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INTERVIEW

An Interview With Michael Goodchild: GIScience and Social Reordering in the New Millennium Fernie, British Columbia, Canada, February 16, 2008

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Professor Michael Goodchild is perhaps the best known GIScientist in the world. Indeed, he coined the term in a landmark 1991 paper in which he argued that geographic information *systems* (GIS) was a term that poorly described the spatial theory and commensurate analysis that had flourished with the development of computational cartography (Goodchild, 1992). Geographic information *science*, by contrast, implicitly recognized that researchers in GIS are fundamentally curious about conceptual models of space, unique characteristics of spatial data, and problems related to their analysis. Indeed, Goodchild suggested that the discipline needed to develop unique conceptual models of space, explore the sphericity of spatial data, and develop models to calculate error propagation (Goodchild, 1992). The purview of this research agenda was more closely related to geographic information science than systems. The past 17 years have seen exponential growth in these inquiries and the parallel establishment of GIScience as a critical forum in the information society. In the new millennium, however, we are faced with a rapidly evolving information society—one profoundly affected by geographic issues.

Ten years ago, I interviewed Goodchild about a completely different set of issues (Schuurman, 1999). At the time, terse epistemological dissent was brewing between human geographers critical of the implications of GIS and those who were active in its development (Schuurman, 2000). The epistemological battles have mellowed considerably—if not disappeared. Importantly, however, the concerns of human geographers at the time (1999) have been completely usurped by the astronomical changes to GIS and geography in general wrought by the World Wide Web (www).

In this interview, we address some of the changes introduced by a www that is altering (virtual) distances and social relations. We discuss a range of issues, including the role of GIS in the information sciences, virtuality, the impact of Web 2.0 on scientific paradigms, movement toward collaborations and interdisciplinarity, challenges of verification in a digital world, trust, and devolution of authority. Each of these is relevant to a rapidly morphing GIScience as well as to the profound social reordering of our networked society.

Nadine Schuurman (NS): So, we're going to start the interview now for *The Information Society*. In 1991, you coined the term "geographic information science." At that time, you characterized GI science as a subset of the information sciences. Has that relationship developed as you envisaged, and in what areas can it be developed further?

Michael Goodchild (MG): I think one thing that has emerged from that is the conviction, certainly on my part, that this is a very special subset. That unlike many other branches of information science, you can rigorously define geographic information science as a subset because of its required geographic component. In other words, you have to know geographic location. And that's not true, broadly, of many other divisions. As a result, we can make progress in a number of ways. I think the metadata standard, for example, that exists for geospatial data is particularly helpful and rigorous, much more so than metadata standards in many other fields. I've even argued that because geographic information science is so well defined, it's possible to make progress in GI science that

will ultimately influence the whole of information science. So, I think there is a very clearly enunciated theory now of geographic information, which is particularly valuable and invites comparison with other fields.

I always remember Jonathan Raper when he was appointed to a chair of Information Science at City University, saying that his first response was to try to find out what information science was and being very frustrated at the lack of a clear and rehearsed definition. That's not true with geographic information science, which is very well defined. And I think that, in some ways, serves as a model, and I've heard this view expressed from people outside the field.

NS: In 1997, the National Science Foundation launched Project Varenius, with the aim of the enhancing geographic information science. Varenius incorporated three components: computational, cognitive, and societal. Were all of these equally developed?

MG: I think there's been a lot of attention to all three. I'm not sure that I'd use the word equal. It's very difficult to quantify scientific progress. And progress on the societal side is always going to be different from progress on the computational side or even the cognitive side. Certainly it's possible to point to centers of energy and communities in each of those three domains. So the ACM GIS group, on the computational side, would match to the COSIT conferences, which have emphasized the cognitive side, or the Societal GIS conferences, which have emphasized the societal side. And there's a balance to some degree, but I don't think it's a perfect balance. I think the three-part model has survived remarkably well. I don't think anyone has really suggested there should be four or two. What is, I think, the greatest interest is how specific areas within GI science map into that three-vertex triangle. And obviously, there, there have been shifts. So, people now may be taking a more cognitive view of certain topics. For example, the uncertainty question is now seen much more as a cognitive question than it used to be.

NS: What are the social implications of a more visible world—enabled by the combination of Web 2.0 and GIScience?

