaw D J 1994 (reprint 1997) Bringing geographical information systems into business. Harlow, Longman/ Cambridge (UK) GeoInformation International

Griswold v. Counecticut. 1965 381 US 479 (1965)

Grubb T G, King R M 1991 Assessing human disturbance of breeding bald eagles with classification tree models. *Journal* of Wildlife Management 55: 500–11

Grunbaum B, Shephard G C 1977a Tilings by regular polygons. *Mathematics Magazine* 50: 227–47

Grunbaum B, Shephard G C 1977b The 81 types of isohedral tilings in the plane. *Mathematical Proceedings of the Cambridge Philosophical Society* 82: 177–96

Grunbaum B, Shephard G C 1986 *Tilings and patterns*. New York, W H Freeman & Co.

Grünreich D 1985 Computer-assisted generalisation. *Papers* CERCO Cartography Course. Frankfürt am Main, Institut für Angewandte Geodäsie

Grünreich D 1992 ATKIS – a topographic information system as a basis for GIS and digital cartography in Germany. In Vinken R (ed.) From digital map series in geosciences to geoinformation systems. *Geologisches Jahrbuch Reihe A*, Heft 122. Hanover, Federal Institute of Geosciences Resources: 207–16

Grünreich D, Powitz B M, Schmidt C 1992 Research and development in computer-assisted generalisation of topographic information at the Institute of Cartography, Hannover University. *Proceedings EGIS 92 (Third European Conference and Exhibition on Geographical Information Systems)*. Utrecht, EGIS Foundation: 532–41

GS+ *Geostatistics for the environmental sciences* 1995 Plainwell, Gamma Design Software

Guber A L, Best R G, Chatfield T A, Miller K A 1995 A geographic information system for radiologic emergency response. *Proceedings, Fifteenth Annual ESRI User Conference.* Redlands, ESRI

Guercio R, Soccodato F M 1996 GIS procedure for automatic extraction of geomorphological attributes from TIN-DTM. *HydroGIS 96: application of geographic information systems in hydrology and water resources management.* IAHS Publ. no. 235: 175–82

Guibas L J, Seidel R 1987 Computing convolutions by reciprocal search. *Discrete and Computational Geometry* 2: 175–93

Günther O, Lamberts J 1994 Object-oriented techniques for the management of geographic and environmental data. *The Computer Journal* 37: 16–25

Guptill S C 1990 An enhanced digital line graph design. United States Geological Survey Circular No. 1048

Guptill S C 1993 Describing spatial data quality. Proceedings, Sixteenth International Cartographic Conference: 552–60

Guptill S C, Stonebraker M 1992 The Sequoia 2000 approach to managing large spatial object databases. *Proceedings, Fifth International Symposium on Spatial Data Handling, Charleston, South Carolina.* International Geographical Union: 642–51

Gurak L J 1995 Rhetorical dynamics of corporate communication in cyberspace. The protest over Lotus MarketPlace. *IEEE Transactions on Professional Communication* 38: 2–10

Gustafson E J, Parker G R 1992 Relationship between landcover proportion and indices of landscape spatial pattern. *Landscape Ecology* 7: 101–10

Güting R 1988 Geo-relational algebra: a model and query language for geometric database systems. In Schmidt J, Ceri S, Missikoff M (eds) Advances in database technology – EDBT 88 International Conference on Extending Database Technology, Venice, Italy. New York, Springer 303: 506–27

Guttman A 1984 R-trees: a dynamic index structure for spatial searching. ACM SIGMOD 13: 47–57

Guy C 1994 The retail development process: location, property and planning. London, Routledge

Haarslev V, Wessel M 1997 Querying GIS with animated spatial sketches. In Tortona J (ed.) *Thirteenth IEEE Symposium on Visual Languages, Capri, Italy.* IEEE Society

Haas L M, Chang W, Lohman G M, McPherson J, Wilms P F, Lapis G, Lindsay B, Piransesh H, Carey M J, Shekita E 1990 Starburst mid-flight: as the dust clears. *IEEE Transactions on Knowledge and Data Engineering* 2: 143–160

Habermas J 1978 Knowledge and human interests. London, Heinemann

Habermas J 1984 The theory of communicative action: 1. reasons and the rationalization of society. Cambridge (USA), MIT Press

Hacking I 1983 *Representing and intervening*. Cambridge (UK), Cambridge University Press

Hagens W W, Fairfax A E 1996 Precision voter targeting: GIS maps out a strategy. *Geo Info Systems* November: 24–30

Hägerstrand T 1953/1968 Innovation diffusions as a spatial process. Chicago, University of Chicago Press

Hägerstrand T 1970 What about people in regional science? Papers of the Regional Science Association 14: 7–21

Haggett P 1965 *Locational analysis in human geography*. London, Edward Arnold

Haggett P 1979 *Geography: a modern synthesis*, 3rd edition. New York, Harper and Row

Haggett P, Chorley R J 1969 Network models in geography.

London, Edward Arnold

Haggett P, Cliff A D, Frey A E 1977 Locational analysis in human geography, 2nd edition. London, Edward Arnold

Haines-Young R, Green D R, Cousins S 1993 (eds) Landscape ecology and geographical information systems. London, Taylor and Francis

Haines-Young R, Petch J R 1985 *Physical geography: its nature and methods.* London, Harper and Row

Haining R P 1990 Spatial data analysis in the social and environmental sciences. Cambridge (UK), Cambridge University Press

 Haining R P 1994 Designing spatial data analysis modules for geographical information systems. In Fotheringham S, Rogerson P (eds) *Spatial analysis and GIS*. London, Taylor and Francis: 45–63

Haining R P 1995 Data problems in spatial econometric modeling. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics.* Berlin, Springer: 156–71

Haining R P 1998 Spatial statistics and the analysis of health data. In Gatrell A C, Löytönen M (eds) *GIS and health*. London, Taylor and Francis

Haining R P, Arbia G 1993 Error propagation through map operations. *Technometrics* 35: 293–305

Haining R P, Griffith D A, Bennett R J 1984 A statistical approach to the problem of missing spatial data using a firstorder Markov model. *The Professional Geographer* 36: 338–45

Hakala J, Husby O, Koch T 1996 Warwick framework and Dublin core set provide a comprehensive infrastructure for network resource description. *http://www.ub2.lu.se/tk/ warwick.html*

Hake G 1975 Zum Begriffssystem der Generalisierung. Nachrichten aus dem Karten- und Vermessungswesen, Sonderheft zum 65 Geburtstag von Prof Knorr: 53–62

Hakimi L 5 1964 Optimum locations of switching centers and the absolute centers and medians of a graph. *Operations Research* 12: 450–9

Halcrow Fox/SERRL 1996 *Rural accessibility in England*. Report to the Rural Development Commission. London, Birkbeck College

Hall A D 1962 *A methodology for systems engineering*. Princeton, Van Nostrand

Hall F G, Strebel D E, Nickeson J E, Goetz S J 1991 Radiometric rectification: towards a common radiometric response among multidate, multisensor images. *Remote Sensing of Environment* 35: 11–27

Hall F G, Townshend J R G, Engman E T 1995 Status of remote sensing algorithms for estimation of land surface state parameters. *Remote Sensing of Environment* 51: 138–56

Hall G B, MacLennan M H 1990 Video support in teaching about geographic information systems: a review of six videotapes. *International Journal of Geographic Information Systems* 41: 87–95

Hall P 1988 The industrial revolution in reverse? The Planner

74: 15–19

Halliday S L, Wolfe M L 1991 Assessing ground water pollution potential from nitrogen fertilizer using a geographic information system. *Water Resources Bulletin* 27: 237–45

Hammer R D, Young F J, Wollenhaupt N C, Barney T L, Haithcoate T W 1995 Slope class maps from soil survey and digital elevation models. *Soil Science Society of America Journal* 59: 509–19

Hammersley J M, Handscomb D C 1979 Monte Carlo methods. London, Chapman and Hall

Han S Y, Kim T J 1989 Can expert systems help with planning? Journal of the American Planning Association 55: 296–308

Hancock J R 1993 Multivariate regionalisation: an approach using interactive statistical visualisation. *Proceedings, AutoCarto 11 Minneapolis*: 218–27

Hand G, George J, Sasse C 1979 (eds) *European electoral* systems handbook. London, Butterworth

Handy C B 1993 Understanding organisations. Harmondsworth, Penguin

Handy C B 1994 The empty raincoat: making sense of the future. London, Hutchinson

Hansen A J, Garman S L, Marks B, Urban D L 1993 An approach for managing vertebrate diversity across multipleuse landscapes. *Ecological Applications* 3: 481–96

Hanski I 1994 Patch-occupancy dynamics in fragmented landscapes. *Tree* 9: 131–5

Hanski I, Thomas C D 1994 Metapopulation dynamics and conservation: a spatially explicit model applied to butterflies. *Biological Conservation* 68: 167–80

Hanson S (ed.) 1995 *The geography of urban transportation*, 2nd edition. New York, Guilford Press

Hansson L 1992 Landscape ecology of boreal forests. *Tree* 7: 299–302

Hansson L, Angelstam P 1991 Landscape ecology as a theoretical basis for nature conservation. *Landscape Ecology* 5: 191–201

Harder R, Desmarais R 1972 Interpolation using surface splines. Journal of Aircraft 9: 1989–91

Hardie P 1993 Using a gazetteer and spatial analysis to integrate local authority records. *Mapping Awareness* 7(10): 28–30

Harding D J, Bufton J L, Frawley J 1994 Satellite laser altimetry of terrestrial topography: vertical accuracy as a function of surface slope, roughness and cloud cover. *IEEE Transactions on Geoscience and Remote Sensing* 32: 329–39

Hardy P 1996 Map generalisation – the Laser-Scan way. Technical paper. Cambridge (UK), Laser-Scan Ltd

Hardy R L 1990 Theory and applications of the multiquadricbiharmonic method. *Computers and Mathematics with Applications* 19: 163–208

Hargrove W, Levine D, Hoffman F 1995 Clinch River environmental restoration program. *http://www.esd*.

ornl.gov/programs/CRERP/

Harley J B 1989 Deconstructing the map. Cartographica 26: 1-20

Harley J B 1991 Can there be a cartographic ethics? Cartographic Perspectives 10: 9–16

Harman H H 1976 *Modern factor analysis*. Chicago, University of Chicago Press

Harp E, Jibson R 1995 Inventory of the landslides triggered by the Northridge, California earthquake. USGS Open File Report: 95–213

Harris B 1989 Beyond geographic information systems: computers and the planning professional. *Journal of the American Planning Association* 55: 85–92

Harris B, Batty M 1993 Locational models, geographic information, and planning support systems. *Journal of Planning Education and Research* 12: 184–98

Harris R 1997 Earth observation data policy. Chichester, John Wiley & Sons

Harris T M, Weiner D, Warner T A, Levin R 1995 Pursuing social goals through participatory GIS. In Pickles J (ed.) *Ground truth: the social implications of GIS*. New York, Guilford Press: 196–222

Harris T M, Weiner D 1996 GIS and society: the social implications of how people, space, and environment are represented in GIS. Scientific report for the Initiative-19 Specialist Meeting, 2–5 March, Koininia Retreat Center, South Haven, NCGIA Technical Report 96–7. Santa Barbara, NCGIA

Harrison C M 1995 Housing characteristics and population: a GIS analysis of impact and recovery after hurricane Andrew. URISA Proceedings 1: 273–82

Harrison J 1995 Finding the information. Parks 5: 12-19

Hartman R 1997 Focus on GIS component software featuring ESRI MapObjects. Santa Fe, Onword Press

Hartshorne R 1939 The nature of geography: a critical survey of current thought in the light of the past. *Association of American Geographers* 29: 173–655

Hartshorne R 1959 *Perspective on the nature of geography*. Chicago, Rand-McNally/London, John Murray

Harvey D 1966 Geographic processes and the analysis of point patterns. *Transactions, Institute of British Geographers* 40: 81–95

Harvey D 1969 Explanation in geography. London, Edward Arnold

Harvey D 1982 The limits to capital. Oxford, Basil Blackwell

Harvey R 1995 'Eliciting and mapping the attributes of landscape perception: an integration of personal construct theory (PCT) with geographic information systems (GIS)'. PhD thesis, Heriot-Watt University, Department of Landscape Architecture

Harvison P E, Speaker R C, Turner M L Jr 1985 Drawing the lines – by the numbers: the statistical foundations of the electoral process. (US) *Government Information Quarterly* 2: 389–405 Haslett J 1992 Spatial data analysis – challenges. *The Statistician* 41: 271–84

Haslett J, Bradley R, Craig P, Unwin A, Wills G 1991 Dynamic graphics for exploring spatial data with applications to locating global and local anomalies. *The American Statistician* 45: 234–42

Haslett J, Power G M 1995 Interactive computer graphics for a more open exploration of stream sediment geochemical data. *Computers and Geosciences* 21: 77–87

Haslett J, Wills G, Unwin A 1990 SPIDER – an interactive statistical tool for the analysis of spatially distributed data. *International Journal of Geographical Information Systems* 4: 285–96

Haunold P, Kuhn W 1994 A keystroke level analysis of a graphics application: manual map digitising. In Adelson B, Dumais S, Olson J (eds) *Human factors in computing systems, CHI 94 conference proceedings.* Boston, ACM Press: 337–43

Hawke D 1991 Characterising the performance of geographic information systems. *Proceedings, Third Annual Colloquium of the Spatial Information Research Centre, Dunedin.* University of Otago

Haynes K, Fotheringham S 1984 Gravity and spatial interaction models. Newbury Park, Sage Publications

Haynes R M, Lovett A A, Gale S H, Brainard J S, Bentham C G 1995 Evaluation of methods for calculating census health indicators for GP practices. *Public Health* 109: 369–74

Hayward S 1984 Computers for animation. Norwich, Page Bros

Hazelhoff L, Gunnink J L 1992 Linking tools for exploratory analysis of spatial data with GIS. *EGIS 92, Proceedings Third European Conference on Geographical Information Systems.* Utrecht, EGIS Foundation: 204–13

Hazleton N W J 1991 'Integrating time, dynamic modelling, and geographical information systems: development of 4dimensional GIS'. Unpublished PhD disseration, Dept of Surveying and Land Information, University of Melbourne

Hazelton N W J, Leahy F J, Williamson I P 1990 On the design of temporally-referenced, 3-dimensional geographical information systems: development of 4-dimensional GIS. *GIS/LIS 90 Proceedings*: 357–72

Healey P 1986 The role of development plans in the British planning system, an empirical assessment. *Urban Law and Policy* 8: 1–32

Healey R G 1991 Database management systems. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 251–67

Health Systems Trust 1995 *South African health review*. Durban, Health Systems Trust

Hearnshaw H M, Unwin D J (eds) 1994 Visualisation in geographical information systems. Chichester, John Wiley & Sons

Hecht-Nielsen R 1990 *Neurocomputing*. Reading (USA), Addison-Wesley

Heikkila E J, Moore J E, Kim T J 1990 Future directions for EGIS: applications to land use and transportation planning. In Kim T J, Wiggins L L, Wright J R (eds) *Expert systems: applications to urban planning*. New York, Springer: 225–40

Held G D, Stonebraker M R, Wong E 1975 INGRES: a relational database system. *Proceedings AFIPS 44, Montvale*. AFIPS Press: 409–16

Heller M 1990 *The ontology of physical objects*. Cambridge (UK), Cambridge University Press

Heller M 1990 Triangulation algorithms for adaptive terrain modelling. *Proceedings, Fourth International Symposium on Spatial Data Handling*. Columbus, International Geographical Union: 163–74

Helstrom C W 1991 Probability and stochastic processes for engineers. New York, Macmillan

Hennell T, Knight D, Rowe P 1994 A pilot study into budget setting using synthetic practice illness ratios (SPIRO scores) calculated from Super Profiles area types. *Working Paper 43*. Urban Research and Policy Evaluation Regional Research Laboratory, University of Liverpool

Hepple L W 1996 Directions and opportunities in spatial econometrics. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment.* Cambridge (UK), GeoInformation International

Herr A M, Queen L P 1993 Crane habitat evaluation using GIS and remote sensing. *Photogrammetric Engineering and Remote Sensing* 59: 1531–8

Herring J 1991 The mathematical modelling of spatial and non-spatial information in GIS. In Mark D M, Frank A U (eds) *Cognitive and linguistic aspects of geographic space*. NATO ASID. Dordrecht, Kluwer: 313–50

Hershelberg J 1989 Finding the upper envelope of n line segments in O($n \log n$) time. *Information Processing Letters* 33: 169–74

Herskovits A 1986 Language and spatial cognition: an interdisciplinary study of the prepositions in English. Cambridge (UK), Cambridge University Press

Herzen B von, Barr A H 1987 Accurate triangulations of deformed, intersecting surfaces. *Computer Graphics* 21: 103–10

Hess G 1994 Pattern and error in landscape ecology: a commentary. *Landscape Ecology* 9: 3–5

Hesse W J, Williamson I P 1990 A review of digital cadastral databases in Australia and New Zealand. *Australian Surveyor* 35: 351–67

Hester v. United States 1924 265 US 57(1924)

Heuvelink G B M 1993 'Error propagation in quantitative spatial modelling: applications in geographical information systems'. PhD thesis. Utrecht, Netherlands Geographical Studies 163

Heuvelink G B M 1996 Identification of field attribute error under different models of spatial variation. *International Journal of Geographical Information Systems* 10: 921–36

Heuvelink G B M 1998 Uncertainty analysis in environmental modelling under a change of spatial scale. *Nutrient Cycling*

in Agro-Ecosystems

Heuvelink G B M, Burrough P A 1993 Error propagation in cartographic modelling using Boolean logic and continuous classification. *International Journal of Geographical Information Systems* 7: 231–46

Heuvelink G B M, Burrough P A, Stein A 1989 Propagation of errors in spatial modelling with GIS. *International Journal of Geographical Information Systems* 3: 303–22

Hickman C E 1995 Feature-based data models and linear referencing systems: aids to avoiding excessive segmentation of network links. *Proceedings GIS-T 95, Geographic Information Systems for Transportation Symposium.*Washington DC, American Association of State Highway and Transportation Officials: 89–113

Hill M O 1991 Patterns of species distribution in Britain elucidated by canonical correspondence analysis. *Journal of Biogeography* 18: 247–55

Hillis W D 1992 What is Massively Parallel Computing and why is it important? In Metropolis N, Carlo Rota G (eds) *A new era in computation*. Cambridge (USA), MIT Press: 1–15

Hillsman E L 1984 The *p*-median structure as a unified linear model for location–allocation analysis. *Environment and Planning A* 16: 305–18

Hillsman E L, Rhoda R 1978 Errors in measuring distances from populations to service centers. *Annals of Regional Science* 7: 74–88

Hinton J C 1996 GIS and remote sensing integration for environmental applications. *International Journal of Geographical Information Systems* 10: 877–90

Hirschfield A, Brown P J B, Bundred P 1995 The spatial analysis of community health services on Wirral using geographic information systems. *Journal of the Operational Research Society* 46: 147–59

Hirschheim R A 1985 Office automation: a social and organisational perspective. Chichester, John Wiley & Sons

Hitchner L E 1992 Virtual planetary exploration: a very large virtual environment. *Proceedings of SIGGRAPH tutorial on implementing immersive virtual environments*

Hjalmars U, Kulldorff M, Gustafson G 1996 Childhood leukaemia in Sweden: using GIS and a spatial scan statistic for cluster detection. *Statistics in Medicine* 15: 707–15

HM Land Registry 1994 HM Land Registry – England and Wales: a guide for overseas visitors. London, HM Land Registry: 1–60

Hobbs F 1995 The rendering of relief images from digital contour data. *The Cartographic Journal* 32: 111–16

Hobbs N T, Hanley T A 1990 Habitat evaluation: do use/availability data reflect carrying capacity? *Journal of Wildlife Management* 54: 515–22

Hobbs R J, Saunders D A, Arnold G W 1993 Integrated landscape ecology: a Western Australian perspective. *Biological Conservation* 64: 231–8

Hodgson M E, Jensen J R, Mackey H E, Coulter M C 1988 Monitoring wood stork foraging habitat using remote sensing

and geographical information systems. *Photogrammetric* Engineering and Remote Sensing 54: 1601–7

Hodgson M E, Palm R 1992 Attitude toward disaster: a GIS design for analyzing human response to earthquake hazards. *Geo Info Systems* July–August: 41–51

Hodgson M J 1988 An hierarchical location–allocation model for primary health care delivery in a developing area. *Social Science and Medicine* 26: 153–61

Hodgson M J, Storrier A L G 1995 Functional error in geographical analysis: the case of spatial separation in location–allocation. *Geographical Systems* 2: 59–82

Hoekstra T W, Flather C H 1986 Theoretical basis for integrating wildlife in renewable resource inventories. *Journal* of Environmental Management 24: 95–110

Hofmann-Wellenhof B, Lichtenegger H, Collins J 1994 *Global positioning systems: theory and practice*, 3rd edition. Berlin, Springer

Hofstadter D R 1985 Metamagical themas: quests for the essence of mind and pattern. New York, Basic Books

Hogweg P 1988 Cellular automata as a paradigm for ecological modeling. *Mathematics and Computations* 27: 81–100

Holdridge L R 1947 Determination of world plant formations from simple climatic data. *Science* 105: 367–8

Holland A 1990 'The impact of AVM on transit operations'. Unpublished MSc thesis. Department of Geography, University of Calgary

Holland J 1975 *Adaptation in natural and artificial systems*. Ann Arbor, University of Michigan Press

Holroyd F, Bell S B M 1992 Raster GIS: models of raster encoding. *Computers and Geosciences* 18: 419–26

Holt D, Steel D G, Tranmer M 1996 Area homogeneity and the modifiable areal unit problem. *Geographical Systems* 3: 181–200

Holt-Jensen A 1980 *Geography: its history and concepts.* London, Harper and Row

Homer C G, Edwards T C, Ramsey R D, Price K P 1993 Use of remote sensing methods in modelling sage grouse winter habitat. *Journal of Wildlife Management* 57: 78–84

Honeycutt D M 1986 Epsilon, generalisation, and probability in spatial databases. Unpublished manuscript

Hooker C A 1973 Metaphysics and modern physics: a prolegomenon to the understanding of quantum theory. In Hooker C A (ed.) *Contemporary research in the foundations and philosophy of quantum theory*. Dordrecht, Reidel

Hopkins L D 1977 Methods for generating land suitability maps: a comparative evaluation. *Journal of the American Planning Association* 44: 386–400

Horn M E T 1995 Solution techniques for large regional partitioning problems. *Geographical Analysis* 27: 230–48

Horn M E T, O'Callaghan J, Garner B 1988 Design of integrated systems for spatial planning tasks. *Proceedings, Third International Symposium on Spatial Data Handling.* Sydney, International Geographical Union: 107–16

Hornsby A G, Rao P S C, Booth J G, Rao P V, Pennell K D,

Jessup R E, Means G D 1990 *Evaluation of models for predicting fate of pesticides.* Final Project Report WM-255 submitted to the Florida Department of Environmental Regulation. Gainesville, Departments of Soil Science and Statistics, University of Florida

Horowitz J L 1995 Modeling choices of residential location and mode of travel to work. In Hanson S (ed.) *The geography of urban transportation*, 2nd edition. New York, Guilford Press: 219–39

Houlding S 1994 *Three-dimensional geoscience modelling*. Berlin, Springer

Howe A 1991 Assessing potential of branch outlets using GIS. In Cadoux-Hudson J, Heywood D I (eds) *Geographic Information 1991*. The Yearbook of the Association for Geographic Information. London, Taylor and Francis: 173–5

Hoyle B S, Knowles R D 1992 *Modern transport geography*. London, Belhaven Press

Htun N 1997 The need for basic map information in support of environmental assessment and sustainable development strategies. In Rhind D W (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 111–19

Huber D L, Church R L 1985 Transmission corridor location modelling. *Journal of Transportation Engineering* 111: 114–30

Hubert L J 1979 Matching models in the analysis of crossclassifications. *Psychometrika* 44: 21–41

Hudson D 1988 Some comments on data quality in a GIS. Proceedings, 1988 ACSM-ASPRS Annual Convention 2: 203–10

Hugenholtz P B 1994 Analysis of law relating to copyright and electronic delivery in Europe. *Proceedings, Conference of European Commission's Legal Advisory Board on Legal aspects of multimedia and GIS, Lisbon, 27–28 October:* 33–8

Hughes J R 1991 A user's guide to redistricting software. *GIS World* June: 77–81

Hughes P 1993 Terrain renderer for Mars Navigator. In Wolff R S, Yaeger L (eds) *Visualization of Natural Phenomena*. Santa Clara, TELOS – The Electronic Library of Science

Hunsaker C T, Nisbet R A, Lam D C L, Browder J A, Baker W L, Turner M G, Botkin D A 1993 Spatial models of ecological systems and processes: the role of GIS. In Goodchild M F, Parks B O, Steyaert L T (eds) *Environmental* modelling with GIS. Oxford, Oxford University Press: 248–64

Hunt E R Jr 1991 Airborne remote sensing of canopy water thickness scaled from leaf spectral data. *International Journal of Remote Sensing* 12: 643–9

Hunt L, Boots B 1996 MAUP effects in the principal axis factoring technique. *Geographical Systems* 3: 101–22

Hunter G J, Goodchild M F 1993 Managing uncertainty in spatial databases: putting theory into practice. *Journal of the Urban and Regional Information Systems Association* 5(2): 55–62

Hunter G J, Goodchild M F 1995a A methodology for reporting uncertainty in spatial database products. *Journal of the Urban and Regional Information Systems Association* 7: 11–21

Hunter G J, Goodchild M F 1995b Dealing with error in

spatial databases: a simple case study. *Photogrammetric Engineering and Remote Sensing* 61: 529–37

Hunter G J, Goodchild M F 1996a Communication of uncertainty in spatial databases. *Transactions in Geographical Information Systems* 1: 13–24

Hunter G J, Goodchild M F 1996b A new model for handling vector data uncertainty in GIS. *Journal of the Urban and Regional Information Systems Association* 8: 51–7

Hunter G J, Williamson I P 1990 The development of a historical digital cadastral database. *International Journal of Geographical Information Systems* 4: 169–79

Hunting Technical Services 1986 *Monitoring landscape change*. Report to the DOE. 10 vols. Elstree, Hunting Technical Services

Hurcom S 1996 Radio propagation modelling. *Mapping Awareness* 10(8): 22–5

Hurn J 1989 GPS: A guide to the next utility. Sunnyvale, Trimble Navigation Ltd

Hurn J 1993 *Differential GPS explained*. Sunnyvale, Trimble Navigation Ltd

Hutchinson C F, Toledano J 1993 Guidelines for demonstrating geographical information systems based on participatory development. *International Journal of Geographical Information Systems* 7: 453–61

Hutchinson M F 1988 Calculation of hydrologically sound digital elevation models. *Proceedings, Third International Symposium on Spatial Data Handling.* Columbus, International Geographical Union: 117–33

Hutchinson M F 1989 A procedure for gridding elevation and stream line data with automatic removal of spurious pits. *Journal of Hydrology* 106: 211–32

Hutchinson M F 1991 The application of thin plate smoothing splines to continent-wide data assimilation. In Jasper J D (ed.) *Data assimilation systems*. BMRC Research Report No. 27. Melbourne, Bureau of Meteorology: 104–13

Hutchinson M F 1995a Interpolating mean rainfall using thin plate smoothing splines. *International Journal of Geographical Information Systems* 9: 385–403

Hutchinson M F 1995b Stochastic space-time weather models from ground-based data. *Agricultural and Forest Meteorology* 73: 237–64

Hutchinson M F 1996 A locally adaptive approach to the interpolation of digital elevation models. *Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modeling.* Santa Barbara, NCGIA. CD-ROM

Hutchinson M F 1996 Thin plate spline interpolation of mean rainfall: getting the temporal statistics correct. In Goodchild M F, Steyaert L T, Parks B O, Johnston C, Maidment D R, Crane M P, Glendinning S (eds) *GIS and Environmental Modelling: Progress and Research Issues.* Fort Collins, GIS World Inc.

