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LETTER FROM THE GUEST EDITOR

Dear Map Enthusiasts,

First, I would like to welcome all newcomers to *Cartographic Perspectives* (*CP*), thank you for joining us for this special digital issue, and we invite you to learn more about the North American Cartographic Information Society (NACIS) at nacis.org. Second, I'd like to welcome old friends to this new presentation of *CP*. We hope that you will participate in our discussion after exploring the following pages in this new format... and please, don't be shy, we'd like to hear your thoughts.

Since 1989, when the first issue of *CP* was published, the journal has played an integral role in supporting the society's mission. However, in addition to rising production costs, a traditional printed academic journal offers limited distribution to only our members, subscribers, and library patrons. Last spring, we began discussing the possibilities of *CP* as an open source journal. After much talk and wonderment about how the NACIS community would feel about drastically altering the format of the journal, first to digital production, then the possibility of making it open source, we decided to test it, to see what a different format of *CP* might look like. Support for these ideas was reflected in the recent readership survey's results (published in *CP* 63) — the clearest takeaway being that now is a great time for change.

This is a beginning, a starting point. Our colleagues were invited to participate in this special digital issue of *CP* and we were pleasantly surprised by their enthusiasm and support of this issue, and what they were willing to share. Not only have they given all of the NACIS membership a great gift—but in the true spirit of mapgiving, these gifts will be given to the world, freely available via the Web.

A project to give things away, in the hopes of supporting our field, and offering it for free to the entire world? What a great mapgiving project. A few months later, here we are.

The following pages contain excellent contributions in a spiffy new layout. As you work your way through the content you will notice a common theme of openness, sharing—ultimately of building. This can only serve to strengthen our field and educate potential clients, organizations, and the general public about the power of representing spatial data through great maps. David DiBiase offers his recent work in the Open Educational Resources Movement and reasons to support it.

You will find several contributors who have followed through with providing Open Education Resources, Rob E. Roth and Kevin S. Ross offer a tutorial, complete with datasets and code—an entire code library, with a challenge to you to add to it. Mark Harrower and co-authors offer Cartography 2.0, a FREE online textbook for teaching interactive maps. Nathaniel Vaughn Kelso and Tom Patterson describe Natural Earth Vector a free set of data which makes any cartographer's jaw drop, because of the thought, detail and time that they are giving...yes, *GIVING away*. Charlie Frye offers his experience and challenges all of us to be thinking about how to help others understand the importance of the role of a cartographer. Finally, Bill Buckingham and Samuel Dennis describe work that they are doing where the role of the cartographer is as a guide to allow a non-map expert, in their case community members to make their own maps, where the cartographic decisions have been made by the cartographer. We hope you will be able to put the content of this issue to use in your classroom, your lab or your production shop.

There were many challenges associated with pulling off this special digital issue, most critically: *time*. From the moment of “cold calling” contributors, to presenting it to you here at the, 2009 NACIS business meeting in Sacramento, we had four months. This left us with a list of things we would have like to include in future digital issues. For instance, interactive word clouds—which we have used in the place of abstracts, more interactive maps, generally taking advantage of the digital format further. However, in another sense, the compressed time frame turns out to be an amazing benefit—in a world where our field is changing so drastically, so quickly—a fast turnaround is critical. Other benefits to a digital issue include: interactive content, color within the article at no additional cost, flexibility to update or easily try new things, exposure for NACIS that goes beyond our membership, no printing costs—which are projected to exceed the revenue generated through the collection of our society's membership dues.

This issue would not have been possible without the help of many people. First, I'd like to extend a big thank you to each of the contributors, who have donated their time to share this information with us. A special thank you to NACIS, Fritz Kessler, Editor of *CP*, in particular for his guidance and support in completing this experiment. Lastly, I would like to express my appreciation, to the University of Wisconsin—Madison Geography Department for supporting me in this process.

I cannot encourage you strongly enough, to discuss the possibilities of sharing *CP* openly, digitally. Share with us, how this format can enhance the presentation of your work, what additional features would you like to see, what would you change, in addition to any concerns you have. We encourage you to collaborate with us, your colleagues, and map enthusiasts—novice or expert—in putting better maps into the world.

As always the most critical factor in the success of a journal are quality submissions. Please assemble your thoughts and work into words to share it with us in *CP*.

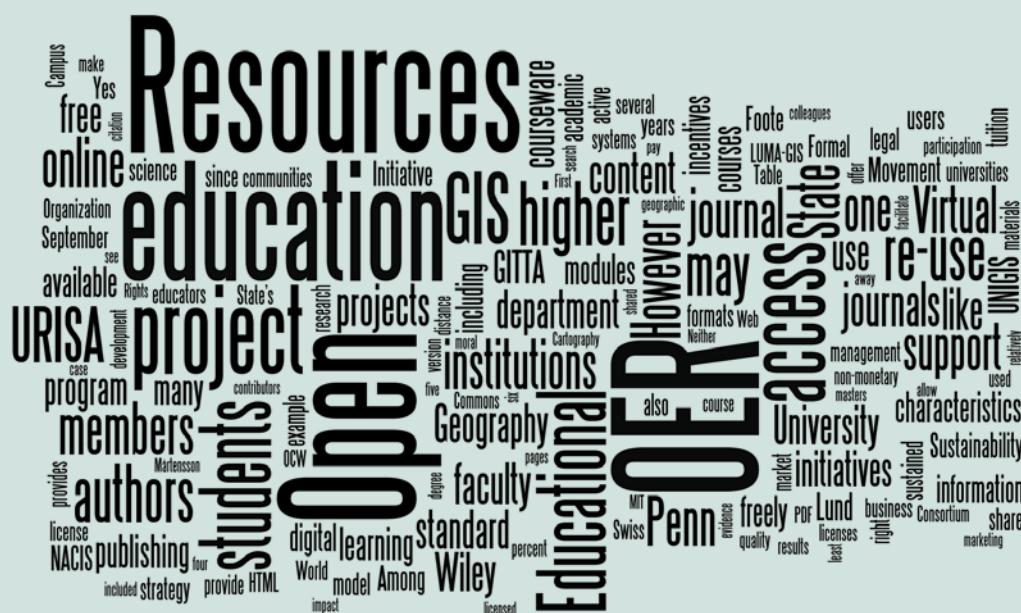
Thank you for reading,

Tanya Buckingham

Freeing CP: GIS&T and NACIS in the Open Educational Resources Movement

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ABSTRACT

This article positions higher education in geographic information science and technology (GIS&T), including cartography, in relation to the Open Educational Resources (OER) movement. After defining OER and the movement it denotes I compare several initiatives designed to promote free sharing of GIS&T-related educational resources and, in one special case, free provision of graduate education. Finally I consider a justification for conceiving *Cartographic Perspectives* as an open educational resource, and for freeing it from its current exclusive distribution to NACIS members, subscribers and their patrons.

INTRODUCTION

Of the various definitions of OER the Organization for Economic Cooperation and Development's (OECD 2007, p. 30) may be the most widely-cited:

“open educational resources are digitised materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research.”

Under this definition OER includes:

“Learning content: Full courses, courseware, content modules, learning objects, collections and journals” and

“Tools: Software to supported the development and use, reuse and delivery of learning content, including searching and organization of content, content and learning management systems, content development tools, and online learning communities”

Readers who have shared their educational resources informally for years—via unrestricted Web sites, for instance—may wonder, “how is ‘OER’ different than what I already do?” Formal OER projects are distinctive in at least four respects (Table 1). First, truly open resources are not only freely available for use, they are also licensed for legal re-use by teachers, learners and anyone else, ideally using standard rather than idiosyncratic license agreements. Second, formal OER projects make it easier to re-use resources by providing them in a variety of standard formats that can be imported into learning management systems or content management systems (i.e., IMS Content Packages and SCORM archives). Third, like open source software projects, formal OER initiatives are associated with active developer and user communities. And fourth, successful OER projects provide incentives for resource providers to maintain and expand high-quality content. Granted, few OER projects embody all these characteristics. However, projects that incorporate even some offer clear advantages over isolated personal initiatives.

1. Standard licenses allow legal use and re-use
2. Standard digital formats that facilitate re-use
3. Active communities of authors and users
4. Incentives for sustained participation

Table 1: Characteristics of formal OER Projects

THE OER MOVEMENT

I use the word “movement” here in its sense of a group of people who share a common ideology and who try together to achieve certain general goals (WordNet 2009). It seems to me that the common ideology shared by OER proponents are the beliefs that education ennobles humankind, and that education is at its best when learners are encouraged to construct knowledge actively, often by “remixing” elements of knowledge and expression produced by predecessors (Jenkins 2006, Lessig 2008). More than ideology, these shared beliefs may constitute the “moral ideal” that is one of the defining characteristics of the education profession (Davis 2002).

“The founders of the OER movement were inspired by the success of certain open source software projects in synergizing the efforts of many volunteer developers.”

The founders of the OER movement were inspired by the success of certain open source software projects in synergizing the efforts of many volunteer developers. (Raymond’s 2001 book *The Cathedral and the Bazaar* presents the classic case of the Linux operating system.) You can find many of the thought leaders at an annual Open Education Conference, which in its sixth year (2009) attracted over 200 on-site participants and many more on-line followers (see <http://openedconference.org/>). Among the most influential founders is David Wiley of Brigham Young University. While still a PhD student at Utah State University in 1998, Wiley coined the term “open content” and created an early license agreement that promoted content sharing while preserving authors’ copyright (Wiley 2006, Smith 2009).

Wiley provides evidence of the scope and momentum of the OER movement in a recent report to the Organization for Economic Cooperation and Development, in which he estimates that more than 2,500 open access courses are available from over 200 universities (Wiley 2007). Nearly all of these have appeared within the past ten years, and the proliferation of open courseware appears to continue unabated. Many of these institutions’ OER offerings can be searched and accessed through the OpenCourseWare Consortium (<http://www.ocwconsortium.org>) and the Open Educational Resources Commons (<http://www.oercommons.org/>), among others.

The OER movement is making an impact in the publishing industry as well. For example, in September 2009 the Directory of Open Access Journals (<http://www.doaj.org>) listed 4,355 open access scholarly journals (perhaps five percent of all scholarly journals), including 1,651 that are searchable at the article level. Meanwhile the same price pressures that plague academic journal subscribers (especially research libraries) confront students and families who purchase assigned textbooks. While a commercial market for low-cost digital textbooks may have been “two years away for the last ten years” (Lyman, cited in Oda and Sansilo 2009), one firm reports a ten-fold increase in the number of colleges that have adopted the free and low-cost open-source textbooks in only the past year (Flat World Knowledge 2009). And as of July 1, 2010, the 2008 U.S Higher Education Authorization Act requires higher education institutions to include textbook price information in course catalogs used by college students to plan their semester schedules.

