In January 1998 I interviewed GIS theorist and researcher Michael Goodchild at his office at the University of California, Santa Barbara. We spoke of the debates that were raging in geography about the role of GIS with an emphasis on identifying productive ways of engaging GIScientists with their critics from human geography. Among the issues that emerged were individual privacy, epistemology, infrastructural changes wrought by localized data collection, and Big Science.

Ten years later I interviewed Professor Goodchild again. Since then, Web 2.0 and the ubiquity of data and mapping have radically altered the intellectual landscape of GIS. In this new interview we discuss the possible eclipse of GIS by free, web-based technologies that include Google Earth, mash-ups, and data scraping. Not surprisingly, issues such as individual privacy and critical GIS remain relevant, but they are joined by a host of previously unimaginable phenomena that bear scrutiny by geographers.

Web 2.0 is the host for the emerging technologies that have so altered our environment in GIScience. Web 2.0 broadly refers to a new generation of Internet services and technology. ‘The participatory web’ as opposed to the ‘web as static information source’ is frequently attached to descriptions of Web 2.0; user-created content and collaboration are its hallmarks. The concept that the average Internet user can create content is considered an essential element of Web 2.0 (Hendler and Golbeck, 2008). Web 2.0 promises to democratize the Internet to a degree not seen (Barsky and Purdon, 2006). Recognizable applications include wikis, blogs, mash-ups, and, more recently volunteered geographic information and citizen sensors (see also Elwood, 2008). Overall, the target of Web 2.0 is a richer more complete Web experience available to all Internet users. The implications for geographers are, however, extensive.

Neogeography is one term that has emerged to describe a set of Web 2.0 techniques and tools that fall outside the realm of traditional, proprietary GIS such as ArcGIS (Turner, 2006). Neogeography is bringing traditional cartographic and GIS skills to the masses. It is democratizing a once exclusive domain (Boulos et al, 2006), but in the process removes authority and certainty (unwarranted in some cases) associated with GIS maps. GIS and geography have to adjust to this dynamic technical and social landscape. Mapping has evolved rapidly from paper, to GIS, to web-based mapping. Each transformation is associated with profound social impacts.

We face scenarios, previously unimaginable, of human beings as sensors gathering constant information with their cell phones and reporting back information to central, web-based data-collating sites. These data could be as innocuous as snow quality on ski hills or animal deaths on the highway with GPS locations. Or they could include

maps of observed traffic violators with photo-recorded plate numbers or athletes breaking the terms of their contracts with sponsors. The possibilities, benign and malevolent, are limitless.

Geographers had perhaps a decade to assimilate the repercussions and implications of GIS on the discipline from an intellectual perspective. Now a new, unknown beast has emerged. In this interview with Michael Goodchild, we explore the new Brave New World.

References
NS Michael, our last interview was almost a decade ago during a period in which a
decade of critique from human geographers was just ending. Moreover, geographic
information science as a body of theory was just emerging and beginning to gain
recognition from outside GIS. The pressing issue in 1999 was whether geographers
of many stripes could accept the ubiquity of GIS and its importance as a form of
representation and analysis within the discipline. Ironically, over the ensuing ten years,
geographic information and analysis has slowly migrated somewhat out of the domain
of geography into web-based open access forums. Large numbers of people are exper-
imenting with naïve mapping, mash-ups of multiple forms of geographic information.
And almost everyone uses web-based map queries to navigate around cities and
between them. Has GIS slipped away from geography?

MG I think that depends very much on how you define GIS. And I think geographers
might well be willing to define GIS very narrowly as involving some degree of analysis,
some degree of insight and understanding which largely escapes the newer technolo-
gies. So Google Earth, for example, has really no ability to analyze in the sense that
we’ve understood that term in GIS. So, I think your choices are to stay with a fairly
traditional definition of GIS, in which case the answer is clearly no, or to expand
the definition of GIS to include all of these new technologies and then, of course, the
response becomes much more complex.

I think that with the new technologies and neogeography and so on, there's
abundant room for mistakes. And one of my biggest concerns right now is to find
answers in the world of Google Earth and neogeography to the question: what do
people need to know about geography? Is this going to be a matter of rediscovering
what geographers have known for a long time? Is it going to be a matter of reinventing,
or are we going to be able to develop some mechanism which allows everybody to
share what we as geographers know about the world? Unless we can do that, I think
we're in for a very problematic period of time in which these technologies—very
powerful technologies—are open to misuse, misinterpretation, and so on.

NS So, in this scenario, GIS really becomes more about representation. What responsi-
ability do GIScientists have in this scenario?