Hutchinson M F, Bischof R J 1983 A new method for estimating the spatial distribution of mean seasonal and annual rainfall applied to the Hunter Valley, New South Wales. *Australian Meteorological Magazine* 31: 179–84 Hutchinson M F, Dowling T 11991 A continental hydrological assessment of a new grid-based digital elevation model of Australia. *Hydrological Processes* 5: 45–58

Hutchinson M F, Gessler P E 1993 Splines – more than just a smooth interpolator. *Geoderma* 62: 45–67

Hutchinson M F, Gessler P E, Xu T, Gallant J C 1997 Filtering Wagga TOPSAR data to improve drainage accuracy. In Milne A K (ed.) *Proceedings, International Workshop on Radar Image Processing and Applications*. Canberra, CSIRO: 80–3

Hutchinson M F, Nix H A, McMahon J P, Ord K D 1996 The development of a topographic and climate database for Africa. *Proceedings, Third International Conference Integrating GIS and Environmental Modeling*. Santa Barbara, NCGIA. CD-ROM

Hutflesz A, Six H-W, Widmayer P 1990 The R-file: an efficient access structure for proximity queries. *Proceedings, IEEE Sixth International Conference on Data Engineering, Los Angeles, California.* Los Alamitos, IEEE Computer Society Press: 372–9

Hutson J L, Wagenet R J 1993 A pragmatic field-scale approach for modeling pesticides. *Journal of Environmental Quality* 22: 494–9

Huttenlocher D P, Klanderman O A, Rucklidge W J 1993 Comparing images using the Hausdorff distance. *IEEE Transactions on Pattern Analysis and Machine Intelligence* 15: 850–63

Huxhold W E 1991 An introduction to urban geographic information systems. New York, Oxford University Press

Huxhold W E 1993 The application of research and development from the information systems field to GIS implementation in local government: some theories in successful adoption and use of GIS technology. In Masser I, Onsrud H J (eds) *Diffusion and use of geographic information technologies*. Dordrecht, Kluwer: 61–75

Huxhold WE, Levinsohn A O 1995 Managing geographic information system projects. New York, Oxford University Press

Ibaraki T, Katoh N 1989 Resource allocation problems: algorithmic approaches. Cambridge (USA), MIT Press

ICA (International Cartographic Association) 1973 Multilingual dictionary of technical terms in cartography. Wiesbaden, Franz Steiner

Ichoku C, Karnieli A 1996 A review of mixture modelling techniques for sub-pixel land cover estimation. *Remote Sensing Reviews* 13: 161–86

IDON Corporation 1990 Final report: a federal geographic information systems (GIS) network requirements study. Contract report prepared for the Data Communications and Networking Subcommittee, Interagency Committee on Geomatics, Government of Canada

Idrisi 1996 WEIGHT command. http://www.idrisi.clarku. edu/PRODUCTS/specindr. htm#DECISION SUPPORT

Ijjasz-Vasquez E J, Rodriguez-Iturbe I, Bras R L 1992 On the multi-fractal characterisation of river basins. *Geomorphology*

5: 297-310

- Imhof E 1964 Beiträge zur Geschichte der topographischen Kartographie. International Year Book of Cartography 4: 129–54
- Ims R A, Rolstad J, Wegge P 1993 Predicting space use responses to habitat fragmentation: can voles *microtus oeconomus* serve as an experimental model system (EMS) for capercaillie grouse *Tetrao urogallus* in boreal forest? *Biological Conservation* 63: 261–8
- Ingoldsby T R 1991 Transparent access to geographically related data from heterogeneous networked systems. *Proceedings of 1991 Annual Conference of the Urban and Regional Information Systems Association* 3: 14–24
- Innes J E, Simpson D W 1993 Implementing GIS for planning: lessons from the history of technological innovation. *American Planning Association Journal* 59: 230–6
- Inskeep W P, Wraith J M, Wilson J P, Snyder R D, Macur R E 1996 Input parameter and model resolution effects on predictions of solute transport. *Journal of Environmental Quality* 25: 453–62
- Ireland P 1994 GIS: another sword for St Michael. *Mapping Awareness* 8(3): 26–9

Isaaks E H, Srivastava R M 1989 An introduction to applied geostatistics. Oxford, Oxford University Press

- Isbell R F 1996 *The Australian soil classification*. Australian Soil and Land Survey Handbook 4. Collingwood, CSIRO
- ISO 1992 Database language SQL. Document ISO/IEC 9075. International Organisation for Standardisation
- ISO 1993 Industrial automation systems product data representation and exchange STEP. Draft International Standard ISO/DIS 10303
- ISO 1996a SQL multimedia and application packages (SQL/MM) part 3: spatial. SQL/MM: MAD-005. International Organisation for Standardisation
- ISO 1996b Geographic information rules for application schema. ISO 15046–9. ISO TC21 1: WG2 N030 Geographic information-Geomatics, Working group 2. International Organisation for Standardisation
- ISO 2709-1996 1996c Format for information exchange. New York, American National Standards Institute Inc.
- ISO 15046-15 1997 ISO Standard 15046-15, Geographic information metadata, Version 2.0, 20 January
- ISO/IEC JTC 1/SC 21 1996 SQL multimedia and application packages (SQL/MM) Part 3: spatial.
- ISO/IEC JTC 1/SC 21 N 10441, ISO/IEC CD 13249–3: 199x (E) SQL/MM: MAD005. ftp://speckle.ncslnisf.gov/isowg3/ sqlmm/MADdocs/
- ISO/TC 211 Secretariat 1996 ISO/TC 211 Geographic Information/Geomatic. http://www.statkart.noi/isotc211/
- Itami R M, Clark J D 1992 Spatial dynamic simulations using discrete time and discrete event theory in cell-based GIS systems. *Proceedings, Fifth International Symposium on Spatial Data Handling, Charleston, South Carolina.*

International Geographical Union: 702-12

- Jackson M J, Woodsford P A 1991 GIS data capture hardware and software. In Maguire D J, Goodchild M F, Rhind D W (eds) Geographical information systems: principles and applications. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 239–49
- Jacobson B 1992 The ultimate user interface. Byte 17: 175-82
- Jacobson I, Christerson M 1995 Modeling with use cases: a confused world of OOA and OOD. *Journal of Object-Oriented Programming* (September): 15–20
- Jacobson I, Christerson M, Jonsson P, Overgaard G 1993 *Object-oriented software engineering.* Reading (USA), Addison-Wesley
- Jacobson R 1994 Virtual worlds capture spatial reality. *GIS World* (December): 36–9
- Jacquemoud S 1993 Inversion of the PROSPECT + SAIL canopy reflectance model from AVIRIS equivalent spectra: theoretical study. *Remote Sensing of Environment* 44: 281–92
- Jacquemoud S, Baret F 1990 PROSPECT: a model of leaf optical properties spectra. *Remote Sensing of Environment* 34: 75–92
- Jacquemoud S, Baret F, Andrieu B, Danson F M, Jaggard K 1995 Extraction of vegetation biophysical parameters by inversion of the PROSPECT + SAIL models on sugar beet canopy reflectance data application to TM and AVIRIS sensors. *Remote Sensing of Environment* 52: 163–72
- Jacquemoud S, Baret F, Hanocq J F 1992 Modelling spectral and bidirectional soil reflectance. *Remote Sensing of Environment* 41: 123–32
- Jacquez G M 1996 Disease cluster tests for imprecise locations. Statistics in Medicine 15: 873–85
- Jacquez G M, Grimson R, Waller L A, Wartenberg D 1996 The analysis of disease clusters. Part 2: introduction to techniques. Infection Control and Hospital Epidemiology 17: 385–97
- Jagadish H V 1990 Linear clustering of objects with multiple attributes. *ACM/SIGMOD, Atlantic City.* New York, ACM: 332–42
- Jain R 1991 The art of computer systems performance analysis: techniques for experimental design, measurement, simulation, and modeling. New York, John Wiley & Sons Inc.
- Jammer M 1964 The concept of space in antiquity. In Smart J J (ed.) *Problems of space and time*. New York, Macmillan
- Jankowski P 1995 Integrating geographical information systems and multiple criteria decision-making methods. *International Journal of Geographical Information Systems* 9: 251–73
- Jansen M J W, Rossing W A H, Daamen R A 1994 Monte Carlo estimation of uncertainty contributions from several independent multivariate sources. In Grasman J, Straten G van (eds) *Predictability and non-linear modelling in natural sciences and economics*. Dordrecht, Kluwer: 334–43
- Janssen R, Rietveld P 1990 Multicriteria analysis and geographical information systems: an application to agricultural landuse in the Netherlands. In Scholten H J, Stillwell J C H (eds) *Geographical information systems for urban and regional planning*. Amsterdam, Kluwer Academic:

129–39

Jeffrey D 1987 Route guidance and in-vehicle information systems. In Bonsall P, Bell M (eds) *Information technology applications in transport.* Utrecht, VNU Science Press: 319–51

Jenkins A 1992 Through a model darkly: an educational postscript. *Cartographica* 23: 103–8

Jensen C S, Clifford J, Gadia S K, Segev A, Snodgrass T R 1993 A glossary of temporal database concepts. *Proceedings International Workshop on an Infrastructure for Temporal Databases, Arlington, Texas*: A25–A29

Jensen J R, Narumalani S, Weatherbee O, Morris K S 1992 Predictive modelling of cattail and waterlily distribution in a South Carolina Reservoir using GIS. *Photogrammetric Engineering and Remote Sensing* 58: 1561–8

Jenson S K 1991 Applications of hydrologic information automatically extracted from digital elevation models. *Hydrological Processes* 5: 31–44

Jenson S K, Domingue J O 1988 Extracting topographic structure from digital elevation data for geographic information system analysis. *Photogrammetric Engineering and Remote Sensing* 54: 1593–1600

Ji W, Mitchell L C 1995 Analytical model-based decision support GIS for wetland resource management. In Lyon J G, McCarthy J (eds) *Wetland and environmental application of GIS*. New York, Lewis Publishers: 31–45

João E 1994 'Causes and consequences of generalisation'. PhD thesis. Birkbeck College, University of London

Jobson T A, Rooyen M M van, Reynecke C D, Biljon W R van, Scheepers C F 1986 *The KANDELAAR geographic information and map compilation system: functional description*. Report. National Research Institute of Mathematical Sciences, Pretoria, CSIR: 59pp

Johannesson P 1995 Representation and communication: a speech act-based approach to information systems design. *Information Systems* 20: 291–303

Johns R C 1990 Transportation information systems using machine vision technology. *Proceedings, URISA Annual Conference*. Washington DC, URISA 1: 199–208

Johnson A R, Wiens J A, Milne B T, Crist T O 1992 Animal movements and population dynamics in heterogeneous landscapes. *Landscape Ecology* 7: 63–75

Johnson D, Shelley P, Taylor M, Callahan S 1991 The FINDAR Directory System: a meta-model for metadata. In Medyckyj-Scott D, Newman I, Ruggles C, Walker D (eds) *Metadata in the Geosciences*. Loughborough, Group D Publications: 123–37

Johnson G O 1992 GIS applications in emergency management. URISA Journal 4(1): 66–72

Johnson G O 1994 The value of computer methods for hazards vulnerability analysis. URISA Proceedings 1: 661–74

Johnson J P, Dansby H B 1995 Liability in private sector GIS. Proceedings, Conference on Law and Information Policy for Spatial Databases. Orono, University of Maine, NCGIA: 285–92

Johnson L B 1990 Analysing spatial and temporal phenomena using geographical information systems: a review of ecological applications. *Landscape Ecology* 4: 31–43

Johnson M E 1987 *Multivariate statistical simulation*. New York, John Wiley & Sons Inc.

Johnston C A, Naiman R J 1990 The use of a geographical information system to analyze long-term landscape alteration by beaver. *Landscape Ecology* 4: 5–19

Johnston R J 1989 Philosophy, ideology, and geography. In Gregory D, Walford R (eds) *Horizons in human geography*. London, Macmillan: 48–66

Johnston R J 1995 The business of British geography. In Cliff A D, Gould P R, Hoare A G, Thrift N J (eds) *Diffusing* geography: essays for Peter Haggett. Oxford, Blackwell: 317–41

Johnston R J 1997 Geography and geographer: Anglo-American human geography since 1945, 5th edition. London, Edward Arnold

Johnston R J, Gregory S 1994 The United Kingdom. In Johnston R J, Claval P (eds) Geography since the Second World War, an international survey. London, Croom Helm: 107–31

Johnston R J, Hughes C A 1979 Constituency delimitation and the unintentional gerrymander in Brisbane. *Australian Geographic Studies* 16: 99–110

Johnston R J, Rossiter D J 1981 Shape and the definition of parliamentary constituencies. Urban Studies 18: 219–23

Jones A P, Bentham G 1995 Emergency medical service accessibility and outcome from road traffic accidents. *Public Health* 109: 169–77

Jones A P, Liedekerk M van, Cooper A 1995 Mapping the effects of Chernobyl: using GIS to show the European Perspective. *Proceedings, Fifteenth Annual ESRI User Conference*. Redlands, ESRI

Jones C 1997 Geographical information systems and computer cartography. London, Academic Press

Jones C B, Bundy G L, Ware J M 1995 Map generalisation with a triangulated data structure. *Cartography and Geographic Information Systems* 22: 317–31

Jones C B, Kidner D B, Luo L Q, Bundy G L, Ware J M 1996 Database design for a multi-scale spatial information system. *International Journal of Geographical Information Systems* 10: 901–20

Jones C B, Kidner D B, Ware J M 1994 The implicit triangular irregular network and multiscale databases. *The Computer Journal* 37: 43–57

Jones K, Moon G 1987 Health, disease and society. London, Routledge

Jones N L, Wright S G, Maidment D R 1990 Watershed delineation with triangle based terrain models. *Journal of Hydraulic Engineering. ASCE* 116: 1232–51

Jones R M, Edmonds E A, Branki N E 1994 An analysis of media integration for spatial planning environments. *Environment and Planning B: Planning and Design* 21: 121–33

Jong P de, Springer C, Veen F van 1984 On extreme values of Moran's I and Geary's c. Geographical Analysis 16: 17–24

Jordan T 1988 The intellectual core: President's column. AAG Newsletter 23: 1

Jørgensen S E 1990 Modelling concepts. In Jørgensen S E (ed.) *Modelling in ecotoxicology*. Developments in environmental modelling 16. Amsterdam, Elsevier Science

Jørgensen S E, Patten B, Stra-kraba M 1992 Ecosystems emerging: toward an ecology of complex systems in a complex future. *Ecological Modelling* 62: 1–27

Journel A G 1996 Modelling uncertainty and spatial dependence: stochastic imaging. *International Journal of Geographical Information Systems* 10: 517–22

Journel A G, Huijbregts C J 1978 *Mining geostatistics*. New York, Academic Press

Jupp D L B, Strahler A H, Woodcock C E 1988 Autocorrelation and regularisation in digital images: 1. Basic theory. *IEEE Transactions on Geoscience and Remote Sensing* 26: 463–73

Kainz W 1995 Logical consistency. In Guptill S C, Morrison J L (eds) *Elements of spatial data quality*. Oxford, Elsevier Science: 103–37

Kamel I, Faloutsos C 1994 Hubert R-tree: an improved R-tree using fractals. *VLDB Conference*

Kangas J, Kuusipalo J 1993 Integrating biodiversity into forest management planning and decision-making. *Forest Ecology and Management* 61: 1–15

Kansa E J, Carlson R E 1992 Improved accuracy of multiquadric interpolation using variable shape parameters. *Computers and Mathematics with Applications* 24: 99–120

Kaplan A, Schott H F 1951 A calculus for empirical classes. *Methodos* 3: 165–88

Karacapilidis N, Papadias D, Egenhofer M 1995 Collaborative spatial decision-making with qualitative constraints. *Proceedings, Third International ACM Workshop on Advances in Geographic Information Systems*: 53–9

Karimi H A 1993 Autonomous route management and guidance systems (ARMGS): a GIS for emergency fleet management. Proceedings, First Sharjah Conference on Geographic Information Systems and Applications (GISA 93). Sharjah: 121–8

Karjala D S 1995 Copyright in electronic maps. *Jurimetrics Journal* 35: 395–415

Katz M J, Overmars M H, Sharir M 1991 Efficient hidden surface removal for objects with small union size. *Proceedings, Seventh ACM Symposium on Computational Geometry.* New York, ACM Press: 31–40

Katz R 1991 *High performance network and channel-based storage*. Sequoia 2000 Technical Report 91/2. Computer Science Division, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley

Katz v. United States 1967 389 US 347 (1967)

Kauahikaua J, Margriter S, Moore R 1995 GIS-aided volcanic activity hazard analysis for the Hawaii geothermal project

environmental impact statement. In Carrara A, Guzzetti F (eds) *Geographical information systems in assessing natural hazards.* Dordrecht, Kluwer: 235–57

Kaufman Y J 1988 Atmospheric effect on spectral signature – measurement and corrections. *IEEE Transactions on Geoscience and Remote Sensing* 26: 441–50

Kaufman Y J 1993 Aerosol optical thickness and atmospheric path radiance. *Journal of Geophysical Research* 98: 2677–92

Kay W 1987 Battle for the high street. London, Piatkus

Keefer B M, Smith J L, Gregoire T G 1991 Modelling and evaluating the effects of stream mode digitizing errors on map variables. *Photogrammetric Engineering and Remote Sensing* 57: 957–63

Keen P G W 1981 Information systems and organisational change. *Communications of the Association for Computing Machinery* 24: 24–33

Keen P G W, Morton M S S 1978 Decision support systems: an organisational perspective. Reading (USA), Addison-Wesley

Kelejian H H, Robinson D P 1993 A suggested method of estimation for spatial interdependent models with autocorrelated errors, and an application to a county expenditure model. *Papers in Regional Science* 72: 297–312

Kelejian H H, Robinson D P 1995 Spatial correlation: a suggested alternative to the autoregressive model. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics.* Berlin, Springer: 75–95

Keller P R, Keller M M 1992 Visual cues, practical data visualization. Piscataway, IEEE Press

Keller S F 1995 'Generalisation by example': interactive parameter control in line generalisation using genetic algorithms. *Cartography crossing borders (Proceedings, Seventeenth International Cartographic Conference)*. Barcelona, Institut Cartografic de Catalunya: 1974–83

Keller T, Jones D 1996 Metadata: the foundation of effective experiment management. *Proceedings, First IEEE Metadata Conference*. IEEE Computer Society Mass Storage Systems and Technology Technical Committee. *http://www. computer.org/conferen/meta96/meta_home.html*

Kellogg R L, TeSelle G W, Goebel J J 1994 Highlights from the 1992 National Resources Inventory. *Journal of Soil and Water Conservation* 49: 521–7

Kelly G A 1955 *The psychology of personal constructs*. New York, Norton

Kelly R E, McConnell P R H, Mildenberger S J 1977 The Gestalt photomapping system. *Photogrammetric Engineering and Remote Sensing* 43: 1407–17

Kelly-Bootle S 1995 *The computer contradictionary*, 2nd edition. Cambridge (USA), MIT Press

Kelmelis J 1991 'Time and space in geographic information: toward a four-dimensional spatio-temporal data model'. Unpublished PhD dissertation. Department of Geography, Pennsylvania State University

Kelsall J, Diggle P J 1995 Nonparametric estimation of spatial

variation in relative risk. Statistics in Medicine 14: 2335-42

Kelsey J L, Thompson W D, Evans A S 1986 Methods in observational epidemiology. Oxford, Oxford University Press

Kemp K K 1992a Environmental modelling with GIS: a strategy for dealing with spatial continuity. National Center for Geographic Information and Analysis Technical Report 93–3. Santa Barbara, NCGIA

Kemp K K 1992b The NCGIA Core Curriculum evaluation program: a review and assessment. *Cartographica* 28: 88–93

Kemp K K, Frank A U 1996 Towards a consensus on a European GIS curriculum: the international postgraduate course on GIS. *International Journal of Geographical Information Systems* 10: 477–97

Kemp K K, Goodchild F M 1992 Evaluating a major innovation in Higher Education: the NCGIA Core Curriculum in GIS. Journal of Geography in Higher Education 16: 21–36

Kemp K K, Goodchild M F 1992 Developing a curriculum in GIS: the NCGIA Core Curriculum project. *Cartographica* 28: 39–54

Kemp W P, Kalaris T M, Quimby W F 1989 Rangeland grasshopper (*orthoptera: acrididae*) spatial variability: macroscale population assessment. *Journal of Economic Entomology* 82: 1270–6

Kennedy M 1996 The global positioning system and GIS: an introduction. Michigan, Ann Arbor Press

Kern J S 1994 Spatial patterns of soil organic carbon in the contiguous United States. Soil Science Society of America Journal 58: 439–55

Kern J S 1995 Geographic patterns of soil water-holding capacity in the contiguous United States. *Soil Science Society of America Journal* 59: 1126–33

Kessel S R 1990 An Australian geographical information and modelling system for natural area management. *International Journal of Geographical Information Systems* 4: 333–62

Kessel S R 1975 The Glacier National Park basic resources and fire ecology model. *Bulletin of the Ecological Society of America* 56: 49

Kidner D B, Jones C B 1994 A deductive object-oriented GIS for handling multiple representations. In Waugh T C, Healey R G (eds) Advances in GIS research (Proceedings Sixth International Symposium on Spatial Data Handling): 882–900

Kim S H, Gaus M P, Lee G, Chang K C 1992 A GIS-based regional risk approach for bridges subjected to earthquakes. *Proceedings, ASCE Specialty Conference on Computing in Civil Engineering, Dallas:* 460–7

Kim W (ed.) 1995 Modern database systems: the object model, interoperability, and beyond. New York, ACM Press

Kim W, Garza J, Ballou N, Woelk D 1990 Architecture of the ORION next-generation database system. *IEEE Transactions on Knowledge and Data Engineering* 2: 109–25

Kimes D S, Sellers P J, Diner D J 1987 Extraction of spectral hemispherical reflectance (albedo) of surfaces from nadir and directional reflectance data. *International Journal of Remote Sensing* 8: 1727–46

Kindleberger C 1990 Hypermedia for state and local government. *Journal of the Urban and Regional Information Systems Association* 2: 52–5

King L J 1962 A quantitative expression of the pattern of urban settlement in selected areas of the United States. *Tijdschrift voor Economische en Sociale Geografie* 53: 1–7

King L J 1969 *Statistical analysis in geography*. Englewood Cliffs, Prentice-Hall

King S A, Basoz N I, Kiremidjian A S, Law K H 1995a Use of GIS for seismic hazard mitigation study. *Proceedings Second ASCE Congress on Computing in Civil Engineering, Atlanta*

King S A, Kiremidjian A S, Law K H, Basoz N I 1995b Earthquake damage and loss estimation through geographic information systems. *Proceedings, Fifth International Conference on Seismic Zonation, Nice*

Kingham S 1993 'Air pollution and respiratory disease in Preston: a geographical information systems approach'. Unpublished PhD thesis, Lancaster University

Kirby K C, Pazner M 1990 Graphic map algebra. In Kishimoto H, Brassel K (ed.) Proceedings, Fourth International Symposium on Spatial Data Handling. Columbus, International Geographical Union 1: 413–22

Kirby R F, Potts R B 1969 The minimum route problem for networks with turn penalties and prohibitions. *Transportation Research* 3: 397–408

Kirkby M J, Cox N J 1995 A climatic index for soil erosion potential (CSEP) including seasonal and vegetation factors. *Catena* 25: 333–52

Kirkpatrick D G 1983 Optimal search in planar subdivision. *SIAM Journal of Computing* 12: 28–33

Kite G W 1995 The SLURP model. In Singh V P (ed.) Computer models of watershed hydrology. Highland Ranch, Water Resources Publications: 521–62

Kleiner A, Brassel K E 1986 Hierarchical grid structures for static geographic databases. In Blakemore M (ed.) AutoCarlo London. London, The Royal Institution of Chartered Surveyors: 485–96

Klesh L 1989 'Design and implementation of automatic dispatch vehicle information and location systems'. Unpublished MSc thesis. Department of Geomatics Engineering, University of Calgary, Calgary

Klijn F, Udo de Haes H A 1994 A hierarchical approach to ecosystems and its implications for ecological land classification. *Landscape Ecology* 9: 89–104

Kling R 1980 Social analysis of computing: theoretical perspectives in recent empirical research. *Computing Surveys* 12: 61–110

Klir G J, Yuan B 1995 Fuzzy sets and fuzzy logic: theory and applications. Englewood Cliffs, Prentice-Hall

Klosterman R E 1992 Evolving views of computer-aided planning. *Journal of Planning Literature* 6: 249–60

- Klosterman R E 1995 Planning support systems. In Wyatt R, Hossain H (eds) *Proceedings, Fourth International Conference* on Computers in Urban Planning and Urban Management. Melbourne, July. Vol. 1: 19–35
- Koelsch F 1995 *The infomedia revolution: how it is changing our world and your life*. Toronto, McGraw Hill
- Koller D, Lindstrom P, Ribarsky W, Hodges L F, Faust N, Turner G 1995 Virtual GIS: a real-time 3D geographical information system. Georgia Institute of Technology technical report. ftp://fttp.gvu.gatech.edu/pub/gvu/tech-reports/95–14.ps.Z

Konecny G, Lohmann P, Engel H, Kruck E 1987 Evaluation of SPOT imagery on analytical instruments. *Photogrammefric Engineering and Remote Sensing* 53: 1223–30

Korporal K D, Hillary N M 1993 *The Statistics Canada Crop Condition Assessment Program*. Ottawa, Statistics Canada

Korte G B 1994 *The GIS book: the smart manager's guide to purchasing, implementing, and running a geographic information system.* Santa Fe, Onword Press

Korte G B 1996 Weighing GIS benefits with financial analysis. GIS World 9(7): 48–52

Kosko B 1990 Fuzziness v. probability. International Journal of General Systems 17: 211–40

Kousser J M 1996 Estimating the partisan consequences of districting plans – simply. *Legislative Studies Quarterly* 21521–41

Koussoulakou A, Kraak M-J 1992 Spatio-temporal maps and cartographic communication. *The Cartographic Journal* 29: 101–8

Kowalski R 1992 Database updates in the event calculus. Journal of Logic Programming 12: 121–46

Kraak M-J 1994a Interactive modelling environment for 3-D maps, functionality and interface issues. In MacEachren A M, Taylor D R F (eds) *Visualisation in modern cartography*. Oxford, Pergamon: 269–86

Kraak M-J, MacEachren AM 1994b Visualisation of the temporal component of spatial data. Sixth International Symposium on Spatial Data Handling, Edinburgh, Scotland. International Geographical Union: 391–409

Kraak M-J, MacEachren A M 1994c Visualization of spatial data's temporal component. In Waugh T C, Healey R G (eds) Advances in GIS research – Proceedings, Fifth Spatial Data Handling Conference. London, Taylor and Francis: 391–409

Kraak M-J, Ormeling F J 1996 Cartography visualization of spatial data. Harlow, Longman

Kraak M-J, Ormeling F J, Müller J C 1995 GIS-cartography: visual decision support for spatio-temporal data handling. International Journal of Geographical Information Systems 9: 637–45

Kraak M-J, Smets G, Sidjanin P 1995 Virtual reality, the new 3-dimensional interface for geographical information systems. Presented at *First Conference on Spatial Multimedia and Virtual Reality, Lisbon, Portugal, 18–20 October*

Kragt J E, Baker B E, Rourke T J 1993 A GIS decision support tool for modeling and managing flooding and dam failure for the readiness management system. Proceedings, Thirteenth Annual ESRI User Conference. Redlands, ESRI 3: 93–101

Kramer H J 1994 Observation of the Earth and its environment: survey of missions and sensors. Berlin, Springer

Krcho J 1973 Morphometric analysis of relief on the basis of geometric aspect of field theory. *Acta Geographica Universitae Comenianae, Geographica Physica* 1. Bratislava, SPN

Krige D, Fincham R J 1994 GIS and educational planning in South Africa. *International GIS Sourcebook 1994*. Fort Collins, GIS World Inc.: 305–6

Krishna Iyer P V A 1949 The first and second moments of some probability distributions arising from points on a lattice, and their applications. *Biometrika* 36: 135–41

Kruess A, Tscharntke T 1994 Habitat fragmentation, species loss and biological control. *Science* 264: 1581–4

Krummel J R, Gardner R H, Suguhara G, O'Neill R V, Coleman P R 1987 Landscape patterns in a disturbed environment. *Oikos* 48: 321–4

Krygier J 1994 Sound and cartographic visualization. In MacEachren A M, Taylor D R F (eds) *Visualization in modern cartography*, Oxford, Pergamon: 149–66

Kucera G L 1996 *Temporal extensions to spatial data models*. Final Report to Intergraph Corp. under contract entitled 'Spatial-temporal modeling for environmental decision support'. Victoria (Canada), Mercator Systems Ltd

Kucera H A, Sondheim M 1992 SAIF – conquering space and time. *GIS 92 Symposium*. Vancouver, Canada

Kuhn T S 1962 *The structure of scientific revolutions*. Chicago, University of Chicago Press

Kuhn W 1990 Editing spatial relations. In Kishimoto H, Brassel K (eds) Proceedings, Fourth International Symposium on Spatial Data Handling, Zurich. Columbus, International Geographical Union 1: 423–32

Kuhn W 1991 Are displays maps or views? In Mark D, White D (eds) *Proceedings, Tenth International Symposium on Computer-Assisted Cartography (AutoCarto 10)*. American Congress of Surveying and Mapping: 261–74

Kuhn W 1992 Paradigms of GIS use. *Proceedings, Fifih International Symposium of Spatial Data Handling.* Columbus, International Geographical Union 1:91–103

Kuhn W 1995a Semantics of geographic information. GeoInfo, Department of Geoinformation, Technical University of Vienna

Kuhn W 1995b 7±2 questions and answers on metaphors for GIS user interfaces. In Nyerges T L, Mark D M, Laurini R, Egenhofer M J (eds) *Cognitive aspects of human–computer interaction for geographic information systems*. Dordrecht, Kluwer: 113–22

Kuhn W 1996 Handling data spatially: spatialising user interfaces. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 877–93

Kulldorff M 1997 Statistical methods for spatial epidemiology:

tests for randomness. In Gatrell A C, Löytönen M (eds) GIS and health. London, Taylor and Francis

Kupfer J A 1995 Landscape ecology and biogeography. Progress in Physical Geography 19: 18–34

Kuusk A 1994 A multispectral canopy reflectance model. *Remote Sensing of Environment* 50: 75–82

Laffey S C 1996 Development of a railroad information system for the Chicago region. *Proceedings GIS/LIS 96.* Falls Church, ACSM/ASPRS: 749–54

Lagacherie P, Andrieux P, Bouzigues R 1996 The soil boundaries: from reality to coding in GIS. In Burrough P A, Frank A U (eds) *Geographic objects with indeterminate boundaries*. London, Taylor and Francis: 275–86

LaGro J 1990 Assessing patch shape in landscape mosaics. Photogrammetric Engineering and Remote Sensing 57: 285–93

Lai P, Gillies C F 1991 The impact of geographical information systems on the role of spatial data libraries. *International Journal of Geographical Information Systems* 5: 241–51

Lakatos 11976 *Proofs and refutations*. Cambridge (UK), Cambridge University Press

Lake R W 1993 Planning and applied geography: positivism, ethics, and GIS. *Progress in Human Geography* 17: 404–13

Lake R W 1996 Information communities support information sharing. *GIS World* 9(2): 72–3

Lakoff G 1987 Women, fire, and dangerous things: what categories reveal about the mind. Chicago, University of Chicago Press

Lakoff G, Johnson M E 1980 *Metaphors we live by.* Chicago, University of Chicago Press

Lalanne L 1863 Untitled. Comptes Rendus des Séances de l'Academie des Sciences, 57 (July–Dec): 206–10

Lam N S-N 1983 Spatial interpolation methods: a review. *The American Cartographer* 10: 129–19

Lam N S-N 1990 Description and measurement of LANDSAT-TM images using fractals. *Photogrammetric Engineering and Remote Sensing* 56: 187–95

Lamb W R, Evans B J, Perry M I, McKimley M I, Petrie G M, Wessels D P 1994 The base-wide environmental analysis and restoration (BEAR) system for Eielson Air Force Base, Alaska. *Technical Papers of ASCM/ASPRS Convention and Exposition.* Washington DC, ACSM: 2: 196–9

Lammers R B 1998 'Extending hydro-ecological simulation models from local to regional scales'. Unpublished PhD dissertation, University of Toronto

Lammers R B, Band L E 1990 Automating object representation of drainage basins. *Computers and Geosciences* 16: 787–810

Lanari R, Fornaro G, Riccio D, Migliaccio M, Papathanassiou K, Moreira J, Schwabisch M, Dutra L, Puglisi G, Franceschetti G, Coltelli M 1997 Generation of digital elevation models by using SIR-C/X-SAR multifrequency two-pass interferometry: the Etna case study. *IEEE Transactions on Geoscience and Remote Sensing* 34: 1097–114

Landis J D 1995 Imagining land use futures: applying the California urban futures model. *Journal of the American*

Planning Association 61: 438-57

Lane J S, Hartgen D T 1989 Factors affecting the adoption of information systems in State DOTs. *Transportation Publication Report No. 18.* Charlotte, North Carolina Transportation Academy, Department of Geography and Earth Sciences, University of North Carolina

Lang L 1992 GIS comes to life. *Computer Graphics World* October: 27–36

Lang T 1970 Computer programs for mapping. London, Architectural Press

Langford I 1994 Using empirical Bayes estimates in the geographical analysis of disease risk. *Area 26*: 142–9

Langford I, Bentham G 1996 Regional variations in mortality rates in England and Wales – an analysis using multilevel modelling. *Social Science and Medicine* 42: 987–98

Langford M 1991 *Getting started in GIS*. Leicester, Midlands Regional Research. Booklet and disks

Langran G 1989a A review of temporal database research and its use in GIS applications. *International Journal of Geographical Information Systems* 3(3): 215–32

Langran G 1989b 'Time in geographic information systems'. PhD dissertation, University of Washington

Langran G 1990 Temporal GIS design tradeoffs. Journal of the Urban and Regional Information Systems Association 2: 16–25

Langran G 1992 *Time in geographic information systems*. London, Taylor and Francis

Langran G 1993 One GIS, many realities. GIS 93, Vancouver

Langran G, Chrisman N R 1988 A framework for temporal geographic information. *Cartographica* 25: 1–14

Langston P, Clarke G P, Clarke D 1997 Retail saturation, retail location and retail competition: an analysis of British grocery retailing. *Environment and Planning A* 29: 77–104

Langton C G (ed.) 1989 Artificial life. The proceedings of an interdisciplinary workshop on the synthesis and simulation of living systems. Reading (USA), Addison-Wesley

Lanter D 1991 Design of a lineage-based meta-database for GIS. Cartography and Geographic Information Systems 18: 255-61

Lanter D, Surbey C 1994 Metadata analysis of GIS data processing: a case study. In Waugh T C, Healey R G (eds) Advances in GIS research. London, Taylor and Francis: 314–24

Lanter D, Veregin H 1992 A research paradigm for propagating error in layer-based GIS. *Photogrammetric Engineering and Remote Sensing* 58: 526–33, 825–33

Lanza L, Siccardi F 1995 The role of GIS as a tool for the assessment of flood hazard at the regional scale. In Carrara A, Guzzetti F (eds) *Geographical information systems in assessing natural hazards.* Dordrecht, Kluwer: 199–21

Larijani L C 1994 The virtual reality primer. New York, McGraw-Hill

Larson E 1992 The naked consumer: how our private lives become public commodities. New York, Penguin

Larsson G 1991 Land registration and cadastral systems. Harlow,

Longman/New York, John Wiley & Sons Inc.