SUSTAINABILITY OF OER INITIATIVES

The OER movement captured the attention of educators everywhere in 2001 when the Massachusetts Institute of Technology with much fanfare announced its OpenCourseWare Initiative (Vest 2006). With substantial philanthropic support and industry partnerships, MIT set out to make educational resources used in all its classes freely available worldwide under the recently-developed Creative Commons license. By September 2009, MIT’s OpenCourseWare initiative (<http://ocw.mit.edu>) listed 1,900 “courses.” Links to courseware are organized by academic department. Among many other resources the Department of Urban Studies and Planning lists a “Workshop on Geographic Information Systems” conducted

in Fall 2005. Courseware associated with the workshop includes lecture notes, laboratory assignments, and a final exam. (The two-hour exam is somewhat remarkable in that students are provided with datasets and are expected to answer questions by interrogating the assigned data using GIS software.)

Visitors to the MIT Open CourseWare site may also find resources by keyword search. On September 11, 2009 my search on “gis” yielded 333 results, sorted by relevance. The first 10 results included six HTML pages of lecture notes and reading lists (some with links to further resources) and four PDF files consisting of exported presentation slides, assignments, or discussion notes. An “advanced search” option allows one to restrict results to particular resource types, such as course home pages, videos or video lectures, lab assignments, exams, animations and simulations. An advanced search on “cartography” yielded 31 results (including one reference to “genomic cartography”).

Considering how plain many of them appear to be, it’s easy to underestimate the impact of MIT’s open educational resources.. Earlier this year I had the chance to ask Chuck Vest, who was MIT’s president when the OCW initiative was conceived and announced, how he responds to the many skeptical observers who have dismissed the initiative as “hype.” Rather than resort to Web site traffic counts or other statistics, Vest described how OCW resources had been used by the Bahá’í Institute for Higher Education to create an “underground university” that counteracts the Iranian government’s denial of higher education opportunities to Iranian Bahá’ís. How many of us produce educational resources that have such an impact?

As Wiley (2007) points out, however, the MIT example is unique, and because of its high cost and reliance on philanthropic support, probably unsustainable. In 2007 the OCW initiative employed 29 people and had an average annual budget of \$4.3M. While acknowledging MIT’s success in attracting foundation support and vendor partnerships, Wiley concludes that there is “very little chance that any other institution will be able to replicate the MIT model” (p. 8).

Other higher education institutions have launched OER initiatives, but none so far has embodied a sustainability plan of the sort that Wiley characterizes as “OCW 2.0” (Wiley 2009). His own alma mater, Utah State University, offers open courseware associated with 80 different courses (<http://ocw.usu.edu/>). Utah State’s relatively modest OCW project employed just a full-time director and some student assistants and cost only about \$0.125M per year to operate through June 30, 2009. Then, however, the director was laid off due to budget constraints after support from the Hewlett Foundation and state legislature was exhausted. Wiley called the dismissal “heartbreaking” (Parry 2009).

Rice University has shown that it is possible to grow a substantial OER initiative with minimal centralized University support. In September 2009 Rice’s Connexions project (<http://cnx.org/>) listed “14,838 reusable modules” in “796 collections.” Like OER Commons, Connexions is a “referatory”

“...OCW resources had been used by the Bahá’í Institute for Higher Education to create an “underground university” that counteracts the Iranian government’s denial of higher education opportunities...”

that provides links to resources served locally by contributing institutions. Authors contribute resources voluntarily from institutions around the world with little or no backing. Wiley (2007) points out Rice's success at sustaining its decentralized OER initiative reflects the presence of an influential champion. For the same reasons Wiley's own departure from Utah State may have undermined the sustainability of that project.

In the following section I review a cross-section of major OER initiatives related specifically to GIS&T with reference to the four characteristics outlined in Table 1 above.

GIS&T IN OER

THE GEOGRAPHER'S CRAFT AND VIRTUAL GEOGRAPHY DEPARTMENT PROJECTS

Ken Foote was among the first to organize a Web-based collection of open resources for GIS education beginning with the Geographer's Craft project in 1992 (Foote 2007; <http://www.colorado.edu/geography/gcraft/contents.html>). This was a year-long course that used an active-learning, problem-solving approach to introduce geographic research techniques, all built around hypermedia, web-based course materials. By 1996, with funding from two NSF grants, Foote and his students created one of the first comprehensive, on-line bodies of educational resources in geography, including fourteen units on key topics in GIScience. Foote found that within months of units going online, file downloads from outside the university far exceeded those made by his students at the University of Texas. The files were being used across all Internet domains (.edu, .com, .mil) and from Internet addresses worldwide. The resources continue to be widely used, and those written by Peter Dana on map projections, coordinate systems, GPS, and geodetic datums are cited widely in digital and paper reference materials and still top lists of Internet search results on those topics.

The widespread use of the Geographer's Craft resources suggested that a similar sharing of materials might be possible if other faculty were willing to contribute. From 1996 through 1999 his National Science Foundation-funded "Virtual Geography Department" attracted over 100 contributors whose interests and expertise spanned the discipline. Foote's stated objective—"to develop a Web-based clearinghouse for high quality curricular materials and laboratory modules that can be used by students and faculty all over the world" (1999, p. 113)—typified later OER projects. However, his broader goal was to exploit the Web to promote and sustain "intradisciplinary collaboration" (p. 108). To this end project emphasized workshops in which educators worked together to learn Web publishing skills and pedagogical strategies for using Web-based resources in higher education.

His 1999 article "Building Disciplinary Collaborations on the World Wide Web" compares several kindred projects—including the Virtual Geography Department—in regard to project goals and the strengths and weaknesses of strategies adopted to achieve them. Project sustainability was a key

concern, as was the oft-cited lack of incentives for sustained voluntary faculty contributions. As Foote seemed to expect, several of the high-profile initiatives he compared were soon abandoned (e.g., the Core Curriculum in GIScience, successor to the NCGIA's Core Curriculum in GIS project) or stopped short of fulfilling their potential as OER clearinghouses (e.g., the Alexandria Digital Library).

The Virtual Geography Department itself still exists (see <http://www.colorado.edu/geography/virtdept/contents.html>), but its contents are dated. For example, as of August 31, 2009, only five of the 34 courses linked from the Virtual Department's "Geographic Information Science" resource page offer open and up-to-date syllabi and laboratory exercises, and most of those provide required exercise data only to registered on-campus students. Rights to re-use resources vary. One syllabus even states that "use of these materials by other instructors in their courses is expressly forbidden without my written permission." Most resources are provided as HTML documents, word processing or Portable Document Format (PDF) documents.

1. Standard licenses allow legal use and re-use?	No - mixed
2. Standard digital formats that facilitate re-use?	Mostly HTML, word processing and PDF documents with some standardized metadata descriptions
3. Active communities of authors and users?	Not sustained
4. Incentives for sustained participation?	No

Table 2: OER Characteristics of the Virtual Geography Department

Project reviewer Michael Solem (2000) concluded that the Virtual Geography Department succeeded in "diffusing innovative practice in geography by training faculty members in Web pedagogy and online curriculum development" (p. 353), despite the fact that "some participants failed to follow through with new online materials after the conclusion of the workshops..." (p. 363).

Anderson (2009) describes several types of business models that include provision of "free" goods. Of these, the Virtual Geography Department typifies a "non-monetary market." The primary incentive for voluntary contributions in a non-monetary market is the enhanced reputation that accrues to authors and/or institutions from the widespread distribution and use of their works. As Foote himself observed, however, that incentive is inadequate for most academic geographers since such contributions are rarely included among the criteria by which university faculty members are awarded promotion and tenure. Foote (2009) also notes that:

...for most faculty, sharing teaching materials—putting them out in public—is a foreign and uncomfortable experience. Though they do this with their research writings, they are far more hesitant to do the same with their teaching materials.

For these and other reasons, sustainability has proven as elusive for the Virtual Geography Department as for most of the other projects that Foote compared in 1999. One exception is the UNIGIS project.

"The primary incentive for voluntary contributions in a non-monetary market is the enhanced reputation that accrues to authors and/or institutions from the widespread distribution and use of their works."

UNIGIS INTERNATIONAL NETWORK

The UNIGIS network was the project about which Foote was most optimistic in 1999. Founded in 1990 and expanded by educators in the U.K., Austria and the Netherlands, UNIGIS began as a print-based correspondence course, then migrated to Web-based distance learning in the late 1990s. Ten years later, despite many organizational and technological changes, UNIGIS International continues to thrive (<http://www.unigis.org>). Ten universities in Europe, Africa, South and North America operate nodes. UNIGIS students register in and earn postbaccalaureate certificates, diplomas, and masters degrees from one of the participating universities, but may earn credits for modules offered by several different institutions. Partners share curricula and educational resources, including revisions and translations. They also share marketing and administrative costs (Molendijk and Sholten, 2005). Foote observed that “formal collaborations that have permanent staff and means of funding, such as the UNIGIS project, may offer a more viable, long-term model for developing collaborations” (Foote 1999, p. 114).

However, UNIGIS is not an OER project. Educational resources created and shared by Consortium members are not open to others except fee-paying students. Indeed, the essence of the relationship between members is an exclusive license agreement that governs access to educational resources copyrighted by the Consortium. Therefore the original question Foote posed in 1999 remains unanswered: Is it possible to create a sustainable OER project for GIS?

PENN STATE ‘WORLD CAMPUS’

In North America, UNIGIS nodes compete for students with several universities that offer distance education in GIS&T, including Penn State University. Penn State’s online GIS Certificate and Masters degree programs attract about 1500 enrollments annually from about 400 students who register through the University’s online “World Campus” (<http://worldcampus.psu.edu>). Key to Penn State’s success is a University policy that rewards entrepreneurialism by returning a large share of tuition revenue to academic units who create and sustain online programs. In fiscal year 2008-09, for instance, the share of tuition revenue returned to the Penn State program was \$2.2M USD, much of which supported salaries of the fifteen full-time-equivalent instructors and support staff.