MG I think GIScientists have to ask fundamental questions about emerging technol-
gies. They have to keep up with developments in the broader community so that they
can reflect on those developments and ask questions about the representations that are
implied. Without such a period of reflection and engagement, these new developments
really are far more dangerous than GIS was perceived to be in the 1990s. And the
critique that's needed is an even stronger critique now than it was then.

NS So, does this changing authority of geographic information and its emphasis on
representation somehow change the authority of GIS specialists in geography?
MG I think it will eventually. I think there's always going to be room for the qualified professional. The difficulty I have is in persuading people that, in order to work with these technologies, they need to acquire a body of knowledge—that working with these technologies is not purely intuitive. If you contrast, for example, statistics, there's no way that someone without any knowledge of statistics would undertake a statistical test and would attempt to publish the results. No way. And yet people do that all the time with geographic information technologies. And that's very scary. There are abundant cases in point. There's a very common case in point involving the Greenwich Meridian. If one searches the blogosphere for commentary on the Greenwich Meridian in Google Earth, there are frequent comments that Google Earth misses the Greenwich Observatory. If you go to zero longitude in Google Earth, you end up 100 metres away from the Greenwich Observatory. And this is usually interpreted as a mistake. It's interpreted as a clumsiness on the part of Google. In fact, it's the truth. The zero of longitude, according to the current World Geodetic System, does not pass through the Greenwich Observatory.

NS That's a really good story to illustrate that representation is always subject to interpretation.

MG Yes.

NS Is it possible to professionalize GI science in the face of ubiquitous mapping?

MG Yes, I think in any field like this, there have to be experts. There have to be people who know more about the field than other people do. As I said earlier, I'm very interested in the question of what everybody needs to know because I think everybody needs to know something. But at the same time, I think there have to be experts who know more. Particularly, I think the expertise that is so rare or so valuable in this field is the expertise which combines deep knowledge of the technology with deep knowledge of the Earth's surface. It's impossible to function effectively in this field with only one of those two. You can have a fabulous understanding of the technology and yet if you know nothing about the Earth's surface—if you haven't travelled or if you haven't taken courses or read widely about the Earth's surface—you are lost, really, when it comes to real applications.

NS One of the concerns of critics of GIS has revolved around the eye of God afforded by mapping. There's been a sense that a map speaks with a perhaps undeserved authority and that people interpret it as a truth about the world. How does the migration of mapping to the masses on the web affect representation?

MG I think some of the story remains the same. So, the base imagery that's used by Google Earth or Google Maps or Microsoft Virtual Earth remains in that domain of the God's eye view, the authoritative view. But the mash-ups that are being created—and they're being created by thousands of individuals—are much more reflective of the second viewpoint, that it is up to the individual to create representations of the world as that individual perceives the world. And that's a very different viewpoint. For example, about a year ago a congressman noted that Google appeared to have replaced the imagery of New Orleans with pre-Katrina imagery, some two years after the hurricane. The suggestion was made that this was a cleaning up of New Orleans to look more attractive. Google and Microsoft are in that traditional position of being able to create a God's eye view. The rest of us are limited to our own ground view and our own personal view, which I think is really exciting.
NS  Yes, it is, actually. Volunteered geographic information [VGI] is a rapidly emerging phenomenon that you’ve identified and which has the potential to completely reinvent spatial data infrastructures. Could you describe how you developed the concept of VGI and what some of the infrastructural implications of this data are?

MG  Well, there are a number of terms that are popular around the Internet, such as ‘Web 2.0’ and ‘user-generated content’ and I was interested in identifying the key issues which they illustrated. And it seemed to me that the key issue that was really of greatest interest was the fact that so much information is volunteered. And it’s volunteered by people who have no authority, in many cases no training, but are somehow motivated to provide information for more general use. And for that reason I thought that to focus on the voluntary aspect was really critical. I think that there are other aspects as well. If you have a number of people volunteering the same information, then arguably the consensus that they produce is closer to the truth than any one of the individuals may be. But it was the voluntary aspect that really caught my attention, and the fact that it’s so sharply in contrast with the way we’ve proceeded over the past four centuries, in which we’ve relied on the authority of agencies and systems to provide our geographic information. We’ve set up structures, such as boards of geographic names to approve the names people assign to features. And we’ve changed the names of features when we found the existing names, the vernacular names to be unacceptable for some reason.

All of that, suddenly, has changed and I’ve argued that we are, in effect, back to the days of the 1500s when it was possible for someone—a cartographer—but with no qualifications whatever, and no authority, to produce a map which led, in effect, to the naming of America. That was one individual who put a name on a map and that map was distributed and the name became the name of America. And that, I think, is fascinating and we’re returning to that world in a way.