Laslett G M, McBratney A B, Pahl P J, Hutchinson M F 1987 Comparison of several spatial prediction methods for soil pH. *Journal of Soils Science* 38: 32–50

Lass L W, Callihan R H 1993 GPS and GIS for weed surveys and management. *Weed Technology* 7: 249–56

Lathrop R G, Bognar J A 1994 Development and validation of AVHRR-derived regional forest cover data for the northeastern US. International Journal of Remote Sensing 15: 2695–702

Latour B 1993 *We have never been modern*. Cambridge (USA), Harvard University Press

Lattuada R, Raper J F 1996 Applications of 3D Delaunay triangulation algorithms in geoscientific modelling. In *Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modelling.* Santa Fe, 21–26 January. Santa Barbara, NCGIA. CD

Laurini R 1994 Sharing geographic information in distributed databases. *Proceedings, 1994 Annual Conference of the Urban and Regional Information Systems Association (URISA)*: 441–54

Laurini R, Milleret-Raffort F 1990 Principles of geomatic hypermaps. *Proceedings, Fourth International Symposium on Spatial Data Handling, Zurich:* 642–51

Laviolette M, Seaman J W 1994 The efficacy of fuzzy representations of uncertainty. *IEEE Transactions on Fuzzy Systems* 2: 4–15

Lawrence V V 1997 GIS in disguise: improving decision-making with geography. *Geographic information – exploiting the benefits: AGI 97 conference proceedings*. London, Blenheim/Association for Geographic Information: 3.2.1–3.2.5

Laws D, Gross M, Fabos J 1989 Information resources and public decision-making. *Proceedings URISA 89 Conference*, *Boston* 4: 160–74

Lawson A B 1993 On the analysis of mortality events associated with a pre-specified fixed point. *Journal of the Royal Statistical Society A* 156: 363–77

Layard R, Glaister S (eds) 1994 *Cost-benefit analysis*, 2nd edition. New York, Cambridge University Press: 21

Le Caer G, Delanny R 1993 Correlations in topological models of 2D random cellular structures. *Journal of Physics A: Mathematical and General* 26: 3931–54

Le Sueur D, Martin C, Sharpe B, Ngxongo S 1995 Using a geographic information system to investigate the macro- and micro-epidemiology of malaria in South Africa. *Proceedings Africa GIS Conference, Abidjan*: 548–50

Leberl F W 1986 ASTRA – a system for automated scale transition. *Photogrammetric Engineering and Remote Sensing* 52: 251–8

Leclerc Y G, Lau S Q Jr 1994 TerraVision: a terrain visualization system. SRI International 540 (April)

Lee B D, Tomlin C D 1997 Automate transportation corridor allocation. *GIS World* 10(1): 56–60

Lee D 1995 Experiment on formalising the generalisation

process. In Müller J-C, Lagrange J-P, Weibel R (eds) *GIS and* generalisation: methodological and practical issues. London, Taylor and Francis: 219–34

Lee J 1991a Analyses of visibility sites on topographic surfaces. International Journal of Geographical Information Systems 5: 413–29

Lee J 199lb Comparison of existing methods for building triangular irregular network models of terrain from grid digital elevation model. *International Journal of Geographical Information Systems* 5: 267–85

Lee J, Preparata F P 1977 Location of a point in a planar subdivision and its applications. *SIAM Journal of Computing* 6: 594–606

Leenaers H 1991 Deposition and storage of solid-bound heavy metals in the floodplains of the river Geul (The Netherlands). *Environmental Monitoring and Assessment* 18: 79–103

Leenhardt D 1995 Errors in the estimation of soil water properties and their propagation through a hydrological model. *Soil Use and Management* 11: 15–21

Lees B G, Ritman K 1991 Decision-tree and rule induction approach to integration of remotely-sensed and GIS data in mapping vegetation in disturbed hilly environments. *Environmental Management* 15: 823–31

Legates D R, Willmott C J 1986 Interpolation of point values from isoline maps. *The American Cartographer* 13: 308–23

Leick A 1990 GPS satellite surveying. New York, John Wiley & Sons Inc.

Leitner M, Buttenfield B P 1995 Acquisition of procedural cartographic knowledge by reverse engineering. *Cartography* and Geographic Information Systems 22: 232–41

Lemmens M J P M 1988 A survey on stereo matching techniques. *International Archives of Photogrammetry and Remote Sensing* 27: V11–V23

Lenczowski R 1997 The military as users and producers of global spatial data. In Rhind D W (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 85–110

Leonard R A, Knisel W G, Still D A 1987 GLEAMS: groundwater loading effects of agricultural management systems. *Transactions of the American Society of Agricultural Engineers* 30: 1403–18

Lepper M J C de, Scholten H J, Stern R M (eds) 1995 *The* added value of geographical information systems in public and environmental health. Dordrecht, Kluwer

LeSage J P 1995 A multiprocess mixture model to estimate space-time dimensions of weekly pricing of certificates of deposit. In Anselin L, Florax R J G M (eds) *New directions in spatial econometrics.* Berlin, Springer: 359–97

Lescourret F, Genard M 1994 Habitat, landscape and bird composition in mountain forest fragments. *Journal of Environmental Management* 40: 317–28

Lessard P, L'Eplattenier R, Norval R, Kundert K, Dolan T, Croze H, Walker B, Irvin A, Perry B 1990 Geographical information systems for studying the epidemiology of cattle diseases caused by Theileria parva. *The Veterinary Record* 126: 255–62

Lester M 1990 Tracking the temporal polygon: a conceptual model of multidimensional time for geographic information systems. Presented at *Temporal Workshop (NCGIA), Orono*

Leung Y 1997 Feedforward neural network models for spatial pattern classification. In Fischer M M, Getis A (eds) *Recent developments in spatial analysis – spatial statistics, behavioural modelling and neurocomputing.* Berlin, Springer

Leung Y 1988 Spatial analysis and planning under imprecision. New York, Elsevier Science

Leung Y, Goodchild M F, Lin C C 1992 Visualisation of fuzzy scenes and probability fields. *Proceedings, Fifth International Symposium on Spatial Data Handling, Charleston:* 480–90

Levin S A 1992 The problem of pattern and scale in ecology. *Ecology* 73: 1943–67

Levine G 1981 Introductory statistics for psychology: the logic and the methods. New York, Academic Press

Levine J, Landis J D 1989 Geographic information systems for local planning. *Journal of the American Planning Association* 55: 209–20

Levy R M 1995 Visualisation of urban alternatives. Environment and Planning B: Planning and Design 22: 343–58

Lewis A, Stein J L, Stein J A, Nix H A, Mackey B G, Bowyer J K 1991 *An assessment of regional conservation adequacy: Tasmania.* Forestry and Timber Inquiry Consultancy Series No. FTC91/17. Canberra, Resource Assessment Commission

Lewis F T 1928 The correlation between cell division and the shapes and sizes of prismatic cells in the epidermis of *Cucumis. Anatomical Record* 38: 341–76

Lewis F T 1930 A volumetric study of growth and cell division in two types of epithelium – the longitudinally prismatic cells of *Tradescantia* and the radially prismatic epidermal cells of *Cucumis. Anatomical Record* 47: 59–99

Lewis F T 1931 A comparison between the mosaic of polygons in a film of artificial emulsion and in cucumber epidermis and human amnion. *Anatomical Record* 50: 235–65

Lewis F T 1943 The geometry of growth and cell division in epithelial mosaics. *American Journal of Botany* 30: 766–76

Lewis F T 1944 The geometry of growth and cell division in columnar parenchyma. *American Journal of Botany* 31: 619–29

Lewis P A W, Orav E J 1989 Simulation methodology for statisticians, operations analysts, and engineers Vol. 1. Pacific Grove, Wadsworth & Brooks/Cole

LGMB 1993 Geographic Information Systems (GIS) case studies. Experiences in geographic information management. Luton, Local Government Management Board

Library of Congress 1996 The USMARC formats: background and principles. Washington DC, Library of Congress. http: //lcweb.loc.gov/marc/96princil.html

Library of Congress 1997 Metadata, Dublin Core and

USMARC: a review of current efforts, Discussion Paper No. 99. Washington DC, Library of Congress: 4. gopher: //marvel. loc.gov/OO/ listarch/usmarc/dp99.doc

Lichtner W 1979 Computer-assisted processes of cartographic generalisation in topographic maps. *GeoProcessing* 1: 183–99

Liebhold A M, Halverson J A, Elmes G A 1992 Gypsy moth invasion in North America: a quantitative analysis. *Journal* of Biogeography 19: 513–20

Liebhold A M, Rossi R E, Kemp W P 1993 Geostatistics and geographic information systems in applied insect ecology. *Annual Review of Entomology* 38: 303–27

Liederkerke M van, Jones A, Graziani G 1996 The European Tracer Experiment system: where GIS and WWW meet. *Proceedings, 1996 ESRI User Conference.* Redlands, ESRI

Liggett R S, Jepson W H 1995 An integrated environment for urban simulation. *Environment and Planning B: Planning and Design* 22: 291–30

Light D L 1990 Characteristics of remote sensors for mapping and earth science applications. *Photogrammetric Engineering and Remote Sensing* 56: 1613–23

Lijphart A 1982 Comparative perspectives on fair representation: the plurality-majority rule, geographical districting, and alternative electoral arrangements. In Grofman B, Lijphart A, McKay R B, Scarrow H A (eds) 1982 *Representation and redistricting issues*. Lexington, Lexington Press: 143–59

Lillywhite J 1991 Identifying available spatial metadata: the problem. In Medyckyj-Scott D, Newman I, Ruggles C, Walker D (eds) *Metadata in the Geosciences*. Loughborough, Group D Publications: 3–11

Lind M, Christensen T 1996 The address as key to GIS. Proceedings of the second joint European conference and exhibition on geographical information. Barcelona Vol. 2: 868–77

Lindenmayer D B, Nix H A, McMahon J P, Hutchinson M F, Tanton M T 1991 The conservation of Leadbeater's possum *gymnobelideus leadbeateri* (McCoy): a case study of the use of bioclimatic modelling. *Journal of Biogeography* 18: 371–83

Lindstrom P, Koller D, Ribarsky W, Hodges L F, Faust N, Turner G 1996 Real-time, continuous level of detail rendering of height fields. *Proceedings of SIGGRAPH, New Orleans, 4–9 August:* 109–18

Linz A, Bryant P 1994 The all-hazard situation assessment program. Proceedings First Federal Geographic Technology Conference. Washington DC, GIS World Inc. 1: 165–9

Lithgow T 1995 GIS hits the streets. In Green D R, Rix D, Cornin C (eds) *The AGI sourcebook for geographic information systems, 1996.* London, The Association for Geographic Information: 72–7

Little R, Mirless J 1994 The costs and benefits of analysis: project appraisal and planning 20 years on. In Layard R, Glaister S (eds) *Cost-benefit analysis*, 2nd edition. New York, Cambridge University Press: 199–234

Litwin W, Mark L, Roussopoulos N 1990 Interoperability of

multiple autonomous databases. ACM Computing Surveys 22: 265–93

Livingstone D N 1992a *The geographical imagination*. Cambridge (USA), Blackwell

Livingstone D N 1992b *The geographical tradition: episodes in the history of a contested enterprise*. Oxford, Blackwell

Livingstone S A, Todd C S, Krohn W B, Owen R B 1990 Habitat models for nesting bald eagles in Maine. *Journal of Wildlife Management* 54: 644–53

Lloyd D 1990 A phenological classification of terrestrial vegetation cover using shortwave vegetation index imagery. International Journal of Remote Sensing 11: 2269–79

Loague K, Yost R S, Green R E, Liang T C 1989 Uncertainty in pesticide leaching assessment in Hawaii. *Journal of Contaminant Hydrology* 4: 139–61

Loeb A L 1976 Space structures – their harmony and counterpoint. Reading (USA), Addison-Wesley

Logan I T 1995 Cost and benefit considerations in data collection and the application of data collection techniques. Paper presented at Cambridge Survey Officers' Conference

Lomas T, Kharrazi M, Broadwin R, Deane M, Smith M, Armstrong M 1990 GIS in public health: an application of GIS technology in an epidemiological study near a toxic waste site. *Proceedings, Annual ESRI User Conference.* Redlands, ESRI

Lombard K, Church R L 1993 The gateway shortest path problem: generating alternative routes for a corridor location problem. *Geographical Systems* 1: 25–45

London Planning Advisory Committee 1994 High accessibility town centres in London. London, LPAC

Long D S, Carlson G R, DeGloria S D 1995 Quality of field management maps. In Robert P C, Rust R H (eds) *Sitespecific management for agricultural systems*. Madison, American Society of Agronomy: 251–71

Long D S, Carlson G R, Nielsen G A, Lachapelle G 1995 Increasing profitability with variable rate fertilization. *Montana AgResearch* 12: 4–8

Long D S, DeGloria S D, Galbraith J M 1991 Use of the global positioning system in soil survey. *Journal of Soil and Water Conservation* 46: 293–7

Longley P, Batty M 1996a Analysis, modelling, forecasting, and GIS technology. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 1–15

Longley P, Batty M (eds) 1996b *Spatial analysis: modelling in a GIS environment.* Cambridge (UK), GeoInformation International

Longley P, Clarke G 1995a Applied geographical information systems: developments and prospects. In Longley P, Clarke G (eds) *GIS for business and service planning*. Cambridge (UK), GeoInformation International: 3–9

Longley P, Clarke G 1995b GIS for business and service

planning. Cambridge (UK), GeoInformation International

Longley P, Higgs G, Martin D 1994 The predictive use of GIS to model property valuations. *International Journal of Geographical Information Systems* 8: 217–35

Lopez X R, John S 1993 Data exchange and integration in UK local government. *Mapping Awareness* 7(5): 37–40

Lopez-Abente G 1997 Bayesian analysis of emerging neoplasms in Spain. In Gatrell A C, Löytönen M (eds) *GIS and health*. London, Taylor and Francis

Lösch A 1954 *The economics of location*. New Haven, Yale University Press

Loukes D K, Walsh W J P 1996 Integration of GPS and GIS for highway inventory data capture. *Proceedings GIS-T 96, Geographic Information Systems for Transportation Symposium.* Washington DC, American Association of State Highway and Transportation Officials: 27–40

Lounsbery M, DeRose T, Warren J 1994 Multiresolution analysis for surfaces of arbitrary topological type. Technical Report. Department of Computer Science and Engineering, University of Washington. *ftp://cs.washington.edu/pub/ graphics/TR931005b.ps.Z*

Louviere J 1988 Conjoint analysis of stated preferences. Journal of Transport Economics and Policy 22: 93–119

Love B 1984 'The effect of road traffic noise on housing prices in Calgary 1978–1982'. Unpublished MSc thesis, Department of Geography, University of Calgary

Love D, Lindquist P 1995 The geographical accessibility of hospitals to the aged: a geographic information systems analysis within Illinois. *Health Services Research* 29: 627–51

Love J 1995 Pricing government information. In *Agenda for* access: public access to Federal information for sustainability through the Information Superhighway. Report prepared by the Bauman Foundation, Washington DC: Chapter 10

Loveland T R, Merchant J W, Brown J F, Ohlen D O, Read B C, Olson P, Hutchinson J 1995 Development of a land-cover database for the conterminous US. *Annals of the Association of American Geographers* 85: 339–55 plus map

Loveland T R, Merchant J W, Ohlen D O, Brown J F 1991 Development of a land-cover characteristics database for the conterminous US. *Photogrammetric Engineering and Remote Sensing* 57: 1453–63

Lovett A A, Tate N J 1992 A combined GIS/geostatistical analysis of PCB concentrations in soil samples from the Panteg district, South Wales. In Harts J (ed.) *Proceedings, Third European Conference on Geographical Information Systems* Vol. 2. Amsterdam, EGIS Foundation: 1538–9

Lowell K 1994 A fuzzy surface cartographic representation for forestry based on Voronoi diagram area stealing. *Canadian Journal of Forest Research* 24: 1970–80

Lownsbery B, Newton J 1996 The key to enduring access: multi-organisational collaboration on the development of metadata for use in archiving nuclear weapons data. *Proceedings, First IEEE Metadata Conference.* IEEE Computer Society Mass Storage Systems and Technology Technical Committee. http://www.computer.org/conferen/ meta96/meta_home.html

Lowry J H, Miller H J, Hepner G F 1995 A GIS-based sensitivity analysis of community vulnerability contaminants on the Mexico/US border. *Photogrammetric Engineering and Remote Sensing* 61: 1347–59

Lu X, Xiang W N 1995 A GIS model for hazardous chemicals pathway analysis. URISA Proceedings. San Antonio 1: 293–9

Luk W S, Kloster S 1986 ELFS: English language from SQL. *ACM Transactions on Database Systems* 11: 447–72

Lummaux J C 1997 Partenariat public privé. Paper given to Workshop organised by CNIG/AFIGÉO/EUROGI on geographic information: public/private partnerships, Paris, 2 April. See also http://www.frw.ruu.nl/eurogileurogi.html

Lyman P 1996 What is a digital library? Technology, intellectual property, and the public interest. *Daedalus* 125: 1–33

Lyon D 1994 *The electronic eye: the rise of surveillance society*. Minneapolis, University of Minnesota Press

Lyon D, Zureik E 1996 *Computers, surveillance and privacy.* Minneapolis, University of Minnesota Press

Lyytinen K, Hirschheim R 1987 Information systems failures revisited: a survey and classification of the literature. *Oxford Surveys in Information Technology* 4: 257–309

MacDevette D R 1993 The status of advanced information technology applications for natural resource management in southern Africa. *Proceedings, Conference on 'Application of Advanced Information Technologies: Effective Management of Natural Resources*'. Spokane, 18–19 July: 9–17

MacDevette D R 1994 Developing environmental decision support systems for the real world: lessons from South Africa. *Proceedings Decision Support – 2001 symposium Toronto, 12–16 September*: 768–77

Macdonald Holmes J M 1944 The geographical basis of government. Sydney, Angus and Robertson

MacDougall E B 1991 A prototype interface for exploratory analysis of geographic data. *Proceedings, Eleventh Annual ESRI User Conference* Vol. 2. Redlands, ESRI Inc.: 547–53

MacDougall E B 1992 Exploratory analysis, dynamic statistical visualization, and geographic information systems. *Cartography and Geographic Information Systems* 19: 237–46

MacEachren A M 1994a Some truth with maps: a primer on design and symbolization. Washington DC, Association of American Geographers

MacEachren A M 1994b Visualization in modern cartography: setting the agenda. In MacEachren A M, Taylor D R F (eds) *Visualization in modern cartography*. Oxford, Pergamon: 1–12

MacEachren A M 1995 How maps work: representation, visualisation, and design. New York, Guilford Press

MacEachren A M, Howard D, Wyss M von, Askov D, Taormino T 1993 Visualising the health of Chesapeake Bay: an uncertain endeavor. *Proceedings GIS/LIS 93 Minneapolis*: 449–58

MacEachren A M, Monmonier M 1992 Geographic visualization: introduction. *Cartography and Geographic Information Systems* 19: 197–200

MacEachren A M, Taylor D R F (eds) 1994 Visualization in modern cartography. Oxford, Pergamon

Macedonia M R, Zyda M J 1994 NPSNET: a network software architecture for large scale virtual environments. *PRESENCE: Teleoperators and Virtual Environments* 3: 265–87

Mackaness W A 1993 Events and episodes – just patterns in time. ICA Conference Proceedings, Cologne

Mackaness W A 1994 An algorithm for conflict identification and feature displacement in automated map generalisation. *Cartography and Geographic Information Systems* 21: 219–32

Mackaness W A, Beard M K 1993 Use of graph theory to support map generalisation. *Cartography and Geographic Information Systems* 20: 210–21

Mackay D S 1997 'Representation of heterogeneous topography and forest cover for long-term hydroecological modelling'. Unpublished PhD dissertation, Dept. of Civil Engineering, University of Toronto

Mackay D S, Band L E 1994 Extraction and representation of watershed structure including lakes and wetlands from digital terrain and remote sensing information. *EOS, Transactions AGU* 75: 175

Mackay D S, Robinson V B, Band L E 1992 Classification of higher order topographic objects on digital terrain data. *Computers, Environment and Urban Systems* 16: 473–96

Mackay D S, Robinson V B, Band L E 1994 A knowledgebased approach to the management of geographic information systems for simulation of forested ecosystems. In Michener W K, Brunt J W, Stafford S G (eds.) *Environmental information management and analysis: ecosystem to global scales.* London, Taylor and Francis: 511–34

Mackenzie D 1990 Inventing accuracy: an historical sociology of nuclear missile guidance. Cambridge (USA), MIT Press

Mackey B G 1993 A spatial analysis of the environmental relations of rainforest structural types. *Journal of Biogeography* 20: 303–36

Mackey B G 1996 The role of GIS and environmental modelling in the conservation of biodiversity. *Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modelling.* Santa Barbara, NCGIA. CD

Mackinlay J 1986 Automating the design of graphical presentations of relational information. *ACM Transactions on Graphics* 5: 110–41

MacMillan W D, Pierce T 1996 Active computer-aided redistricting. In McLean I, Butler D (eds) *Fixing the boundaries: defining and redefining single-member electoral districts.* Aldershot, Dartmouth Publishing: 219–34

Maffini G 1987 Raster versus vector data encoding and handling: a commentary. *Photogrammetric Engineering and Remote Sensing* 53: 1397–8

Magalhaes G C 1997 Telecommunications outside plant management throughout Brasil. *Proceedings, AM/FM International Conference.* Aurora, AM/FM International: 386–92

MAGIC project, MAGIC Consortium. http://www.magic.net/

Magillo P, De Floriani L 1994 Computing visibility maps on hierarchical terrain models. In Pissinou N, Makki K (eds) *Proceedings, Second ACM Workshop on Advances in Geographic Information Systems (GIS 94)*. New York, ACM Press: 8–15

Magrogan P J, Schardt J A, Chronoles M J 1996 Object-oriented conceptualisation. Report on object analysis and design. *Journal of Object-Oriented Programming* (September): 54–63

Maguire D J 1989 The Domesday interactive video system in geography teaching. *Journal of Geography in Higher Education* 13: 55–68

Maguire D J 1990 A research plan for GIS in the 1990s. In Foster M J, Shand P (eds) *The Association for Geographic Information yearbook 1990*. London, Taylor and Francis and Miles Arnold: 267–77

Maguire D J 1991 An overview and definitions of GIS. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 9–20

Maguire D J 1995 Implementing spatial analysis and GIS applications for business and service planning. In Longley P, Clarke G P (eds) *GIS for business and service planning*. Cambridge (UK), GeoInformation International: 171–91

Maguire D J, Goodchild M F, Rhind D W (eds) 1991 Geographical information systems: principles and applications. Harlow, Longman/New York, John Wiley & Sons Inc.

Maguire D J, Smith R, Jones S 1993 GIS on the move: some transportation applications of GIS. *Proceedings, Thirteenth Annual ESRI User Conference* Vol. 3: 39–46

Maguire S A 1994 *Debugging the development process*. Redmond, Microsoft Press

Mahoney R P, McLaren R A 1993 Best practice guidelines for GIS implementation in GB local government. *Proceedings, Association for Geographic Information Conference.* Rickmansworth, Westrade Fairs Ltd: 1.20.1–1.20.6

Maiocchi R, Pernici B, Barbic F 1992 Automatic deduction of temporal information. *ACM Transactions of Database Systems* 17: 647–88

Mairson H G, Stolfi J 1988 Reporting and counting intersections between two sets of line segments. In Earnshaw R A (ed.) *Theoretical foundations of computer graphics and CAD*. NATO ASI Series F40. Berlin, Springer: 307–25

Majid D A 1997 Geographical data infrastructure in Asia and the Pacific. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 206–10

Majure J, Cook D, Cressie N, Kaiser M, Lahiri S, Symanzik J 1995 Spatial CDF estimation and visualisation with applications to forest health monitoring. *Computing Science and Statistics* 27: 93–101

Majure J, Cressie N 1997 Dynamic graphics for exploring spatial

dependence in multivariate spatial data. Geographical Systems

- Majure J, Cressie N, Cook D, Symanzik J 1996b GIS, spatial statistical graphics, and forest health. *Proceedings, Third International Conferencel Workshop on Integrating GIS and Environmental Modeling, Santa Fe, 21–26 January.* Santa Barbara, NCGIA. CD
- Makarovic B 1984 Structures for geo-information and their application in selective sampling for digital terrain models. *ITC Journal* 1984: 285–95

Maling D H 1973 *Coordinate systems and map projections.* London, George Philip

Mallet J-L 1992 GOCAD: a computer-aided design application for geological applications. University of Nancy

Mandelbrot B B 1977 *Fractals: form, chance, and dimension.* San Francisco, Freeman

Mandelbrot B B 1982 *The fractal geometry of nature*. San Francisco, Freeman

Mantel N 1967 The detection of disease clustering and a generalized regression approach. *Cancer Research* 27: 209–20

MapGuide 1996 Mill Valley, Autodesk Inc. http://www. mapguide.com

Mapping Science Committee 1993 *Toward a coordinated spatial data infrastructure for the Nation.* Washington DC, National Academy Press: 171 pp

Mapping Science Committee 1994 Promoting the National Spatial Data Infrastructure through partnerships. Washington DC, National Academy Press: 113 pp

Mapping Science Committee 1995 A data foundation for the National Spatial Data Infrastructure. Washington DC, National Academy Press

Mapping Science Committee 1997 *The future of spatial data and society: summary of a workshop.* Washington DC, National Academy Press

Marascuilo L A, Levin J R 1983 Multivariate statistics in the social sciences: a researcher's guide. Monterey, Brooks/Cole

Marble D F, Amundson S E 1988 Microcomputer-based geographic information systems and their role in urban and regional planning. *Environment and Planning B: Planning and Design* 15: 305–24

Marble D F, Sen L 1986 The development of standardized benchmarks for spatial database systems. *Proceedings, Second International Symposium on Spatial Data Handling*: 488–96

Marceau D J, Gratton D J, Fournier R A, Fortin J P 1994 Remote sensing and the measurement of geographical entities in a forest environment: 2. The optimal spatial resolution. *Remote Sensing of the Environment* 49: 105–17

Marcus M G 1979 Coming full circle: physical geography in the twentieth century. *Annals of the Association of American Geographers* 69: 521–32

Margerum R D, Born S M 1995 Integrated environmental management: moving from theory to practice. *Journal of Environmental Planning and Management* 38: 371–91 Margules C R 1989 Introduction to some Australian developments in conservation evaluation. *Biological Conservation* 50: 1–11

Mark D M 1986 Knowledge-based approaches for contour-togrid interpolation on desert pediments and similar surfaces of low relief. Second International Symposium on Spatial Data Handling. Columbus, International Geographical Union: 225–34

Mark D M 1988 Network models in geomorphology. In Anderson M G (ed.) *Modelling geomorphological systems*. New York, John Wiley & Sons Inc.

Mark D M 1992 Spatial metaphors for human–computer interaction. In Cowen D (ad.) *Proceedings, Fifth International Symposium on Spatial Data Handling.* International Geographical Union 1: 104–12

Mark D M 1993 Toward a theoretical framework for geographic entity types. In Frank A U, Campari I (eds) *Spatial information theory: a theoretical basis for GIS*. Lecture Notes in Computer Sciences No. 716. Berlin, Springer: 270–83

Mark D M, Aronson P B 1984 Scale-dependent fractal dimensions of topographic surfaces: an empirical investigation with application to geomorphology and computer mapping. *Mathematical Geology* 16: 671–83

Mark D M, Comas D, Egenhofer M J, Freundschuh S M, Gould M D, Nunes J 1995 Evaluating and refining computational models of spatial relations through crosslinguistic human-subjects testing. In Frank A U, Kuhn W (eds) Spatial information theory: a theoretical basis for GIS. Lecture Notes in Computer Science No. 988. Berlin, Springer: 553–68

Mark D M, Egenhofer M J 1994a Calibrating the meanings of spatial predicates from natural language: line-region relations. *Proceedings, Spatial Data Handling 1994* 1: 538–53

Mark D M, Egenhofer M J 1994b Modeling spatial relations between lines and regions: combining formal mathematical models and human subjects testing. *Cartography and Geographic Information Systems* 21: 195–212

Mark D M, Egenhofer M J 1995 Topology of prototypical spatial relations between lines and regions in English and Spanish. *Proceedings, AutoCarto 12, Charlotte, North Carolina, March 1995*: 245–54

Mark D M, Frank A U (eds) 1991 *Cognitive and linguistic aspects of geographic space*. NATO ASI Series D: Behavioural and Social Sciences, Vol. 63. Dordrecht, Kluwer

Mark D M, Frank A U 1996 Experiential and formal models of geographic space. *Environment and Planning B: Planning and Design* 23: 3–24

Mark D M, Gould M 1991 Interaction with geographic information: a commentary. *Photogrammetric Engineering and Remote Sensing* 57: 1427–30

Mark D M, Svorou S, Zubin D 1987 Spatial terms and spatial concepts: geographic, cognitive, and linguistic perspectives. *Proceedings, International Symposium on Geographic Information Systems: The Research Agenda, November.* Crystal City, Virginia 2: 101–112 Marks D, Dozier J, Frew J 1984 Automated basin delineation from digital elevation data. *Geoprocessing* 2: 299–311

Markus L, Robey D 1988 Information technology and organizational change: causal structure in theory and research. *Management Science* 34: 583–98

Marmie A 1995 Promoting and providing GIS data via the Internet. Proceedings, 1995 ESRI User Conference. Redlands, ESRI. http://www.esri.com/resources/userconf/ proc95/tp250/p2101.html

Marshall R J 1991 A review of methods for the statistical analysis of spatial patterns of disease. *Journal of the Royal Statistical Society A* 154: 421–41

Marshall W F 1996 Sound plan key to making cost effective rehabilitation decisions. *Pipeline and Gas Industry* 79(8): 21–5

Martin D J 1989 Mapping population data from zone centroid locations. *Transactions of the Institute of British Geographers* NS 14: 90–7

Martin D J 1996 Geographic information systems: socioeconomic applications, 2nd edition. London, Routledge

Martin D, Higgs G 1996 Georeferencing people and places: a comparison of detailed datasets. In Parker D (ed.) *Innovations in GIS 3*. London, Taylor and Francis: 37–47

Martin D, Longley P, Higgs G 1994 The use of GIS in the analysis of diverse urban databases. *Computers, Environment, and Urban Systems* 18: 55–66

Martin D, Williams H C W L 1992 Market-area analysis and accessibility to health care centres. *Environment and Planning A* 24: 1009–19

Martin J 1991 *Rapid application development*. New York, Macmillan

Martin J, Odell J J 1993 *Principles of object-oriented analysis* and design. Englewood Cliffs, Prentice-Hall

Martin J, Odell J J 1995 *Object-oriented methods. A foundation.* New Jersey, Prentice-Hall: 11–24

Martz L W, Jong E de 1988 Catch: a FORTRAN program for measuring catchment area from digital elevation models. *Computers and Geosciences* 14: 627–40

Martz L W, Garbrecht J 992 Numerical definition of drainage network and sub-catchment areas from digital elevation models. *Computers and Geosciences* 18: 747–61

Maskarinec G 1996 Investigating increased incidence of events in the islands: a Hawaii Department of Health perspective. *Statistics in Medicine* 15: 699–705

Masser I 1998 *Governments and geographic information*. London, Taylor and Francis

Masser I, Campbell H 1991 Conditions for the effective utilization of computers in urban planning in developing countries. *Computers, Environment and Urban Systems* 15: 55–67

Masser I, Campbell H, Craglia M 1996 *GIS diffusion: the adoption and use of GIS in local government in Europe.* London, Taylor and Francis

Masser I, Morais Arnaud A, Salgé F, Scholten H 1993 to 1996

GISDATA Research Programme – newsletter numbers 1 to 4. Strasbourg, European Science Foundation

Masser I, Onsrud H J (eds) 1993 *Diffusion and use of* geographic information technologies. Dordrecht, Kluwer

Massimino M J, Sheridan T B 1993 Sensory substitution for force feedback in teleoperation. *PRESENCE: Teleoperators* and Virtual Environments 2: 145–57

Masuoka P, Acevedo W, Fifer S, Foresman T, Tuttle M 1996 Techniques for visualising urban growth using a temporal GIS database. *Proceedings, Annual ASPRS/ACSM Conference*. Falls Church, ACSM/ASPRS Vol. 3: 89–100

Matheron G 1971 The theory of regionalised variables and its applications. Les Cahiers du Centre de Morphologie Mathematique de Fontainebleu 5. Paris

Matheron G 1981 Splines and Kriging: their formal equivalence. Syracuse University Geological Contributions: 77–95

MathSoft 1996a *S+Spatialstats user's manual, version 1.0.* Seattle, MathSoft Inc.

