

Neogeography and volunteered geographic information: a conversation with Michael Goodchild and Andrew Turner

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Wilson/Graham: There are a few terms circulating describing the current proliferation of locational data and practices, including geoweb, maps 2.0, volunteered geographic information (VGI), and neogeography. How are we to understand the relationship between these terms, specifically volunteered geographic information and neogeography?

Goodchild: Neogeography implies a reinventing of geography, in which the traditional roles of expert producer of geographic information and amateur user have broken down, with the amateur becoming both a producer and user—or what some have termed a prosumer. Implicit is a definition of geography as a discipline devoted to the production of geographic information; most contemporary geographers would find this naive, since it places emphasis on the collection and compilation of mere facts, and may seem therefore more allied with the discipline of cartography than geography.

VGI also addresses the production of geographic information, emphasizing the voluntary nature of much contemporary activity, and distinguishing it therefore from its professional or authoritative equivalent, which has traditionally been the preserve of national mapping agencies and commercial map-makers. It thus focuses on the production of geographic information, rather than on the entire discipline of geography. It leaves open the question of whether other aspects of the discipline of geography, including the analysis and modeling of phenomena distributed over the surface of the Earth, can also be subject to a breaking down of the distinction between expert and amateur.

Both terms describe the results of a dramatic meltdown in the initial costs of entry into map-making, due to the widespread availability of GPS and other means of determining position, and access to advanced cartographic skills encapsulated in software.

Turner: Over the last two decades, increased access to the Internet has dramatically lowered the barriers to information access and publishing. From simple website publishing, online search, and more recently social media tools, anyone is able to instantaneously find, consume, and create information that is shared globally within seconds from a myriad of common, consumer interfaces.

In particular, it is now common for a person to be carrying a portable, geolocatable, rich media producing, Internet-connected, device. Users are able to flow into and out of their global network, publishing and consuming in situ as they experience and discover in the world. The tools and information are being weaved into their very livelihood, like a necessary article of clothing or wallet.

People use these tools to both find relevant, localized information that helps them enjoy their lives, as well as a way to share their own perspectives. What information an individual chooses to search, interact, and share is very contextual and is based on their individual values, their community and culture, their immediate needs, desires, immediate environment. The information users seek to interact with can be intimately personal, related

to business, or as a way to share their history with friends and family—on a vacation, during the week, or at any time and place.

It is this practice of individuals, communities, and networks to interact, utilize, and produce highly personalized, located information that is at the heart of neogeography. The ability for anyone, without requisite rigorous training or knowledge of spatial technology or characteristics, to indelibly mark and analyze their space in complex, but personally or colloquially meaningful ways.

There are many components of neogeography such as production, consumption, analysis, visualization, sharing. Terms such as volunteered geographic information primarily deal with the explicit process of gathering information from a range of expert and nonexpert sources. The geoweb and related terms refer to the technical mechanisms of relating and linking together spatial records, and publishing standards.

Neogeography is not at odds with any of the other terms such as GIS, VGI, PPGIS, geoweb—but is a more organic and individual-centered approach to people and communities in sharing and utilization of geographically relevant information.

In directly differentiating volunteered geographic information from neogeography—it is the difference between mere collection of data and input from individuals versus the personal interaction of individuals with spatial information in personal ways—VGI projects, like more traditional participatory GIS (PGIS), typically provide a mechanism for users to explicitly publish information into a larger repository—or for researchers to inspect and analyze collaborative projects. Neogeography, by contrast, considers foremost the individual's goals and tools for achieving and enhancing these goals through accessible interfaces.

Wilson/Graham: Your initial responses to our prompt motivates a series of questions. Is neogeography an overreaching term, assuming that geography is a discipline primarily devoted to the production of geographic information? Is the difference between neogeo and VGI really about the level of personalization of the data practices? What are the implications for the data produced as a result of this difference? What is the relationship between neogeo and VGI and traditional GIS? Are we to believe that neogeo is more collaborative or participatory than participatory GIS and VGI? Are neogeography and VGI two different perspectives on the same data practices? Or do they involve different data practices? What are the social, political, and economic implications of these developments? What is the responsibility of academic geography vis-à-vis neogeography and VGI? How will that responsibility or relationship change?