NS  So, could you tell us what citizen sensors are?

MG  There has been a lot of talk of sensor networks, which are perceived as sensors distributed in the environment, inert, but gathering information that is useful for various purposes. And so we put out sensors to register the weather and we put out sensors to register noise and to measure air quality. There’s an air quality sensor very close to my house. But I think a much more exciting area is when the human being actually becomes the sensor. Because human beings are remarkably intelligent and they know their local areas very well and they’re equipped with five senses. And as a result, what the human can tell you about a local environment can be much richer than what an inert sensor can tell you. It’s not necessarily as scientific, not necessarily as precise, but it may be very rich. And if we’re in, for example, the context of a major disaster, relying on people to tell us what is happening in a local area, I think information sensed by people has enormous potential. What it requires is the mechanisms that would make it possible for an individual to upload what is known through a mechanism such as a cell phone to some central site where that information is composited and integrated and then redistributed for use. And I think that has a very exciting potential as an early warning system for future disasters, or as an early source of information on a disaster’s impacts.

NS  So, citizens are potentially the source of our volunteered geographic information?

MG  Yes.

NS  Does a world of citizen sensors change the way we experience privacy?
I don’t know. I think there’s a lot of discussion right now about the privacy implications of Google Earth, Microsoft Virtual Earth, and other services. There have been examples where people have detected information from the imagery in those systems that appears to compromise confidentiality. Whether individual citizens will object to this, I think, is another matter. I’m very interested in the possibility of, for example, a system that would allow individuals to create records on the web of their own environmental behaviour. So, I could go to a website, perhaps, and enter information about my own commuting pattern and the fact that I cycle to work or the fact that I eat only organic foods, or what have you. This is something we already do to a degree. This is the world of Facebook, in some ways. That’s a very interesting possibility, I think, in terms of peer-to-peer interaction and peer pressure in society. It has implications for privacy. But if you volunteer the information yourself, how can you be said to be violating privacy if it’s information about you? It’s when it comes to information about somebody else that the privacy issue surfaces. And the ability of individuals to provide information about other people is, I think, a lot more problematic.

Yes, of course. Does volunteered geographic information then change fundamental social practices?

I think it may in areas like the role of information in communities. The concept of volunteered geographic information is essentially local. People can know their local areas better than people with access to many other sources. And so there’s, I think, tremendous potential here for changing practices in areas such as planning or community action, when we have the mechanisms to collect and synthesize enormous amounts of data contributed by the individual stakeholders in the community.

Will a hierarchy persist between conventional data sources and citizen sources? For example, will the Christmas Bird Count always be a less trusted data source than one trusted in a scientific study?

I think we have to look back over science and ask, ‘What exactly was it that made scientists authorities?’ Darwin was an amateur, who had no qualifications whatever in the modern sense. He had no PhD. We’ve invented this system of authority that is very recent in human history and is not necessarily very reliable. I think that the system is under some pressure at the moment, but I think the eventual solution will be a compromise. The old authorities such as the national mapping agencies will enlist volunteers within their own system. That’s already happening, for example, in the US Geological Survey, which has increasingly relied on volunteered information to update its maps. And it’s happening in Europe, in the Ordnance Survey in Great Britain, which is doing a very similar thing. So, I think the future is some kind of compromise like that. But you have to distinguish between kinds of information which require skill, such as the Christmas Bird Count, and kinds of information which everybody knows, such as the names of streets. Much geographic information is stuff that everybody knows. There’s no problem; you don’t need training to know the name of your street.

You had noted that national mapping agencies are downsizing efforts to map territory or to update existing digital and paper libraries. Is this linked to the proliferation of citizen-generated geographic information?

No, I’ve felt that this process started a long time before Web 2.0. This goes back more than twenty years now. But I think a very specific trend in the United States is particularly scary and that’s the fact that, while we’ve downsized the civilian mapping agencies, we have ramped up the defense mapping agencies, to the point now where the
best source of even domestic map information in the United States is the Defense Department. And that information is not readily available. It's not the right of every citizen to have access to that data as it is, for example, for the US Geological Survey data. And this, I think, is a very disturbing trend. I used to be able to go around the world and people would express jealousy of the United States because so many of our data were free. They still are, in principle, except for the data which have been developed behind the curtain of national security. And that is, I think, a very disturbing trend, as I say.

NS Many cities now have surveillance networks based on cameras. London is a good example. These have real implications for privacy as well as for security. How will initiatives like Google Earth's Street View affect ongoing debates about our individual right to privacy?