MathSoft 1996b S+Gislink. Seattle, MathSoft Inc.

Matsuyama T, Hao L V, Nagao M 1984 A file organization for geographic information systems based on spatial proximity. *Computer Vision, Graphics and Image Processing* 26: 303–18

Maxwell J C 1960 Quantitative geomorphology of the San Dimas Experimental Forest. Technical Report 19. Washington DC, Office of Naval Research

Mayhew L 1986 Urban hospital location. London, Allen and Unwin, London Research Series in Geography

McAusland S, Summerside A 1993 First steps to success. Proceedings, Association for Geographic Information Conference. Rickmansworth, Westrade Fairs Ltd: 1.17.1–1.17.3

McBratney A B, Webster R, Burgess T M 1981 The design of optimal sampling schemes for local estimation and mapping of regionalized variables: 1. Theory and method. *Computers and Geosciences* 7: 331–4

McBratney A B, Whelan B M 1995 Continuous models of soil variation for continuous soil management. In Robert P C, Rust R H (eds) *Site-specific management for agricultural systems*. Madison, American Society of Agronomy: 325–38

McCauley J D, Engel B A 1997 Approximation of noisy bivariate traverse data for precision mapping. *Transactions of the American Society of Agricultural Engineers*

McCormick B, DeFanti T A, Brown M D 1987 Visualization in scientific computing. ACM SIGGRAPH Computer Graphics 21 special issue

McCullagh M J 1988 Terrain and surface modelling systems: theory and practice. *Photogrammetric Record* 12: 747–79

McDonald R A 1995 Opening the Cold War sky to the public: declassifying satellite reconnaissance imagery. *Photogrammetric Engineering and Remote Sensing* 61: 385–90

McDonald R C, Isbell R F, Speight J G, Walker J, Hopkins M S 1990 Australian soil and land survey field handbook, 2nd edition. Melbourne, Inkata Press

McDonnell R A, Kemp K 1995 International GIS dictionary.

Cambridge (UK), GeoInformation International

McDowell L 1995 Understanding diversity: the problem of/for theory. In Johnston R J, Taylor P J, Watts M J (eds) *Geographies of global change: remapping the world in the late twentieth century*. Oxford, Blackwell: 280–94

McGranaghan M 1993 A cartographic view of data quality. Cartographica 30: 8–19

McGrath M, Whiteford A 1994 Inequality in the size distribution of income. *Stellenbosch Economic Project*. Occasional Paper No. 10. Stellenbosch, University of Stellenbosch: 20 pp

McGraw K L, Harbison-Briggs K 1989 *Knowledge acquisition:* principles and guidelines. Englewood Cliffs, Prentice-Hall

McGuffie K, Hendersen-Sellers A 1997 *A climate modelling* primer, 2nd edition. Chichester, John Wiley & Sons

McHaffie P H 1994 Manufacturing metaphors: public cartography, the market, and democracy. In Pickles J (ed.) *Ground truth: the social implications of geographic information systems.* New York, Guilford Press: 113–29

McHarg I L 1969 *Design with nature*. New York, Natural History Press

McHarg I L 1996 *A quest for life*. New York, John Wiley & Sons Inc.

McKay L 1994 Data brokering in land information – Land Information Alberta. *Proceedings, 22nd Annual Conference of AURISA* 1: 171–82

McKendry J E, Machlis G E 1991 The role of geography in extending biodiversity gap analysis. *Applied Geography* 11: 135–52

McKenzie N J, Austin M P 1993 A quantitative Australian approach to medium and small scale surveys based on soil stratigraphy and environmental correlation. *Geoderma* 57: 329–55

McKenzie N L, Belbin L, Margules C R, Keighery G J 1989 Selecting representative reserve systems in remote areas: a case study of the Nullarbor Region, Australia. *Biological Conservation* 50: 239–61

McKerrow N, Fincham R 1995 Combating the legacy of Apartheid in health: Edendale in KwaZulu Natal, South Africa. In Balch J, Johnson P, Morgan R (eds) *Transcending the legacy: children in the new Southern Africa*. Amsterdam, AEI, SARDC, and UNICEF: 113–19

McLaren M 1992 GIS prepares utilities for earthquakes. GIS World 5(4): 60–4

McLaren R 1997 Response in 'Question time for GIS – where are we going?' *Surveying World* 5, 6, 17. Hitchin, PV Publications

McLaughlin D, Reid L B, Li S G, Hyman J 1993 A stochastic method for characterising groundwater contamination. *Ground water* 31: 237–49

McLean I, Butler D (eds) 1996 Fixing the boundaries: defining and redefining single-member electoral districts. Aldershot, Dartmouth Publishing

McLean I, Mortimore R 1992 Apportionment and the Boundary

Commission of England. Electoral Studies 4: 293-309

McMaster R B 1987 Automated line generalisation. *Cartographica* 24: 74–111

McMaster R B 1988 Modeling community vulnerability to hazardous materials using geographic information systems. *Proceedings, Third International Symposium on Spatial Data Handling.* Columbus, IGU: 143–56

McMaster R B (ed.) 1989 Numerical generalisation in cartography. *Cartographica* 26

McMaster R B 1995 Knowledge acquisition for cartographic generalisation: experimental methods. In Müller J-C, Lagrange J-P, Weibel R (eds) *GIS and generalisation: methodological and practical issues*. London, Taylor and Francis: 161–79

McMaster R B, Mark D M 1991 The design of a graphical user interface for knowledge acquisition in cartographic generalisation. *Proceedings GIS/LIS 91*. Bethesda, ACSM/ASPRS: 311–20

McMaster R B, Shea K S 1992 *Generalisation in digital cartography*. Washington DC, Association of American Geographers

McMichael A J 1993 *Planetary overload: global environmental* change and the health of the human species. Cambridge (UK), Cambridge University Press

McMillen D P 1992 Probit with spatial autocorrelation. Journal of Regional Science 32: 335–48

McRae H 1993 Taking the bull by the horns. *The Independent*, 12 March 1993

Medyckyj-Scoff D, Hearnshaw H M (eds) 1993 Human factors in geographical information systems. London, Belhaven Press

Meehan W J 1994 Automated distribution dispatching using AM/FM/GIS. In Kunze A E (ed.) *The best of AM/FM/GIS: a special collection of past conference proceedings for the gas industry*. Aurora, AM/FM International

Meehan W J 1995 Process reengineering using GIS: an AM/FM example. ESRI White Paper Series. Redlands, ESRI

Megiddo N 1983 Linear-time algorithms for linear programming in R3 and related problems. *SIAM Journal on Computing* 12: 759–76

Mejia-Navarro M, Wohl E E, Oaks S D 1994 Geologic hazards, vulnerability, and risk assessment using GIS: model for Glenwood Springs, Colorado. *Geomorphology* 10: 331–54

Melton J 1996 SQL language summary. ACM Computing Surveys 28: 141–3

Melton M A 1958 Correlation structure of morphometric properties of drainage systems and their controlling agents. *Journal of Geology* 66: 442–60

Mendeleev D 11906 *Kpoznaniyu rossii* (Russian information). St Petersburg, A S Suvorina

Merchant J W, Yang L, Yang W 1994 Validation of continentalscale land cover databases developed from AVHRR data. *Proceedings, Pecora 12 Symposium.* Bethesda, American Society of Photogrammetry and Remote Sensing: 63–72 Mertes L K, Daniel D L, Melack J M, Nelson B, Martinelli L A, Forsberg B R 1995 Spatial patterns of hydrology, geomorphology, and vegetation on the floodplain of the Amazon River in Brazil from a remote sensing perspective. *Geomorphology* 13: 215–32

Mesev T V, Longley P A, Batty M, Xie Y 1995 Morphology from imagery – detecting and measuring the density of urban land-use. *Environment and Planning A* 27: 759–80

Metropolis N 1993 The age of computing. In Metropolis N, Rota G C (eds) *A new era of computation*. Cambridge (USA), MIT Press: 119–30

Meyers J R, Daniels M J, Killpack C C 1996 Costs and benefits: implementing an ARC/INFO-based AM/FM/GIS. ESRI White Paper Series. Redlands, ESRI

Michaelsen J, Schimel D S, Friedl M A, Davis F W, Dubayah R C 1996 Regression tree analysis of satellite and terrain data to guide vegetation sampling and surveys. *Journal of Vegetation Science* 5: 673–86

Miller A 1990 GIS in a networking environment. *Proceedings* GIS 90, International Symposium on Geographic Information Systems: 255–62

Miller B 1992 Collective action and rational choice: place, community, and the limits of individual self-interest. *Economic Geography* 68: 22–42

Miller B 1995 Beyond method, beyond ethics: integrating social theory into GIS and GIS into social theory. *Cartography and Geographic Information Systems* 22: 98–103

Miller D R, Aspinall R J, Morrice J G 1992 Recreation potential and management in the Cairngorms: use of GIS for analysis of landscape in an area of high scenic value. In Cadoux-Hudson J, Heywood D I (eds) *The yearbook of the Association for Geographic Information 1992/3*. London, Taylor and Francis: 82–92

Miller D R, Morrice J G 1996 An assessment of the uncertainty of delimited catchment boundaries. *HydroGIS* 96: Application of Geographic Information Systems in Hydrology and Water Resources Management. IARS Publ. no. 235: 445–52

Miller H J 1991 Modelling accessibility using space-time prism concepts within geographical information systems. *International Journal of Geographical Information Systems* 5: 287–301

Miller H J 1996 GIS and geometric representation in facility location problems. *International Journal of Geographical Information Systems* 10: 791–816

Miller H J, Storm J D 1996 Geographic information system design for network equilibrium-based travel demand models. *Transportation Research C* 4: 373–89

Miller R G, Karimi H A, Feuchtwanger M 1989 Uncertainty and its management in geographic information systems. *Proceedings, Canadian Institute of Surveying and Mapping National Conference on GIS, Ottawa*: 252–60

Mills K, Fox G, Heimbach R 1992 Implementing an intervisibility analysis model on a parallel computing system. *Computers and Geosciences* 18: 1047–54

Milne B T, Johnston K M, Forman R T T 1989 Scale-

dependent proximity of wildlife habitat in a spatially-neutral Bayesian model. *Landscape Ecology* 2: 101–10

Milne G 1936 A provisional soil map of East Africa. Amani Memoirs 28

Mimno P 1996 Building enterprise-class client/server applications. Lisle, Dynasty Technologies, Inc. http://www. dynasty.com/product/mimno_wp.htm

Mine M 1995 Virtual environment interaction techniques. *Technical Report TR95–018.* Department of Computer Science, University of North Carolina, Chapel Hill

Misund G 1997 Varioscale TIN based surfaces. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 353–64

Mitas L, Mitasova H 1988 General variational approach to the interpolation problem. *Computers and Mathematics with Applications* 16: 983–92

Mitas L, Mitasova H 1996 *Multivariate approximation by regularized spline with tension*. Urbana, National Center for Supercomputing Applications: 1–5

Mitas L, Mitasova H, Brown W M 1997 Role of dynamic cartography in simulations of landscape processes based on multivariate fields. *Computers and Geosciences* 23: 437–46 includes CD-ROM and wn@elsevieir, nlllocate/cgvis

Mitasova H, Hofierka J 1993 Interpolation by regularised spline with tension: II. Application to terrain modeling and surface geometry analysis. *Mathematical Geology* 25: 657–69

Mitasova H, Hofierka J, Zlocha M, Iverson L 1996 Modelling topographic potential for erosion and deposition using GIS. *International Journal of Geographical Information Systems* 10: 629–41

Mitasova H, Mitas L 1993 Interpolation by regularised spline with tension: I. Theory and implementation. *Mathematical Geology* 25: 641–55

Mitasova H, Mitas L, Brown W M, Gerdes D P, Kosinovsky I, Baker T 1995 Modelling spatially and temporally distributed phenomena: new methods and tools for GRASS GIS. *International Journal of Geographical Information Systems* 9: 433–6

Mitchell W 1995 *City of bits: space, place and the Infobahn.* Cambridge (USA), MIT Press

Miyares I M, McGlade M S 1994 Specialisation in 'Jobs in Geography' 1980–1993. *The Professional Geographer* 46: 170–7

Moellering H 1980 The real-time animation of 3-dimensional maps. *The American Cartographer* 7: 67–75

Moellering H (ed.) 1991 Spatial database transfer standards: current international status. Oxford and New York, Elsevier Science on behalf of the International Cartographic Association: 191–215

Moellering H 1996 Spatial database transfer standards 2: characteristics for assessing standards for the transfer of spatial data and full descriptions of the national and international standards in the world. Oxford, Elsevier Science on behalf of the International Cartographic Association: 80 Moellering H, Wortman K 1994 *Technical characteristics for* assessing standards for the transfer of spatial data and brief international descriptions. ICA technical report

Molenaar M (ed.) 1996a *Methods for the generalisation of geodatabases*. Publications on Geodesy No. 43. Delft, Netherlands Geodetic Commission

Molenaar M 1996b The role of topologic and hierarchical spatial object models in database generalisation. In Molenaar M (ed.) *Methods for the generalisation of geodatabases*. Publications on Geodesy. Delft, Netherlands Geodetic Commission 43: 13–36

Molenaar M, Hoop S de 1994 *Advanced geographic data modelling.* Publications on Geodesy New Series, No.40. Delft, Netherlands Geodetic Commission

Moller-Jenson L 1990 Knowledge-based classification of an urban area using texture and context information in LANDSAT-TM imagery. *Photogrammetric Engineering and Remote Sensing* 56: 899–904

Monckton C G 1994 An investigation into the spatial structure of error in digital elevation data. In Worboys M (ed.) *Innovations in GIS 1*. London, Taylor and Francis: 201–11

Mondschein L G 1994 The role of spatial information systems in environmental emergency management. *Journal of the American Society for Information Science* 45: 678–85

Monmonier M 1989 Geographic brushing: enhancing exploratory analysis of the scatterplot matrix. *Geographical Analysis* 21: 81–4

Monmonier M 1990 Strategies for the visualization of geographic time-series data. *Cartographica* 27: 30–45

Monmonier M 1991a *How to lie with maps*. Chicago, University of Chicago Press

Monmonier M 1991b Role of interpolation in feature displacement. In Buttenfield B P, McMaster R B (eds) *Map* generalisation: making rules for knowledge representation. Harlow, Longman: 189–203

Monmonier M 1992 Authoring graphic scripts: experiences and principles. *Cartography and Geographic Information Systems* 19: 247–60

Monmonier M 1996 *How to lie with maps*, 2nd edition. Chicago, University of Chicago Press

Montgomery D R, Dietrich W E 1988 Where do channels begin? *Nature* 336: 232–4

Moody D 1996 The seven habits of highly effective data modellers. *Database Programming and Design* (October): 57–64

Mooney D J, Grant D M 1997 The Australian national spatial data infrastructure. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 197–205

Mooney H A 1991 Emergence of the study of global ecology: is terrestrial ecology an impediment to progress? *Ecological Applications* 1: 2–5

Moore D M, Lees B G, Davey S M 1991 A new method for predicting vegetation distributions using decision tree analysis in a geographical information system. *Environmental Management* 15: 59–71 Moore G C 1993 Implications from MIS research for the study of GIS diffusion: some initial evidence. In Masser I, Onsrud H J (eds) *Diffusion and use of geographic information technologies*. Dordrecht, Kluwer: 77–94

Moore I D, Gessler P E, Nielsen G A, Peterson G A 1993 Soil attribute prediction using terrain analysis. *Soil Science Society of America Journal* 57: 443–52

Moore I D, Grayson R B 1991 Terrain-based catchment partitioning and runoff prediction using vector elevation data. *Water Resources Research* 27: 1177–91

Moore I D, Lewis A, Gallant J C 1993 Terrain attributes: estimation of scale effects. In Jakeman A J, Beck M B, McAleer M (eds) *Modelling change in environmental systems*. New York: John Wiley & Sons Inc.: 189–214

Moore I D, O'Loughlin E M, Burch G J 1988 A contour-based topographic model for hydrological and ecological applications. *Earth Surface Processes and Landforms* 13: 305–20

Moore I D, Wilson J P 1992 Length-slope factors for the revised universal soil loss equation: simplified method of estimation. *Journal of Soil and Water Conservation* 47: 423–8

Moore I D, Wilson J P 1994 Reply to 'Comment on lengthslope factors for the Revised Universal Soil Loss Equation: simplified method of estimation' by G R Foster. *Journal of Soil and Water Conservation* 49: 174–80

Moraczewski I R 1993 Fuzzy logic for phytosociology. 1: syntaxa as vague concepts. *Vegetatio* 106: 1–11

Morain S, Budge A 1996 The National Spatial Data Infrastructure – why should you care? *GIS World* 9(8): 32–4

Moran P A P 1948 The interpretation of statistical maps. Journal of the Royal Statistical Society B 10: 243–51

Morehouse S 1995 GIS-based map compilation and generalisation. In Müller J-C, Lagrange J-P, Weibel R (eds) *GIS and generalisation: methodological and practical issues*. London, Taylor and Francis: 21–30

Morgan G 1986 Images of organization. Newbury Park, Sage Publications

Morgan G 1989 Creative organisation theory. London, Sage Publications

Morgan J M, Fleury B, Becker R A 1996 *Directory of* academic GIS education. Dubuque, Kendall Publishing Co.

Morgan P H, Nott S 1995 *Development control: law, policy and practice*, 2nd edition. London, Butterworth

Morrill R L 1965a *Migration and the growth of urban settlement*. Lund, C W K Gleerup

Morrill R L 1965b The negro ghetto. *The Geographical Review* 55: 339–61

Morrill R L 1981 *Political redistricting and geographic theory.* Washington DC, Association of American Geographers

Morrill R L 1987 Redistricting, region and representation. Political Geography Quarterly 6: 241–60

Morrill R L 1991 Making redistricting models more flexible and realistic. *The Operational Geographer* 9: 2–9

Morrison A C, Getis A, Santiago M, Rigau-Peres J G, Reiter

P 1996 Exploratory space-time analysis of reported dengue cases during an outbreak in Florida, Puerto Rico, 1991–92. *American Journal of Tropical Medicine*

Morrison J L 1992 Implementing the Spatial Data Transfer Standard – introduction. *Cartography and Geographic Information Systems* 19: 277

Morrison J L 1997 Topographic mapping in the twenty-first century. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 14–27

Mortenson M E 1985 *Geometric modelling* New York, John Wiley & Sons Inc.

Mounsey H 1991 Multisource, multinational environmental GIS: lessons learned from CORINE. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 185–200

Mowrer H T 1994 Monte Carlo techniques for propagating uncertainty through simulation models and raster-based GIS. In Congalton R G (ed.) *Proceedings, international symposium on spatial accuracy of natural resource databases.* Washington, American Society for Photogrammetry and Remote Sensing: 179–188

Mowshowitz A 1976 The conquest of will: information processing in human affairs. Reading (USA), Addison-Wesley

Moxey A, Allanson P 1994 Area interpolation of spatially extensive variables: a comparison of alternative techniques. *International Journal of Geographical Information Systems* 8: 479–87

Moy C C, Austin R F 1997 TIME Telekon's network inventory system: AM/FM/GIS in the Big Durian. *Proceedings, AM/FM International Conference*. Aurora, AM/FM International: 683–90

Moyer D D, Danielsen D K 1996 Densifying statewide high accuracy reference networks (HARNs): GPS networks for transportation network support. *Proceedings GIS-T 96, Geographic Information Systems for Transportation Symposium.* Washington DC, American Association of State Highway and Transportation Officials: 10–26

Muchaxo J 1995 Multi-scale representation for large territories. Proceedings First Conference on Spatial Multimedia and Virtual Reality, Lisbon, Portugal, 18–20 October

Muchaxo J, Neves J N, Câmara A 1996 Wavelets and level-ofdetail management: real-time and multiresolution for geographical data. Interim report

Mulla D J 1988 Using geostatistics and spectral analysis to study spatial patterns in the topography of southeastern Washington State, USA. *Earth Surface Processes and Landforms* 13: 389–405

Mulla D J 1991 Using geostatistics and GIS to manage spatial patterns in soil fertility. In Kranzler G (ed.) *Proceedings, Automated Agriculture in the 21st Century Symposium.* St Joseph, American Society of Agricultural Engineers: 336–45

Müller J-C 1991 Generalisation of spatial databases. In

Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications.* Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 457–75

Müller J-C, Lagrange J-P, Weibel R 1995 (eds) *GIS and* generalisation: methodological and practical issues. London, Taylor and Francis

Müller J-C, Wang Z 1992 Area patch generalisation: a competitive approach *The Cartographic Journal* 29: 137–44

Musgrave A 1993 *Common sense science and scepticism.* Cambridge (UK), Cambridge University Press

Mustière S 1995 'Mesures de la qualité de la généralisation du linéaire'. Unpublished MSc thesis, St-Mandé (F), Ecole Nationale des Sciences Géographiques

Mwalyosi R B B 1991 Ecological evaluation for wildlife corridors and buffer zones for Lake Manyara National Park, Tanzania, and its immediate environment. *Biological Conservation* 57: 171–86

Myers D 1984 CoKriging – new developments. In Verly G, David M, Journel A, Marechal A (eds) *Geostatistics for Natural Resource Characterisation* Part 1. Dordrecht, Reidel: 295–305

Myneni R B, Hall F G, Sellers P J, Marshak A L 1995 The interpretation of spectral vegetation indices. *IEEE Transactions on Geoscience and Remote Sensing* 33: 481–6

Myneni R B, Ross J, Asrar G 1990 A review of the theory of photon transport in leaf canopies. *Agricultural Forestry Meteorology* 45: 1–153

Myneni R B, Williams D L 1994 On the relationship between FAPAR and NDVI. *Remote Sensing of Environment* 49: 200–11

Nagy G 1994 Terrain visibility. *Computer and Graphics* 18: 763–73

Naisbitt J 1984 Megatrends. London, Macdonald

NASA 1995 1995 Mission to Planet Earth, Earth Observing System: Reference Handbook. Washington DC, National Aeronautics and Space Administration: 40

NASA 1996 Directory Interchange Format (DIF) writer's guide, version 5.0a. Washington DC, NASA. http://gcmd.gsfc. nasa.gov/difguide/difman.html

Natal Nutrition Working Group 1993 *The evaluation and monitoring of the National Nutrition and Social Development Programme (NNSDP), Natal Region.* Pietermaritzburg, University of Natal

Naude A, Feast K 1996 Identifying suitable land for affordable housing. A decision support system (DSS) approach in South Africa. *EIS News.* July. Program on Environment Information Systems in Sub-Saharan Africa. Pretoria, c/o CSIR: 14–15

NCGIA 1989 The research plan of the National Center for Geographic Information and Analysis. *International Journal* of Geographical Information Systems 3: 117–36

Nebert D D 1994 Serving digital information through the WWW and Wide Area Information Server technology. Paper presented at Second International WWW Conference Mosaic and the Web, Chicago

Nebert D D 1996 Supporting search for spatial data on the Internet: what it means to be a clearinghouse node. Proceedings of 1996 ESRI User Conference, Palm Springs. Redlands, ESRI. http://www.esri.com/resources/userconfproc96/ TO100/PAP096/P96.htm

Neft D S 1966 *Statistical analysis for areal distributions*, Monograph Series 2. Philadelphia, Regional Science Research Institute

Negroponte N 1989 An iconoclastic view beyond the desktop metaphor. *International Journal of Human Computer Interaction* 1: 109–13

Negroponte N 1995 Being digital. New York, Basic Books

Nelder J A, Wedderburn R W M 1972 Generalized linear models. *Journal of the Royal Statistical Society A* 135: 370–84

Nelder V J, Crossley D C, Cofinas M 1995 Using geographical information systems (GIS) to determine the adequacy of sampling in vegetation surveys. *Biological Conservation* 73: 1–17

Nemani R, Running S W, Band L E, Peterson D L 1993 Regional hydroecological simulation system: an illustration of ecosystem models in a GIS. In Goodchild M F, Parks B O, Steyaert L T (eds) *Environmental modeling with GIS*. New York, Oxford University Press: 297–304

Neves J N, Gonçalves P, Muchaxo J, Jordão L, Silva J P 1995 Virtual GIS Room: interfacing spatial information in virtual environments. *Proceedings, First Conference on Spatial Multimedia and Virtual Reality, Lisbon, Portugal, 18–20 October*

Newell R G 1993 Customising a GIS. GIS Europe 2(1): 20-1

Newell R G 1994 The why and the how of the long transaction. In Green D R, Rix D, Cadoux-Hudson J (eds) *Geographical information: the source book for GIS.* London, Association for Geographical Information: 237–41

Newsom D E, Mitrani J E 1993 Geographic information system (GIS) applications in emergency management. *Proceedings, 1993 International Emergency Management and Engineering Conference.* San Diego, Society for Computer Simulation (SCS): 61

Newton J 1996 Application of metadata standards. Proceedings, First IEEE Metadata Conference. IEEE Computer Society Mass Storage Systems and Technology Technical Committee. http://www.computer.org/conferen/ meta96/meta_home.html

Newton P W, Taylor M A P (eds) 1986 *Microcomputers for local government planning and management*. Melbourne, Hargreen

Newton P W, Taylor M A P, Sharpe R (eds) 1988 *Desktop planning: microcomputer applications for infrastructure and services planning and management.* Melbourne, Hargreen

Newton P W, Zwart P R, Cavill M 1992 Inhibitors and facilitators in high-speed networking of spatial information

systems. In Newton P W, Zwart P R, Cavill M E (eds) Networking spatial information systems. London, Belhaven Press

Ng R, Han J 1994 *Efficient and effective clustering methods for spatial data mining.* Technical Report 94–13. Vancouver, University of British Columbia, Department of Computer Science

Nichol D G 1990 Region adjacency analysis of remotelysensed imagery. *International Journal of Remote Sensing* 11: 2089–101

Nickerson B G 1988 Automated cartographic generalisation for linear features. *Cartographica* 25: 15–66

Nickerson B G 1991 Knowledge engineering for generalisation. In Buttenfield B P, McMaster R B (eds) *Map* generalisation: making rules for knowledge representation. Harlow, Longman: 40–56

Nicola G de 1996 Staying online in Italy. GIS Europe 5(3): 44-5

Niedda M 1996 Use of network algorithms in spatially distributed models for the study of river basin response. *HydroGIS 96: application of geographic information systems in hydrology and water resources management.* IAHS Publ. no. 235: 207–1

Nielsen D R, Wendroth G, Parlange M B 1995 Opportunities for examining on-farm soil variability. In Robert P C, Rust R H (eds) *Site-specific management for agricultural systems*. Madison, American Society of Agronomy: 95–132

Nielson G 1983 A method for interpolating scattered data based upon a minimum norm network. *Mathematics and Computation* 40: 253–71

Nielsen G A, Caprio J M, McDaniel P A, Snyder, R D, Montagne C 1990 MAPS: a GIS for land resource management in Montana. *Journal of Soil and Water Conservation* 45: 450–3

Nielson G M 1993 Scattered data modeling. *IEEE Computer* Graphics and Applications 13: 60–70

Niemi R G 1982 The effects of districting on trade-offs among party competition, electoral responsiveness, and seats-votes relationships. In Grofman B, Lijphart A, McKay R B, Scarrow H A (eds) 1982 *Representation and redistricting issues*. Lexington, Lexington Press: 35–42

Nievergelt J, Hinterberger H, Sevcik K C 1984 The grid file: an adaptable, symmetric multikey file structure. *ACM Transactions on Database Systems* 9: 38–71

Nijkamp P, Scholten H J 1991 Information systems: caveats in design and use. *Proceedings, Second European Conference on GIS (EGIS 91), Brussels* 1: 737–46

Niklasz L, Podolcsák Á, Baldwin R A, Remetey-Füllöpp G 1996. Land administration guidelines with special reference to countries in transition, Appendix A – The Hungarian experience. New York and Geneva, United Nations: 77–87

Nix H A 1986 A biogeographic analysis of Australian elapid snakes. In Longmore R (ed.) *Atlas of elapid snakes of Australia*. Australian Flora and Fauna Series No. 7. Canberra, Australian Government: 4–15

Nobre F F, Carvalho M 5 1995 Spatial and temporal analysis of epidemiological data. In Savigny D de, Wijeyaratne P (eds) *GIS for health and the environment*. Ottawa, International Development Research Centre: 21–31

Nofziger D L, Hornsby A G 1986 A microcomputer-based management tool for chemical movement in soil. *Applied Agricultural Research* 1: 50–6

Nofziger D L, Hornsby A G 1987 CMLS: chemical movement through layered soils model users' manual. Gainesville, University of Florida

Nordbeck S, Rystedt B 1970 Isarithmic maps and the continuity of reference interval functions. *Geografiska Annaler* 52B: 92–123

Norman D A 1986 Cognitive engineering. In Norman D A, Draper S W (eds) User centered system design: new perspectives on human-computer interaction. Hillsdale, Lawrence Erlbaum: 31–61

North Carolina General Statutes 1996. Raleigh, General Assembly of North Carolina

Norton T W, Nix H A 1991 Application of biological modelling and GIS to identify regional wildlife corridors. In Saunders D A, Hobbs R J (eds) *Nature conservation 2: the role of corridors.* Canberra, Surrey Beatty and Sons: 19–26

Nulty W G, Barholdi J J III 1994 Robust multi-dimensional searching with space-filling curves. In Waugh T C, Healey R G (eds). *Proceedings, Sixth International Symposium on Spatial Data Handling Edinburgh, Scotland.* London, Taylor and Francis: 805–18

Nyerges T L 1989 GIS support for micro-macro spatial modeling. *Proceedings of AutoCarto 9.* Falls Church, ACSM/ASPRS: 567–79

Nyerges T L 1995 Geographical information system support for urban/regional transportation analysis. In Hanson S (ed.) 1995 *The geography of urban transportation*, 2nd edition. New York, Guilford Press: 240–65

Nyerges T L, Chrisman N R 1989 A framework for model curricula development in cartography and geographic information systems. *Professional Geographer* 41: 283–93

Nyerges T L, Dueker K J 1988 *Geographic information systems in transportation*. HPN-22. Washington DC, US Department of Transportation, Federal Highway Administration, Office of Planning

Nyerges T L, Mark D M, Laurini R, Egenhofer M J (eds) 1995 Cognitive aspects of human-computer interaction for geographic information systems. NATO ASI Series D: Behavioural and Social Sciences. Dordrecht, Kluwer