As of September 2009, fourteen of the program’s 26 online courses are at least partly available as open educational resources. The open “courseware modules” consist mainly of HTML pages and associated graphics that are served through a content management system (Drupal). This is paired with a password-protected learning management system (ANGEL) in which select materials and communications are shared only with registered students who pay tuition and earn academic credit. The courseware is contributed voluntarily by faculty members and is licensed for non-commercial re-use through a standard Creative Commons share-alike version 3.0 license. Users are invited to submit comments and requests to faculty authors through Penn State’s College of Earth and Mineral Sciences’ Open Educational Resources initiative (<http://open.ems.psu.edu>).

The costs of maintaining these open resources (which are also used in classes by fee-paying students) are charged to the programs' operating budget, along with faculty salaries and related expenses. Since 2008 the Penn State program's marketing strategy has included open access to select courseware. The rationale for is based on the expectation that in an increasingly competitive higher education marketplace, adult learners will choose to register with an institution whose educational resources are open access and of superior quality. Feedback from one student suggests how the strategy works:

The ability to access course information ... was critical in my decision to choose Penn State over other distance education providers. Distance education was new to me and I had some concerns regarding quality and value. When I discovered the wealth of well-presented information provided for GEOG 482 and other courses in Penn State's GIS program, I immediately felt an increased level of comfort with the quality of education I would be receiving (Foster, personal communication, 27 July 2009).

The Penn State program exemplifies the type of business model Anderson (2009) calls "Freemium." In this "most common" strategy, online businesses give away a free good to many users but earn revenue from a relative few who are willing to pay for additional features. As Anderson (2009, p. 185) observes,

... a college education is more than lectures and readings. Tuition buys direct proximity to ask questions, share ideas, and solicit feedback from academics ... for universities, free content is marketing.

Time will tell if Penn State's OER strategy is sustainable. From Foote's (1999) perspective a weakness may be that the approach is motivated by primarily by competitiveness, not cooperation.

1. Standard licenses allow legal use and re-use?	Yes
2. Standard digital formats that facilitate re-use?	No - Mostly HTML word processing and PDF documents
3. Active communities of authors and users?	Yes
4. Incentives for sustained participation?	Yes

Table 3: OER Characteristics of the Penn State World Campus program

In regard to the distinguishing characteristics of formal OER initiatives outlined above, the Penn State approach to open education embodies three of the four characteristics: (1) it's resources are licensed for legal re-use; it provides access to a community of authors as well as a collection of resources; and it provides incentives for contributors (whose salaries depend wholly or partly on the quality of their workproducts and the success of the marketing strategy). The Penn State initiative falls short in regard to technical interoperability, however, since it fails to provide resources in standardized exchange formats like IMS and SCORM (see below). From technical perspective the most ambitious collection of open educational resources in GIS&T may be the GITTA project (<http://www.gitta.info>).

GITTA PROJECT

GITTA (Geographic Information Technology Training Alliance) is a joint project of ten groups at seven Swiss universities and federal institutes of technology that created six multi-lingual online modules to supplement classroom-based GIS&T education. Established in 2001 with support from the Swiss federal government, the GITTA project was one of 50 contributors to the Swiss Virtual Campus (<http://virtualcampus.ch>) which promotes online and blended learning in Swiss higher education institutions. By September 2009 the Swiss Virtual Campus listed 82 courseware projects and promised 30 more to come.

The six GITTA modules today consist of over 40 lessons (23 English, twelve German and five French) plus eight case studies (six German and two French). Lessons included six to thirteen HTML pages of text and graphics (including some Flash and SVG) plus quizzes and questions, bibliographies, glossaries and metadata. The modules are freely available to anyone who subscribes to the project newsletter, and are licensed for use and re-use through a Creative Commons Attribution-Noncommercial-Share Alike 2.5 Generic license. In addition to HTML pages and printer-friendly PDF files, the modules are provided as standards-compliant IMS Content Packages and SCORM (Shareable Content Object Reference Model) archives that can be imported to commercial and open-source learning management systems such as Blackboard and Moodle.

1. Standard licenses allow legal use and re-use?	Yes
2. Standard digital formats that facilitate re-use?	Yes
3. Active communities of authors and users?	Yes
4. Incentives for sustained participation?	Maybe

Table 4: OER Characteristics of the GITTA project

In sum, the GITTA project embodies at least three of the four distinguishing characteristics of formal OER initiatives: its resources are freely available and licensed for legal re-use; it provides access to a community of authors; and it facilitates re-use by providing resources in standard interoperable formats. Strengths include the sophisticated technical and pedagogical frameworks within which its modules were designed. A formal sustainability plan is in place (Weibel et al 2009), though it's unclear that the non-monetary incentives to courseware authors will succeed in sustaining their participation. To support continuing development of lessons and modules after its five-year grant, the GITTA project formed an association of dues-paying members in 2006 (Grossman, Weibel and Fisler 2008). Since dues are modest, and since benefits to dues-paying members appear to be not much greater those enjoyed by users who access the its resources for free, GITTA's business model more resembles a "non-monetary market" like the Virtual Geography Department than a "freemium" strategy like Penn State's. Ken Foote would approve of the fact that one of the Swiss Virtual Campus' stated objectives is to "strengthen collaboration among

universities” (Swiss Virtual Campus 2009). It remains to be seen if the project will prove to be more sustainable over the long term than the Virtual Geography Department, which was founded with similar goals. In the short term, a €25,000 MedidaPrix prize awarded to the project in 2008 is sure to help.

LUMA-GIS

Perhaps the most formidable sustainability challenge in GIS&T higher education is the online masters degree program offered by the University of Lund in Sweden. The Lund University Master’s in Geographical Information Systems (LUMA-GIS) is free—students admitted to the program pay zero tuition. Not surprisingly, the Lund program is popular—as of September 2009, 766 students had been admitted, with 1,789 more enrolling in individual courses. The 2,555 total active students participate online from 91 countries (Mårtensson 2009).

Lund began developing online courses in 1999. Development accelerated in 2001 when it and nine partner institutions gained support from the European Commission’s Leonardo da Vinci programme for vocational education and training. (Onstein and Mårtensson 2004). In 2004 Lund established a complete eleven-course online master’s degree, which includes a final thesis project defended in person. Students are welcome study at their own pace, part-time or full-time. Although student demographics vary widely, the typical Lund online student is single, male, over 30 years of age, works full-time, and studies from home. (Mårtensson, Pilesjö and Galland 2007). Five years after the masters program was established, only five students defended theses and earned degrees. Mårtensson (2009) speculates that this low completion rate is due to the program’s “relatively low priority” in adult students’ busy lives.

Given the willingness of students to pay substantial tuition and fees for online masters degrees at other institutions, why does Lund give away its degree and its faculty members’ time and expertise? One explanation is that higher education is tuition-free (or nearly so) in many European countries—including Sweden—where taxpayer support for public higher education is significantly greater than in the U.S. However, this explanation fails to account for the number of students that the Lund program serves. Mårtensson (2009) reports that the financial support the Lund program receives from the Swedish national government is really only sufficient to support the staff and facilities needed to supervise about 50 graduate students. He and his colleagues accept many more because they’re committed to “capacity building of GIS in developing countries.” Besides meeting this need, the primary incentive for faculty is to “place Lund University on the map.” For these reasons the LUMA-GIS program exemplifies the “non-monetary market” business model.

The LUMA-GIS program is not an OER project. Its courseware is available only to registered students through a password-protected course management system. The program is pertinent to this discussion, however, insofar as it is motivated by the same “moral ideal” that guides OER advocates and projects. Also relevant is the sustainability that LUMA-GIS has demonstrated to date.

“Although student demographics vary widely, the typical Lund online student is single, male, over 30 years of age, works full-time, and studies from home.”

DISCUSSION

Like LUMA-GIS and the Virtual Geography Department, the GITTA project embodies a “non-monetary market” business model. Unlike LUMA-GIS, GITTA is an OER project. To succeed where the Virtual Geography Department and most of its contemporaries could not in sustaining an active developer community, the GITTA project needs to deliver added value to its dues-paying member organizations and to deploy dues income in ways that incentivize participation by authors. In the U.S., where public support is inadequate to offer free university education, entrepreneurial institutions may create mechanisms for deploying tuition revenue in ways that provide incentives to authors. Where this happens, as at Penn State, the “Freemium” business model may be a viable means for sustaining OER initiatives. Ironically, OER may prove to be more sustainable where taxpayer support for higher education is least (i.e., the U.S.), since competition for tuition-paying students in such places provides a justification for OER as a marketing strategy. The justification follows from the expectation that in an increasingly competitive higher education market, rational adult students will choose providers whose courseware is open for inspection and is of the highest quality. But regardless of an institution’s level of taxpayer support or competitive position, how can it hurt to share educational resources with others who can’t afford to pay or who don’t need a degree?

GIS&T JOURNALS IN OER

OPEN ACCESS PUBLISHING

The need for open educational resources in GIS&T education may be most acute in the arena of scholarly publishing. Obviously teachers and learners in higher education—particularly in graduate education—need ready access to original source materials like academic journals. As subscription costs increase, however, research libraries are forced to be more and more selective about the titles they provide their patrons. Following the concentration of ownership of journal titles by a relatively few for-profit publishers (including Elsevier, Candoover and Cinvenn, Thompson and Wiley)(Munroe 2007), the cost of journal subscriptions has increased far beyond the rate of inflation in recent years. For example, Edlin and Rubinfeld (2004, p. 120) observe that “prices of library subscriptions periodicals in law, medicine, and physical science rose by 205 percent, 479 percent, and 615 percent between 1984 and 2001, a period when the overall price increases as reflected by the Consumer Price Index was 70 percent.” Overall, prices of for-profit journals are now as much as 500 percent higher than non-profit journals.

A 2008 survey of 45 academic libraries (an international sample of two-year and four-year colleges, research universities and small hospitals) concludes that “journal publishers have been able to continuously increase prices because they control peer review and this control or peer review has not been challenged by academics themselves” (Primary Research Group 2008, p. 28). About a quarter of survey respondents believe that open access publishing is slowing increases in journal prices, while nearly half of others believe it will eventually have some effect.