Goodchild: Andrew's response to the initial charge shifts what has often in the past been a primary emphasis on the production of geographic data to the much broader context of the interaction between geography and people—neogeography is less about who is an expert and who is an amateur in the production of geographic information, and more about the complex ways in which people interact with geography. In short, neogeography is a new way of *doing* small-g geography that stresses the personal and individual, rather than a challenge to the academic preserve of big-G Geography and its related disciplines. Neogeography results when people have the ability to make maps at scales that are far more detailed than in the past, to map phenomena that have never been mapped, and to use social networks as ways of mediating these activities.

From this perspective, neogeography mirrors some of the trends that have been evident in Geography in the past two decades. One dimension of the social critique of GIS that emerged in the late 1980s and early 1990s focused on its apparent insistence on a single, *God's eye* view of the world and inability to capture individual differences. A second, postmodern generation of GIS was imagined that would emphasize the representation of subjective, qualitative views of the world, an agenda that became part of the emerging public

participation GIS movement. If GIS had earlier been conceptualized on scientific principles of formalization, replication, and universally shared meaning, then this second generation represented a significant shift away from the notion that the contents of a GIS database were scientific observations that could be analyzed using GIS tools, just as statistical packages provide tools for the scientific analysis of other types of data.

Another, related trend in Geography has been towards what is often termed *place-based* analysis. The methodological debates of the 1950s and the Quantitative Revolution in Geography that followed placed great value on the *nomothetic*, insisting that the principles and theories that were the product of research should apply equally everywhere in space and time. Regional and descriptive geography were rejected as mere journalism because their results were *idiographic*, with no general significance. Yet clearly the environment and human responses to it vary over the surface of the Earth, a principle that has been enshrined in the literature of geographic information science as *spatial heterogeneity*. The techniques of place-based analysis that have appeared over the past two decades emphasize local variation, while at the same time insisting that general ideas still apply—only the details vary. Personalizing geography, and conceptualizing it as an activity of spatially defined social groups, seems to imply similar goals, while begging a discussion of scale and exactly what is meant by local.

I tried above to distinguish between big-G Geography, the academic discipline, and small-g geography, the broader activity. Professional Geographers would I think take exception to the notion that Geography is primarily devoted to the production of geographic *information*, thinking of themselves as contributing to geographic *knowledge* by synthesizing and interpreting data and information obtained from a wide range of sources. In that sense the geographic data and information acquired through VGI may certainly contribute to the production of geographic knowledge. But there is a strong belief that Geographers have advanced expertise in that production process, and impose a *discipline* of logic and deduction that justifies the use of the term to refer to Geography. In other words, while there is plenty of acceptance of the role of neogeography in producing useful and reliable data and information, the idea of a *neoGeography* producing geographic *knowledge* would cause plenty of anxiety.

Your question about the difference between neogeo and VGI being about the level of personalization of the data practices suggests neogeography as a subset of VGI with an emphasis on the personal, whereas I read Andrew Turner as arguing that neogeography extends beyond data production and is thus a superset. If personalization implies the possibility of individual, subjective perspectives and qualitative data then it raises issues about the measurement of quality. One of the strongest arguments for crowdsourcing lies in the belief that the truth of an assertion rises with the number of people able to review and edit it—often known as Linus's law. But personalization moves us in the opposite direction, if only one pair of eyes is available to review any asserted fact.

One of the strongest arguments for the practical use of GIS has been the replicability of any GIS analysis—that one person can easily check the results obtained by another, by performing the same sequence of operations. This has allowed decision makers to argue in court that their decisions are not 'arbitrary and capricious'. It will be interesting to see how crowdsourced or participatory results stand up against the same kind of examination. I suspect that, while the arguments Andrew Turner has presented for neogeography appeal strongly on a social level, they will play very differently in a courtroom.

With respect specifically to data practices I think neogeo and VGI are identical. But as a new paradigm for the interaction between people and geography I think neogeography provides a much broader perspective.