O'Callaghan J F, Mark D M 1984 The extraction of drainage networks from digital elevation data. *Computer Vision, Graphics, and Image Processing* 28: 323–44

O'Conaill M A, Mason D C, Bell S B M 1993 Spatio-temporal GIS techniques for environmental modelling. In Mather P M (ed.) *Geographical information handling: research and applications*. Chichester, John Wiley & Sons: 103–112

O'Loughlin E 1990 Modelling soil water status in complex terrain. Agricultural and Forest Meteorology 50: 23–38

O'Loughlin J, Anselin L 1991 Bringing geography back to the

study of international relations: dependence and regional context in Africa, 1966–78. International Interactions 17: 29–61

O'Neill R V, Gardner R H, Turner M G 1992a A hierarchical neutral model for landscape analysis. *Landscape Ecology* 7: 55–61

O'Neill R V, Gardner R H, Turner M G, Romme W H 1992b Epidemiology theory and disturbance spread on landscapes. *Landscape Ecology* 7: 19–26

Obermeyer N J 1990 *Bureaucrats, clients and geography.* Chicago, University of Chicago Geography Research Papers, #216

Obermeyer N J 1995 Ameliorating inter-organisational conflict in order to share geographic information. In Rushton G, Goodchild M (eds) *Organisations sharing geographic information*. New Brunswick, Center for Urban Planning Research

Obermeyer N, Pinto J K 1994 Managing geographic information systems. New York, Guilford Press

OECD 1976 Policy issues in data protection and privacy. Paris, Organisation for Economic Cooperation and Development

OECD 1992 Privacy and data protection – issues and challenges. Paris, Organisation for Economic Cooperation and Development

OECD 1997 Best practice guidelines for user charging for government services. Paris, Organisation for Economic Cooperation and Development

Office of National Statistics 1997 Harmonised concepts and questions for government social surveys. London, Her Majesty's Stationery Office

OGC (Open GIS Consortium) 1996a Vision and mission statements. http://www.opengis.org/vision.html

OGC (Open GIS Consortium) 1996b The OpenGIS guide, introduction to interoperable geoprocessing Part 1. http://ogis. org/guide/guide1.html

OGC (Open GIS Consortium) 1996c The OpenGIS abstract specification. http://www.opengis.org/public/abstract.html

Okabe A, Boots B, Sugihara K 1992 Spatial tessellations: concepts and applications of Voronoi diagrams. Chichester, John Wiley & Sons

Okabe A, Boots B, Sugihara K 1994 Nearest neighbourhood operations with generalized Voronoi diagrams. *International Journal of Geographical Information Systems* 8: 43–71

Okabe A, Suzuki A 1995 Using Voronoi diagrams. In Drezner Z (ed.) *Facility location: a survey of applications and methods*. New York, Springer: 103–17

Okabe A, Tagashira N 1996. Spatial aggregation bias in a regression model containing a distance variable. *Geographical Systems* 3: 77–100

Okunieff P, Siegel D, Miao Q, Gordon S 1995 Location referencing methods for intelligent transportation systems (ITS) user services: recommended approach. *Proceedings GIS-T 95, Geographic Information Systems for Transportation* *Symposium.* Washington DC, American Association of State Highway and Transportation Officials: 57–76

Oliver M A, Muir K R, Webster R, Parkes S E, Cameron A H, Stevens M, Mann J R 1992 A geostatistical approach to the analysis of pattern in rare disease. *Journal of Public Health Medicine* 14: 280–9

Oliver M A, Webster R 1986 Semi-variograms for modelling the spatial pattern of landform and soil properties. *Earth Surface Processes and Landforms* 11: 491–504

Oliver M A, Webster R 1990 Kriging: a method of interpolation for GIS. *International Journal of Geographical Information Systems* 4: 313–32

Olle T W 1991 Information systems methodologies, 2nd edition. Reading (USA), Addison-Wesley

Olmstead v. United States 1928 277 US 438 (1928)

Olsen E R, Ramsey R D, Winn D S 1993 A modified fractal dimension as a measure of landscape diversity. *Photogrammetric Engineering and Remote Sensing* 59: 1517–20

Olson J S, Watts J A, Allison L J 1985 *Major world ecosystem complexes ranked in live vegetation: a database.* Oak Ridge, Carbon Dioxide Information Center, Oak Ridge National Laboratory

OMB 1993 Circular A-130: Management of Federal Information Resources. June 25. Washington DC, US Office of Management and Budget

Omernik J M 1996 Ecoregions: a spatial framework for environmental management. In Davis W S, Simon T P (eds) *Biological assessment and criteria: tools for water resource planning and decision-making*. Boca Raton, Lewis Publishers: 49–62

Onsrud H J 1992 In support of open access for publicly held geographic information. *GIS Law* 1: 3–6

Onsrud H J 1995 (ed.) Law and information policy for spatial databases. Orono, NCGIA

Onsrud H J, Pinto J K 1991 Diffusion of geographic information innovations. *International Journal of Geographical Information Systems* 5: 447–67

Onsrud H J, Rushton G (eds) 1995a Institutions sharing geographic information. Piscataway, Rutgers University Press

Onsrud H J, Rushton G (eds) 1995b Sharing geographic information. New Brunswick, Center for Urban Policy Research

Oosterom P van 1989 A reactive data structure for geographic information systems. *AutoCarto* 9: 665–74

Oosterom P van 1990 A modified binary space partitioning tree for geographic information systems. *International Journal of Geographical Information Systems* 4: 133–46

Oosterom P van 1991 The Reactive-tree: a storage structure for a seamless, scaleless geographic database. In Mark D M, White D (eds) *AutoCarto 10*. American Congress on Surveying and Mapping: 393–407

Oosterom P van 1994 Reactive data structures for geographic

information systems. Oxford, Oxford University Press

Oosterom P van, Bos J van den 1989 An object-oriented approach to the design of geographic information systems. *Computers and Graphics* 13: 409–18

Oosterom P van, Claassen E 1990 Orientation insensitive indexing methods for geometric objects. *Fourth International Symposium on Spatial Data Handling, Zurich*: 1016–29

Oosterom P van, Schenkelaars V 1995 The development of an interactive multi-scale GIS. *International Journal of Geographical Information Systems* 9: 489–507

Oosterom P van, Vijlbrief T 1996 The spatial location code. In Kraak M-J, Molenaar M (eds) *Proceedings, Seventh International Symposium on Spatial Data Handling, Delft, The Netherlands.* London, Taylor and Francis

Openshaw S 1977 A geographical solution to scale and aggregation problems in region-building, partitioning, and spatial modelling. *Transactions of the Institute of British Geographers* 2: 459–72

Openshaw S 1978 An optimal zoning approach to the study of spatially aggregated data. In Masser I, Brown P J B (eds) *Spatial representation and spatial interaction*. Boston (USA), Martinus Nijhoff: 95–113

Openshaw S 1984 *The modifiable areal unit problem*. Concepts and Techniques in Modern Geography 38. Norwich, GeoBooks

Openshaw S 1986 Nuclear power: siting and safety. London, Routledge

Openshaw S 1989a Computer modelling in human geography. In MacMillan W (ed.) *Remodelling geography*. Oxford, Blackwell: 70–88

Openshaw S 1989b Learning to live with errors in spatial databases. In Goodchild M, Gopal S (eds) *Accuracy of spatial databases*. London, Taylor and Francis: 263–76

Openshaw S 1990 Spatial analysis and geographical information systems: a review of progress and possibilities. In Scholten H, Stillwell J (eds) *Geographical information systems* for urban and regional planning. Dordrecht, Kluwer: 153–63

Openshaw S 1991a A spatial analysis research agenda. In Masser I, Blakemore M (eds) *Handling geographical information: methodology and potential applications.* Harlow, Longman/New York, John Wiley & Sons Inc.: 18–37

Openshaw S 1991b A view on the GIS crisis in geography, or using GIS to put Humpty Dumpty back together again. *Environment and Planning A* 23: 621–8

Openshaw S 1991c Developing appropriate spatial analysis methods for GIS. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 389–402

Openshaw S 1992 Further thoughts on geography and GIS: a reply. *Environment and Planning A* 24: 463–6

Openshaw S 1993 Modelling spatial interaction using a neural

net. In Fischer M M, Nijkamp P (eds) *Geographic information systems, spatial modelling, and policy evaluation*. Berlin, Springer: 147–64

Openshaw S 1994a A concepts-rich approach to spatial analysis, theory generation, and scientific discovery in GIS using massively parallel computing. In Worboys M F (ed.) *Innovations in GIS 1.* London, Taylor and Francis: 123–38

Openshaw S 1994b Computational human geography: exploring the geocyberspace. *The Leeds Review* 37: 201–20

Openshaw S 1994c Computational human geography: towards a research agenda. *Environment and Planning A* 26: 499–505

Openshaw S 1994d GIS crime and spatial analysis. *Proceedings* GIS and Public Policy Conference. Ulster, Ulster Business School: 22–35

Openshaw S 1994e Two exploratory space-time-attribute pattern analysers relevant to GIS. In Fotheringham S, Rogerson P (eds) *Spatial analysis and GIS*. London, Taylor and Francis: 83–104

Openshaw S 1994f What is GISable spatial analysis? In New tools for spatial analysis. Luxembourg, Eurostat: 157–62

Openshaw S 1995a *Census users' handbook.* Cambridge (UK), GeoInformation International

Openshaw S 1995b Developing automated and smart spatial pattern exploration tools for geographical information systems applications. *The Statistician* 44: 3–16

Openshaw S 1996a Developing GIS-relevant zone-based spatial analysis methods. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 55–73

Openshaw S 1996b GIS and society: a lot of fuss about very little that matters and not enough about that which does! In Harris T, Weiner D (eds) GIS and society: the social implications of how people, space, and environment are represented in GIS. Scientific report for the Initiative-19 Specialist Meeting, 2–5 March, Koininia Retreat Center, South Haven. NCGIA Technical Report 96–7: D54–D58. Santa Barbara, NCGIA

Openshaw S 1997 Supercomputing in Geographical Research. Proceedings of Conference on IT in the Humanities. London, British Association

Openshaw S, Alvanides 5 1997 Designing zoning systems for representation of socioeconomic data. In Frank I, Raper J, Cheylan J (eds) *Time and motion of socioeconomic units*. GISDATA series. London, Taylor and Francis

Openshaw S, Charlton M, Carver S 1991 Error propagation: a Monte Carlo simulation. In Masser I, Blakemore M (eds) *Handling geographical information.* Harlow, Longman/New York, John Wiley & Sons Inc.: 78–101

Openshaw S, Charlton M, Wymer C, Craft A 1987 A Mark I geographical analysis machine for the automated analysis of point datasets. *International Journal of Geographical Information Systems* 1: 335–58

Openshaw S, Craft A 1991 Using Geographical Analysis Machines to search for evidence of clusters and clustering in childhood leukaemia and non-Hodgkin lymphomas in Britain. In Draper G (ed.) *The geographical epidemiology of childhood leukaemia and non-Hodgkin lymphomas in Great Britain, 1966–83.* London, Her Majesty's Stationery Office: 89–103

Openshaw S, Cross A 1991 Crime pattern analysis: the development of Arc/Crime. *Proceedings of AGI Annual Conference*. Birmingham (UK)

Openshaw S, Cross A, Charlton M 1990 Building a prototype Geographical Correlates Exploration Machine. *International Journal of Geographical Information Systems* 4: 297–312

Openshaw S, Cross A, Charlton M, Brunsdon C, Lillie J 1990 Lessons learnt from a postmortem of a failed GIS. *Proceedings, Association for Geographic Information Conference,* Rickmansworth, Westrade Fairs Ltd: 2.3.1–2.3.5

Openshaw S, Fischer M M 1995 A framework for research on spatial analysis relevant to geostatistical information systems in Europe. *Geographical Systems* 2: 325–37

Openshaw S, Openshaw C A 1997 Artficial intelligence in geography. Chichester, John Wiley & Sons

Openshaw S, Perrée T 1996 User-centred intelligent spatial analysis of point data. In Parker D (ed.) *Innovations in GIS 3*. London, Taylor and Francis: 119–34

Openshaw S, Rao L 1995 Algorithms for re-engineering 1991 Census geography. *Environment and Planning A* 27: 425–46

Openshaw S, Schmidt J 1996 Parallel simulated annealing and genetic algorithms for re-engineering zoning systems. *Geographical Systems* 3: 201–20

Openshaw S, Schmidt J 1997 A Social Science Benchmark (SSB/I) Code for serial, vector, and parallel supercomputers. International Journal of Geographical and Environmental Modelling

Openshaw S, Taylor P J 1979 A million or so correlation coefficients: three experiments on the modifiable areal unit problem. In Bennett R J, Thrift N J, Wrigley N (eds) *Statistical applications in the spatial sciences*. London, Pion

Openshaw S, Taylor P J 1981 The modifiable areal unit problem. In Wrigley N, Bennett R J (eds) *Quantitative geography: a British view*. London, Routledge: 60–70

Openshaw S, Wymer C, Charlton M 1986 A geographical information and mapping system for the BBC Domesday optical discs. *Transactions of the Institute of British Geographers* 11: 296–304

Oppong J R 1992 'Location–allocation models for primary health care in Suhum District Ghana'. Unpublished PhD thesis, Department of Geography, University of Alberta, Edmonton

Oracle Corporation 1996 Oracle Designer/2000. Release I.3

Ord J K 1975 Estimation methods for models of spatial interaction. *Journal of the American Statistical Society* 70: 120–6

Ord J K, Getis A 1995 Local spatial autocorrelation statistics: distributional issues and applications. *Geographical Analysis* 27: 286-306

Ordnance Survey 1995 Urban Areas 91, user guide. Southampton, Ordnance Survey

Orenstein J A, Manola F A 1988 PROBE spatial data modeling and query processing in an image database application. *IEEE Transactions on Software Engineering* 14(5): 611–29

Orlob G T (ed.) 1983 Mathematical modeling of water quality: streams, lakes and reservoirs. New York, John Wiley & Sons Inc.

Osborne D, Gaebler T 1992 *Reinventing government*. Reading (USA), Addison-Wesley

Ostresh L M 1973 A shortest path algorithm. In Rushton G, Goodchild M F, Ostresh L (eds) *Computer programs for location–allocation problems*. Monograph No. 6. Iowa, Department of Geography, University of Iowa: 141–2

Oswald H, Raetzsch H 1984 A system for generation and display of digital elevation models. *GeoProcessing* 2: 197–218

Oswald R 1994 Manitoba Land Related Information System land information utility. Proceedings, 1994 Conference of the Urban and Regional Information Systems Association (URISA): 179–92

Ottoson L, Rystedt B 1991 National GIS programmes in Sweden. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 39–46

Overmars M, Sharir M 1992 A simple output-sensitive algorithm for hidden surface removal. *ACM Transactions on Graphics* 11: 1–11

Ozsoyoglu G, Snodgrass T R 1995 Temporal and real-time databases: a survey. *IEEE Knowledge and Data Engineering* 7: 513–32

Padmanbhan G, Leipnik M R, Yoon J 1992 *A glossary of GIS terminology*. NCGIA Technical Papers Series 92-13. Santa Barbara, NCGIA

Paelinck J 1967 L'efficacité de la politique économique regionale. Namur, Faculté des Sciences Economiques: 58

Paelinck J, Klaassen L 1979 *Spatial econometrics*. Farnborough, Saxon House

Palm R 1990 Natural hazards: an integrative framework for research and planning. Baltimore, Johns Hopkins University Press

Pannatier Y 1996 VARIOWIN: software for spatial data analysis in 2D. New York, Springer

Pantazis D, Donnay J P 1996 La conception de SIG, méthode et formalisme. Paris, Hermès

Panuska J C, Moore I D, Kramer L A 1991 Terrain analysis: integration into the agricultural non-point source (AGNPS) pollution model. *Journal of Soil and Water Conservation* 46: 59–64

Papageorgiou G J 1978 Spatial externalities: parts I and II. Annals of the Association of American Geographers 68: 465–92

Paradis J, Beard M K 1994 Visualisation of data quality for the decision-maker: a data quality filter. *Journal of the Urban and Regional Information Systems Association* 6: 25–34

Parkes D N, Thrift N J 1980 Times, spaces, and places: a

chronogeographic perspective. New York, John Wiley & Sons Inc.

Parrot R, Stutz F P 1991 Urban GIS applications. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications.* Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 247–60

Pas E I 1995 The urban transportation planning process. In Hanson S (ed.) 1973 *The geography of urban transportation*, 2nd edition. New York, Guilford Press: 53–77

Pastor J, Broschart M 1990 The spatial pattern of a northern conifer-hardwood landscape. *Landscape Ecology* 4: 55–68

Paterson M S, Yao F F 1989 Binary partitions with applications to hidden-surface removal and solid modeling. *Proceedings, Fifth ACM Symposium on Computational Geometry.* New York, ACM: 23–32

Paton N, Abdelmoty A, Williams M 1996 Programming spatial databases: a deductive object-oriented approach. In Parker D (ed.) *Innovations in GIS 3*. London, Taylor and Francis: 69–78

Patterson J 1995 North Carolina: the first state-wide publicswitched broadband network or the world's first information superhighway. *Wake Forest Law Review* 30: 127–43

Patterson J, Smith W L 1994 The North Carolina information highway. *ILEE Network* Nov./Dec.: 12–17

Paulsson B 1992 Urban applications of satellite remote sensing and GIS analysis. Washington DC, The World Bank

Pausch R, Burnette T 1995 Navigation and locomotion in virtual worlds via flight into hand-held miniatures. *Proceedings SIGGRAPH 1995, Los Angeles:* 399–400

Pawlak Z 1982 Rough sets. International Journal of Computer and Information Sciences 11: 341–56

Pearman H 1993 Designing a land and property gazetteer. Mapping Awareness 7(5): 19–21

Pederson E 1993 Geographic and manipulable space in two Tamil linguistic systems. In Frank A U, Campari I (eds) *Spatial information theory: a theoretical basis for GIS.* Lecture Notes in Computer Science No. 716. Berlin, Springer: 294–311

Pereira J M C, Itami R M 1991 GIS-based habitat modelling using logistic multiple regression: a case study of the Mount Graham red squirrel. *Photogrammetric Engineering and Remote Sensing* 57: 1475–86

Perkins W A, Wigmosta M S, Nijssen B 1996 Development and testing of road and stream drainage network simulation within a distributed hydrologic model. *EOS* 77: 232

Perrings C, Folke C, Mäler K-G 1992 The ecology and economics of biodiversity loss: the research agenda. *Ambio* 21: 201–11

Perritt H H Jr 1994 Commercialisation of Government Information: comparisons between the European Union and the United States. *Internet Research* 4(2): 7–23

Perritt H H Jr 1995 Tort and criminal liability as a function of the right to control content. *Proceedings, Conference on Law* and Information Policy for Spatial Databases. Orono, University of Maine, NCGIA: 313–15 Perritt H H Jr 1996 *Law and the information superhighway*. Chichester, John Wiley & Sons

Perry J N 1995 Spatial analysis by distance indices. *Journal of Animal Ecology* 64: 303–14

Perry R 1985 Comprehensive emergency management evacuating threatened populations. London, JAI Press Inc.

Peshkin M A, Strandburg K J, Rivier N 1991 Entropic predictions for cellular networks. *Physical Review Letters* 67: 1803–6

Petach M C, Wagenet R J, DeGloria S D 1991 Regional water flow and pesticide leaching using simulations with spatially distributed data. *Geoderma* 48: 245–69

Petch J R, Kolejka J 1993 The tradition of landscape ecology in Czechoslovakia. In Haines-Young R, Green D R, Cousins S (eds) *Landscape ecology and geographical information systems*. London, Taylor and Francis: 39–56

Petchenik B B (ed.) 1988 Special issue on the history of GIS. The American Cartographer 15: 249–322

Petersen J K, Kuhn W 1991 Defining GIS data structures by sketching examples. ACSM/ASPRS Annual Convention. American Congress on Surveying and Mapping 2: 261–9

Peterson C 1991 Precision GPS navigation for improving agricultural productivity. GPS World 2: 38–44

Peterson M P 1995 *Interactive and animated cartography*. Englewood Cliffs, Prentice-Hall

Petrie G, Kennie T J M 1990 Terrain modelling in surveying and civil engineering. Caithness, Whittles Publishing

Petrotechnical Open Software Corporation (POSC) 1995 POSC technical information. http://www.posc.org/technical_ toc.html

Pettigrew A M 1985 *The awakening giant: continuity and change in ICI.* Oxford, Basil Blackwell

Pettigrew A M 1988 *The management of change*. Oxford, Basil Blackwell

Peucker T K, Chrisman N 1975 Cartographic data structures. *The American Cartographer* 2: 55–69

Peucker T K, Douglas D H 1975 Detection of surface specific points by local parallel processing of discrete terrain elevation data. *Computer Graphics and Image Processing* 4: 375–87

Peuquet D J 1984 A conceptual framework and comparison of spatial data models. *Cartographica* 21: 34–48, 66–133

Peuquet D J 1988 Representations of geographic space: toward a conceptual synthesis. *Annals of the Association of American Geographers* 78: 375–94

Peuquet D J 1994 It's about time: a conceptual framework for the representation of temporal dynamics in geographic information systems. *Annals of the Association of American Geographers* 84: 441–61

Peuquet D J, Bacastow T 1991 Organizational issues in the development of geographical information systems: a case study of US Army topographic information automation. *International Journal of Geographical Information Systems* 5: 303–19

Peuquet D J, Duan N 1995 An event-based spatio-temporal data model (ESTDM) for temporal analysis of geographic data. *International Journal of Geographical Information Systems* 9: 2–24

Peuquet D J, Marble D F 1990 Introductory readings in geographic information systems. London, Taylor and Francis

Peuquet D J, Qian L 1996 An integrated database design for temporal GIS. Seventh International Symposium on Spatial Data Handling, Delft, Holland. International Geographical Union: 2–1 to 2–11

Peuquet D J, Wentz E 1994 An approach for time-based analysis of spatio-temporal data. *Sixth International Symposium on Spatial Data Handling, Edinburgh, Scotland.* International Geographical Union: 489–504

Peuquet D J, Zhan C-X 1987 An algorithm to determine the directional relationship between arbitrarily shaped polygons in the plane. *Pattern Recognition* 20: 65–74

Pfeffer J 1981 Power in organisations. London, Pitman Publishing

Pfeffer J 1992 Managing with power: politics and influence in organizations. Boston, Harvard Business School Press

Piaget J, Inhelder B 1956 *The child's conception of space*. London, Routledge

Pickering A 1989 Big science as a form of life. Paper read at 'The restructuring of the physical sciences in Europe and the United States 1945–1960', 19–23 September 1988, Singapore

Pickles J 1991 Geography, GIS, and the surveillant society. *Papers* and Proceedings of Applied Geography Conferences 14: 80–91

Pickles J 1992 Review of D Martin 'GIS and their socioeconomic applications'. *Environment and Planning D: Society and Space* 10: 597–606

Pickles J 1993 Discourse on method and the history of discipline: reflections on Jerome Dobson's 1983 'Automated geography'. *The Professional Geographer* 45: 451–5

Pickles J (ed.) 1995a Ground truth: the social implications of geographic information systems. London, Guilford Press

Pickles J 1995b Representations in an electronic age: geography GIS and democracy. In Pickles J (ed.) *Ground truth: the social implications of geographic information systems*. London, Guilford Press: 1–30

Pickles J 1997 Tool or science? GIS, technoscience, and the theroretical turn. *Annals of the Association of American Cartographers* 87: 363–72

Pignol V, Delanny R, Le Caer G 1993 Characterization of topological properties of 2-dimensional cellular structures by image analysis. *Acta Stereologica* 12: 149–54

Pigot S, Hazelton B 1992 The fundamentals of a topological model for a 4-dimensional GIS. *Proceedings, Fifth International Symposium on Spatial Data Handling, Charleston, South Carolina.* International Geographical Union: 580–91

Pike R J, Rozema W J 1975 Spectral analysis of landforms. Annals of the Association of American Geographers 65: 499–516

Pile S, Rose G 1992 All or nothing? Politics and critique in the modernism–postmodernism debate. *Environment and*

Planning D: Society and Space 10: 123-36

Pilon D, Whalen T, Palmer C 1996 Communications toolkit. Technical Paper. Network Services and Interface Design Laboratory, Communication Research Centre, Industry Canada. http://debra.dgbt.doc.cal~daniel/cscw.text.html

Pinker S 1994 *The language instinct*. New York, William Morrow & Co. Inc.

Piper S, Fincham R 1994 International GIS: South Africa. International GIS Sourcebook 1994. Fort Collins, GIS World Inc.: 303–4

Pizano A, Klinger A, Cardenas A 1989 Specification of spatial integrity constraints in pictorial databases. *IEEE Computer* 22: 59–71

Planning 1996 Government's urban growth projections. London, November

Plazanet C 1995 Measurements, characterisation, and classification for automated line feature generalisation. ACSM/ASPRS Annual Convention and Exposition 4 (Proceedings AutoCarto 12): 59–68

Plazanet C 1996 'Analyse de la géométrie des objets linéaires pour l'enrichissement des bases de données. Intégration dans le processus de généralisation cartographique des routes'. PhD Thesis, Université Marne la Vallée

Plazanet C, Affholder J-G, Fritsch E 1995 The importance of geometric modeling in linear feature generalisation. Cartography and Geographic Information Systems 22: 291–305

Pleuwe B 1994 The GeoWeb project: using WAIS and the World Wide Web to aid location of distributed datasets. Paper presented at WWW 94 Conference, Chicago, 17–20 October. http://wings.buffalo.edul~plewelpaperwww.html

Pleuwe B 1997 GIS online: information retrieval, mapping and the Internet. Santa Fe, Onword Press

Plotnick R E, Gardner R H, O'Neill R V 1993 Lacunarity indices as measures of landscape texture. *Landscape Ecology* 8: 201–11

Poiker T K (ed.) 1993 Proceedings 'Geographic Information and Society' workshop, Friday Harbor, 11–14 November. Santa Barbara, NCGIA

Poiker T K 1985 Geographic information systems in the geographic curriculum. *The Operational Geographer* 8: 38–41

Polyorides N 1993 An experiment in multimedia GIS. Proceedings, European GIS Conference Genoa, Italy April: 203–12

Popko E 1988 An enterprise implementation of AM/FM. Internal paper. Geo-Facilities Information Systems Application Center, IBM Corporation, Houston, Texas

Popper K 1959 *The logic of scientific discovery*. London, Hutchinson

Portugali J, Sonis M 1991 Palestinian national identity and the Israeli labor market: Q-analysis. *The Professional Geographer* 43: 265–79

POST 1995 Information superhighways: the UK National information infrastructure. London, Parliamentary Office for Science and Technology, House of Commons Post W M, Emanuel W R, Zinke P J, Stangenberger A G 1982 Soil carbon pools and world life zones. *Nature* 29: 156–9

Potvin C, Travis J 1993 Concluding remarks: a drop in the ocean.... *Ecology* 74: 1674–6

Powell M J D 1992 Tabulation of thin plate splines on a very fine 2-dimensional grid. In Braess D, Schumaker L L (eds) *Numerical methods of approximation theory* 9: 221–44

Prata A J, Cechet R P, Barton I J, Llewellyn-Jones D T 1990 The Along-Track Scanning Radiometer for ERS-1: scan geometry and data simulation. *IEEE Transactions on Geoscience and Remote Sensing* 28: 3–13

Pratchett T 1986 The light fantastic. Gerrards Cross, Colin Smythe

Prather T S, Callihan R H 1993 Weed eradication using geographic information systems. Weed Technology 7: 265–9

Preparata F P, Shamos M I 1985 Computational geometry: an introduction. Berlin, Springer

Preparata F P, Vitter J S 1992 A simplified technique for hidden-line elimination in terrains. In Finkel A, Jantzen M (eds) Lecture notes in computer science 577. Berlin, Springer: 135–44

Prescott J R V 1987 Political frontiers and boundaries. London, Allen and Unwin

Pretty R W 1992 LANs, MANs, and WANs: introductory tutorial on computer networking. In Newton P W, Zwart P R, Cavill M E (eds) *Networking spatial information systems*. London, Belhaven Press

Price D J de S 1963 *Little science big science*. New York, Columbia University Press

Price J C 1987 Calibration of satellite radiometers and the comparison of vegetation indices. *Remote Sensing of Environment* 21: 15–27

Price J C 1990 On the information content of soil reflectance spectra. *Remote Sensing of Environment* 33: 113–21

Pries R A 1995 A system for large-scale image mapping and GIS data collection. *Photogrammetric Engineering and Remote Sensing* 61: 503–11

Priestal G, Downs P W 1996 Automated parameter estimation for catchment scale river channel studies: the benefits of raster-vector integration. *HydroGIS 96: application of geographic information systems in hydrology and water resources management.* IAHS Publ. no. 235: 215–2

Primavesi A L, Evans P A 1988 *Flora of Leicestershire*. Leicester, Leicestershire County Museum Service

Prisley S P, Smith J L 1991 The effect of spatial data variability on decisions reached in a GIS environment. In Heit M, Shortread A (eds) *GIS applications in natural resources.* Fort Collins, GIS World Inc.: 167–70

Probst J R, Weinrich J 1993 Relating Kirtland's warbler population to changing landscape composition and structure. *Landscape Ecology* 8: 257–71

Pugh D 1992 The National Land and Property Gazetteer. Mapping Awareness 6(5): 32–3

Puppo E 1996 Variable resolution terrain surfaces. In Fiala F,

Kranakis E, Sack J R (eds) *Proceedings, Canadian Conference on Computational Geometry*: 202–10. Also published in longer version as *Technical Report 6/96*, CNR – Institute for Applied Mathematics, Genova, Italy. *http://www.disi.unige.it/person/PuppoE*

Puppo E 1996 Variable resolution terrain surfaces. Proceedings, Canadian Conference on Computational Geometry: 202–10

Puppo E, Marzano P 1996 Discrete visibility problems and graph algorithms. *International Journal of Geographical Information Systems* 11: 139–61

Pyramid Research 1995 Cellular and PCS markets in Eastern Europe and the Newly Independent States. London, The Economist Intelligence Unit

Pyramid Research Africa 1995 *Middle East Newsletter* 2(2): 3. London, The Economist Intelligence Unit

Pyramid Research 1997 Telecommunications Development Report 15 May. London, The Economist Intelligence Unit 12: 18

Quang P X 1993 Nonparametric estimators for variable circular plot surveys. *Biometrics* 49: 837–52

Qi Y, Wu J 1996 Effects of changing spatial resolution on the results of landscape pattern analysis using spatial autocorrelation indices. *Landscape Ecology* 11: 39–49

Quinn P F, Beven K J, Chevallier P, Planchon O 1991 The prediction of hillslope paths for distributed hydrological modelling using digital terrain models. *Hydrological Processes* 5: 59–79

Quinn P F, Beven K J, Lamb R 1995 The ln(*a*/tanß) index: how to calculate it and how to use it within the TOPMODEL framework. *Hydrological Processes* 9: 161–82

Radke J 1995 Modeling urban/wild-land interface fire hazards within a geographical information system. *Geographic Information Sciences* 1:9–21

Ramachandran B, MacLeod F, Dowers S 1994 Modelling temporal changes in a GIS using an object-oriented approach. Proceedings, Sixth International Symposium on Spatial Data Handling, Edinburgh, 5–9 September: 518–37

Rao M, Sastry S V C, Yadar P D, Kharod K, Pathan S K,
Dhinwa P S, Majumdar K L, Sampat Kumar D, Patkar V N,
Phatak V K 1991 A weighted index model for urban suitability assessment – a GIS approach. Bombay, Bombay
Metropolitan Regional Development Authority

Raper J F (ed.) 1989 Three-dimensional applications in geographical information systems. London, Taylor and Francis