MG I think in most cases we are able to trade off the right to privacy against benefits in convenience or security. That’s clearly what people do in London: they must believe that the benefits of surveillance cameras in London outweigh the loss of privacy. I think if one really wants to be private, it’s remarkably easy to do so. In the UK, for example, it’s been amply demonstrated that by wearing a hoodie you can remain largely invisible in the surveillance camera network. If you are being tracked by GPS, it’s remarkably easy to hide yourself because I would estimate that for about 95% of our lives, we are invisible to GPS because we’re indoors or we’re under bridges or we’re in parking structures or in vehicles. It’s remarkably easy to be invisible if you want to be invisible.

NS Sensor networks gather geographic information about rising ocean levels, seismic activity, and human activities like traffic volumes. How will this change the distribution of information on the Internet?

MG I think a lot of that kind of information is becoming available and, of course, we have an enormously rich set of information sources now feeding real-time information. The idea of knowing where things are in real time is remarkably recent—if you go back far enough there were no real-time sources of geographic information of any kind. This web-based phenomenon has exploded very rapidly, so you can now see the location of every commercial aircraft flying a flight across North America, for example. You can see the location of every news story that’s developing around the world. You can see real-time weather data. And that, I think, is sure to continue to increase. We’re going to get more and more used to the notion that geography is something that changes constantly and that it’s possible to know how it’s changing. That’s very, very different from the world of even five years ago when almost all geographic information was information about the static things on the earth’s surface, the things that didn’t move, like the mountains and the rivers and the roads. But we now know the locations of large numbers of vehicles and we know the locations of aircraft and this is enabling us to do all kinds of things that we couldn’t do before.

NS In Vancouver, after World War II, a volunteer program to monitor precipitation was initiated. Though it is now defunct, the data gathered by individuals in their back gardens are still used today. Are we witnessing a return to the bottom-up volunteer population of data suppliers and how will bottom-up data-generation change the relationships between individuals and the state?

MG I think this is a very interesting question. The whole issue of information in 21st-century society is very dynamic at the moment. The old notion that it was governments’ responsibility to collect data, make them anonymous if necessary, and
distribute them is changing very rapidly. And it’s changing, in part, because people increasingly resent that approach. If you ask, ‘Why are people so willing to volunteer geographic information to websites that are in many cases run by companies when they’re increasingly resistant to the notion of filling in census forms?’ the answer is, I think, largely because of the anonymity of official records. When I create a record on one of these volunteered geographic information sites, my identity persists in most cases with the data. It’s clear that I contributed a particular record. So, I can feel some degree of responsibility and some degree of pride in that record. That’s absolutely impossible for the census. Give it to the government, and the government immediately obliterates any connection with me—in the interests of preserving my privacy, of course—and then does what it will with the data.

I think we’re coming to the notion that information in 21st-century society is everybody’s responsibility and it’s everybody’s responsibility to contribute it and also to use it and to share it. And that’s a very, very different world.

NS You note in a recent position paper on volunteered geographic information that Google Earth’s imagery for the University of California, Santa Barbara is misregistered by approximately 15 m. How will we identify uncertainty in a world of devolved geographic information? What effect will this have on geographic authority?

MG That’s a very important question and I’m giving a talk about that later this year. I think this issue of registration is critical. In many cases, 15 or 20 m doesn’t matter. I think it’s not so much a question of whether 20 m matters or not, the question is, what exactly are the applications where 20 m does matter? Because for any level of accuracy, there is at least one application for which that level of accuracy is not sufficient. And it doesn’t matter whether the misregistration is 20 m or 10 m or 2 m. There will be something you can’t do because of that. And the difficulty right now is that unless you personally investigate—and it’s a complex process to investigate—you have no way of knowing that the registration is 20 m off.

My own department, for example, publishes on its web page and on its t-shirts the location of the department in latitude and longitude, and the precision of that location is 30 cm. And yet, those data were obtained from Google Earth and Google Earth is misregistered by 15 m. So, we know that we are at least 15 m off. I think what will have to happen is that enough people become interested in this to either pressure Google to improve accuracy—and hopefully document it—or to develop a subculture of people who measure and publish this kind of information. The biggest difficulty is that this is something Google can change—but doesn’t always choose to. Over the course of the past year, the imagery of another part of Santa Barbara which was misregistered by 40 m has been reduced to around 10 m. What that’s meant is that the Earth has, in effect, shifted by 30 m. And everything that was registered to the old map is now misregistered on the new map.