MG: I find that people's immediate reaction to Google Earth is to admire the planet as a whole and maybe to do things with the whole of the planet, like imagining how it would look if it were spinning around the equator rather than around the poles, or spinning in the wrong direction. And then, their immediate next step is to go local and to zoom in on their house to see their local neighborhood. This combination of the global and the local, I think, is one of the things that the virtual globes do extremely well. And that, I do think, has changed our perception. No previous generation has ever been able to link the local to the global in the way that we can, to see the curvature of Earth from

an airplane in the way that we can or to gain some sense of how the planet as a whole operates, which we now can. So certainly, the perceptions have changed. They changed, in part, when NASA produced the first images of Earth and they changed again as a result of the virtual globes. I think they are a really fabulous development for this field, and the technology that allows it to happen is a remarkable technology.

NS: What about scientific paradigms? In other words, will the practice of working with geographically distributed individuals on common projects change the requirement of proof? Will hypothesis testing be replaced by form of consensus?

MG: This is a very interesting question. I think, arguably, society is moving in that direction. And a very good example is the global climate models, which are widely used now to predict global climate change. The fact is that we have a collection of some twenty such models worldwide and they disagree in their forecasts. And so it's become common practice to take majority votes among those models and to say, "Well, because fifteen of the twenty models predict an increase in temperature, that's scientific evidence that temperature will increase." *It's not.* That's not a legitimate scientific argument and yet we make it. Because we've become so inured as a society to the concept of consensus, the concept of democracy, that we've allowed it to leak over into our scientific practices. I think that's a very powerful trend. It's very difficult nowadays for anyone, even in science, to butt the consensus, to ask a question in an audience listening to a scientific paper when that question is unpopular with the rest of the audience. You have to go back, I think, almost thirty years to the days when awkward questions were routinely asked from the audience.

NS: Now we ask helpful questions.

MG: Right.

NS: There is a movement toward shared scientific work. Shades, perhaps, of cooperation among physicists and other scientists between the two World Wars in the twentieth century. To wit, protein wiki and other tools for sharing scientific knowledge have emerged. What are the academic repercussions of sharing knowledge?

MG: We're still struggling with that because on the one hand, scientific funding is increasingly geared to collaboration. Scientific funding agencies place a great deal of emphasis on collaboration, and particularly collaboration across disciplines. Academic administrators are very strong on interdisciplinary work. At the same time, the whole process of academic advancement is still strictly individual and discipline-based. We worry a great deal about measuring the contribution that an individual makes to a team or to a jointly shared research, and we still place greater value on a single-authored paper than a multiple-authored paper. I think we have yet to rewrite the

methodology of science to reflect collaborative activity. The methodology of science is still largely individualistic. And most of the examples that are cited in courses on scientific methodology are individual examples. We talk about the work of Galileo or the work of Einstein, but we don't talk about the work of a team, in which the members may well be close to anonymous.

We still believe strongly that scientific reporting should report sufficient detail to allow someone else to repeat the analysis. We still use the term "black box" as a pejorative term. And yet, that doesn't reflect our common practice anymore. We use software, and don't understand every step in the analysis that results. GIS is a perfect example. Many GIS packages are not documented sufficiently to allow someone to know exactly what the software is doing. So, I think we're in urgent need of a rewrite of scientific philosophy because we live within a paradigm that reflects an earlier reality of the amateur polymath . . . the Darwins, the Einsteins. And our current practices are so different from theirs.

NS: Do you envisage a future in which every portion of the world will be visible through pictures and geographic information, all served on the Web?

MG: I think that would be nice and it already is to a degree because satellite remote sensing covers most of the earth's surface. But we have enormous problems to get to a point where information can be volunteered locally about every part of the earth's surface because that runs right into the digital divide. And the digital divide is only getting worse. I think the one bright light on the horizon is the potential of the cell phone because we are about, I believe, to reach the point where 50% of the human race has cell phones. And that service penetrates virtually every part of the planet. And so, if that is the mechanism for volunteering information and also the mechanism for receiving the results, then I think we have a chance of overcoming the digital divide.