Raper J F 1992a Key 3D modelling concepts for geoscientific analysis. In Turner K (ed.) *Three-dimensional modelling with* geoscientific information systems. Dordrecht, Kluwer: 215–32

Raper J F 1992b Using computer demonstrators and tutors in GIS teaching: lessons from the development of Geographical Information Systems Tutor. *Cartographica* 28: 75–87

Raper J F 1996a Unsolved problems of spatial representation. In Kraak M-J, Molenaar M (eds) *Advances in GIS research* 2: Seventh International Symposium on Spatial Data Handling, Delft, Netherlands 12–16 August. International

Geographical Union: 14.1-11

- Raper J F 1996b Progress towards spatial multimedia. In Craglia M, Couclelis H (eds) *Geographic information research: bridging the Atlantic.* London, Taylor and Francis: 512–30
- Raper J F, Livingstone D 1995a Development of a geomorphological data model using object-oriented design. *International Journal of Geographical Information Systems* 9: 359–83
- Raper J F, Livingstone D 1995b The development of a spatial data explorer for an environmental hyperdocument. *Environment and Planning B: Planning and Design* 22: 679–87
- Raper J F, McCarthy T, Livingstone D 1993 Interfacing GIS with virtual reality technology. *Proceedings, Association for Geographic Information Conference, Birmingham, 16–18 November* 3: 1–4
- Raper J F, Rhind D W, Shepherd J R 1992 *Postcodes: the new geography*. Harlow, Longman
- Ratcliffe D A (ed.) 1977 A nature conservation review. Oxford, Oxford University Press
- Ravenhill W L D 1955 The settlement of Cornwall during the Celtic period. *Geography* 40: 237–48
- Ravenstein E G 1885 The laws of migration. *Journal of the Royal Statistical Society* 48: 52
- Rector J M 1993 Utilities. In Castle G H (ed.) *Profiting from a geographical information system*. Fort Collins, GIS World Inc.: 193–208
- Redfern P 1989 Population registers: some administrative and statistical pros and cons. *Journal of the Royal Statistical Society A* 152: 1–28
- Redman T C 1992 Data Quality. New York, Bantam
- Rees W G 1990 *Physical principles of remote sensing*. Cambridge (UK), Cambridge University Press
- Regnauld N 1997 Recognition of building clusters for generalisation. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 185–98
- Reichenbacher T 1995 Knowledge acquisition in map generalisation using interactive systems and machine learning. *Cartography crossing borders (Proceedings, Seventeenth International Cartographic Conference).* Barcelona, Institut Cartografic de Catalunya: 2221–30
- Reid H G 1993 Retail trade. In Castle G (ed.) *Profiting from a* geographical information system. Fort Collins, GIS World Inc.
- Reif J, Sen S 1988 An efficient output-sensitive hidden surface removal algorithm and its parallelization. *Proceedings, Fourth ACM Symposium on Computational Geomotry*. New York, ACM Press: 193–200
- Reilly W J 1929 Methods for the study of retail relationships. University of Texas, Bulletin: 2944
- Reinhardt A 1994 Building the data highway. Byte 19: 46-74
- Reisner P 1981 Human factors studies of database query languages: a survey and assessment. ACM Computing

Surveys 13: 13–31

- Rejeski D 1993 GIS and risk: a three culture problem. In Goodchild M F, Parks B O, Steyaert L T (eds) *Environmental modeling with GIS*. New York, Oxford University Press: 319–31
- Rejeski D, Kapuscinski J 1990 *Risk modelling with geographic information systems: approaches and issues.* Washington DC, Office of Information Resources Management, US Environment Protection Agency
- Renard K G, Foster G R, Weesies G A, McCool D K, Yoder D C 1993 Predicting soil erosion by water: a guide to conservation planning with the revised universal soil loss equation. Washington DC, United States Department of Agriculture, Agriculture Handbook No. 703
- Renka R J, Cline A K1984 A triangle-based C¹ interpolation method. *Rocky Mountain Journal of Mathematics* 14: 223–37
- Renner S A, Rosenthal A S, Scarano J G 1996 Data interoperability: standardisation or mediation. *Proceedings, First IEEE Metadata Conference.* IEEE Computer Society Mass Storage Systems and Technology Technical Committee. *http://www.computer.org/conferen/meta96/meta_home.html*
- Replogle M 1989 Integration of a GIS with computer transportation models for land use and transportation planning. In Hartgen D T (ed.) *Proceedings, Second Conference on the Application of Transportation Planning Methods.* Charlotte, University of North Carolina
- ReVelle C S 1987 Urban public facility location. In Mills E S (ed.) *Handbook of regional and urban economics*, Vol. 11. Amsterdam, Elsevier Science: 1053–96
- ReVelle C S, Swain R 1970 Central facilities location. Geographical Analysis 2: 30–4
- Reybold W U, TeSelle G W 1989 Soil geographic databases. Journal of Soil and Water Conservation 44: 28–9
- Reynolds J 1991 GIS for competitive advantage: the UK retail sector. *Mapping Awareness* 5(1): 33–6
- Rhind D W 1988a A GIS research agenda. International Journal of Geographical Information Systems 2: 23–8
- Rhind D W 1988b Personality as a factor in the development of a discipline. *American Cartographer* 15: 3277–89
- Rhind D W 1989 Computing, academic geography, and the world outside. In MacMillan W (ed.) *Remodelling geography*. Oxford, Blackwell: 177–90
- Rhind D W 1991a Counting the people. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 127–37
- Rhind D W 199lb Geographical information systems and environmental problems. *International Social Science Journal* XLIII: 649–68
- Rhind D W 1992 Data access, charging and copyright and their implications for GIS. *International Journal of Geographical Information Systems* 6: 13–30
- Rhind D W 1996a Economic, legal, and public policy issues influencing the creation, accessibility, and use of GIS databases.

Transactions in Geographical Information Systems 1: 3-11

Rhind D W 1996b Remote sensing, digital mapping, and geographical information systems: the creation of national policy in the United Kingdom. *Environment and Planning C: Government and Policy* 4: 91–102

Rhind D W 1997a Facing the challenges: redesigning and rebuilding Ordnance Survey. In Rhind D (ed.) Framework for the world. Cambridge (UK), GeoInformation International: 275–304

Rhind D W (ed.) 1997b *Framework for the world*. Cambridge (UK), GeoInformation International

Rhind D W (ed.) 1997c Implementing a global geospatial data infrastructure. Proceedings, Second Global Geospatial Data Infrastructure Conference, University of North Carolina, 19–22 October

Rhind D W (ed.) 1998 The incubation of GIS in Europe. In Foresman T W (ed.) *The history of geographic information systems*. Englewood Cliffs, Prentice-Hall: 293–306

Rhind D W, Armstrong P, Openshaw S 1988 The Domesday machine: a nation-wide geographical information system. *The Geographical Journal* 154: 56–8

Rhind D W, Clark P 1988 Cartographic inputs to global databases. In Mounsey H M, Tomlinson R F (eds) *Building databases for global science*. London, Taylor and Francis: 79–104

Rhind D W, Goodchild M F, Maguire D J 1991 Epilogue. In Rhind D W, Goodchild M F, Maguire D J (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 313–27

Rhind D W, Hudson R 1980 Land use. London, Methuen

Rhind D W, Openshaw S 1988 The analysis of geographical data: data rich, technology adequate, theory poor. *Proceedings, Fourth international Working Conference on Statistical and Scientific Database Management*. Berlin, Springer: 427–54

Richards J A 1993 Remote sensing digital image analysis: an introduction. Berlin, Springer

Richardson C W, Wright D A 1984 *WGEN: a model for generating daily weather variables.* Washington DC, United States Department of Agriculture, Agricultural Research Service Report No. 8

Richardson D E 1994 Generalisation of spatial and thematic data using inheritance and classification and aggregation hierarchies. In Waugh T C, Healey R G (eds) Advances in GIS research (Proceedings, Sixth International Symposium on Spatial Data Handling): 901–20

Ridley M 1997 The case for network information systems: the BT. Paper presented at 'Becoming a Lean Communications Provider, Managing Network Infrastructure'. Saint-Paul-de-Vence, Unisys International Industry Forum, France, 11–13 June

Rieger M, Coulson M 1993 Consensus or confusion: cartographers' knowledge of generalisation. *Cartographica* 30: 69–80

Riise T, Gronning M, Klauber M R, Barrett-Connor E,

Nyland H, Albrektsen G 1991 Clustering of residence of multiple sclerosis patients at age 13 to 20 years in Hordaland, Norway. *American Journal of Epidemiology* 133: 932–9

Ringrose S, Vanderpost C, Matheson W 1996 The use of integrated remotely-sensed and GIS data to determine causes of vegetation cover change in southern Botswana. *Applied Geography* 16: 225–42

Ripley B D 1977 Modelling spatial patterns. *Journal of the Royal Statistical Society B* 39: 172–212

Ripley B D 1981 *Spatial statistics*. New York, John Wiley & Sons Inc.

Rippa S 1990 Minimal roughness property of the Delaunay triangulation. *Computer Aided Geometric Design* 7(7): 489–97

Rivier N 1985 Statistical crystallography. Structure of random cellular networks. *Philosophical Magazine B* 52: 795–819

Rivier N 1986 Structure of random cellular networks. In Kato Y, Takaki R, Toriwaki J (eds) *Proceedings, First International Symposium for Science on Form*. Tokyo, KTK Scientific: 451–8

Rivier N 1990 Maximum entropy and equations of state for random cellular structures. In Fougere P F (ed.) *Maximum entropy and Bayesian methods*. Dordrecht, Clair: 297–308

Rivier N 1991 Geometry of random packings and froths. In Bideau D, Dodds J A (eds) *Physics of granular media*. New York, Nova Science: 3–25

Rivier N 1993 Order and disorder in packings and froths. In Bideau D, Hansen A (eds) *Disorder and granular media*. Amsterdam, Elsevier Science: 55–102

Rivier N 1994 Maximum entropy for random cellular structures. In Nadal J P, Grassberger P (eds) *From statistical mechanics to statistical inference and back.* Dordrecht, Clair: 77–93

Rivier N, Lissowski A 1982 On the correlation between sizes and shapes of cells in epithelial mosaics. *Journal of Physics* A: Mathematical and General 15: L143–8

Rivoirard J 1994 Introduction to disjunctive Kriging and nonlinear geostatistics. Oxford, Clarendon Press

Rix D, Markham R 1994 GIS certification ethics and professionalism. *Proceedings AGI* 94: 621–5

Robert P C, Rust R H (eds) *Site-specific managementfor agricultural systems*. Madison, American Society of Agronomy: 201–8

Roberts S M, Schein R H 1995 Earth shattering: global imagery and GIS. In Pickles J (ed.) *Ground truth: the social implications of geographic information systems*. New York, Guilford Press: 171–95

Robertson G P 1987 Geostatistics in ecology: interpolating with known variance. *Ecology* 68: 744–8

Robertson J G M, Eknert B, Ihse M 1990 Habitat analysis from infra-red aerial photographs and the conservation of birds in Swedish agricultural landscapes. *Ambio* 19: 195–203

Robertson P K 1991 A methodology for choosing data representations. *IEEE Computer Graphics and Applications* 11: 56–67 Robinson A H 1956 The necessity of weighting values in correlation of areal data. *Annals of the Association of American Geographers* 46: 233–6

Robinson A H 1958 *Elements of cartography*, 2nd edition. New York, John Wiley & Sons Inc.

Robinson A H, Lindberg J B, Brinkmann W L 1961 A correlation and regression analysis applied to rural farm densities in the Great Plains. *Annals of the Association of American Geographers* 51: 211–21

Robinson A H, Morrison J L, Muehrcke P C, Kimerling A J, Guptill S C 1994 *Elements of cartography*, 6th edition. New York, John Wiley & Sons Inc.

Robinson A H, Sale R D, Morrison J, Muehrcke P 1984 *Elements of cartography*, 5th edition. New York, John Wiley & Sons Inc.

Robinson G J 1995 A hierarchical top-down bottom-up approach to topographical map generalisation. In Buttenfield B P, McMaster R B (eds) *Map generalisation: making rules for knowledge representation.* Harlow, Longman: 235–5

Robinson G K 1950 Ecological correlation and the behaviour of individuals. *American Sociological Review* 15: 351–7

Robinson J T 1981 The K-D-B-tree: a search structure for large multidimensional dynamic indexes. ACM SIGMOD 10: 10–18

Robinson V B 1981 In Jackson P, Smith S J (eds) Social interaction and ethnic segregation. London, Academic Press

Robinson V B 1988 Some implications of fuzzy set theory applied to geographic databases. *Computers, Environment, and Urban Systems* 12: 89–98

Robinson V B, Lundberg G 1987 Organisation and knowledge base considerations for the design of distributed geographic information systems – lessons from semantic modeling. *Proceedings, International Symposium on Geographic Information Systems: The Research Agenda, November.* Crystal City, Virginia 2: 245–55

Robinson V B, Mackay D S 1995 Semantic modeling for the integration of geographic information and regional hydroecological simulation management. *Computers, Environment and Urban Systems* 19: 321–40

Robinson V B, Wong R 1987 Acquiring approximate representation of some spatial relations. *Proceedings, Eighth International Symposium on Computer-Assisted Cartography*: 604–22

Robinson W A, Gartner C 1997 The reform of national mapping organisations: the New Zealand experience. In Rhind D (ed.) *Framework for the world*. Cambridge (UK), GeoInformation International: 247–64

Rodcay G K (ed.) 1995 *GIS World Sourcebook 1996*. Fort Collins, GIS World Inc.

Roessel J W van 1987 Design of a spatial data structure using the relational normal forms. *International Journal of Geographic Information Systems* 1: 33–50

Rogers A 1965 A stochastic analysis of the spatial clustering

of retail establishments. *Journals of the American Statistical* Association 60: 1094–103

Rogers A 1969 Quadrat analysis of urban dispersion: 1. Theoretical techniques. *Environment and Planning* 1: 47–80

Rogers C 1996 A project manager's guide to data conversion (or six things your mother never told you). *Utility Automation* May/June: 21–3

Rogers E H 1993 The diffusion of innovations model. In Masser I, Onsrud H J (eds) *Diffusion and use of geographic information technology*. Dordrecht, Kluwer: 9–24

Rogowski A S 1995 Quantifying soil variability in GIS applications: II. Spatial distribution of soil properties. *International Journal of Geographical Information Systems* 10: 455–75

Rogowski A S 1997 Catchment infiltration II: contributing areas. *Transactions in GIS* 1: 267–83

Rogowski A S, Hoover J R 1996 Catchinent infiltration I: distribution of variables. *Transactions in GIS* 1: 95–110

Rogowski A S, Wolf J K 1994 Incorporating variability into soil map unit delineations. *Soil Science Society of America Journal* 58: 163–74

Rosch E 1973 On the internal structure of perceptual and semantic categories. In Moore T E (ed.) *Cognitive development and the acquisition of language*. New York, Academic Press

Rosch E 1978 Principles of categorization. In Rosch E, Lloyd B B (eds) *Cognition and categorization*. Hillsdale, Erlbaum

Rosenberg J B 1985 Geographical data structures compared: a study of data structures supporting region queries. *IEEE Transactions on Computer Aided Design* CAD-4(1): 53–67

Rosenblueth E 1975 Point estimates for probability moments. Proceedings, National Academy of Sciences of the United States of America 72: 3812–14

Rosenfeld C L, Gaston G G, Pearson M L 1996 Integrated flood response in the Pacific Northwest: state and federal agencies, along with local governments, employ RADARSAT, aerial videography and GPS to aid in disaster response. *Earth Observing Magazine* 5(11): 20–3

Roshannejad A A, Kainz W 1995 Handling identities in spatio-temporal databases. *Auto Carto 12, Charlotte, North Carolina*: 119–26

Rosing K E, Hillsman E L, Rosing-Vogelaar H 1979 A note comparing optimal and heuristic solutions to the *p*-median problem. *Geographical Analysis* 11: 86–9

Ross S M 1990 A course in simulation. New York, Macmillan

Rossi R E, Mulla D J, Journel A G, Franz E H 1992 Geostatistical tools for modelling and interpreting ecological spatial dependence. *Ecological Monographs* 62: 277–314

Roughgarden J, Running S W, Matson P A 1991 What does remote sensing do for ecology? *Ecology* 72: 1918–22

Rouhani S, Myers D E 1990 Problems in space-time Kriging of geohydrological data. *Mathematical Geology* 22: 611–23

Roujean J-L, Leroy M, Deschamps P Y 1992 A bidirectional reflectance model of the Earth's surface for the correction

of remote sensing data. *Journal of Geophysical Research* 97: 20 455–68

Rousseau D, Rousseau T, Lecordix F 1995 An evaluation of map generaliser, an Intergraph interactive generalisation software package. Technical report. St-Mandé (F), Institut Géographique National, Laboratoire COGIT

Roussopoulos N, Leifker D 1985 Direct spatial search on pictorial databases using packed R-trees. ACM SIGMOD 14(4): 17–31

Routh K 1990 Loma Prieta, California earthquake, 1989 spurs development of a GIS based emergency response system. *URISA Proceedings*. Edmonton (Canada) 1: 78–83

Roux F G 1991 Comment le génie vient au logiciel. *L'informatique Professionnelle* 93(April): 19–26

Rowell R C 1996 Theory and practice: linear referencing at the Idaho Transportation Department. *Proceedings GIS-T 96, Geographic Information Systems for Transportation Symposium.* Washington DC, American Association of State Highway and Transportation Officials: 1–9

Royal Town Planning Institute 1992 Geographic information systems: a planner's introductory guide prepared by the Institute's GIS Panel. London, The Royal Town Planning Institute

Ruas A 1995a Multiple paradigms for automating map generalisation: geometry, topology, hierarchical partitioning and local triangulation. ACSM/ASPRS Annual Convention and Exposition 4 (Proceedings AutoCarto 12): 69–78

Ruas A 1995b Multiple representations and generalisation. Lecture notes for Nordic Cartography Seminar 95. *ftp: //sturm.ign.fr*

Ruas A, Lagrange J-P 1995 Data and knowledge modelling for generalisation. In Müller J-C, Lagrange J-P, Weibel R (eds) GIS and generalisation: methodological and practical issues. London, Taylor and Francis: 73–90

Ruas A, Plazanet C 1997 Strategies for automated generalisation. In Kraak M-J, Molenaar M (eds) *Advances in GIS research II* (*Proceedings, Seventh International Symposium on Spatial Data Handling*). London, Taylor and Francis: 319–36

Rule J B 1973 Private lives and public surveillance. London, Allen Lane

Rule J, Attewell P 1991 What do computers do? In Dunlop C, Kling R (eds) *Computerization and controversy: value conflicts and social choices.* San Diego, Academic Press: 131–49

Rumbaugh J 1996 Layered additive models: design as a process of recording decisions. *Journal of Object-Oriented Programming* (March–April): 21–48

Rumbaugh J, Blaha M, Premerlani W, Eddy F, Lorensen W 1991 *Object-oriented modelling and design*. Englewood Cliffs, Prentice-Hall

Rumley D, Minghi J V (eds) 1991 *The geography of border landscapes*. London, Routledge

Rundstrom R 1991 Mapping, postmodernism, indigenous people, and the changing direction of North American cartography. *Cartographica* 28: 1–12

Rundstrom R 1995 GIS, indigenous peoples, and epistemological diversity. *Cartography and Geographic* Information Systems 22: 45-57

Running S W, Justice C O, Salomonson V, Hall D, Barker J, Kaufmann Y J, Strahler A H, Huete A R, Muller J-P, Vanderbilt V, Wan Z M, Teillet P, Carneggie D 1994 Terrestrial remote sensing science and algorithms planned for EOS/ MODIS. International Journal of Remote Sensing 15: 3587–620

Running S W, Thornton P E 1996 Generating daily surfaces of temperature and precipitation over complex topography. In Goodchild M F, Steyaert L T, Parks B O, Johnston C, Maidment D, Crane M, Glendinning S (eds) GIS and environmental modeling progress and research issues. Fort Collins, GIS World Inc.: 93–8

Runyon T, Hammitt R, Lindquist R 1994 Buried danger: integrating GIS and GPS to identity radiologically contaminated sites. *Geo Info Systems* 8(4): 28–36

Rural Development Commission/Housing Corporation 1997 The rural settlements gazetteer of England. London, Rural Development Commission/Housing Corporation

Rusak Mazur E, Castner H W 1990 Horton's ordering scheme and the generalisation of river networks. *The Cartographic Journal* 27: 104–12

Rushton G, Armstrong M P, Lynch C, Rohrer J 1996 Improving public health through geographical information systems: an instructional guide to major concepts and their implementation. Department of Geography, University of Iowa. CD-ROM

Rushton G, Goodchild M F, Ostresh L (eds) 1973 *Computer* programs for location–allocation problems. Monograph No.6. Iowa, Department of Geography, University of Iowa

Rushton G, Lolonis P 1996 Exploratory spatial analysis of birth defect rates in an urban population. *Statistics in Medicine* 15: 717–26

Rydin Y 1994 *The British planning system: an introduction.* London, Macmillan

S+SpatialStats 1996 Seattle, MathSoft Inc.

Saarenmaa H, Perttunen J, Väkevä J, Nikula A 1994 Objectoriented modelling of tasks and agents in integrated forest health management. *AI Applications* 8: 43–59

Saarenmaa H, Stone N D, Folse L J, Packard J M, Grant W E, Makela M E, Coulson R N 1988 An artificial intelligence modelling approach to simulating animal habitat interactions. *Ecological Modelling* 44: 125–41

Sabbagh G J, Geleta S, Elliot R L, Williams J R, Griggs R H 1991 Modification of EPIC to simulate pesticide activities: EPIC-PST. *Transactions of the American Society of Agricultural Engineers* 34: 1683–92

Sabel C E, Ralphs M P 1994 Domesday 2000, a national land information system for Britain. *Mapping Awareness* 6(5): 55–8

Sack R 1980 Conceptions of space in social thought: a geographic perspective. Minneapolis, University of Minnesota Press

Saeed S E O 1993 British Telecom uses GIS to gear investment to the marketplace. *GIS Europe* 2(1): 10–12

Saetersdal M, Birks H J B 1993 Assessing the representativeness of nature reserves using multivariate

analysis: vascular plants and breeding birds in deciduous forests, western Norway. *Biological Conservation* 65: 121–32

Sahay S, Walsham G 1996 Implementation of GIS in India: organizational issues and implications. *International Journal* of Geographical Information Systems 10: 385–404

Sainsbury R M 1995 *Paradoxes*, 2nd edition. Cambridge (UK), Cambridge University Press

Salgé F 1994 Geographic information: the challenge for Europe. In Shand P J, Ireland P J (eds) *The 1994 European GIS Yearbook*. London, Blenheim

Salgé F 1995 Semantic accuracy. In Guptill S C, Morrison J L (eds) *Elements of spatial data quality*. Oxford, Elsevier Science: 139–51

Salgé F 1996a From an understanding of the European GI economic activity to the reality of a European dataset. GISDATA specialist meeting, Buoux, May

Salgé F 1996b Spatial data handling keynote address: twelve years' impact of spatial data handling research on the GIS community. *Proceedings, Spatial Data Handling Symposium*

Salgé F, Smith N, Ahonen P 1992 Towards harmonized geographical data for Europe: MEGRIN and the needs for research. *Proceedings, Fifth International Symposium on Spatial Data Handling, Charleston:* 294–302

Salski A 1992 Fuzzy knowledge-based models in ecological research. *Ecological Modelling* 63: 103–12

Sambridge M, Braun J, McQueen H 1995 Geophysical parameterization and interpolation of irregular data using natural neighbours. *Geophysical Journal International* 122: 837–57

Samet H 1984 The quadtree and related hierarchical data structures. *Computing Surveys* 16: 187–260

Samet H 1990 *The design and analysis of spatial data structures.* Reading (USA), Addison-Wesley

Samet H, Sivan R 1992 Algorithms for constructing quadtree surface maps. *Proceedings, Fifth International Symposium on Spatial Data Handling*: 361–70

Samuelson P 1994 Copyright's Fair Use doctrine and digital data. *Comm. ACM* 32: 21–7

Sandgren U 1997 Merger, government firms and privatisation? The new Swedish approach. In Rhind D (ed.) Framework for the world. Cambridge (UK), GeoInformation International: 235–46

Sarjakoski T 1992 *Suitability of the Sharp JX-600 desktop scanner for the digitisation of aerial colour photographs.* International Archives of Photogrammetry and Remote Sensing 29(B2): 79–86

Sarnak N, Tarjan R E 1986 Planar point location using persistent search trees. *Communications of the Association for Computing Machinery* 29: 669–79

Sasowsky K C, Peterson G W, Evans B M 1992 Accuracy of SPOT digital elevation model and derivatives: utility for Alaska's North Slope. *Photogrammetric Engineering and Remote Sensing* 60: 1327–32

Savigny D de, Wijeyaratne P (eds) 1994 GIS for health and the

environment. Ottawa, International Development Research Centre

Sawyer J E 1994 Concepts of variable rate technology applied with considerations for fertilizer application. *Journal of Production Agriculture* 7: 195–201

Sayer A 1992 Method in social science: a realist approach, 2nd edition. London, Routledge

Scarlatos L, Pavlidis T 1990 Hierarchical triangulation using terrain features. *Proceedings, IEEE Conference on Visualization.* IEEE Computer Society: 168–75

Scarlatos L, Pavlidis T 1991 Adaptive hierarchical triangulation. *Proceedings AutoCarto 10*. Bethesda, ACSM/ASPRS: 234–46

Scarlatos L, Pavlidis T 1992 Hierarchical triangulation using cartographic coherence. *CVGIP: Graphical Models and Image Processing* 54: 147–61

 Scarponcini P 1995 A method for determining a standard linear reference scheme. *Proceedings GIS-T 95, Geographic Information Systems for Transportation Symposium.* Washington DC, American Association of State Highway and Transportation Officials: 1–22

Schaerstrom A 1996 Pathogenic paths? A time geographical approach in medical geography. Lund, Lund University Press

Schalkoff R J 1992 Pattern recognition: statistical, structural and neural approaches. New York, John Wiley & Sons Inc.

Schein E H 1980 Organizational psychology. London, Prentice-Hall

Schein E H 1985 Organizational culture and leadership: a dynamic view. San Francisco, Jossey-Bass

Schilling D A, Jayaraman V, Barkhi R 1993 A review of covering problems in facility location. Location Science 1: 25–55

Schlegel A, Weibel R 1995 Extending a general-purpose GIS for computer-assisted generalisation. *Cartography crossing borders (Proceedings, Seventeenth International Cartographic Conference)*. Barcelona, Institut Cartogràfic de Catalunya: 2211–20

Schmidt J W, Knight R L 1981 The status of computer-aided scheduling in North America. In Wren A (ed.) Computer scheduling of public transport. New York, North-Holland: 17–22

Schmiegelow F K A 1990 The use of atlas data to test appropiate hypotheses about faunal collapse. In Ingram B (ed.) *Landscape approaches to wildlife and ecosystem management in Canada*. Montreal, Polyscience

Schneider J B 1983 A review of a decade of applications of computer graphics software in the transportation field. *Computers, Environment and Urban Systems* 9: 1–20

Schon D A, Rein M 1994 Frame reflection. New York, Basic Books

Schrage M 1995 Groupware requires much more than bandwidth. *Business Communications Review*: 35–8

Schreier G (ed.) 1993 SAR Geocoding: data and systems. Karlsruhe, Wichmann Schröder P, Sweldens W 1995 Spherical wavelets: efficiently representing functions on the sphere. *Proceedings SIGGRAPH 1995*, 6–11 August, Los Angeles and Research Report, Department of Mathematics, University of South Carolina: 01

Schroeter H, Olsen L 1996 The evolution of the space/earth information system. In Lautenschlager M, Reinke M (eds) *Climate and environmental database systems*. Boston (USA), Kluwer: 25–35

Schüller J K 1992a A review and integrating analysis of spatially-variable control of crop production. *Fertiliser Research* 33: 1–34

Schüller J 1992b GIS applications in environmental planning and assessment. *Computers, Environment and Urban Systems* 16: 337–53

Schüller J K, Wang M W 1994 Spatially-variable fertilizer and pesticide application with GPS and DGPS. *Computers and Electronics in Agriculture* 11: 69–83

Schulz T T, Joyce L A 1992 A spatial application of a marten habitat model. *Wildlife Society Bulletin* 20: 74–83

Schumm S A 1956 Evolution of drainage systems and slopes in badlands at Perth Amboy, New Jersey. *Geological Society* of America Bulletin 67: 597–646

Schylberg L 1993 Computational methods for generalisation of cartographic data in a raster environment. Fotogrammetric Reports No. 60. Stockholm, Royal Institute of Technology, Department of Geodesy and Photogrammetry

Scott G 1994 Civil service reform in New Zealand. In *Reforming* government in practice: lessons and prospects. European Policy Forum/BDO binder. London, Hamlyn: 15–30

Scott J M, Davis F, Csuti B, Noss R, Buttenfield B, Groves C, Anderson H, Caicco S, D'Erchia F, Edwards T C, Ulliman J, Wright R G 1993 GAP Analysis: a geographical approach to protection of biological diversity. *Wildlife Monographs* 123: 1–41

Sedunary M E 1984 LOTS and the nodal approach to a total land information system. In Hamilton A C, McLaughlin J D (eds) Proceedings of 'The Decision Maker and Land Information Systems' – FIG Commission III International Symposium

Sellwood R 1987 Statistics of changes in land use: a new series. Statistical News 79: 11–16

Selvin S, Merrill D W, Sacks S 1988 Transformations of maps to investigate clusters of disease. *Social Science and Medicine* 26: 215–21

Sen A K 1994 Shadow prices and markets: feasibility constraints. In Layard R, Glaister S (eds) *Cost-benefit analysis*, 2nd edition. New York, Cambridge University Press: 59–99

Senior M L 1991 Deprivation payments to OPs: not what the doctor ordered. *Environment and Planning C: Government and Policy* 9: 79–94

Seymour J 1991 Lotus' MarketPlace succumbs to media hysteria. *PC Week* 8: 57

Shapira A 1990 'Visibility and terrain labeling'. Masters thesis. Troy, Rensselaer Polytechnic Institute

Sharif A R B M 1996 'Natural-language spatial relations: metric refinements of topological properties'. Unpublished Doctoral dissertation, Department of Spatial Information Science and Engineering, University of Maine

Sharir M 1988 The shortest watchtower and related problems for polyhedral terrains. *Information Processing Letters* 29: 265–70

Sharma P, Pullar D, McDonald G 1996 Identifying national training priorities in GIS: an Australian case study. Paper presented to the Second International Conference on GIS in Higher Education, Columbia, September

Sharp B L, Le Sueur D 1996 Malaria in South Africa: the past, the present and selected implications for the future. *South African Medical Journal* 86: 83–9, 1077–81

Shea K S, McMaster R B 1989 Cartographic generalisation in a digital environment: when and how to generalise. *Proceedings AutoCarto 9*. Bethesda, ASPRS/ACSM: 56–67

Shepherd 1994 Multi-sensory GIS: mapping out the research frontier. In Waugh T C, Healey R G (eds) Advances in GIS research (Proceedings, Sixth International Symposium on Spatial Data Handling): 356–90

Shepherd J, Abakuks A 1992 *The national survey of vacant land in urban areas of England*. London, Her Majesty's Stationery Office

Sheppard E (ed.) 1995 Special issue: GIS and society. Cartography and GIS 22(1)

Sheppard E S 1995 Dissenting from spatial analyse. *Urban Geography* 16: 283–303

Shiffer M J 1992 Towards a collaborative planning system. Environment and Planning B: Planning and Design 19: 709–22