“Journal publishers have been able to continuously increase prices because they control peer review and this control or peer review has not been challenged by academics themselves”

OPEN ACCESS PUBLISHING IN GIS&T

The Directory of Open Access Journals lists three journals whose keywords include “gis,” twelve journals concerned with “cartography,” and 44 with “geography.” However, only two open access journals are included among the 46 leading geographic information science (GIScience) journals identified by Caron *et al* (2008)—the *URISA Journal* and *Mappemonde*. (The open *Journal of Spatial Information Science* wasn’t announced until 2009.) Caron and colleagues’ study addressed the absence of a comparative analysis of research publications in the relatively young and ill-defined GIScience field. They combined a Delphi study of “40 international experts” and a quantitative comparison of journal citation rates (specifically, JCR impact factors) to identify and rank leading periodicals. The *URISA Journal* provides an instructive example.

In 1998-99 Harlan Onsrud offered to serve as editor on the condition that the URISA Board of Directors agreed to publish open-access version the journal. Onsrud was concerned about escalating costs of academic journal subscriptions, and about scholars’ responsibility to “maximize dissemination of our works and our readership” (Onsrud 2009). At the time, URISA President Joseph Ferreira stated that “while commercial publishers best make progress through exclusivity and control, the URISA Journal editors believe that science and new knowledge is best advanced through an intellectual environment of openness and freedom” (URISA 1999) Ferreira’s position thus presages his MIT faculty colleagues’ recommendation 2001. As of September 2009 there are 192 articles in 39 issues of the *URISA Journal* freely available for use and re-use at http://www.urisa.org/journal_archives, making this one of the richest open educational resources collections in the GIS&T field. A shortcoming is that URISA’s license limits re-use of digital articles to URISA members.

1. Standard licenses allow legal use and re-use?	Non-standard; re-use rights limited to URISA members
2. Standard digital formats that facilitate re-use?	N/A - PDF files
3. Active communities of authors and users?	Yes
4. Incentives for sustained participation?	Yes

Table 5: OER Characteristics of the URISA Journal

Besides the obvious benefits to educators and students, what benefits accrue to URISA as an organization, and to authors who contribute research articles? Certainly the journal’s reputation has not suffered. The URISA Journal is ranked 14th in relative importance among 46 GIScience periodicals in Caron and colleagues’ 2008 analysis. (*MappeMonde* is 42nd; *Cartographic Perspectives* is 37th.) Neither has open access hurt the organization financially. According to URISA Executive Director Wendy Nelson, both membership in the organization and library subscriptions have been stable since 2000 (Nelson 2009). And current editor Jochen Albrecht (2009) confirms that submission rates haven’t been affected either. Authors who contribute manuscripts to the *URISA Journal* apparently

see neither advantage nor disadvantage in open access publishing (Albrecht 2009). This impression is consistent, in a sense, with the equivocal findings of bibliometricians who have attempted to document such advantages.

“[A] ‘selection bias’ suggests that authors who tend to be more frequently cited also tend to make their articles freely available.”

DO AUTHORS BENEFIT FROM OPEN ACCESS PUBLISHING?

It’s reasonable to assume that authors would prefer to publish in open access journals if they knew that their work would be more widely read and cited.

Craig *et al* (2007, p. 4) observe that several “early studies have shown correlation between free online availability ... and higher citation counts.” Antleman (2004), Subler (2004) and Eysenbach (2006) are among those who provide evidence that open access publishing “provably increases the visibility and impact” of authors’ work (Subler 2004, p. 8).

However, while acknowledging the association between citation rates and open access, critics like Craig and colleagues warn against inferring causality since confounding factors are usually not taken into account in such studies. For example, a “selection bias” suggests that authors who tend to be more frequently cited also tend to make their articles freely available (Moed 2006). Furthermore, it’s well known that the generality of apparent citation effects is limited due to the culturally specific nature of scholarly publishing and citation behaviors across disciplines.

It’s hard to say, therefore, if publishing in open access journals is beneficial for individual authors. At the same time, however, there is no evidence that open access publishing has been detrimental to one of the first GIS&T professional associations that attempted it (URISA). So, NACIS members should ask, why (or why not) “open” *Cartographic Perspectives*?

JUSTIFYING OER INITIATIVES IN GIS&T

Financial considerations aside, why should professional associations like URISA and NACIS make their publications freely available? Why should higher education institutions and their faculty members give away their educational resources? One reason is the conviction that sharing such resources freely is the “right” thing to do. One participant in the 2009 Open Education conference reported that participants discussed OER as a “moral imperative” (Camplese 2009). Can OER be justified on ethical grounds? For a moral imperative to exist, one or both of two conditions must exist: either (a) people have a right to free educational resources, or (b) educators are duty-bound to provide them. In fact, neither is the case.

In regard to rights, Article 26 of the United Nations’ Universal Declaration on Human Rights (<http://www.un.org/en/documents/udhr/>) does state that “Everyone has the right to education” and that “education shall be free, at least in the elementary and fundamental stages.” However, the Declaration goes on to state that “higher education shall be equally accessible to all on the basis of merit.” In other words, the Declaration recognizes the right of higher education institutions to be selective. If institutions have a right to choose which students gain access to its human resources (faculty), then it follows that institutions also have the right to restrict access to educational resources. OER is therefore not a right that higher education institutions are bound to honor.

What about our duties as educators and editors? At a minimum, these are codified in institutional statements of professional ethics like Penn State's (1996). This policy states that faculty members' primary responsibilities are to "seek and to state the truth as they see it" and to preserve, protect and defend academic freedom. In regards to professors' obligations to society, the policy does state that they are obliged to "promote conditions of free inquiry..." This could be taken to mean that faculty members are duty-bound to publish only in open access journals and to share all educational resources freely under Creative Commons licenses. Unfortunately, that interpretation is contradicted by common practice. No faculty member at Penn State or elsewhere would pass up an opportunity to be published in *Science*, for example, on the grounds that it is a breach of professional ethics to publish in a proprietary, limited-access journal.

Therefore, in fact or in practice, educators in higher education institutions are bound neither by rights nor by duties to participate in OER initiatives.

SUSTAINING OER INITIATIVES IN GIS&T

The foregoing is not to suggest that "opening" educational resources is a bad idea. Like other proponents I believe that sharing resources freely comes close to what philosopher of professions Michael Davis (2002) calls the "moral ideal" of the education profession. My point is that if OER is not justifiable solely on ethical grounds, the case must be made that it can be a sound business strategy. Unfortunately there is as yet no evidence available to support that claim. Although OER has a relatively long history in GIS&T, the *URISA Journal* may be the field's only sustained formal OER project. And those closest to that project have no evidence of advantages or disadvantages accruing to contributors, users or the organization. Recent developments are encouraging, however. In Europe and other places where taxpayer support for higher education keeps tuition low, non-monetary markets like the GITTA project may prove sustainable if contributors perceive sufficient value in enhanced reputation, increased collaboration and the satisfaction of participating in a "gift culture." Where tuitions are high, as in the U.S., entrepreneurial institutions may succeed creating what Wiley (2009) calls "OCW 2.0"—a "new generation of OpenCourseWare projects ... built around sustainability plans."


[Such] second generation projects [could be] integrated with distance education offerings, where the public can use and reuse course materials for free (just like first generation OCWs) with the added option of paying to take the courses online for credit (Wiley 2009).

It's also possible that the international UNIGIS distance learning network could recognize the potential of an OER "freemium" to expand markets and goodwill. Foote's optimism about UNIGIS may still be justified.

"if OER is not justifiable solely on ethical grounds, the case must be made that it can be a sound business strategy."

CONCLUSION: WHY GIVE AWAY CP?

The more appropriate question may be, why not? Like URISA, NACIS could offer a freely-available digital version of Cartographic Perspectives in addition to its regular print version. Like URISA, NACIS should expect neither to lose nor gain subscribers, members or contributing authors as a result of adding an open digital version. And if it were to publicize its open version more assertively and measure results systematically, NACIS might even realize benefits that URISA has not.

Access to *CP* is currently an exclusive benefit for NACIS members and subscribers. This is akin to restricting access to National Public Radio to dues-paying members and underwriters. Denying access to NPR to those who don't contribute during pledge drives does not make it a stronger or more valuable service. Similarly, "freeing" *CP* from its current exclusive distribution to NACIS members, subscribers and their patrons just makes sense. 

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Extending the Google Maps API for Event Animation Mashups

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INTRODUCTION

There is an unfortunate preconception among trained cartographers that mashups—Google-based or otherwise—represent a bastardization of the discipline, with the overcrowded push-pin map becoming the straw man (or straw map) of every Cartography lecture and conference presentation. However, mashups are becoming ubiquitous and today are perhaps the most recognizable map form on the Internet. The cartographic community needs to get serious about mashups, rather than dismiss them as the flavor of the week. We should be the guiding voice, rather than the skeptical outsiders. To be fair, many trained cartographers are doing wonderful things with mashups, but even they need to be more active in extending the API and releasing their source code (for an example of good open source practice published in this journal, see Peterson, 2008). If we do not do this, all of the sound cartographic knowledge generated during the past century will be shredded by a cloud of pushpins.

When asked to participate in this special issue illustrating the benefits of the new open-access, web-delivered, all-digital format of *Cartographic Perspectives*, we felt that a techniques piece approaching this issue was a natural fit. In the following section, we provide a brief overview of mashups broadly and Google Maps mashups particularly. In the third section, we introduce event animation—our focus in this paper—and describe some of the best mashups supporting this technique. In the fourth section, we introduce and describe our contribution: a code library extending the Google Maps API to include event animation. A tutorial containing step-by-step instructions for using the code library is included as an appendix following the main article. We conclude the main body of the paper by offering a few positive words for the new *CP* format and the many possibilities made available through it.

GOOGLE MAPS MASHUPS

A *mashup* is an application, typically served on the web, that integrates elements from multiple sources to form a new service (Shneiderman and Plaisant, 2010). The term mashup originated in the music industry, where there is a longstanding tradition of sampling, remixing, and mashing song tracks. The *Grey Album* in particular (a mashup of the Beatle's *White Album* and Jay-Z's *Black Album*)—and the legal battle that ensued over its distribution—is cited as being particularly influential in placing the term mashup into popular consciousness (McConchie, 2008).

Mashups embody the Web 2.0 philosophy, making use of the Internet as a platform atop which disparate data sources and services can be stitched together in various ways according to user needs (or, equally as common, user whims) (O'Reilly, 2007). Although mashups do not need to be map-based, it is no wonder why map mashups are one of the most common variant of web mashups. Countless novice and expert mapmakers have experienced the 'a-ha' moment when mapping a dataset atop a basemap of familiar features or when charting multiple datasets in relation to one another. Often times, the map mashup is simply the extension of this practice to digital mapmaking. However, a map mashup can be so much more when the mapped geospatial information is combined with sophisticated, geographically-enabled web services. The map component of a mashup helps the user to submit the proper parameters to the web service by providing spatial context and to interpret the results of the web service by displaying the results spatially.