I think Google itself has created something really interesting in this new facility in Google Maps to shift, to edit. You can, as a citizen, go to Google Maps and move things if you think they’re in the wrong location. Many, many people have done this for their own house. I did it for my own house, which was about 70 m off on Google Maps, and I shifted it to closer to its correct location. I think one of the things that people find it difficult to understand is that there is no such thing as perfect knowledge of location on the Earth’s surface—that in absolute terms we, for very good reasons, cannot get much better than about 3 m accuracy on the Earth’s surface simply because the frame of reference is not that well defined. So accuracy has to be an issue that surfaces as we get more and more into this.
NS Is there any difference between VGI and what Google Earth calls crowd sourcing?

MG Yes, I think so, because the notion of crowd sourcing is that the source of the information is a crowd. And that implies that you have some kind of consensus-producing process. By having many people estimate the same property, you will be more accurate than if a single person did it. Most of VGI on the other hand, is created by individual people and so there is no opportunity for convergence of that kind. So, that was one of the reasons for emphasizing the volunteered aspect of geographic information. Because I didn’t want to imply that crowd sourcing was necessarily an aspect of it.

NS There has been some excellent work in GI science over the past decade to develop ontology-based GIS. Will these efforts migrate to web-based mapping programs or are they too conceptually sophisticated to be adopted by general users?

MG I think that work is very important in making it possible for people to integrate data from different sources. And a prime example is the Inspire Project in Europe, which is having to confront the enormous problem of reconciling the differences in mapping practice between different countries. That, unfortunately, I think, is a permanent problem that will never go away because in reality, the Earth’s surface is heterogeneous and, as a result, when people in one limited part of the Earth need to create a system of some kind, they create one that’s unique to that region. As a result, when two regions compare their mapping practices, they don’t agree. I think that’s a problem that humans have always had. It’s a problem that’s been with us ever since the dawn of civilization and it won’t go away. And there is no magic bullet in information technology which will make it go away. I don’t think we necessarily need to address it by establishing a single uniform classification system of the whole Earth. It would, for example, do away with the Argentinean notion of a pampas, because it was not compatible with the Mongolian notion of a steppe. It seems to me that a lot of the richness of geography comes from the regional differences and to remove regional differences would be a mistake.

NS There has been nagging suspicion in some areas of geography that GIS is closely linked to military funding. Certainly, we know that much framework mapping was supported and controlled by the military in the past. How will citizen mapping change that perception and does an element of military control remain?

MG I think the military are increasingly relying on citizen sources, particularly the intelligence community. Much of what the intelligence community refers to as ‘geoint’ and ‘humint’ is, in fact, intelligence that is sourced from individual citizens without the citizen in any way knowing that they’re providing information to the intelligence community. So the line, in that sense, is blurring between the civilian and the military. I think Neil Smith was absolutely right when he criticized GIS for failing to admit its military roots and its military connections. I think we continue to do that. It’s comparatively unusual for people to bridge the gap between civilian-oriented GIS and military-oriented GIS, and I think we ought to do a better job of that.

As I said earlier, there is a real growing problem in the centralization of mapping authority in the United States in the military community. Mapping has always been a very valuable commodity for the military, and geography as a discipline has always flourished during wartime. That is, I believe, enormously unfortunate. I hope that one of the effects of volunteered geographic information will be to, if you like, civilize the military. This is happening quite dramatically in several parts of the world where mapping has remained in military hands. So, in India, for example, Google
is sponsoring individual citizen groups to create maps of fifteen Indian cities, directly running up against the tradition in India of mapping being a military activity, with a product that is, in effect, inaccessible to the citizen. And so we are seeing these technologies being used to create end-runs around military authority, which I think is a very positive step.

NS  Do earlier critiques of GIS that rattled geography in the 1990s have relevance to the emerging neogeographies? What will critics of GIS focus on in this reconfigured world of geographic information and analysis?

MG  I'm waiting to see with great excitement. As has happened several times since the early '90s, people who have taken a critical approach to GIS have remarked that the critical approach is even more needed now. I remember that being said about the transition from GIS to GI science and I'm sure it's going to be said about the transition from paleogeography to neogeography. I thought then that if there were people whose specialty was critique that I would far rather have them direct their energies at GIS than at anything else. And I think similarly about the current situation, that if there are people out there who are calling themselves neogeographers and who are excited about the potential of geographic information technologies, then building bridges to them is tremendously important. I think that's starting to happen.

   Ever since I developed this interest in volunteered geographic information, there's been an active discussion in the blogosphere about how ironic it is that the academic elite are finally discovering something that the neogeographers have been talking about for two or three years. That, to me, is all positive. This is, in effect, engaging an all-new cohort of people in what we've always found to be exciting. Inevitably, they're not going to know the literature that we know, but so what? They're sources of energy and creativity and that's what's important.
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