Shiffer M J 1993 Augmenting geographic information with collaborative multimedia technologies. In McMaster R B, Armstrong M P (eds) *Proceedings AutoCarto 11*. American Society for Photogrammetry and Remote Sensing/American Congress on Surveying and Mapping: 367–76

Shiffer M J 1995a Environmental review with hypermedia systems. *Environment and Planning B: Planning and Design* 22: 359–72

Shiffer M J 1995b Geographic interaction in the city planning context: beyond the multimedia prototype. In Nyerges T L, Mark D M, Laurini R, Egenhofer M (eds) Cognitive aspects of human-computer interaction for geographic information systems. Dordrecht, Kluwer: 295–310

Shiffer M J 1995c Interactive multimedia planning support: moving from stand-alone systems to the World Wide Web. Environment and Planning B: Planning and Design 22: 649–64

Shlaer S, Mellor S 1991 *Object lifecycles: modelling the world in states.* Englewood Cliffs, Prentice–Hall

Shneiderman B 1983 Direct manipulation: a step beyond programming languages. *IEEE Computer* 16: 57–69

Shneiderman B 1994 Dynamic queries for visual information seeking. *IEEE Software* 11: 70–7

Shoham Y, McDermott D 1988 Problems in formal temporal reasoning. *Artificial Intelligence* 36: 49–61

Show I T 1979 Plankton community and physical environment simulation for the Gulf of Mexico region. *The 1979 Summer Computer Simulation Conference, San Diego*. Society for Computer Simulation

Shreve R L 1966 Statistical law of stream numbers. *Journal of Geology* 74: 17–37

Shreve R L 1967 Infinite topologically random stream networks. *Journal of Geology* 75: 178–86

Shu-Quiang W, Unwin D J 1992 Modelling landslide distribution on loess soils in China: an investigation. International Journal of Geographical Information Systems 6: 391–405

Sibson R 1981 A brief description of natural neighbour interpolation. In Barnett V (ed.) *Interpreting multivariate data*. Chichester, John Wiley & Sons: 21–36

Siegel S 1956 Nonparametric statistics for the behavioral sciences. New York, McGraw-Hill

Silva F N de, Pidd M, Eglese R 1993 Spatial decision support systems for emergency planning: an operational research/geographical information systems approach to evacuation planning. *1993 International Emergency Management and Engineering Conference*. San Diego, Society for Computer Simulation: 130–3

Silverman B W 1986 Density estimation for statistics and data analysis. London, Chapman and Hall

Simkowitz H J 1988 Transportation applications of geographic information systems. *Computers, Environment and Urban Systems* 12: 253–71

Simmel G 1971 [1903] The metropolis and mental life. In Georg Simmel on individuality and social forms. Chicago, University of Chicago Press: 324–39

Simmons A J, Bengtsson L 1988 Atmospheric general circulation models: their design and use for climate studies. In Schlesinger M (ed.) *Physically-based modelling and simulation of climate and climatic change*. Boston (USA), Kluwer Vol. 2: 627–52

Simmons M A, Cullinan V I, Thomas J M 1992 Satellite imagery as a tool to evaluate ecological scale. *Landscape Ecology* 7: 77–85

Simon D 1996 *Transport and development in the third world*. London, Routledge

Simon H 1969 The architecture of complexity. In Simon H (ed.) *The sciences of the artificial*. Cambridge (USA), MIT Press

Simon H A 1945/1976 Administrative behavior: a study of decision-making processes in administrative organisations. New York, Free Press

Simon H A 1952 A behavioural model of rational choice. *Quarterly Journal of Economics* 69: 99–118

Simpson I A, Dennis P (eds) 1996 The spatial dynamics of biodiversity: towards an understanding of spatial patterns and processes in the landscape. Garstang, IALE (UK) Sinton D F 1977 The user's guide to IMGRID, an information manipulation system for grid cell structures. Cambridge (USA), Department of Landscape Architecture, Harvard University

Sinton D F 1978 The inherent structure of information as a constraint in analysis. In Dutton G (ed.) *Harvard papers on geographic information systems*. Reading (USA), Addison-Wesley

Skidmore A K, Ryan P J, Dawes W, Short D, O'Loughlin E 1991 Use of an expert system to map forest soils from a geographic information system. *International Journal of Geographical Information Systems* 5: 431–45

Sklar F H, Costanza R 1991 The development of dynamic spatial models for landscape ecology: a review and prognosis. In Turner M G, Gardner R H (eds) Quantitative methods in landscape ecology: the analysis and interpretation of landscape heterogeneity. New York, Springer: 239–88

Sloan T M 1996 'The impact of parallel computing on the performance of geographical information systems'. Unpublished MPhil dissertation, Department of Geography, University of Edinburgh

Slocum T A, Egbert S, Weber C, Bishop I, Dungan J, Armstrong M, Ruggles A, Demetrius-Kleanthis D, Rhyne T, Knapp L, Carron J, Okazaki D 1994 Visualization software tools. In MacEachren A M, Taylor D R F (eds) *Visualization in modern cartography*. Oxford, Pergamon: 91–122

Smans M, Muir C S, Boyle P 1992 Atlas of cancer mortality in the European Economic Community. Lyon, IARC Scientific Publications No. 107

Smith B 1994 National Land Information System pilot project. *Mapping Awareness* 8(10): 34–5

Smith B 1995 More things in heaven and earth. Grazer Philosophische Studien 50: 187–200

Smith D A, Tomlinson R F 1992 Assessing the costs and benefits of geographical information systems: methodological and implementation issues. *International Journal of Geographical Information Systems* 6: 247–56

Smith D C, Irby C, Kimball R, Verplank B, Harslem E 1982 Designing the Star user interface. *Byte* 7: 242–82

Smith D M 1985 The 'new blood' scheme and its application to geography. *Area* 17: 237–43

Smith J L, Prisley S P, Weih R C 1991 Considering the effect of spatial data variability on the outcomes of forest management decisions. *Proceedings GIS/LIS 91 Conference, Atlanta* 1: 286–92

Smith K 1992 Environmental hazards: assessing risk and reducing disaster. London, Routledge

Smith L C, Gluck M 1996 (eds) *Geographic information* systems and libraries: patrons, maps and spatial information. Urbana-Champaign, Graduate School of LIS

Smith M O, Johnson P E, Adams J B 1985 Quantitative determination of mineral types and abundances from reflectance spectra using principal components analysis.

Journal of Geophysical Research 90: 792-804

Smith M, Thomas E 1996 National spatial data infrastructure: an Australian viewpoint. *Proceedings, Emerging Global Spatial Data Infrastructure Conference*. Paper 7. Bonn: 16 pp

Smith N 1992 Real wars, theory wars. *Progress in Human* Geography 16: 257–71

Smith T 1996 Alexandria Digital Library. Communications of the ACM 4: 61–2

Smith T R, Andresen D, Carver L, Dolin R, and others 1996 A digital library for geographically referenced materials. *Computer* 29(5): 54; 29(7): 14

Smith T R, Zhan C, Gao P 1990 A knowledge-based, two-step procedure for extracting channel networks from noisy DEM data. Computers and Geosciences 16: 777–86

Smith W H F, Wessel P 1990 Gridding with continuous curvature. *Geophysics* 55: 293–305

Smyth C S 1997 Plug-and-play geoinformation. *Proceedings, Global Spatial Data Infrastucture meeting, Chapel Hill, North Carolina, 19–22 October*

Snodgrass T R 1992 Temporal databases. In Frank A U, Campari I, Formentini U (eds) *Theories of spatio-temporal reasoning in geographic space*. Berlin, Springer: 22–64

Snodgrass T R 1995 Temporal object-oriented databases: a critical comparison. In Kim W (ed.) *Modern database* systems. Reading (USA), Addison-Wesley: 386–408

Snyder J P 1987 *Map projections: a working manual.* Washington DC, US Geological Survey Professional Paper 1395

Snyder J P 1993 Flattening the Earth: two thousand years of map projections. Chicago and London, Chicago University Press

Soil Classification Working Group 1991 Soil classification, a taxonomic system for South Africa. Memoirs on Agricultural Natural Resources of South Africa 15, Pretoria

Soil Conservation Service 1981 Land resources regions and major land resource areas of the US. Washington DC, US Department of Agriculture, Soil Conservation Service, Agricultural Handbook No. 296

Soil Survey Staff 1975 Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. USDA Agricultural Handbook 436. Washington DC, Government Printing Office

Sokal R R, Oden N L, Barker J S F 1987 Spatial structure in Drosophila buzzatii populations: simple and directional spatial autocorrelation. The American Naturalist 129: 122–2

Sonnen D 1996 Spatial information management: an emerging market. *Map World* 1: 24

Sorensen J H, Carnes S A, Rogers G O 1992 An approach for deriving emergency planning zones for chemical munitions emergencies. *Journal of Hazardous Materials* 30: 223–42

Soriano A, Paruelo J M 1992 Biozones: vegetation units defined by functional characters identifiable with the aid of satellite sensor images. *Global Ecology and Biogeography Letters* 2: 82–9 South West Thames Regional Health Authority 1993 Report of the inquiry into the London Ambulance Service. London, South West Thames Regional Health Authority

Spangrud D J, Wilson J P, Jacobsen J S, Nielsen G A, Tyler D A 1995 Sensitivity of computed terrain attributes to the number and pattern of GPS-derived elevation data. In Robert P C, Rust R H (eds) Site-specific management for agricultural systems. Madison, American Society of Agronomy: 285–301

Sparks L 1990 Spatial–structural relationships in retail corporate growth: a case study of Kwiksave Group PLC. *Service Industries Journal* 10: 25–84

Sparks L 1996a Space wars: Wm Low and the 'auld enemy'. Environment and Planning A 28: 1465–84

Sparks L 1996b Challenge and change: Shoprite and the restructuring of grocery retailing in Scotland. *Environment and Planning A* 28: 261–84

Speight J G 1974 A parametric approach to landform regions. Special Publication Institute of British Geographers 7: 213–20

Speight J G 1980 The role of topography in controlling throughflow generation: a discussion. *Earth Surface Processes and Landforms* 5: 187–91

Spiess E 1995 The need for generalisation in a GIS environment. In Müller J-C, Lagrange J-P, Weibel R (eds) GIS and generalisation: methodological and practical issues. London, Taylor and Francis: 31–46

Sproull L S, Goodman P S 1990 Technology and organizations: integration and opportunities. In Goodman P S, Sproull L S, and associates (eds) *Technology and organizations*. San Francisco, Jossey-Bass: 254–65

SSC (Swiss Society of Cartography) 1977 Cartographic generalisation – topographic maps. Cartographic Publication Series, Vol. 2. Zurich, Swiss Society of Cartography

Stamp D 1948 The land of Britain: its use and misuse. Harlow, Longman

Stamps J A, Buechner M, Krishnan V V 1987 The effects of edge permeability and habitat geometry on emigration from patches of habitat. *The American Naturalist* 129: 533–52

Stanislawski L V, Dewitt B A, Shrestha R L 1996 Estimating positional accuracy of data layers within a GIS through error propagation. *Photogrammetric Engineering and Remote Sensing* 62: 429–33

Stanney K 1995 Realizing the full potential of virtual reality: human factors issues that could stand in the way. *Proceedings, VRA15 1995 Research Triangle Park, North Carolina, 11–15 March*

Star J L, Estes J E 1990 *Geographic information systems*. Englewood Cliffs, Prentice-Hall

Star J L, Estes J E, Davis F 1991 Improved integration of remote sensing and geographic information systems: a background to NCGIA Initiative 12. *Photogrammetric Engineering and Remote Sensing* 57: 643–5

Star J L, Estes J E, McGwire K C 1997 Integration of geographic information systems and remote sensing. New York, Cambridge University Press

State A, Hirota G, Chen D T, Garret W F, Livingston M A 1996 Superior augmented reality registration by integrating landmark tracking and magnetic tracking. *Proceedings, SIGGRAPH 1996 New Orleans, 4–9 August:* 429–38

Stearns F 1968 A method for estimating the quantitative reliability of isoline maps. *Annals of the Association of American Geographers* 58: 590–600

Steel C 1996 Beating the threat of the Internet. *Chartered Surveyor Monthly*, Royal Institution of Chartered Surveyors: 6(3) Property Information Management supplement: 9

Steinitz C, Parker P, Jordan L 1976 Hand-drawn overlays: their history and prospective uses. *Landscape Architecture* 66: 444–55

Steward H J 1974 Cartographic generalisation: some concepts and explanations. *Cartographica Monograph* 10

Stewart J Q 1950 The development of social physics. *American Journal of Physics* 18: 239–53

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

Steyaert L T 1993 A perspective on the state of environmental simulation modeling. In Goodchild M F, Parks B O, Steyaert L T (eds) *Environmental modeling with GIS*. New York, Oxford University Press 1630

Steyaert L T 1996 Status of land data for environmental modeling and challenges for geographic information systems in land characterization. In Goodchild M F, Steyaert L T, Parks B O, Johnston C, Maidment D, Crane M, Glendinning S (eds) GIS and environmental modeling: progress and research issues. Fort Collins, GIS World Inc: 17–27

Steyaert L T, Goodchild M F 1994 Integrating geographic information systems and environmental simulation models. In Michener W K, Brunt J W, Stafford S G (eds) *Environmental information management and analysis: ecosystem to global scales.* London, Taylor and Francis: 333–57

Steyaert L T, Loveland T R, Brown J F, Reed B C 1994 Integration of environmental simulation models with satellite remote sensing and geographic information systems technologies: case studies. *Proceedings, Pecora 12 Symposium.* Bethesda, American Society of Photogrammetry and Remote Sensing: 407–17

Stiglitz D 1994 Discount rates: the rate of discount for benefit–cost analysis and the theory of the second best. In Layard R, Glaister S (eds) *Cost-benefit analysis*, 2nd edition. New York, Cambridge University Press: 116–59

Stillman S T 1996 'A comparison of three automated precipitation simulation models: ANUSPLIN, MTCLIM-3D, and PRISM'. Unpublished MS thesis, Department of Earth Sciences. Montana State University

Stoakley R, Conway M, Pausch R 1995 Virtual reality on a

WIM: interactive worlds in miniature. *Proceedings CHI 1995* Denver: 265–72

Stockwell J R, Sorensen J W, Eckert J W, Carreras E M 1993 The United States EPA geographic information system for mapping environmental releases of toxic chemical release inventory (TRI) chemicals. *Risk Analysis* 13: 155–64

Stoms D M 1987 Reasoning with uncertainty in intelligent geographic information systems. *Proceedings GIS 87 Conference, San Francisco*: 693–700

Stoms D M 1992 Effects of habitat map generalization in biodiversity assessment. *Photogrammetric Engineering and Remote Sensing* 58: 1587–91

Stoms D M, Davis F W, Cogan C B 1992 Sensitivity of wildlife habitat models to uncertainties in GIS data. *Photogrammetric Engineering and Remote Sensing* 58: 843–50

Stoms D M, Estes J E 1993 A remote sensing research agenda for mapping and monitoring biodiversity. *International Journal of Remote Sensing* 14: 1839–60

Stone H F, Boyle S L, Hewitt M J III 1990 Development of an EPA quality assurance program for geographic information systems and spatial analysis. *GIS/LIS* 90: 814–19

Stone M, Fishkin K, Bier E 1994 The movable filter as a user interface tool. In Adelson B, Dumais S, Olson J (eds) Human factors in computing systems. CHI 94 conference proceedings. Boston, ACM Press: 306–12

Stonebraker M 1986 Inclusion of abstract data types and abstract indexes in a database system. *Proceedings*, 1986 *IEEE Data Engineering Conference, Los Alamitos*. IEEE Computer Society: 262–9

Stonebraker M, Rowe L 1986 The design of POSTGRES. ACM SIGMOD International Conference on Management of Data, New York. ACM Press: 340–55

Stonebraker M, Rowe L A, Lindsay B, Gray J, Carey M, Beech D 1990 Third-generation database system manifesto. *SIGMOD Record* 19: 31–44

Stonebraker M, Wong E, Kreps P 1976 The design and implementation of INGRES ACM. *Transactions on Database Systems* 1: 189–222

Stopher P R, Meyburg A H 1975 Urban transportation modelling and planning. Lexington, D C Heath and Co.

Stout J 1989 Peak-load staffing: what's fair for personnel and patients? Journal of Emergency Medical Systems 14: 73-4

Stow D A 1993 The role of geographical information systems for landscape ecological studies. In Haines-Young R, Green D R, Cousins S (eds) *Landscape ecology and geographical information systems*. London, Taylor and Francis: 11–21

Strahler A N 1957 Quantitative analysis of watershed geomorphology. *Transactions of the American Geophysical Union* 38: 913–20

Strand E J 1995 GIS thrives in three-tier enterprise environments. *GIS World* 8: 38–40

Strasser T 1995 Desktop GIS in libraries, technology and costs: a view from New York State. *Journal of Academic*

Librarianship 21: 279

- Streb D 1995 Using cable television to distribute GIS access. Proceedings, 1995 ESRI User Conference. Redlands, ESRI
- Stuart R 1996 The design of virtual environments. New York, McGraw-Hill: 175–80

Stuetzle W 1987 Plot windows. Journal of the Amerian Statistical Association 82: 466–75

- Sudduth K A, Kitchen N R, Hughes D F, Drummond S T 1995 Electromagnetic induction sensing as an indicator of productivity of claypan soils. In Robert P C, Rust R H (eds) *Site-specific management for agricultural systems.* Madison, American Society of Agronomy: 671–82
- Sui D Z 1994 GIS and urban studies: positivism, postpositivism, and beyond. Urban Geography 15: 258–78

Sutherland I 1963 Sketchpad: a man-machine graphical communication system. Proceedings, AFIPS Spring Joint Computer Conference. 329–46

Svensson P, Zhexue H 1991 Geo-SAL: a query language for spatial data analysis. In Günther O, Schek H-J (eds) Advances in spaual databases – second symposium, SSD 91. New York, Springer 525: 119–40

Swain R 1974 A parametric decomposition approach for the solution of uncapacitated location problems. *Management Science* 21: 189–98

Swanson T M 1992 Economics of a biodiversity convention. *Ambio* 21: 250–7

Sylvester J J 1857 A question in the geometry of situation. *Quarterly Journal of Mathematics* 1: 79

Symanzik J, Majure J, Cook D 1996 Dynamic graphics in a GIS; a bidirectional link between ArcView 2.0 and XGobi. Computing Science and Statistics 27: 299–303

Symanzik J, Majure J, Cook D, Cressie N 1994 Dynamic graphics in a GIS: a link between ARC/INFO and XGobi. *Computing Science and Statistics* 26: 431–35

Symanzik J, Megretskaia I, Majure J, Cook D 1996 Implementation issues of variogram cloud plots and spatially lagged scatterplots in the linked ArcView 2.1 and XGobi environment. *Computing Science and Statistics* 28

Taaffe E J, Gauthier H L, O'Kelly M E 1996 Geography of transportation, 2nd edition. Upper Saddle River, Prentice-Hall

Takeyama M, Couclelis H 1997 Map dynamics: integrating cellular automata and GIS through Geo-Algebra. *International Journal of Geographical Information Science* 11: 73–91

Talen E 1997 Visualizing fairness: equity maps for planners. Journal of the American Planning Association

Talmi A, Gilat G 1977 Method for smooth approximation of data. Journal of Computational Physics 23: 93–123

Talmy L 1983 How language structures space. In Pick H, Acredolo L (eds) *Spatial orientation: theory, research, and application.* New York, Plenum Press

Tamminen M 1984 Comment on quad- and octtrees. Communications of the ACM 27: 248–9

- Tarboton D G, Bras R L, Rodriguez-Iturbe I 1988 The fractal nature of river networks. *Water Resources Research* 24: 1317–22
- Tavernier R, Louis A 1984 *Soil map of the European Communities*. Luxembourg, Office of Official Publications of the European Communities

Taylor D R F 1994 Perspectives on visualization and modern cartography. In MacEachren A M, Taylor D R F (eds) *Visualization in modern cartography*. Oxford, Pergamon: 333–42

```
Taylor F W 1947 Scientific management. New York, Norton
```

Taylor J R 1982 An introduction to error analysis: the study of uncertainties in physical measurements. Oxford, Oxford University Press/Mill Valley, University Science Books

Taylor M A P 1990 Knowledge-based systems for transport network analysis: a fifth generation perspective on transport network problems. *Transportation Research A* 24: 3–14

Taylor P 1975 Distance decay in spatial interactions. Concepts and Techniques in Modern Geography, 2. Norwich GeoBooks

Taylor P D, Fahr L, Henein K, Merriam G 1993 Connectivity is a vital element of landscape structure. *Oikos* 68: 571–3

Taylor P J 1977 Quantitative methods in geography: an introduction to spatial analysis. Boston, Houghton Mifflin

Taylor P J 1985 The value of a geographical perspective. In Johnston R J (ed.) *The future of geography*. London, Methuen: 92–110

Taylor P J 1990 GKS. Political Geography Quarterly 9: 211–12

Taylor P J, Johnston R J 1979 *Geography of elections*. London, Croom Helm

Teitz M B, Bart P 1968 Heuristic methods for estimating the generalized vertex median of a weighted graph. *Operations Research* 16: 953–61

Teng Y A, Menthon D de, Davis L S 1993 Region-to-region visibility analysis using data parallel machines. *Concurrency: Practice and Experience* 5: 379–406

Teng Y A, Mount D, Puppo E, Davis L S 1997 Parallelizing an algorithm for visibility on polyhedral terrain. *International Journal of Computational Geometry and Applications* 7: 75–84

Thapa K, Bossler J 1992 Accuracy of spatial data used in geographic information systems. *Photogrammetric Engineering and Remote Sensing* 58: 835–41

Thoen B 1995 Web GIS: toy or tool? GIS World (October). http://www.csn.netl~bthoen/webgis.html

Thomas C D, Abery J C G 1995 Estimating rates of butterfly decline from distribution maps: the effects of scale. *Biological Conservation* 73: 59–65

Thomas E N 1960 Maps of residuals from regression: their characteristics and uses in geographic research. *State University of Iowa. Department of Geography, Report*, 2

Thomas R 1992 *Geomedical systems: intervention and control.* London, Routledge

Thompson D 1992 GIS A view from the other dark? side: the

perspective of an instructor of introductory geography courses at University level. *Cartographica* 28: 55–64

Thompson D, Bush J 1995 Slow on the uptake. *The Geographical Magazine* September: 26–7

Thompson R C, Richardson D E 1995 A graph theory approach to road network generalisation. *Cartography* crossing borders (Proceedings, Seventeenth International Cartographic Conference). Barcelona, Institut Cartografic de Catalunya: 1871–80

Thompson S K 1992 *Sampling*. New York, John Wiley & Sons Inc.

Thomson M C, Connor S J, Milligan P, Flasse S 1996 The ecology of malaria as seen from earth observation satellites. *Annals of Tropical Medicine and Parasitology* 90: 243–64

Thorkilsen M, Dietrich J, Larsen L C, Nielsen A 1997 Environmental and geographical information system for dredging control. *Proceedings, CEDA dredging days 1997*. Central Dredging Association: 109–17

Thrall G 1992 Using the JOIN function to compare census tract populations between census years. *Geo Info Systems* 2: 78–81

Thrall G 1995a Surfer: review of 3-dimensional surface modelling software. *Journal of Real Estate Literature* 4: 73–5

Thrall G 1995b New generation of mass-market GIS software: a commentary. *Geo Info Systems* 5: 58–60

Thrall G 1995c The stages of GIS reasoning. *Geo Info Systems* 5: 46–7

Thrall G 1996a Battle builds for business GIS market. *Geo* Info Systems 6: 46–7

Thrall G 1996b Sylvan Maps/OCX: first impressions software review. *Geo Info Systems* 6: 47–8

Thrall G 1996c Modular component programming: the foundations of GIS applications. *Geo Info Systems* 6: 45–6

Thrall G 1996d Maps, data and mapplets: first impressions software review. *Geo Info Systems* 6: 48–9

Thrall G, Marks M 1994 Functional requirements of a geographic information system for performing real estate research and analysis. *Journal of Real Estate Literature* 1: 49–61

Thrall G, McLean M 1997 Blurring the lines between GIS and desktop publishing: first impressions software review. *Geo Info Systems* 7: 49–53

Thrall G, Trudeau M 1996 Java and Applets: breakfast of champions. *Geo Info Systems Showcase* 6: 10–15

Thrall G, Valle J del, Elshaw Thrall S 1995 Review of GUIbased GIS software products. *Geo Info Systems* 5: 60–5

Thrower N 1961 Animated cartography in the United States. International Yearbook of Cartography: 20–8

Thrower N 1996 *Maps and civilization*. Chicago, University of Chicago Press

Thünen J H von 1826 Der isolierte Staat in beziehung auf Lanawirtschafi und Nationalokonomie. Jena, G Fischer

Tiefelsdorf M, Boots B 1994 The exact distribution of Moran's I. Environment and Planning A 27: 985–99 Tilman D 1994 Competition and biodiversity in spatially structured habitats. *Ecology* 75: 2–16

Tim U S 1996 Emerging technologies for hydrologic and water quality modeling research. *Transactions of the American Society of Agricultural Engineers* 39: 465–76

Timpf S, Frank A U 1995 A multi-scale DAG for cartographic objects. ACSM/ASPRS Annual Convention and Exposition 4 (Proceedings, AutoCarto 12) 4: 157–63

Timpf S, Raubal M 1996 Experiences with metadata. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 815–27

Tinline R 1988 An emergency response system for rural Ontario. *Proceedings, Third International Symposium on Medical Geography*. Queen's University, Canada

Tissot A 1981 Mémoire sur la représentation des surfaces et les projections des cartes geographiques. Paris, Gauthier Villars

Tobler W R 1963 Geographic area and map projections. *Geographical Review* 53: 59–78

Tobler W R 1970 A computer movie: simulation of population change in the Detroit region. *Economic Geography* 46: 234-40

Tobler W R 1979a Cellular geography. In Gale S, Olsson G (eds) *Philosophy in geography*. Dordrecht, Reidel: 379–86

Tobler W R 1979b Smooth pycnophylactic interpolation for geographic regions. *Journal of the American Statistical Association* 74: 519–36

Tobler W R 1989 Frame independent spatial analysis. In Goodchild M F, Gopal S (eds) *The accuracy of spatial databases*. London, Taylor and Francis: 115–22

Tobler W R 1996 Converting administrative data to a continuous field on a sphere. *Proceedings, Third International Conference/Workshop on Integrating GIS and Environmental Modeling, Santa Fe, 21–25January.* Santa Barbara, NCGIA. CD and WWW

Tobler W R, Kennedy S 1985 Smooth multi-dimensional interpolation. *Geographical Analysis* 17: 251–7

Tolley R, Turton B 1995 Transport systems, policy and planning: a geographical approach. Harlow, Longman

Tomlin C D 1983 'Digital cartographic modeling techniques in environmental planning'. Unpublished PhD dissertation, Yale University

Tomlin C D 1990 Geographic information systems and cartographic modeling. Englewood Cliffs, Prentice-Hall

Tomlin C D 1992 *Geographic information systems and cartographic modeling* (revised edition). Englewood Cliffs, Prentice-Hall

Tomlinson R F 1967 An introduction to the geographic information system of the Canada Land Inventory. Ottawa, Department of Forestry and Rural Development

Toppen F J 1992 GIS education in the Netherlands: a bit of everything and everything about a bit? *Cartographica* 28: 1–9

Toregas C, ReVelle C S 1972 Optimal location under time or distance constraints. *Papers of the Regional Science*

Association 28: 133-43

Toriwaki J, Fukumura T 1978 Extraction of structural information from grey images. *Computer Graphics and Image Processing* 7: 30–51

Tosta N 1997 National spatial data infrastructures and the roles of national mapping organisations. In Rhind D (ed.) *Framework for the world.* Cambridge (UK), GeoInformation International: 173–86

Townshend J R G, Justice C O 1990 The spatial variation of vegetation changes at very coarse scales. *International Journal of Remote Sensing* 11: 149–57

Townshend J R G, Justice C O, Skole D, Malingreau J-P, Chilar J, Teillet P, Sadowski F, Ruttenberg S 1995 The 1-km resolution global dataset: needs of the International Qeosphere Biosphere Programme. *International Journal of Remote Sensing* 15: 3417–42

Transportation Research Board 1995a *Intelligent transportation systems*. Report No. 1516. Washington DC, Transportation Research Board, National Academy Press

Transportation Research Board 1995b Artificial intelligence and geographical information. Report No. 1497. Washington DC, Transportation Research Board, National Academy Press

Tribe A 1991 Automated recognition of valley heads from digital elevation models. *Earth Surface Processes and Landforms* 16: 33–49

Tribe A 1992 Problems in automated recognition of valley features from digital elevation models and a new method toward their resolution. *Earth Surface Processes and Landforms* 17: 437–54

Tsai V 1993 Delaunay triangulations in TIN creation: an overview and linear-time algorithm. *International Journal of Geographical Information Systems* 7: 501–24

Tsichrizis T C, Lochovsky F H 1977 *Database management systems*. New York, Academic Press

Tufte E R 1983 *The visual display of quantitative information*. Cheshire (USA), Graphics Press

Tukey J W 1977 *Exploratory data analysis*. Reading (USA), Addison-Wesley

Turnbull D 1989 Maps are territories. Chicago, University of Chicago

Turner A K 1992 *Three-dimensional modelling with geoscientific information systems.* NATO ASI Series C Vol. 354. Dordrecht, Kluwer

Turner D P, Koerper G, Gucinski H, Peterson C, Dixon R K 1993 Monitoring global change: comparison of forest cover estimates using remote sensing and inventory approaches. *Environmental Monitoring and Assessment* 26: 295–305

Turner M G 1990 Spatial and temporal analysis of landscape patterns. *Landscape Ecology* 4: 21–30

Turner M G, Gardner R H, Dale V H, O'Neill R V 1989

Predicting the spread of disturbance across heterogeneous landscapes. *Oikos* 55: 121–9

Turton I, Openshaw S 1996 Modelling and optimising flows using parallel spatial interaction models. In Bougé L, Fraigniaud P, Mignotte A, Roberts Y (eds) *Euro-Par96 Parallel Processing* Vol. 2 Lecture Notes in Computer Science (1124). Berlin, Springer: 270–5

UCGIS (University Consortium for Geographic Information Science) 1996a Research priorities for geographic information science. *Cartography and Geographic Information Systems* 23: 115–27

UCGIS (University Consortium for Geographic Information Science) 1996b *The UCGIS research agenda: interoperability.* http://www.ucgis.org

UN ECE (United Nations Economic Commission for Europe) 1996 Land administration guidelines with special reference to countries in transition. United Nations. New York and Geneva, United Nations: 1–94

UNEP 1992 *Convention on biological diversity*. UNEP Environmental Law and Institutions Programme Activity Centre, Nairobi, Kenya

UNEP 1994 *Guidelines for country studies on biological diversity*. United Nations Environment Programme, Nairobi, Kenya

Unwin A 1993 Interactive statistical graphics and GIS – current status and future potential. Position Paper, Workshop on Exploratory Spatial Data Analysis and GIS. NCGIA. Santa Barbara, 25–27 February

Unwin A, Hawkins G, Hofman H, Siegl B 1996 Interactive graphics for datasets with missing values MANET. *Journal* of Computational and Graphical Statistics 5: 113–22

Unwin D J 1981a Introductory spatial analysis. London, Methuen

Unwin D J 1991 The academic setting of GIS. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 81–90

Unwin D J 1992 GIS in the curriculum. In Cadoux-Hudson J, Heywood I (eds) *Geographic Information 1991: the yearbook of the Association for Geographic Information.* London: Association for Geographic Information: 37–42

Unwin D J 1995 Geographic information systems and the problem of error and uncertainty. *Progress in Human Geography* 19: 549–58

Unwin D J et al 1990 A syllabus for teaching geographical information systems. *International Journal of Geographical Information Systems* 44: 457–65

Unwin D J, Capper B 1995 *Professional development for the geographic information industry*. London, Association for Geographic Information

Unwin T 1992 The place of geography. Harlow, Longman

Upton G J, Fingleton B 1985 Spatial data analysis by example.