At the time of writing this piece, the two Google mapping platforms, Google Maps and Google Earth, dominate the map mashup world (Zang et al., 2008); our focus in this paper is on the former. While Google Earth enables a wider range of interactions with a three-dimensional digital globe, it is not natively browser-based, making it difficult to integrate web services (however, a new browser plug-in was recently released, so it will be interesting to see where this leads). A demonstration of the potential of Google Earth mashups for high-end cartography and visualization is provided by Wood and colleagues (2007).

A map mashup can be so much more when the mapped geospatial information is combined with sophisticated, geographically-enabled web services

The Google Maps mapping service was released formally in February of 2005. Soon after the release, numerous websites were established that hacked the service to display their own geospatial information atop the Google Maps tiles. In response to these hacks (and likely sensing opportunity), Google released the Google Maps Application Programming Interface (API) to facilitate development of Google Maps mashups (<http://code.google.com/apis/maps/>) (McConchie, 2008). An *API* is a set of code libraries made available by the developers of an application to allow others access to the services provided in the application (Boulos, 2005). Google provides an API in two different programming languages: JavaScript and ActionScript. The other major mapping services since have followed suit with the release of an API, including MapQuest, Microsoft Bing Maps (formerly Microsoft Virtual Earth), OpenLayers/OpenScales, OpenStreetMap, and Yahoo! Maps.

The Google Maps API is free as long as the mashup remains publicly available and nonproprietary.

The Google Maps API is free as long as the mashup remains publically available and nonproprietary, in many ways answering the calls for a democratization of Cartography (Rød et al., 2001, Wood, 2003) and resolving the GIS and Society debate (Miller, 2006). Google Maps mashups can be run directly in the browser and do not require the user to download a plug-in when using the JavaScript API. The Google Maps API easily draws KML files, a format that is quickly becoming the PDF of spatial information (Harrower, 2009). There also are a wide array of resources for learning and using the Google Maps API, from the online code documentation (<http://code.google.com/apis/maps/documentation/>) to a large set of technical manuals (e.g., Gibson and Erle, 2006, Brown, 2006). There are now even online tools that assist the generation of mashups, such as GeoCommons Maker! (<http://maker.geocommons.com/>), effectively side-stepping the primary barrier to making mashups: requisite programming skills (Harrower et al., 2008).

EVENT ANIMATION & EVENT ANIMATION MASHUPS

Not all kinds of change are created equally, which means not all kinds of animation (a dynamic representation of change over time) are created equally. Andrienko and colleagues (2003) identify three basic kinds of temporal changes: existential changes (appearance and disappearance), changes of spatial properties (e.g., movement, expansion/contraction, shape change), and changes of thematic properties (i.e., changes in attribute value). *Event animation*, or more broadly event visualization, describes the first kind of temporal change, as an *event* is defined as some type of occurrence that exists only at one specific moment in time (e.g., it appears in one time slice and then disappears for the remainder of the animation) (Chung et al., 2005). An event often has spatial and attribute information associated with it, but these values do not change over time in the majority of event animations. Events are commonly represented as points (e.g., a disease incident, a violent crime, an earthquake); this makes event visualization particularly appropriate for the marker-heavy Google Maps platform.

There are a handful of existing, well-designed mashups that support event animation. A review of these applications is important for understanding what functionality should be included in an event animation code library. Our review includes Trulia Hindsight, AsthMap, SpatialKey, and our own DC Crime Visualization. Interestingly, only our DC Crime Visualization uses the Google Maps API, something that goes against the prevalence of the Google platforms revealed in a study completed by Zang et al. (2008).

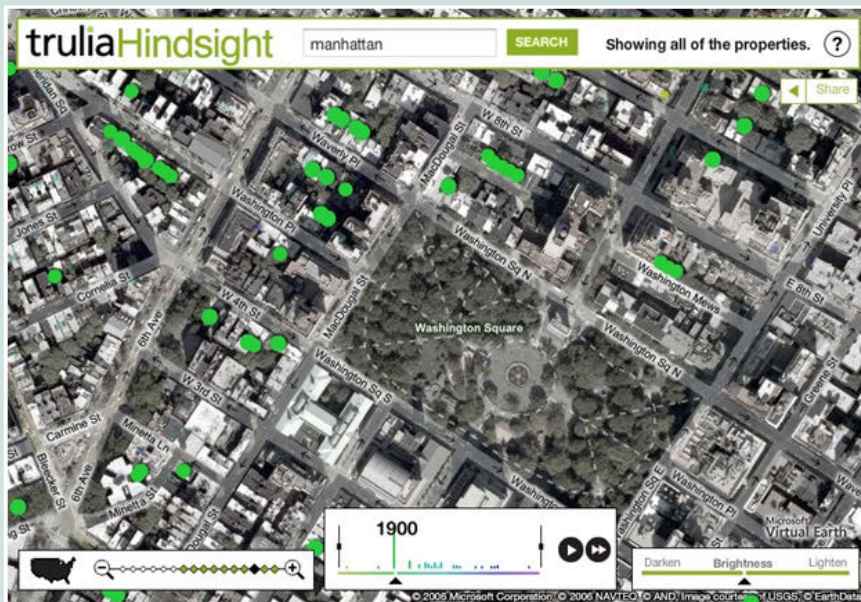


Figure 1: Hindsight (Trulia) - <http://hindsight.trulia.com>

Trulia Hindsight: The Hindsight tool (<http://hindsight.trulia.com/>) developed by Trulia (best known for their real estate search engine) is a mashup that animates housing construction by year, providing prospective buyers a quick overview of the historical development of a neighborhood. Trulia Hindsight uses the Microsoft Virtual Earth platform; only the remotely sensed imagery basemap is made available. Events (construction of a new home) are represented by circles colored according to year built; these circles are not interactive. Basic VCR controls are provided to control the animation as well as a nice temporal legend that doubles as a histogram showing the event frequency for each year. This temporal legend is also interactive, allowing users to jump to a specific year using the slider control and to filter the animation to include only a subset of the years in the animation.

AsthMap: The AsthMap application (demo version with synthetic data available at <http://indiemaps.com/asthMap/>) developed by the University of Wisconsin-Madison Cartography Laboratory is a mashup for mapping and analyzing asthma exacerbations in space and time (Johnson et al., 2007). The tool was designed for use on an individual level (by doctors and patients) to improve treatment and on an aggregate level (by public health officials) to monitor environmental risk factors. Design of AsthMap was inspired by the Trulia Hindsight tool, although several important improvements were added. Like Trulia Hindsight, the Microsoft Virtual Earth platform

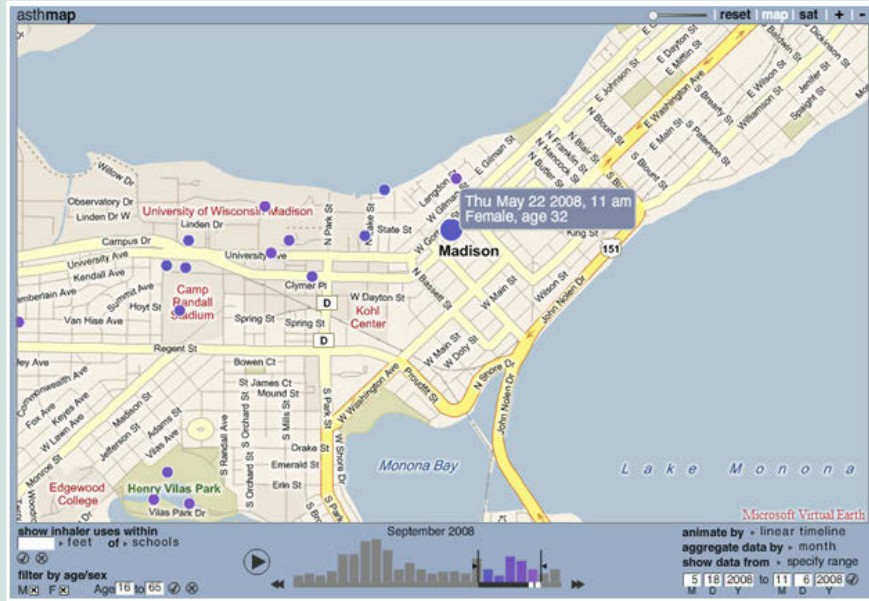


Figure 2: AshMap (UW-Madison Cartography Laboratory) <http://indiemaps.com/ashMap/>

was used, although users are provided the option of using an image or map background. Also like Trulia Hindsight, events (usages of GPS-enabled inhalers) are represented as circles colored according to the date. However, these circles are now interactive, allowing for users to retrieve attribute information about each event. Finally, AshMap also includes similar VCR controls and an interactive histogram. However, much more powerful filtering (by space, time, sex, and age) and re-expression controls (either linear or composite animation binned by year, month, week, or day) are provided to improve interactive exploration.