We have already seen some successes in taking these developments across the digital divide, into communities that are distinctly underresourced with respect to information technology.

Economically, I think we are learning that the open-source and neogeography paradigms enhance rather than detract from traditional activities. Politically, the emphasis on the local suggests a fundamental shift towards issues conceived and debated locally, and away from the homogenizing influences of national and even state-level debates.

Academic Geography (to preserve my big-G, small-g distinction) appears to be doing very well out of the increasing exposure of the general public to geographic technologies, at least in the US. The question of the value of VGI as input to scientific research by Geographers has several dimensions: Can VGI fill a role in the initial, exploratory phases of research when rigorous sampling and observation are less critical? Do the dense observer networks of VGI have an advantage when information is time critical? What kinds of assurances of quality can be devised, especially about data obtained in remote areas where the number of people with local knowledge is limited or nonexistent?

More broadly, neogeography and VGI have softened the edges of Geography and allowed it to expand its significance and reach. On the other hand, the widespread adoption of geographic tools such as GPS navigation are undoubtedly eroding people's basic geographic skills, including route learning.

Turner: Michael has a good point that the roles between a professional compared with amateur user of geographic tools have become less clear. However, a key difference is that the goals themselves remain distinct. Neogeography is not merely the production of information, but also includes map creation, personal analysis, interactive feedback, collaboration, and reading and understanding of geographic information. As such, neogeography is not really a reinvention, but the domain of new possibilities that are now approachable by anyone.

It is vital to understand what is the driving goal of individuals. What motivates them and what do they seek in their lives and activities. It is the application of geographic techniques to this psychology that represents the core aspect of neogeography.

A major question that underlies this conversation is: what is the perception of traditional geographers and professionals to these new communities of neogeographers? Clearly one aspect is the perception that these groups will provide local and dynamic information for use in geomatics and analysis. It considers users as human sensors and not as cognizant individuals that have desires, thoughts, and unique behavior. One person may be gathering all of their local restaurants in order to have a local map of their community, while another may want to annotate and discuss local municipal parks in order to have better access to open spaces, and a third may want to gain insight into their personal health through analyzing local climate and air quality conditions. These users each seek to achieve goals that are unique—while along the way they may generate data it is not their only, or likely even primary, objective.

On the opposite end, from the neogeographer's perspective they are likely not even considering traditional geography. They work within the tools they are comfortable and perceive capabilities to be limited by what these tools provide. They seek advice and input from domain experts—government officials, neighbors, business owners, environmentalists, and are probably not looking to discuss with more generalized GIS analysts on advanced techniques. They are seeking to present and address a problem and using maps, mobile devices, geolocation, and basic map analysis as capabilities to address this problem.

The more vital question we should be addressing is: how do we engage these multiple groups together? Each has their own goals but, as we like to point out, location is an important underlying aspect to almost any data; they are operating within the same spaces and data as one another. Currently with focus about to compartmentalize and define a group we are eschewing recognition that these are groups worth engaging with in active conversation. Discussion should occur about how to allow citizens to generate, create, analyze, and share

data in such a way that professional geographers can utilize this information and even provide their own quality data and insight back to citizens such that they can understand and use these tools themselves.

Another question is what is the effect and possibilities of neogeography interacting with traditional analysis? Scientific institutions are seeking to crowd-source gathering of local data to augment their land-use and climate data while also allowing anyone to access models and perform these analytic questions themselves. This raises concerns about appropriate access to complex models and possibly misleading results. By contrast, people feel disconnected from reports and results and merely told what the ‘experts’ say without any engagement with the local communities. There is the potential through open access to scientific models for a better understanding of stakeholders in their local regions and areas of interest to see impacts of behavior.

Wilson/Graham: We’d now like the conversation to move toward a discussion of actual applications and opportunities in VGI and neogeography, to discuss: what current applications of these practices are driving your understanding of neogeo/VGI?, and where do opportunities exist for interaction across these data environments? We are intrigued by Goodchild’s notion of ‘evidence’ in the courtroom and wonder if there are ways in which VGI and neogeographic data practices might enable different ways of knowing that would counter a critique of ‘arbitrariness’ or ‘capriciousness’.