Vol. 1. New York, John Wiley & Sons Inc.

US 1970 Fair Credit Reporting Act of 1970. 15 USC. Sec. 1681

US 1974 The Privacy Act of 1974. *PL 93–579 15 USC 552a* Sec. 3 (e) (4)

US 1988 Video Privacy Act of 1988. 18 USC Sec. 2901

US Defense Mapping Agency 1992 *Digital chart of the world*. Available as 1700 MB database on four CD-ROMs made available by various suppliers

US Geological Survey 1996 Spatial data transfer standard. http://mcmcweb.er.usgs.gov/sdts/standard.html

US Senate Subcommittee on Constitutional Rights of the Committee on the Judiciary 93d Congress 2d session, 1974 *Federal data banks and constitutional rights.* Washington DC, US Government Printing Office

Usery E L, Pocknee S, Boydell B 1995 Precision farming data management using geographic information systems. *Photogrammetric Engineering and Remote Sensing* 61: 1383–91

USGS 1994 *Standards for digital line graphs*. Reston, US Geological Survey: 1–107

Vail S G 1993 Scale-dependent responses to resource spatial pattern in simple models of consumer movement. *The American Naturalist* 141: 199–216

Vanderbilt V C, Grant L, Ustin S L 1991 Polarisation of light by vegetation. In Myneni R, Ross J (eds) *Photon-vegetation interactions: applications in optical remote sensing and plant ecology*. Berlin, Springer: 191–228

Vane G, Goetz A F H 1993 Terrestrial imaging spectrometry: current status, future trends. *Remote Sensing of Environment* 44: 117–26

Vane G, Green R O, Chrien T G, Enmark H T, Hansen E G, Porter W M 1993 The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). *Remote Sensing of Environment* 44: 127–44

Vanicek D, Krakovsky F D 1986 *Geodesy: the concepts.* Amsterdam, New Holland

Vaughn B M 1996 'GIS applications for hazard preparedness, response, and mitigation'. Graduate project, MSc in Interdisciplinary Science Studies. Baltimore, John Hopkins University

Vega-Garcia C, Woodard P M, Lee B S 1993 Mapping risk of wildfires from human sources of ignition with a GIS. *Proceedings, Thirteenth Annual ESRI User Conference.* Redlands, ESRI 1: 419–26

Ventura S 1991 Conversion of automated geographic data to decision-making information. *Photogrammetric Engineering* and Remote Sensing 56: 511–16

Verboom J, Schotman A, Opdam P, Metz J A J 1991 European nuthatch metapopulations in fragmented agricultural landscape. *Oikos* 61: 149–56

Verdin K L, Jenson S K 1996 Development of continental scale digital elevation models and extraction of hydrographic features. Proceedings, Third International Conference/ Workshop on Integrating GIS and Environmental Modelling. Santa Barbara, NCGIA. CD

Veregin H 1991 GIS data quality evaluation for coverage documentation systems. Las Vegas, Environmental Monitoring Systems Laboratory, US Environmental Protection Agency

Veregin H 1994 Integration of simulation modelling and error propagation for the buffer operation in GIS. *Photogrammetric Engineering and Remote Sensing* 60: 427–35

Veregin H 1995 Developing and testing of an error propagation model for GIS overlay operations. *International Journal of Geographical Information Systems* 9: 595–619

Veregin H 1996 Error propagation through the buffer operation for probability surfaces. *Photogrammetric Engineering and Remote Sensing* 62: 419–28

Veregin H, Hargitai P 1995 An evaluation matrix for geographical data quality. In Guptill S C, Morrison J L (eds) *Elements of spatial data quality*. Oxford, Elsevier Science: 167–88

Veregin H, Lanter D 1995 Data-quality enhancement techniques in layer-based geographic information systems. *Computers, Environment and Urban Systems* 19: 23–36

Vertessy R A, Hatton T J, O'Shaugnessy P J, Jayasuroya M D A 1993 Predicting water yield from a mountain ash forest catchment using a terrain analysis based catchment model. *Journal of Hydrology* 150: 665–700

Vincent V, Thomas R G 1960 An agroecological survey of Southern Rhodesia. Salisbury (SA), Government Printer

Viridians 1996 Victorian Flora Database CD-ROM. Brighton East, Victoria, Viridians Biological Databases

Voelcker J 1986 Helping computers communicate. *IEEE* Spectrum (March): 61–79

Vonderohe A, Chou C-L, Sun F, Adams T 1995 Results of a workshop on a generic data model for linear referencing systems. Proceedings GIS-T 95, Geographic Information Systems for Transportation Symposium. Washington DC, American Association of State Highway and Transportation Officials: 23–56

Voogd H 1983 Multi-criteria evaluation for urban and regional planning. London, Pion

Vorhauer C F, Hamlett J M 1996 GIS: A tool for siting farm ponds. Journal of Soil and Water Conservation 51: 434-8

Vrana R 1989 Historical data as an explicit component of land information systems. *International Journal of Geographical Information Systems* 3: 33–49

Wachowicz M, Healey R G 1994 Towards temporality in GIS. In Worboys M (ed.) *Innovations in GIS 1*. London, Taylor and Francis: 105–15

Wade G, Mueller R, Cook P, Doralswamy P 1994 AVHRR map products for crop condition assessment: a geographic information systems approach. *Photogrammetric Engineering and Remote Sensing* 60: 1145–50

Wadge G 1988 The potential of GIS modeling of gravity flows and slope instabilities. *International Journal of Geographical Information Systems* 2: 143–52 Wadge G, Wislocki A P, Pearson E J 1993 Spatial analysis in GIS for natural hazard assessment. In Goodchild M F, Parks B O, Steyaert L T (eds) *Environmental Modeling with GIS*. New York, Oxford University Press: 332–8

Wadge R J, Hutson J L 1989 *LEACHM: a process based model* of water and solute movement transformations, plant uptake, and chemical reactions in the unsaturated zone. Itacha, Water Resources Institute, Cornell University

Wagenet R J, Hutson J L, Biggar J W 1989 Simulating the fate of a volatile pesticide in unsaturated soil: a case study. *Journal of Environmental Quality* 18: 782–87

Wagner D F 1991 'Development and proof-of-concept of a comprehensive performance evaluation methodology for geographic information systems'. Unpublished PhD dissertation, Department of Geography, Ohio State University, Columbus

Wahba G 1990 *Spline models for observational data*. CNMS-NSF Regional conference series in applied mathematics 59. Philadelphia, SIAM

Wakeford R 1990 American development control: parallels and paradoxes from an English perspective. London, Her Majesty's Stationery Office

Waldo D 1948 The administrative state: a study of the political theory of American public administration. New York, Ronald Press

Walker P A 1990 Modelling wildlife distributions using a geographical information system: kangaroos in relation to climate. *Journal of Biogeography* 17: 279–89

Walker P A, Cocks K D 1991 HABITAT: a procedure for modelling a disjoint environmental envelope for a plant or animal species. *Global Ecology and Biogeography Letters* 1: 108–18

Walker P A, Faith D P 1993 DIVERSITY: a software package for sampling phylogenetic and environmental diversity. Division of Wildlife and Ecology, CSIRO, Lyneham, ACT, Australia

Walker P A, Moore D M 1988 SIMPLE: an inductive modelling and mapping tool for spatially-oriented data. *International Journal of Geographical Information Systems* 2: 347–63

Walker P A, Walker M D 1991 History and pattern of disturbance in Alaskan terrestrial ecosystems: a hierarchical approach to analysing landscape change. *Journal of Applied Ecology* 28: 244–76

Waller L A, Lawson A B 1995 The power of focused tests to detect disease clustering. *Statistics in Medicine* 14: 2291–308

Wallin D O, Elliott C C H, Shugart H H, Tucker C J, Wilhelmi F 1992 Satellite remote sensing of breeding habitat for an African weaver-bird. *Landscape Ecology* 7: 87–99

Walmsley D J 1985 Community of interest: a geographical perspective. *Community of Interest*, Australian Electoral Commission Research Report: 17–32

Walsby J C 1995 The causes and effects of manual digitising on error creation in data input to GIS. In Fisher P F (ed.) *Innovations in GIS 2*. London, Taylor and Francis: 113–22 Walter S D 1993 Visual and statistical assessment of spatial clustering in mapped data. *Statistics in Medicine* 12: 1275–9

Walthall C L, Norman J M, Welles J M, Campbell G, Blad B L 1985 Simple equation to approximate the bidirectional reflectance from vegetative canopies and bare soil surfaces *Applied Optics* 24: 383–7

Wang F, Hall G B, Subaryono 1990 Fuzzy information representation and processing in conventional GIS software: database design and application. *International Journal of Geographical Information Systems* 4: 261–83

Wang M, Gong P, Howarth P J 1991 Thematic mapping from imagery: an aspect of automated map generalization. *Proceedings of AutoCarto 10.* Bethesda, American Congress on Surveying and Mapping: 123–32

Wanner W, Li X, Strahler A H 1995 On the derivation of kernels for kernel-driven models of bidirectional reflectance. *Journal of Geophysical Research* 100: 21 077–89

Ware J M, Jones C B 1997 A spatial model for detecting (and resolving) conflict caused by scale reduction. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis 547–58

Ware J M, Jones C B, Bundy G L 1995 A triangulated spatial model for cartographic generalisation of areal objects. In Frank A U, Kuhn W (eds) *Spatial information theory – a theoretical basis for GIS (Proceedings, COSIT 95)*. Lecture Notes in Computer Science 988. Berlin, Springer: 173–92

Warita Y, Nonomura K 1997 The national and global activities of the Japanese national mapping organisation. In Rhind D W (ed.) *Framework for the world*. Cambridge (UK). GeoInformation International: 31–47

Warnecke L, Johnson J M, Marshall K, Brown R S 1992 State geographic information activities compendium. Lexington, The Council of State Governments

Warntz W, Neft D S 1960 Contributions to a statistical methodology for areal distributions. *Journal of Regional Science* 2: 47–66

Warntz W, Woldenberg M J 1967 Spatial order – concepts and applications. *Harvard Papers in Theoretical Geography* 1

Warren I R, Bach H K 1992 MIKE 21: a modelling system for estuaries, coastal waters and seas. *Environmental Software* 7: 229–40

Warren S, Brandeis L D 1890 The right of privacy. *Harvard Law Review* 4: 193–220

Wartenberg D 1985 Multivariate spatial correlation: a method for exploratory geographical analysis. *Geographical Analysis* 17: 263–83

Waters N M 1973 'The growth of the Southern Ontario Railway System – a network analysis'. Unpublished MA thesis. Department of Geography, University of Western Ontario, London (Canada)

Waters N M 1992a Relational databases and the development of GIS. *The Operational Geographer* 10(1): 21–5

Waters N M 1992b GIS and the sad case of Statistics Canada. GIS World 5(1): 100

Waters N M 1993 GIS and the 5000 year bug: solving software reliability problems. *GIS World* 6(2): 64

Waters N M 1995 GIS, database technology and beautiful formulae. In Rodcay G K (ed.) 1995 GIS World Sourcebook 1996. Fort Collins, GIS World Inc.

Waters N M, Hick S, Simkowitz H, Black W 1992 Geographic information systems in transportation. *Proceedings, Transportation Research Forum* 6: 112–29

Waters N M, Wirasinghe S C, Babolola A, Marion K E D 1986 Location of bus garages. *Journal of Advanced Transportation* 20: 35–150

Watson C C Jr 1992 GIS aids hurricane planning. *GIS World* (special issue) July: 46–52

Watson D F 1992 Contouring: a guide to the analysis and display of spatial data. Oxford, Pergamon Press

Watson D F, Philip G M 1984 Triangle based interpolation. Mathematical Geology 16: 779–95

Watson D F, Philip G M 1987 Neighbourhood-based interpolation. *Geobyte* 2: 12–16

Watson D F 1992 Contouring: a guide to the analysis and display of spatial data. Oxford, Pergamon Press

Watson G H, Jones J G 1993 Positive wavelet representation of fractal signals and images. In Crilly A J, Earnshaw R A, Jones H (eds) *Applications of fractals and chaos*. Berlin, Springer: 117–35

Webcrawler Survey 1996 World Wide Web size and growth. Global Network Navigator, Inc. http://webcrawler.com/ WebCrawler/Facts/size.html

Weber A 1909 Über den Standort der Industrien. Tubingen

Weber C 1997 The representation of spatio-temporal variation in GIS and cartographic displays: the case for sonification and auditory data representation. In Egenhofer M, Golledge R (eds) *Spatial and temporal reasoning in GIS*. New York, Oxford University Press: 74–85

Weber M 1946 Bureaucracy. In Gerth H H, Wright Mills C (ed. and trans.) *From Max Weber: essays in sociology*. New York, Oxford University Press: 196–244

Weber M 1947 *The theory of social and economic organisation*. New York, Free Press

Weber R, Buttenfield B P 1993 A cartographic animation of average yearly surface temperatures for the 48 contiguous United States: 1897–1986. *Cartography and Geographic Information Systems* 20: 141–50

Webster C J 1988 Disaggregated GIS architecture. Lessons from recent developments in multi-site database management systems. *International Journal of Geographical Information Systems* 2: 67–80

Webster C J 1993 GIS and the scientific inputs to urban planning. Part I – description. *Environment and Planning B: Planning and Design* 20: 709–28 Webster C J 1994 G1S and the scientific inputs to urban planning. Part II – prediction and prescription. *Environment and Planning B: Planning and Design* 21: 145–57

Webster R, Oliver M A 1990 Statistical methods in soil and land resource survey. Oxford, Oxford University Press

Wegener M, Masser I 1996 Brave new GIS worlds. In Masser I, Campbell H, Craglia M GIS diffusion: the adoption and use of geographical information systems in local government in Europe. London, Taylor and Francis: 9–21

Weibel R 1991 Amplified intelligence and rule-based systems. In Buttenfield B P, McMaster R B (eds) Map generalisation: making rules for knowledge representation. Harlow, Longman: 172–86

Weibel R 1992 Models and experiments for adaptive computer-assisted terrain generalisation. *Cartography and Geographic Information Systems* 19(3): 133–53

Weibel R 1995a Map generalisation. *Cartography and Geographic Information Systems* (special issue) 22

Weibel R 1995b Three essential building blocks for automated generalisation. In Müller J-C, Lagrange J-P, Weibel R (eds) GIS and generalisation: methodological and practical issues. London, Taylor and Francis: 56–69

Weibel R 1997 A typology of constraints to line simplification. In Kraak M-J, Molenaar M (eds) Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling). London, Taylor and Francis: 533–46

Weibel R 1997 Generalization of spatial data – principles and selected algorithms. In Krefeld M van, Nievergelt J, Roos T, Widmayer P (eds) Algorithmic Foundations of Geographical Information Systems. Lecture Notes in Computer Science. Berlin, Springer

Weibel R, Brandli M 1995 Adaptive methods for the refinement of digital terrain models for geomorphometric applications. *Zeitschrift für Geomorphologie* suppl. 101: 13–30

Weibel R, Ehrliholzer R 1995 An evaluation of MGE Map Generalizer – interim report. Technical report, Department of Geography, University of Zurich

Weibel R, Heller M 1991 Digital terrain modelling. In Maguire D J, Goodchild M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 1: 269–97

Weibel R, Keller S, Reichenbacher T 1995 Overcoming the knowledge acquisition bottleneck in map generalisation: the role of interactive systems and computational intelligence. In Frank A U, Kuhn W (eds) Spatial information theory – a theoretical basis for GIS (Proceedings COSIT 95). Lecture Notes in Computer Science 988. Berlin, Springer: 139–56

Weibel S, Godby J, Miller E, Daniel R 1995 OCLC/NCSA Metadata Workshop Report. Dublin, Online Computer Library Centre. http://www.oclc.org:5046/conferences: /metadata,/dublin_core_report.html

Weiner D, Warner T A, Harris T M, Levin R M 1995 Apartheid representations in a digital landscape: GIS, remote sensing and local knowledge in Kierpersol. South Africa. *Cartography and Geographic Information Systems* 22: 30–44

Weiringa J 1986 Roughness-dependent geographical interpolation of surface wind speed averages. *Quarterly Journal of the Royal Meteorological Society* 112: 867–89

Weiss M J 1988 The clustering of America. New York, Harper and Row

Weiss M J 1994 Latitudes and attitudes: an atlas of American tastes, trends, politics, and passions. Boston, Little Brown and Co.

Wells D 1987 *Guide to GPS positioning*. Fredericton, Canadian GPS Associates

Werschlein T 1996 'Frequenzbasiete linienrepräsentationen für die kartographische generalisierung'. MSc thesis, Department of Geography, University of Zurich

Wesolowsky G O, Love R F 1971 Location of facilities with rectangular distances among point and area destinations. *Naval Research Logistics Quarterly* 18: 83–90

Wesseling C G, Heuvelink G B M 1993 Manipulating quantitative attribute accuracy in vector GIS. In Harts J, Ottens H F L, Scholten H J (eds) *Proceedings EGIS 93*. Utrecht, EGIS Foundation: 675–84

Wessman C A, Aber J D, Peterson D L, Melillo J M 1988 Remote sensing of canopy chemistry and nitrogen cycling in temperate forest ecosystems. *Nature* 335: 154–6

Westin A F 1972 Databanks in a free society: computers recordkeeping and privacy. New York, Quadrangle Books

Wheeler D J 1993 Commentary: linking environmental models with geographical information systems for global change research. *Photogrammetric Engineering and Remote Sensing* 59: 1497–501

White H (ed.) 1992 Artificial neural networks. Approximation and learning theory. Oxford, Blackwell

White M 1991 Car navigation systems. In Maguire D J, Goodchiid M F, Rhind D W (eds) *Geographical information systems: principles and applications*. Harlow, Longman/New York, John Wiley & Sons Inc. Vol. 2: 115–25

Whorf B L 1940 Science and linguistics. *Technology Review* (*MIT*): 42. Reprinted in Carroll J B (ed.) 1956 *Language*, *thought, and reality: selected writings of Benjamin Lee Whorf.* Cambridge (USA), The MIT Press: 207–19

Wickham J D, Norton D J 1994 Mapping and analyzing landscape patterns. *Landscape Ecology* 9: 7–23

Wiens J A 1992 What is landscape ecology, really? *Landscape Ecology* 7: 149–50

Wiens J, Stenseth N C, Horne B van, Ims R A 1993 Ecological mechanisms and landscape ecology. *Oikos* 66: 369–80

Wiggins L L, Shiffer M J 1990 Planning with hypermedia: combining text, graphics, sound, and video. *Journal of the American Planning Association* Spring: 226–35

Wigmosta M S, Vail L W, Lettenmaier D P 1994 A distributed hydrology–vegetation model for complex terrain. *Water*

Resources Research 30: 1665-79

Wild R 1985 Community of interest: a sociological perspective. *Community of Interest*, Australian Electoral Commission Research Report: 2–16

Wildschut A (ed.) 1995 *Prospects for land reform Western Cape Overview*. LAPC Land Reform Preparation Programme Paper. Stellenbosch Centre for Rural Legal Studies

Wilkerson G G, Jones J W, Boote K J, Ingram K T, Mishoe J W 1983 Modelling soybean growth for management. *Transactions of the American Society of Agricultural Engineers* 26: 63–73

Wilkinson G G 1996 A review of current issues in the integration of GIS and remote sensing data. *International Journal of Geographical Information Systems* 10: 85–101

Wilkinson N 1995 Using CRC cards: an informal approach to object-oriented development. New York, SIGS Books

Williams I, Limp W, Briuer F 1990 Using geographic information systems and exploratory data analysis for archeological site classification and analysis. In Allen K, Green F, Zubrow E (eds) *Interpreting space: GIS and archaeology*. London, Taylor and Francis: 239–73

Williams J C Jr 1995 Political districting: a review. *Papers in Regional Science* 74(1): 13–40

Williams J R, Jones C A, Dyke P T 1983 A modeling approach to determine the relation between erosion and soil productivity. *Transactions of the American Society of Agricultural Engineers* 27: 129–44

Williamson I P 1996 Coordinated cadastres – a key to building future GIS. Proceedings, Regional Conference (3–4 July) on Managing Geographic Information Systems for Success. Melbourne, University of Melboure: 60–9

Williamson R A 1997 The LANDSAT legacy: remote sensing policy and the development of commercial remote sensing. *Photogrammetric Engineering and Remote Sensing* 63: 877–85

Williamson T 1994 Vagueness. London, Routledge

Wilson A G 1967 A statistical theory of spatial distribution models. *Transportation Research* 1: 253–69

Wilson A G 1974 Urban and regional models in geography and planning. New York, John Wiley & Sons Inc.

Wilson A G, Coelho J D, MacGill S M, Williams H C W L 1981 *Optimisation in location and transport analysis.* Chichester, John Wiley & Sons

Wilson A G, Rees P H, Leigh C M 1977 *Models of cities and regions: theoretical and empirical developments.* New York, John Wiley & Sons Inc.

Wilson J P 1996 GIS-based land surface/subsurface modeling: new potential for new models. Proceedings, Third International Conference Integrating GIS and Environmental Modeling, Santa Fe, New Mexico, January. Santa Barbara, NCGIA. CD-ROM

Wilson J P, Gallant J C 1996 EROS: A grid-based program for estimating spatially-distributed erosion indices. *Computers*

and Geosciences 22: 707-12

Wilson J P, Gallant J C 1997 Terrain-based approaches to environmental resource evaluation. In Lowe S N, Richards K S, Chandler J H (eds) *Landform monitoring, modelling and analysis.* Chichester, John Wiley & Sons: 219–40

Wilson J P, Inskeep W P, Rubright P R, Cooksey D, Jacobsen J S, Snyder R D 1993 Coupling geographic information systems and models for weed control and groundwater protection. *Weed Technology* 6: 255–64

Wilson J P, Inskeep W P, Wraith J M, Snyder R D 1996 GISbased solute transport modeling applications: scale effects of soil and climate data input. *Journal of Environmental Quality* 25: 445–53

Wingle W L, Poeter E P 1996 Site characterization, visualization, and uncertainty assessment using zonal Kriging and conditional simulation (poster). *Global Exploration and Geotechnology, AAPG Annual Meeting San Diego, May*

Winner L 1977 Autonomous technology: technics-out-of-control as a theme in political thought. Cambridge (USA), MIT Press

Winston P H 1984 *Artificial intelligence*, 2nd edition. Reading (USA), Addison-Wesley

Wirasinghe S C, Waters N M 1983 An approximate procedure for determining the number, capacities and location of solid waste transfer stations in an urban region. *European Journal* of Operations Research 12: 105–11

Wirth L 1938 Urbanism as a way of life. American Journal of Sociology 44: 1-24

Wirth L 1969 Rural-urban differences. In R Sennett (ed.) Classic essays in the culture of cities. New York, Appleton-Century-Crofts: 165–9

Wise J A, Thomas J 1995 Visualising the non-visual: spatial analysis and interaction with information from text documents. *Proceedings of IEEE Visualisation* 95: 51–8

Wise S 1997 The effect of GIS interpolation errors on the use of digital elevation models in geomorphology. In Lowe S N, Richards K S, Chandler J H (eds) *Landform monitoring, modelling, and analysis.* Chichester, John Wiley & Sons: Chapter 7

Wittie L D 1991 Computer networks and distributed systems. *IEEE Compute*: 67–76

Wojtowicz J (ed.) 1995 Virtual design studio. Hong Kong, Hong Kong University Press

Woldenberg M J, Berry B J L 1967 Rivers and central places: analogous systems? *Journal of Regional Science* 7: 129–40

Woldt W, Goderya F, Dahab M, Bogardi I 1996 Consideration of spatial variability in the management of non-point source pollution to groundwater. In Mowrer et al (eds) *Spatial accuracy assessment in natural resources and environmental sciences*. Fort Collins, USDA Forest Service General Technical Report RM-GTR-277: 49–56

Wolfram S 1984 Cellular automata as models of complexity. *Nature* 311: 419–23

Wollenhaupt N C, Wolkowski R P, Clayton M K 1994 Mapping soil test phosphorus and potassium for variable rate fertilizer application. *Journal of Production Agriculture* 7: 441–7

Wolock D M, McCabe G J 1995 Comparison of single and multiple flow direction algorithms for computing topographic parameters in TOPMODEL. *Water Resources Research* 31: 1315–24

Wood D 1992 *The power of maps.* New York, Guilford Press/London, Routledge

Wood J D, Fisher P F 1993 Assessing interpolation accuracy in elevation models. *IEEE Computer Graphics and Applications* 13: 48–56

Wood J, Unwin D, Stynes K, Fisher P, Dykes J 1996 Using the landscape metaphor to understand population data. http://www.geog.le.ac.uk/argus/poplandscape/index.html

Wood M 1994 Visualisation in a historical context. In MacEachren A M, Taylor D R F (eds) Visualisation in modern cartography. Oxford, Pergamon: 13–26

Wood W B 1997 A Jeffersonian vision for mapping the world. *Issues in Science and Technology* XIV, 1. US National Academy/University of Texas at Dallas

Woodcock C E, Strahler A H 1987 The factor of scale in remote sensing. *Remote Sensing of Environment* 21: 311–32

Woodsford P A 1995 Object-orientation, cartographic generalisation, and multi-product databases. Cartography crossing borders (Proceedings, Seventeenth International Cartographic Conference). Barcelona, Institut Cartogràfic de Catalunya: 1054–8

Woollam R 1997 European liberalisation, the final countdown. *Telecommunications Magazine Online* June

Worboys M F 1990 Reasoning about GIS using temporal and dynamic logics. Temporal Workshop (NCGIA), Orono, Maine

Worboys M F 1994a A unified model for spatial and temporal information. *The Computer Journal* 37: 26–33

Worboys M F 1994b Object-oriented approaches to georeferenced information. *International Journal of Geographical Information Systems* 8: 385–99

Worboys M F 1995 *GIS: a computing perspective*. London, Taylor and Francis

Worboys M F, Hearnshaw H M, Maguire D J 1990 Objectoriented data modelling for spatial databases. *International Journal of Geographical Information Systems* 4: 369–83

World Commission on Environment and Development (WCED) 1987 *Our Common Future*. Oxford, Oxford University Press

World Intellectual Property Organisation 1996 Draft treaty on intellectual property in respect of databases. Geneva

Worrall L (ed.) 1990 Geographic information systems: developments and applications. London, Belhaven Press

Wren A 1987 Software for bus operations planning. In Bonsall P, Bell M (eds) *Information technology applications in transport*. Utrecht, VNU Science Press: 211–33

Wright D J, Goodchild M F, Proctor J D 1977 Demystifying the persistent ambiguity of GIS as 'tool' versus 'science'. *Annals of the Association of American Geographers* 87: 34–62

Wright J K 1942 Map-makers are human: comments on the subjective in maps. *Geographical Review* 32: 527–54

Wrigley N 1985 Categorical data analysis for geographers and environmental scientists. Harlow and New York, Longman

Wrigley N 1993 Retail concentration and the internationalisation of British grocery retailing. In Bromley R D F, Thomas C J (eds) *Retail change: contemporary issues*. London, UCL Press: 41–68

Wrigley N 1995 Revisiting the modifiable areal unit problem and the ecological fallacy. In Cliff A D, Gould P R, Hoare A G, Thrift N J (eds) *Diffusing geography: essays for Peter Haggett*. Oxford, Blackwell: 49–71

Wrigley N, Holt D, Steel D, Tranmer M 1996 Analysing, modelling, and resolving the ecological fallacy. In Longley P, Batty M (eds) *Spatial analysis: modelling in a GIS environment*. Cambridge (UK), GeoInformation International: 25–40

Wulfsohn T 1994 What type of geographic information systems do urban planners need to facilitate the growth management of South African cities? Paper presented at the South African Institute of Town and Regional Planning Conference, Cape Town

Wylie B K, Shaffer M J, Brodahl M K, Dubois D, Wagner D G 1994 Predicting spatial distributions of nitrate leaching in northeastern Colorado. *Journal of Soil and Water Conservation* 49: 288–93

Yager R 1988 On ordered weighted averaging aggregation operators in multicriteria decision-making. *IEEE Transactions on Systems, Man, and Cybernetics* 8: 183–90

Yang W, Gold C 1996 Managing spatial objects with the VMO tree. In Kraak M-J, Molenaar M (eds) *Advances in GIS research II (Proceedings, Seventh International Symposium on Spatial Data Handling)*. London, Taylor and Francis

Yapa L 1991 Is GIS appropriate technology? International Journal of Geographic Information Systems 5: 41–58

Yarrington L 1996 Sequential Gaussian simulation. Fernald Geostatistical Techniques, Sandia National Laboratories. http://www.nwer.sandia.gov/fernald/technig.html

Yeh A G-O 1990 A land information system in the programming and monitoring of new town development. *Environment and Planning B: Planning and Design* 17: 375–84

Yeh A G-O 1991 The development and applications of geographic information systems for urban and regional planning in the developing countries. *International Journal of Geographical Information Systems* 5: 5–27 Yeh A G-O, Chow M H 199a An integrated GIS and location–allocation approach to public facilities planning. *Computers, Environment and Urban Systems* 20: 339–50

Yeh A G-O, Li X 1996 Urban growth management in the Pearl River Delta: an integrated remote sensing and GIS approach. *ITC Journal* 1: 77–85

Young E 1992 Hunter-gatherer concepts of land and its ownership in remote Australia and North America. In Anderson K, Gale F (eds) *Inventing places; studies in cultural geography*. Melbourne, Longman: 255–72

Young H P 1988 Measuring the compactness of legislative districts. *Legislative Studies Quarterly* 13: 105–15

Yuan M 1994 Wildfire conceptual modeling for building GIS space-time models. GIS/LIS 94, Phoenix, Arizona: 860–869

Yuan M, Albrecht J 1995 Structural analysis of geographic information and GIS operations: from a user's perspective. In Frank A U, Kuhn W (eds) *Spatial information theory – a theoretical basis for GIS*. Lecture notes in computer science 988. Berlin, Springer: 107–22

Zadeh L A 1965 Fuzzy sets. Information and Control 8: 338-53

Zadeh L A 1980 Fuzzy sets versus probability. *Proceedings IEEE* 68: 421

Zaninetti L 1993 Dynamical Voronoi tessellation IV. The distribution of the asteroids. *Astronomy and Astrophysics* 276: 255–60

Zebker H A, Werner C, Rosen P A, Hensley S 1994 Accuracy of topographic maps derived from ERS-1 interferometric radar. *IEEE Transactions on Geoscience and Remote Sensing* 32: 823–36

Zerbe R O Jr, Dively D D 1994 *Benefit–cost analysis in theory* and practice. New York, HarperCollins

Zevenbergen L W, Thorne C R 1987 Quantitative analysis of land surface topography. *Earth Surface Processes* 12: 47–56

Zhan F B 1996 A set of shortest path algorithms that run fastest on real road networks. *Proceedings GIS/LIS 96.* Falls Church, ACSM/ASPRS: 755–64

Zhang W, Montgomery D R 1994 Digital elevation model grid size, landscape representation, and hydrologic simulation. *Water Resources Research* 30: 1019–28

Zhdanov N 1997 Mapping in Russia: the present state of development. In Rhind D (ed.) Framework for the world. Cambridge (UK), GeoInformation International: 71–82

Zhu A, Band L E 1994 A knowledge-based approach to data integration for soil mapping. *Canadian Journal of Remote Sensing* 20: 408–18

Zhu A, Band L E, Dutton B, Vertessy R 1996 Soil property derivation using a Soil Land Inference Model (SoLIM).