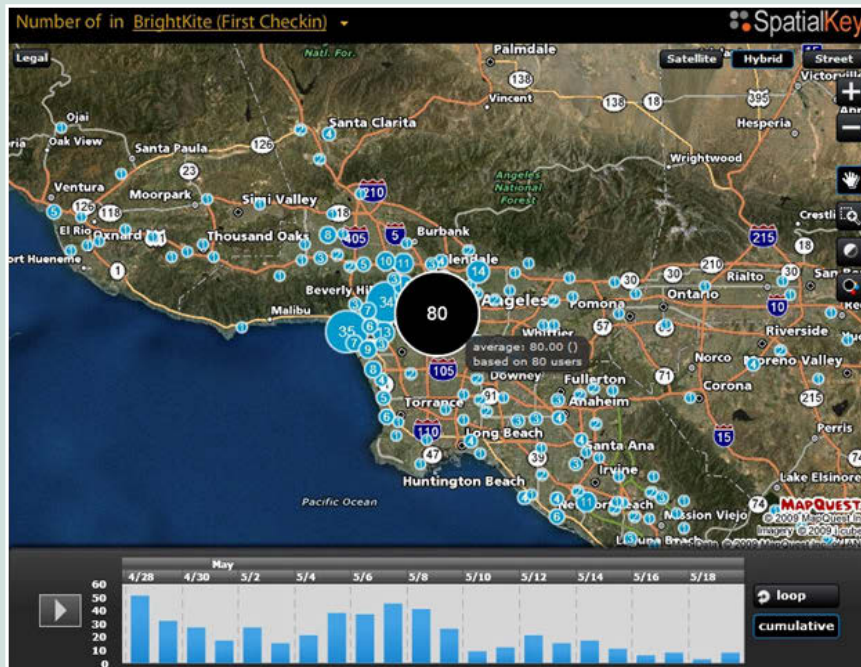


Figure 3: SpatialKey (Universal Mind) - (<http://www.spatialkey.com>)

SpatialKey: SpatialKey (<http://www.spatialkey.com>), developed by Universal Mind, is a collection of mashup templates that provides a suite of visualization techniques for spatiotemporal information, event animation being only one of them (Johnson, 2008). SpatialKey uses the MapQuest platform and provides users with three basemap choices. There are two significant improvements included in the SpatialKey mashup that are not available in Trulia Hindsight or AsthMap. First, the SpatialKey tool allows users to upload their own data, effectively helping them make their own mashups. Once the data is loaded, users are provided with VCR controls and an interactive temporal legend similar to those found in Trulia Hindsight. Second, SpatialKey includes three representation techniques for aggregating individual events by proximity when the display becomes cluttered, a common concern with event visualizations. Aggregation techniques include a graduated circle view (shown in Figure 3), a heat map view (i.e., a kernel density estimation), and a heat grid view (similar to the chorodot map proposed by MacEachren and DiBiase, 1991).

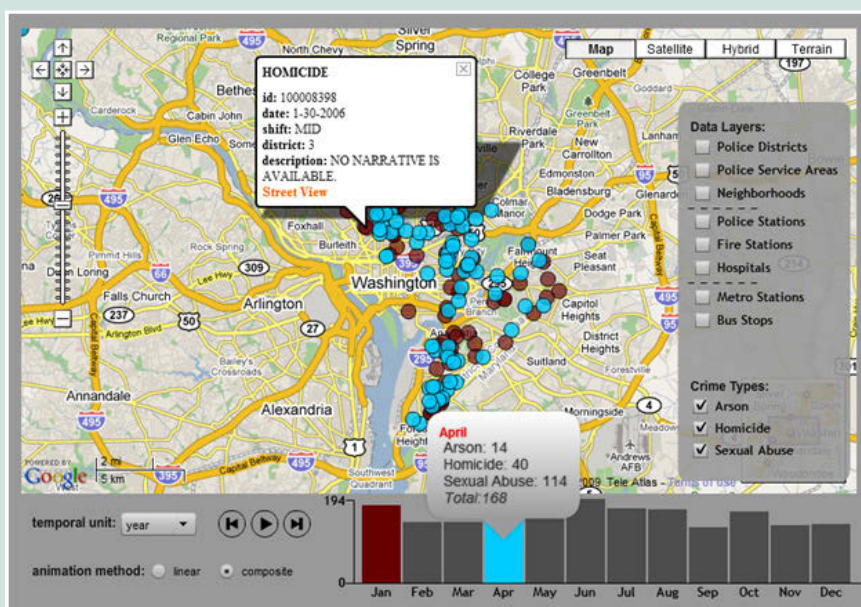


Figure 4: DC Crime Visualization (GeoVISTA Center)
<http://www.geovista.psu.edu/DCcrimeviz/>

DC Crime Visualization: Drawing from these three examples, we developed an event visualization mashup of violent crimes in the District of Columbia (available at <http://www.geovista.psu.edu/DCcrimeViz/>) here at the GeoVISTA Center (Ross et al., 2009). The District of Columbia publishes violent crime incidents to their web-accessible data catalog site (<http://data.octo.dc.gov/>) in near real-time (one business day delay for processing). We have written a script to extract and clean information on select violent crimes (arson, homicide, sexual abuse) for plotting in the mashup. The mashup was developed using the Google Maps API for Flash and provides the basic basemap type toggling, KML layer toggling, and map browsing functionality included in the API. Like its predecessors, the DC Crime Visualization application implements VCR controls and an

interactive temporal legend. Users can also change the animation method (linear or composite) and the binning unit (year, month, week, or day). Two new features are included in the mashup. First, we have extended the interactive temporal legend concept to include a temporal comparison feature. Two different time slices can be viewed simultaneously on the map by rolling over a different histogram bar in the temporal legend (shown Figure 4). We have also modified the pop-up info window to provide a link to the Google Maps Street View web service, allowing users to view the context of the crime. The code library described in the following section is based upon our DC Crime Visualization mashup.

```
1  import com.animation.CSVArray;
2  import com.animation.Bin;
3  import com.animation.AnimatedMap;
4
5  var fileName:String = "crimes.csv";
6  var latName:String = "latitude";
7  var longName:String = "longitude";
8  var myCSVArray:CSVArray = new CSVArray (fileName, latName, longName);
9
10 var dataColumns:Array = new Array ("temporalWeek");
11 var labelColumns:Array = new Array ("labelWeek");
12     var binArray:Array = new Array ();
13     for (var i:int = 0; i < dataColumns.length; i++) {
14         var bin:Bin = new Bin (myCSVArray,dataColumns[i],labelColumns[i]);
15         binArray.push(bin);
16     }
17
18 var key:String = "ABQIAAAAhjVwPC33U9Ph_NTg2AtD4RQs019z176na-d-7NF3sS6ek8haumCyfqzEBA";
19     var lat:Number = 38.895;
20     var long:Number = -77.000;
21     var scale:Number = 12;
22     var myMap:AnimatedMap = new AnimatedMap(key,lat,long,scale,stage,binArray,dataColumns);
```

Figure 5: The code used in the tutorial example for replicating the functionality in the DC Crime Visualization. Although users of the library will need to change the parameters according to their own mapping context, no further scripting is necessary to make an event animation mashup.

EVENT ANIMATION CODE LIBRARY

When asked to participate in this special issue, we decided to refactor our code from the DC Crime Visualization to make it available as a library of stand-alone, object-oriented classes. We were guided by two primary objectives while completing this process. First, we wanted to make the new code library as easy to use as the Google Maps API itself so that novice programmers can still use it. Only a few lines of code are required for setting up a Google Maps mashup, most of which can be copied directly from their online tutorial. We challenged ourselves to maintain the same level of simplicity, limiting the number of required instantiations and making the parameters as logical as possible. Like Google, we also prepared an accompanying tutorial (see the appendix) that provides step-by-step instructions for setting up an event animation mashup. Figure 5 provides the code used in the tutorial example.

Second, we wanted to make the code library as flexible as possible to allow expert users to extend and revise our initial contribution to suit their needs. Our initial implementation is very basic, and, as demonstrated in the review of extant mashups, many other features can be added. It is our hope that our fellow cartographers will help us complete the library over time.

We have chosen to work with the Google Maps API for Flash because our own expertise matches better with ActionScript and because we feel that the Flash environment offers a wider range of possibilities particularly for animation, but also for interactivity. There are obvious drawbacks to this decision, namely that the development environment is proprietary (although a 30-day free trial of Flash or Flex can be obtained from the Adobe website) and that a browser plug-in is required to view Flash applications. Because of this, we encourage others to replicate our work for the JavaScript API.

Our code library contains six classes, each provided as a separate ActionScript (.as) file: `CSVArray`, `Bin`, `AnimatedMap`, `TemporalControls`, `TemporalLegend`, and `ToolTip`. Coding begins by importing three of the classes that are used in the main application (Figure 5, lines #1-3); the other three classes are called by the `AnimatedMap` class and therefore do not need to be imported.

We then require the user to enter parameters related to the CSV dataset and instantiate the `CSVArray` class (Figure 5, lines #5-8). The CSV file should contain three types of information for each event instance: (1) spatial information (the latitude and longitude of the event), (2) temporal information (one or several columns that include sequence information allowing for binning the events into a set of time intervals), and (3) attribute information (any other information that the developer wants to show in the information window when an event is selected on the map). The `CSVArray` object reads in a CSV file that is located at the URL entered into `fileName` parameter and processes it into a form understandable by ActionScript (an array of generic objects, with each object storing the attribute information for a single event). The `latName` and `longName` are the header names for the columns in the CSV file that contain spatial information. We require that this information is provided as geographic coordinates in units of decimal degrees, as this is what the Google Maps API requires. Also, we currently only support the CSV file format. Extension to other coordinate systems (e.g., UTM) or input formats (e.g., XML) are two examples where the cartographic community can help to build a robust code library for mashups.

After creating a `CSVArray` instance, the `Bin` instances are created (Figure 5, lines #10-16). The `Bin` constructor takes three parameters: the `CSVArray` instance (Figure 5, line #8), the header name of the column containing temporal information (Figure 5, line #10), and the header name of the column containing labels for the bins (Figure 5, line #11). We require that the column containing temporal information passed into the `dataColumns` array to be in a numerical format in order to automate the binning sequence (e.g., we require the user convert “Sunday”, “Monday”, “Tuesday” to 1, 2, 3 in the CSV file). The labels for each time slice are

We wanted to make the code library as flexible as possible to allow for expert users to extend and revise our initial contribution to suit their needs

maintained by passing the original column into the `labelColumns` array. In the Figure 5 example, only a single `Bin` instance is created. However, any number of `Bin` instances can be generated for use in the mashup by simply adding more header names into the `dataColumns` and `labelColumns` arrays.

The `for` loop (lines #13-16) creates a separate `Bin` instance for each of the entries in the `dataColumns` array. The product of the `Bin` class is a two-dimensional array of index positions relating to the `CSVArray`; the first dimension stores the order of the bins, with a length equal to the number of time steps (e.g., a length of 7 for a composite week animation), and the second dimension stores the index positions of all events in the `CSVArray` instance that fall within the given bin. Therefore, each `Bin` instance contains the logic needed for a different animation. The set of `Bin` instances are stored in a regular array called `binArray` (Figure 5, lines #12 and #15) for use in the `AnimatedMap` instance. An interface widget is provided by the library in order to toggle among the animations included in the `binArray`.