NS: There are many ways to geocode or tag spatial information, including address matching to GIS, using a GPS or GPS-enabled cameras. There are, however, few ways to verify that the representation associated with the image or map is real or true. Is there a vehicle for determining authenticity or will the world of citizen-gathered geographic information work on the Wikipedia model?

MG: I think the Wikipedia model is very powerful and that already works well in the case of some forms of volunteer geographic information. So, Wikimapia, for example, is modeled on the Wikipedia approach. I think one thing that helps is that when something is wrong it tends to stand out. So if you, for example, were to try to fake streets on the Open Street Map's site, it would be almost immediately obvious to anyone looking at the map. It's actually remarkably difficult to fake geographic information, to create a fake world.

There are some very compelling examples. There's a website called Bergonia, about an imagined continent in the middle of the Atlantic. And it's an excellent exercise for students to ask them to tell you why that imagined continent could not be there. It is very difficult to fake and yet, of course, it happens. But I think we're still very unsure of exactly how the process of voluntary geographic information will be perverted, as it surely will. I don't know the Christmas Bird Count well enough to be able to answer the question, "How is it being perverted?" But I'm sure it is in some ways. But I think in most cases of geographic information, the existence of perversion becomes immediately obvious when the information is examined by an informed user.

NS: Francis Harvey, a GI scientist and science and technology scholar, has written about the issue of trust with respect to the exchange of geographic information between branches of government. How will data reliability be determined when individuals are the data manufacturers?

MG: The old concept was authority. It was that a data set was good because the U.S. Geological Survey produced it or because NASA produced it. That, of course, is very different when the data are produced by individuals who have no particular authority. Data contributed to the Christmas Bird Count assumes the authority of the Audubon Society or of the Christmas Bird Count itself. And data that volunteers contribute to the U.S. Geological Survey's mapping programs again assumes the authority of the USGS. I can see the potential for new societies of people who are dedicated to creating particular kinds of data, and in such cases the society conveys authority on the products.

So, if you were, for example, to contribute data to the Open Street Map project, the Open Street Map already has a degree of authority. It is responsible for the quality of the data it produces and thus far, it has a fairly good reputation for quality. So, I think there's really nothing new here. It's the same process. What would be different is that many of the authorities now are not the traditional government authorities. They are private-sector authorities or they're collections of citizens as authorities. And that is, I think, refreshing and novel.

NS: Will social organizations, such as religious groups, gain collective identity and power through a Web-enabled synergy?

MG: I think some very powerful groups are now emerging in cyberspace. I think the past U.S. election is a lesson in the power of new virtual communities and a loss of power of the conventional media. We've seen one mistake after another in the conventional media in judging the progress of the election campaigns and that's a reflection of reality. People are not getting their news anymore from the conventional sources. Try to find news on U.S. television. People go to the Web to get their news. So yes, I think

it's changed enormously. I don't think it's done away with distance, which is what many people said would happen. So, around 1996/97 when Frances Cairncross published his book *The Death of Distance*, for example, it was very popular to suggest that geography was dead. I think it's become abundantly clear in the dozen years since that geography is very far from dead—that personal contact, physical contact still means an enormous amount and will never be replaced completely by virtual contact.

NS: Could you say a little bit more about the political implications of a collective Web identity and power for these groups?

MG: I think it's still emerging and it's not available to all. Everyone can buy the *Los Angeles Times*, and everyone could have the same information in the traditional system. But everybody doesn't look at the same blogs or at the same sources on the Web. So, that's one fundamental change. We no longer have a common information base in society. Another is quality. And we've seen in the past, I'd say, ten years, the rising power of falsehood, of rumor in electoral processes. We saw it in the 2004 Presidential election campaign, and again in 2008.

NS: Tell me, could you say another couple of words about the change of journalism in this new emerging information system?

MG: Yes, well, the term Web 2.0 has been adapted to journalism also and there's a growing literature on journalism 2.0, which is journalism created by individuals. It's not journalism through the traditional sources in which correspondents created news for us all. This is a world in which individuals create news for some of us and the process by which we obtain and share news is a much more complex process than it used to be. What is it that makes someone find somebody else's blog and follow it? That's a very strange process. There's a social psychology here that has to be sorted out. There's a social psychology of volunteering information which has to be sorted out too, I think.

NS: Mike, this has been exceptionally interesting and I am grateful for you time.

MG: You are very welcome.

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