Introduction to the Special Issue on Internet Geometry and Geography

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Benoit Mandelbrot brought to life for most of us the work of Karl Weierstrass and numerous other mathematicians from the past who had studied the relationship between differentiability and continuity. Most of us learned about the absolute value function, its continuity and lack of differentiability at the origin, as an interesting function that was often used as an examination question that caught many calculus students off guard. Continuing studies in differentiability led, perhaps, to textbook line drawings in black and white showing simple continuous curves with more than one point where differentiability failed. High excitement came into the picture for those who could visualize Peano's space filling curve and imagine what might happen---but full visualization of it was never satisfactory.

Then, along came Mandelbrot! He offered a stunning array of computer graphics: detailed curves that clearly brought out the "wow" factor for more than a generation of scientists. Curves that had been only partially visible to those who chose to consider them were now portrayed in full-color glory, revealing patterns of self-similarity, self-replication, and so forth. The fractional dimension and the considerations of Hausdorff first came to life only many years after their discovery. Because everyone could now enjoy a fractal through the use of computer graphics, many became motivated to understand at least in part what these remarkable graphics might represent. Current technology provided a breakthrough in scientific communications: fractals piqued the interest of random citizens in what might have appeared to be a 'new' geometry--and, even more important, fractal geometry helped to guide the research of scholars in a wide range of disciplines.

The case of the fractal underscores the importance of the medium of communication in scientific research. The internet, coupled with the recent 2006 versions of Google Earth®, offers exciting new ways to visualize scholarly research. Again, as with fractals, there is the "wow" factor. Again, the images pique the interest of academics as well as others. The challenge is to discover how this new style of communication about the geometry of the Earth might guide research. It is to this challenge that the articles in this Special Issue offer a small set of early responses.

The major authors in this Special Issue are among the early leaders in the use of fractal geometry to guide geographic research. They are also among the early leaders in the use of contemporary technology to guide the communication and diffusion of scholarly information across scientific boundaries. The box below enumerates seven key contributions, from 1985-2006, for each. Some are conventional publications while others are internet publications (with links to external sites).

Sandra Lach Arlinghaus

2006*: 3D Atlas of Ann Arbor: 2nd Edition,*. *Ann Arbor: Institute of Mathematical Geography*.

2006*:* **(with input from numerous others noted throughout)** *3D Atlas of Ann Arbor: 1st Edition*, **Ann Arbor: Institute of Mathematical Geography.**

2006*: (with W. C. Arlinghaus) Spatial Synthesis: Centrality and Hierarchy, Volume I, Book 1*. **Ann Arbor: Institute of Mathematical Geography.**
"Spatial Synthesis Sampler" is an included 2003 article that was a 2003 Pirelli INTERNETional Semi-Finalist.

2002*: (with W. C. Arlinghaus and F. Harary) Graph Theory and Geography: An Interactive View E-Book, John Wiley & Sons, NY (Wiley's first E-Book publication).*

Pirelli INTERNETional Award Finalist, 2002

1990-present: ***Solstice: An Electronic Journal o f Geography and Mathematics*****, Ann Arbor: Institute of Mathematical Geography. Pirelli INTERNETional Award Semi-Finalist, 2001. Written about in *Science* (AAAS) and *Science News* as one of the world's first on-line, peer-reviewed, journals.**

1989: **(with W. C. Arlinghaus) "The fractal theory of central place hierarchies: a Diophantine analysis of fractal generators for arbitrary Loschian numbers," *Geographical Analysis: an International Journal of Theoretical Geography*. Ohio State University Press. Vol. 21, No. 2; pp. 103-121.**

1985: **"Fractals take a central place," *Geografiska Annaler*, 67B, pp. 83-88. Journal of the Stockholm School of Economics.**

Michael Batty

2006: Rank clocks, *Nature*, Vol. 444, 30 November, 2006, doi:10.1038. Link to reprint.

2006: Virtual London, in Heywood, I., Cornelius, S., and Carver, S. *An Introduction to Geographical Information Systems*, Pearson Educational, Harlow, UK, pp. 269-271.

2005: *Cities and Complexity: Understanding Cities Through Cellular Automata, Agent-Based Models, and Fractals*, The MIT Press, Cambridge, MA, xxiii + 565 pp.

2005: (with Hudson-Smith, A., and Evans, S.) Building the virtual city: public participation through e-democracy, *Knowledge Technology and Policy*, 18, 62-85.

1997: Virtual geography, *Futures* 29, 337-352

1991: Cities as fractals: simulating growth and form, in T. Crilly, R. A. Earnshaw, and H. Jones (Editors). *Fractals and Chaos*. Springer Verlag, New York, 41-69.

1985: Fractals: geometry between dimensions, *New Scientist*, 105, 1450, 31-35.

External links are provided, on author names above, to documents containing complete publication listings.

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