Following creation of the `binArray`, the `AnimatedMap` class is instantiated (Figure 5, lines #18-22). The `AnimatedMap` class is our adaptation on the `Map` class included in the Google Maps API. Seven parameters are required to instantiate the `AnimatedMap` class: the Google Maps API key (Figure 5, line #18), the center latitude (Figure 5, line #19) and longitude (Figure 5, line #20) for the map, the scale of the map (Figure 5, line #21), a reference to the stage (a reserved word) so that the classes can speak to the specific application, the `binArray` array (Figure 5, line #12), and the `dataColumns` array (Figure 5, line #10).

The `AnimatedMap` class does much of the heavy lifting for the event animation extension. It first creates a `Map` instance using the inputted map parameters, providing logic for resizing the map, formatting markers placed on the map, and interacting with markers placed on the map. The `AnimatedMap` class then calls the `TemporalControls` class, which sets up the simple VCR controls and provides the logic for converting the two-dimensional arrays contained in the `Bin` instances into a working animation. Finally, the `AnimatedMap` class calls the `TemporalLegend` class to draw the histogram and attach the interactivity included in the DC Crime Visualization mashup (including making use of the `ToolTip` class for rolling over the histogram bars).

CONCLUSION

In this paper, we argue that the cartographic community needs to have an active voice in the design and implementation of map-based mashups, providing one small contribution ourselves by extending the Google Maps API for Flash to include event animation. Guidance must come not only in the form of reviews and critiques, but also in the development and public release of code libraries that extend the various map service APIs to include animation, interaction, and representation techniques established by academic and professional cartographers. 21st Century Cartography is

as much about scripting as it is about graphic design. If the cartographic community hopes to continue to shape the way that maps are made and used in a positive way (why else would this community exist?), we need to acknowledge this fact and acquire the necessary skill sets to stay current.

We think that the new open-access, web-delivered, all-digital format of *Cartographic Perspectives* is reflective of the changing nature of Cartography and is a major step in the right direction. The open-access format should ensure that NACIS remains the meeting place for academic cartographers (who have free access to a university library and all its indexed journals) and professional cartographers (who do not have such access). Web-delivery, coupled with the almost unheard of six week review turn-around, means that content can remain current with the rapidly changing field. The all-digital format opens the possibility of publishing multimedia materials along with a traditional textual essay. The code library that we posted to the NACIS website is just one example of utilizing the new digital format—we envision the posting of other materials like geospatial datasets, experimental results, multimedia tutorials, and, most importantly, digital maps as well. In general, we are pleased with the progressive decision to change formats and wish the journal and NACIS success moving forward.

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OVERVIEW

The following tutorial provides step-by-step instructions for using our library extending the Google Maps API for Flash to include event animation. We have written the tutorial in a way that does not require any experience programming with ActionScript3 (AS3) or with the Google Maps API for Flash. For the most part, the code we provide in the following code banks can be copied and pasted directly, only modifying the values of the input parameters according to your particular mapping context. Operational knowledge of AS3 and the API is needed to modify or extend our classes if custom functionality is needed. The Google Maps API for Flash reference is available here:

<http://code.google.com/apis/maps/documentation/flash/reference.html>

SETTING UP THE GOOGLE MAPS API FOR FLASH

INSTALL FLASH

Flash is a proprietary web authoring environment produced by Adobe as part of the Creative Suite. The Google Maps API works with any development environment using AS3 (Flash CS3 or sooner and all versions of Flex). The most recent version (CS4) is available for a 30-day free trial at:

<http://www.adobe.com/downloads/>

Figure 1 provides an annotated overview of the various interface panels of the Flash CS4 authoring environment. Depending on the panel configuration left by the last user of the application, you may see a different set of panels (e.g., some present or not present) or these panels may be in different locations on the interface. Flash panels are interactive; they can be dragged around the application or they can be closed completely. If you do not see a panel referenced in this tutorial, you can activate it using the **Window Tab** in the **Top Menu Bar**. Flash CS4 also allows you to tear-away and move all panels to a preferred configuration.

There are three important file types when authoring content in Flash. The project itself is stored in a file with the extension **FLA** - the FLA file saves all project content, settings, and code. In order to convert your Flash project into a file that can be viewed in the Adobe Flash Player, you must first publish it; this will result in the creation of a file with the extension SWF.

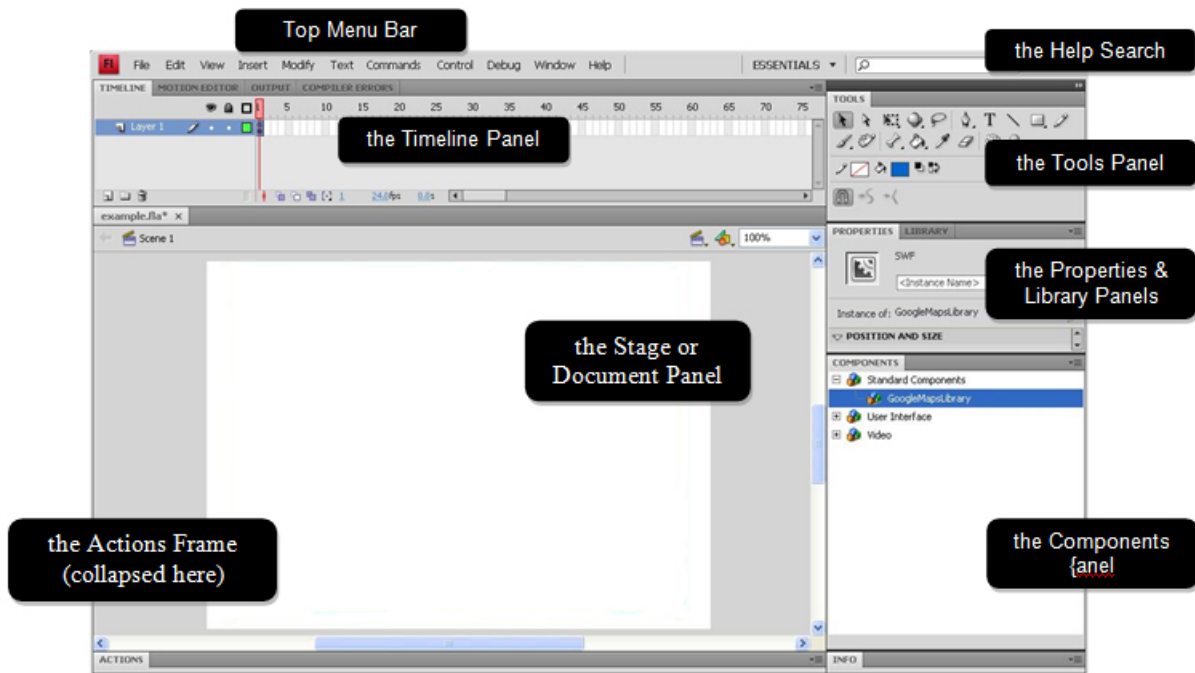


Figure 1 – The Flash authoring environment.

It is important that you save and back-up the FLA file, as this is needed to open the project in Flash CS4 and edit it. It is important that you upload the SWF file to your server space, as this is the format that can be viewed using the Flash Player plug-in. Finally, external classes are saved in files with the extension AS; our code library is provided as a set of AS files.

OBTAIN THE API KEY

Once Flash is installed, it is necessary to add the Google Maps API. Google requires you first to obtain an API key to use the Google Maps API for Flash so that they can ensure you are using the API in accordance with their licensing agreement. You need a Google account to obtain an API key. If you do not already have a Google account (e.g., Gmail), you will need to first sign up for one here:

<https://www.google.com/accounts/ManageAccount>

After signing into your Google account, you can obtain the API key here:

<http://code.google.com/apis/maps/signup.html>

Check the box stating you agree with the terms of use and enter the website location (URL) where you will be hosting your mashup (e.g., <http://www.personal.psu.edu/rer198/>). The API key itself is a long string of letters, numbers, and punctuation symbols. Be sure to record this key in a place where you will not lose it, as your mashup will not work unless you enter the key exactly as given to you.

INSTALL THE GOOGLE MAPS COMPONENT

The next step in setting up the Google Maps API for Flash is installation of the Google Maps component. A component is an AS3 class with related graphics and code designed to provide a user interface quickly. You can think of a component as a pre-programmed interface widget that can be instantiated in your application and then connected to your own data. Google follows this model by providing their mapping service as a custom Flash component.

The custom component must first be installed by copying the **SWC** file (Flash component file) into the Adobe Components Library. The SWC can be obtained at the following link:

<http://maps.googleapis.com/maps/flash/release/sdk.zip>

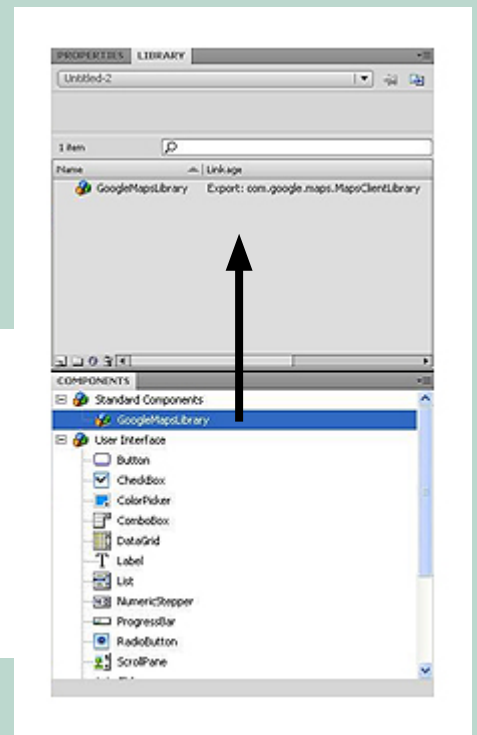
There are two SWC files in the zip folder, one for Flex (labeled so) and one for Flash (left unlabeled). Copy the SWC for Flash into the **Configuration\Components** directory. The following is an example for the Windows operating system:

`C:\Program Files\Adobe\Adobe Flash CS4\language\Configuration\Components\`

Note that your directory may be different depending on the version of Flash you are using, the location you choose when saving and installing Flash, and your operating system.

All installed components are available for use in the **Components Panel** in Flash. If the Components Panel is not currently visible, use the Window Tab at the top of the application to activate it. If you installed the Google Maps component properly, it will show up under the **Standard Components Tab** in the Component Panel. You will need to drag the Google Maps component from the Components Panel to the Library Panel in order to use it (see Figure 2).

Figure 2 – The Google Maps component in the Components Panel. If the Google Maps component was installed correctly on your machine, it should show up under the Standard Components Tab in the Components Panel. You will need to drag and drop the GoogleMapsLibrary component from the Components Panel into the Library Panel in order to use it.