Turner: Michael, I appreciate your initial reflection and it seems as though you have recently considered this concept of neogeography as a broad range of personalized activity rather than specifically focused on amateurs or data creation. I believe this is essential to understanding the differentiation in why neogeography is not at odds with traditional Geography and also not limited to volunteered data.

As you point out, neogeography is an outcome of long trends in geography thought and research—but also combined with a dramatic increase in the exposure and approachability of tools and technologies that are altering the capability at an amazing pace. Neogeography as a research interest could incorporate geography, psychology, anthropology, and any other number of disciplines as is pertinent to a person or community.

I’m particularly curious about the concern professional Geographers would have with neogeography producing geographic knowledge. From my perspective this is a vital difference in the citizen as sensor versus the citizen as cognizant, operating element of a complex system. Individuals are uniquely suited to provide both input into larger systems through observations and narratives, as well as synthesize local, regional, and cross-thematic information into spatially relevant knowledge. This local knowledge is possible both through the time spent at a location across a lifetime and generations, as well as the direct focus and consideration of the impact of the development of knowledge and wisdom to that individual.

Neogeography as research and development focus should be considering just this type of capability. How can we best enable input as well as potentially analytic capabilities to communities and individuals such that they can utilize their information and knowledge?

The specific question of how neogeography is considered in a courtroom or other rigorous scrutiny is definitely an interesting topic. This has recently been a very poignant question as the role of citizen reporting is used in crisis and conflict. Mobile reporting projects enable anyone to contribute information in realtime on acts of violence. It is recognized that this information, while useful for reporting, as well as possibly response, has an unclear use in tribunals or evidence in cases.

I would argue that neogeography has just as vital, although different, place in courts in providing potentially objective, broad perspective, and repeated coverage of events. As the role of citizen engagement in election monitoring and reporting increases, these questions

of local participation are becoming increasingly vital to understand how to appropriately incorporate. However, the use of these techniques is comparatively new.

What is particularly interesting is that the reporting is done through a digital device that can provide authenticity of location, time, media capture such as video, audio, or image, and even some user authentication through restricted access and verification of an individual. In essence there are global networks of verifiable sensing devices in the hands of people that can capture potentially relevant data that could serve in court. In addition, while efforts are made to restrict access to personally identifying information, at some level this data is fully traceable to identify a witness that would provide testimony.

I'm just as interested in the conflicted concerns on the use of neogeography in scientific research and analysis. Modelers seek input and validation from local and regional sources on changed landscapes and climates. They also seek to have their research considered relevant and impacting. However, I've heard numerous concerns about the potential of sharing the models with nonscientific experts. These concerns seem to hinge on the potential for users to reach misleading conclusions through inappropriate use of the models. Yet without access to any ability to understand their personally relevant impact, they are relegated to large-scale model outputs or simplistic, broad-reaching statements on the impact of activities on local environments.

Michael, what are your thoughts on how we can better provide scientific inquiry and experience through tools such as neogeography? Can general users engage in active discussion and research with researchers through contextualization of scientific models and generate their own results for consideration?

Goodchild: Thanks very much Andrew. I'd like to explore two points in particular, both related to the nature of expertise and the relationship between neogeography and the professional geographer.

I've often asked myself the question: Are there limits to the kinds of geographic information that citizens can volunteer? The answer is clearly yes in the case of property boundaries and geodesy, where instrumentation is complex, accuracy requirements are stringent, and professional qualifications are required. I don't see any future in a 'neosurveying'. In other cases, however, I think the answer is much more complex. Mapping of soils, land cover, or vegetation type has traditionally required professional expertise, and these maps are expected to provide reliable representations of complex phenomena that are useful for a wide range of purposes. For example, the uses of soil maps range from farming to global climate modeling. Moreover, expertise is needed both in creating such maps and in interpreting them in specific use cases. An amateur farmer, for example, is unlikely to be able to translate the description of a soil into a decision about what crops to plant, without some form of advice.

From the perspective of neogeography, however, it is entirely reasonable to think that a personalized map might be made just for the specific use case of the amateur farmer. It might be created and shared among the community of amateur farmers in a given area, and might be based not on scientific analysis of soils so much as on accumulated experience in the community. This was never possible before because of the high cost of mapping, and the necessity to create maps for multiple purposes in order to justify the cost. So in asking whether there are limits to the types of geographic information that can be created by neogeographers, I think we need to think outside the box of the traditional types.

The second point builds on your discussion of scientific knowledge, and how such knowledge can be shared beyond the professional scientific community. Scientists will often express concerns about the potential for misuse and misinterpretation, and often within the context of uncertainty. This is rather similar to an opinion poll, which might announce that the support for some candidate is "48% with a margin of error of 3%". I think the general

public is quite familiar with such statements, and understands that the truth (the support in the population as a whole, rather than in the polled sample) might be as high as 51% or as low as 45%, and that the difference between two such polls might well be due to chance. I don't see any problem in presenting similar margins of error on predictions of future average annual temperatures, or sea levels.

I think the problem is more subtle. On the one hand, I suspect that the scientific community is often reluctant to share estimates of uncertainty, if indeed they have them. It's unfortunately true that the result of enormous investment in earth-system science over the past two decades has been in many cases to widen uncertainties, rather than to narrow them. We know a lot more now about how the planet operates, but we are not necessarily any further ahead in narrowing the options for the future. The differences in the predictions of the many global climate models are a case in point. We may say that the majority of such models predict an increase in average annual rainfall in a certain location in some future year, for example, but we know that taking a majority vote among models is not good science. Moreover, presenting uncertainties is far more difficult in geographic information than in the statistical results of an opinion poll, and remains a hard research problem. I'd love to be able to create a Google Earth mashup showing the predicted future coastline of Santa Barbara in 2100, but I'd be dishonest if I presented it as a single line of uniform width. Perhaps I could get the uncertainty message across by widening and narrowing the line, but this is a very simple case and even then I'm not sure the average viewer would understand the message.

So where does this leave us? I think two steps are needed. One is to accustom people to ways of presenting uncertainty in web-based maps, starting perhaps with some simple examples like future coastlines. Perhaps the Open Geospatial Consortium (OGC) could take a lead in developing specifications for uncertainty in standards such as Keyhole Markup Language (KML). The second is to encourage the scientific community to put more effort into estimating uncertainty. That sounds simple, but modeling uncertainty in geographic information is far from straightforward, as the extensive research over the past couple of decades has demonstrated.

Wilson/Graham: We would like to push you both a bit further, to ask questions that each of your responses opens up for us. What role might a 'cognizant' citizenry, capable of contributing data within a complex system, play in the scientific modeling of uncertainty? What precedents can we point to in the use of local knowledges, like neogeography, within the scientific/professional community? Is the binary between local and professional knowledges becoming problematic?

Goodchild: It's tempting to think that the community might become a source of uncertainty, that uncertainty might somehow be reflected in the variation among citizen views. This is an interesting speculation on the crowdsourcing theme, as it assumes that the result of crowdsourcing is in some cases not consensus on a single answer, but consensus on variability. But there's little basis for assuming that variation among citizens can capture scientific uncertainty—that citizens somehow can sense or sample measurement error or prediction variance. A more valid role might be in providing a testbed for communication of uncertainty. As I said in my previous comments, the communication of spatial uncertainty is a hard problem, and experiments with human subjects have generally failed to find reliable methods, especially when covariances are present, as they almost always are with spatial data.

One doesn't have to go too far back in history to find ample precedents in eras when all scientists were amateurs, and when local observation provided much of the basis for science, especially in environmental science. The process by which science was professionalized, and the amateur marginalized, is very interesting. Why should we trust the professional,

and doubt the amateur? Some types of measurement do indeed require lengthy training, but technology has in many cases provided reliable, easy-to-use systems like GPS that are every bit as reliable and accurate as the most difficult-to-use precursors. The essential element is trust, of course, and the surrogates that we as a society use to establish or infer trust. How might a contemporary approach to trust, say through the tracking of the accuracy of contributed facts, have been applied to a Charles Darwin, and substituted for the trust that was attributed to him, perhaps because of his social class? Are there instances of trusted observers from other classes?

Yes, I think the binary between local and professional knowledges is becoming problematic. We need to study the systems that have been used in some VGI projects to measure trust, rather than relying on simple surrogates like professional qualifications or membership in organizations.

Turner: In thinking about what the limits of amateur data collection or surveying are, I think the measure of ‘complex’ is very temporal. A hundred years ago it was very complex to determine your position, and a thousand years ago nearly impossible for the layperson to determine an absolute position for an area they were not familiar with. Today, I can easily perform very complex operations through the enabling of technology. It seems relatively safe to assume this trend will continue and all tasks become comparatively simple—and what were more complex tasks now possible. The key is what is observable by an amateur using available resources and knowledge. Open access to remote imagery, precise geolocation, and relative navigation make surveying possible at improved accuracy and I believe this will continue.

Amateur farming has a similar very long history and trajectory—where gentlemen and similar aristocracy dabbled in agriculture for education and pleasure. The difference is that now it is much easier to connect with neighbors, professional agriculturists, and data to inform me and postulate crops and farming activities without requiring advanced training. There are movements to revitalize urban agriculture and first-generation farming that utilize geographic data and sensors to perform exactly this type of activity. So I agree that neogeography creates the personalized and contextual map for farmers to plan crops but can extend even further with inexpensive and ubiquitous sensor and mobile technology to enable amateur farmers to gather high-resolution geographic information.

That said, it is this gradient, from the personalized interaction with techniques of neogeography to providing high-resolution data and analysis for something like land-use planning, that we are seeking to understand the implications. What perhaps confuses this issue is an increasing persistence of what is traditionally known as ‘Renaissance Man’, or polymath. We no longer form singular expertise and professional roles but are multidomain and multifaceted in our knowledge, techniques, and technology. A professional lawyer may also garden, practice photography, run a local community website, and teach his kids science activities. It is through particular perspectives, or lenses, that we may use terminology and methodology, but we’re integrating the information of varied domains to achieve our goals.

The increased degree of ‘social knowledge’ that is being freely shared used in mapping can be incredibly informative when combined with scientific knowledge and data. This colloquial data is exactly the nature of the emerging trend where people are willingly and emphatically publishing their thoughts, desires, experiences, and culture. Crowdsourcing is not merely about gathering the data of amateur volunteers, but connecting together the information and capabilities of domain and regional experts, hobbyists, and merely interested citizens.

For next actions—I agree that there is a need for better capability in visualizing uncertainty as well as methodologies to incorporate the varying levels of uncertainty in data between professional measurements and analysis, crowdsourced data and volunteered neogeography input. The general question of fitness and quality is beyond a simple ‘degree of precision’

or a calculated percentage. The quality of professional measurements is just as suspect to interrogation as amateur—where fitness will be determined through external, organizational, and personal measurements of trust, connectedness, and reliability.

I do not think we need a definition of a specification, but a discussion on techniques for better selecting and finding data based on necessary qualifications. These could be through trust levels of official organizations, or they could be length of time living in a region, life-experiences, and explicitly demonstrated capability as a member of a community. We also have the ability to measure implicit quality through usage of data and analysis that will further improve our ability to appropriately incorporate neogeography products with professional standards.

Overall, in moving forward, there is a need to provide better tools to the general public for capturing and utilizing geographic data in many, and unforeseeable ways—while integrating them with professional tools to enable collaboration. The tools, techniques, and terminology, need to be more flexible in incorporating these new ideas and demands easily and seamlessly. Through growth of these communities and analysis of their usage it will be possible to understand principles, quality, trust, and accuracy. The result is not just publishing results or uncertainty, but engaging in conversations—where scientists, agriculturists, government, citizens, businesses can all share their perspectives, use the shared knowledge of the communities, and circulate their own data and results.