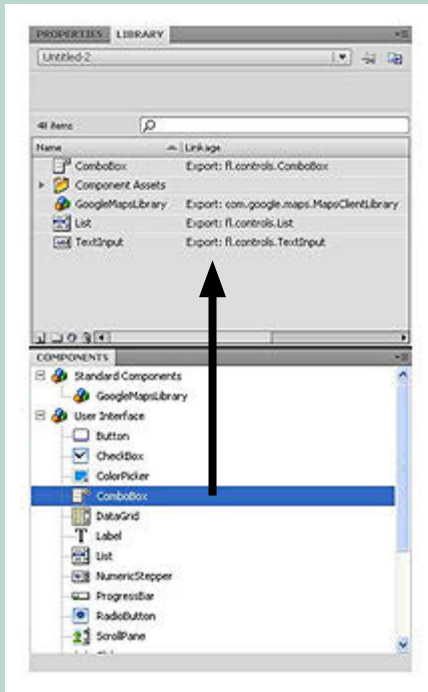


Figure 3 – Adding the ComboBox component to the Library. After installing the GoogleMapsLibrary component, it is necessary to add the ComboBox component to the Library. After dragging it from the Component Panel to the Library Panel, you should see the ComboBox in the Library plus several other assets and components used by the ComboBox component.

ADD THE COMBOBOX COMPONENT TO THE LIBRARY

One other component required for your project is the ComboBox component, which will enable toggling among multiple animations. The ComboBox component can be found in the **User Interface** folder in the Components Panel. To add this component to your project library, make sure the Components Panel and the Library Panel are both visible. Locate the ComboBox component in the Components Panel and drag it into the Library Panel. This will allow the component to be instantiated when using the library. Figure 3 shows the result of this action.

ALLOW THE FLASH PLAYER TO COMMUNICATE WITH GOOGLE

The final step is to ensure that your Flash Player plug-in allows a local connection. To adjust this setting, visit:

http://www.macromedia.com/support/documentation/en/flashplayer/help/settings_manager04a.html

Select the “Always allow” option. This allows Flash Player to connect to datasets and services that are available online. If you do not do this, you will not be able to test your application locally (i.e., without first uploading it to your webspace).

FORMATTING THE CSV FILE

ADD COLUMN HEADER NAMES

Our current library only supports run-time loading of data in a CSV format. The library requires each column in the CSV file to be formatted in a specific way depending on if it contains spatial, temporal, or attribute data. All columns, regardless of type, require a column header. Therefore, the first step in formatting your data is to add a row to the top of the file that contains a name for the column. This name must be formatted as text and cannot

contain commas. Table 1 provides an abbreviated example dataset in Microsoft Excel prior to conversion to the CSV format (File/Save As...).

FORMAT THE COLUMNS WITH SPATIAL DATA

The Google Maps API requires spatial data to use geographic coordinates using decimal degrees as the unit. It also uses the negative sign prefix (-) to represent latitude coordinates in the southern hemisphere and longitude coordinates in the western hemisphere.

FORMAT THE COLUMNS WITH TEMPORAL DATA

Columns containing temporal data must be formatted as numbers in order for the code library to predict the sequence of time steps (e.g., convert “SUN”, “MON”, “TUES” to 1, 2, 3). We have set up the code library so that you can still use the original names for labeling the temporal legend as long as it is included in a separate column. In the Table 1 example, the temporalWeek column includes the temporal data for the animation and the labelWeek column includes the associated labels.

All rows with the same number in the temporal column are placed in the same time slice or bin. This flexible format allows for the generation of linear and composite animations using any number of binning units; non-temporal animations can also be created using the numeric conversion as a way to determine the binning order.

FORMAT THE COLUMNS WITH ATTRIBUTE DATA

The code library is written so that any attribute column is displayed in the pop-up information window when clicking the marker. These columns can be text or numerical. The only restriction is that commas cannot be included in any text strings, as the CSV format uses these to discriminate individual records in the data structure.

latitude	longitude	temporalWeek	labelWeek	district
38.8915	-76.9808	4	WED	DISTRICT 4
38.8872	-76.9575	4	WED	DISTRICT 2
38.8918	-76.9540	5	THU	DISTRICT 1
38.8882	-76.9561	3	TUE	DISTRICT 3
38.8916	-76.9529	6	FRI	DISTRICT 3
38.8914	-76.9446	2	MON	DISTRICT 1
38.8924	-76.9426	6	FRI	DISTRICT 3
38.8924	-76.9426	2	MON	DISTRICT 4
38.8913	-76.9358	6	FRI	DISTRICT 2
38.8913	-76.9368	1	SUN	DISTRICT 1
38.8913	-76.9311	7	SAT	DISTRICT 4
38.8921	-76.9301	2	MON	DISTRICT 3
38.8867	-76.9257	1	SUN	DISTRICT 3
38.8888	-76.9175	4	WED	DISTRICT 1

Table 1 – An sample dataset using the required format. All columns in the CSV require a text header in the first row. Columns containing spatial data must use geographic coordinates reported using decimal degrees. Columns containing temporal data must be formatted numerically reflecting the sequence of bins. Columns containing attribute data can be formatted as text or numbers, but cannot contain commas.

USING THE EVENT ANIMATION LIBRARY

ACQUIRE THE LIBRARY

The complete library is available as a zip file from the following site:

<http://www.nacis.org/CP/CP64/com.zip>

Extract the zip file into the same folder that contains your saved Flash project (FLA). You should notice that the files are in the directory **com\animation** – the com folder needs to be in the same folder as your FLA file for the libraries to import properly. The animation folder contains six files:

- 1. CSVArray.as:** A class for ingesting a CSV file at run-time and converting it into a usable format
- 2. Bin.as:** A class for partitioning the entries in the CSV file according to an attribute, producing a set of bins (i.e., time slices) for the animation
- 3. AnimatedMap.as:** A class for loading the Google Maps map service, setting the layout, and instantiating the TemporalControls and TemporalLegend classes
- 4. TemporalControls.as:** A class for drawing and programming the VCR controls and animation ComboBox selection
- 5. TemporalLegend.as:** A class for drawing and programming the interactive temporal legend
- 6. ToolTip.as:** A class for generating information windows when rolling over the bars in the temporal legend

IMPORT THE CLASSES

The first step in using the code library is importing three of six classes (the remaining three are called directly or indirectly by the `AnimatedMap` class). The `import` function is necessary when using classes outside of the Flash base libraries. You can copy the lines in CodeBank 1 directly into the **Actions Panel**.

```
1 import com.animation.CSVArray;  
2 import com.animation.Bin;  
3 import com.animation.AnimatedMap;
```

CodeBank 1 – Importing the classes.

INSTANTIATE THE CSVARRAY CLASS

The next step is to instantiate the `CSVArray` class. The `CSVArray` constructor takes three parameters: the name of the CSV file (if it is not in the same location as the deployed SWF, the full path is required), the header name of the column containing the latitude information, and the header name of the column containing the longitude information. The parameters must be passed into the `CSVArray` constructor in this order. You can copy the lines #5-8 from CodeBank 2, although the “___” strings included for the three parameters must be filled in with the appropriate information about your dataset. Multiple CSV files can be loaded into a single application if necessary, each requiring its own `CSVArray` instance (thus repeating lines #5-8).

```

1  import com.animation.CSVArray;
2  import com.animation.Bin;
3  import com.animation.AnimatedMap;
4
5  var fileName:String = "";
6  var latName:String = "";
7  var longName:String = "";
8  var myCSVArray:CSVArray = new CSVArray (fileName, latName, longName);

```

CodeBank 2 – Instantiating the CSVArray class.

INSTANTIATE THE BIN CLASS

Once the CSV file is loaded, it can be partitioned to produce the animation by instantiating the Bin class. The Bin class takes three parameters: the CSVArray instance containing the data to be partitioned, the header name of the column used for the partitioning, and the header name of the column used for the X-Axis labels. CodeBank 3 shows the setup required for instantiating two Bin instances. Any number of Bin instances can be created depending on the number of desired animations. The dataColumns array and the labelColumns array simply need to be defined as the list of column header names used as the data and corresponding labels for each animation, respectively. The dataColumns and labelColumns array are associated in that the column entered in the first index position of the dataColumns array will be labeled by the

```

1  import com.animation.CSVArray;
2  import com.animation.Bin;
3  import com.animation.AnimatedMap;
4
5  var fileName:String = "";
6  var latName:String = "";
7  var longName:String = "";
8  var myCSVArray:CSVArray = new CSVArray (fileName, latName, longName);
9
10 var dataColumns:Array = new Array ("", "");
11 var labelColumns:Array = new Array ("", "");
12 var binArray:Array = new Array ();
13 for (var i:int = 0; i < dataColumns.length; i++) {
14     var bin:Bin = new Bin (myCSVArray, dataColumns[i], labelColumns[i]);
15     binArray.push(bin);
16 }

```

CodeBank 3 – Instantiating the Bin class.

column entered in the first index position of the `labelColumns` array, and so on. The column entered at a given index position should be the same in both the `dataColumns` and `labelColumns` array if you do not want to specify a separate label column. Both arrays must have the same length. For lines #10 and #11, you will need to replace the “___” with the appropriate column header names from the CSV file.

After specifying the `dataColumns` and `labelColumns` array, the for loop (lines #13-16) creates the `Bin` instances and stores them in an array called `binArray`. The first `Bin` included in the array will be set as the default. Lines #12-16 can be copied directly into your code.

INSTANTIATE THE ANIMATEDMAP CLASS

The final step in using the library is to instantiate the `AnimatedMap` class, as shown in CodeBank 4. The `AnimatedMap` class takes seven parameters: the Google Maps API key (line #18), the latitude of origin (line #19), the longitude of origin (line #20), the default scale (line #21), a reference to the main stage (the keyword `stage` should be submitted here in all cases), the `binArray` (line #15), and the `dataColumns` array (line #10). Default values are currently put in for the `lat`, `long`, and `scale` variables; adjust these according to your specific mapping context.

```
1  import com.animation.CSVArray;
2  import com.animation.Bin;
3  import com.animation.AnimatedMap;
4
5  var fileName:String = "___";
6  var latName:String = "___";
7  var longName:String = "___";
8  var myCSVArray:CSVArray = new CSVArray (fileName, latName, longName);
9
10 var dataColumns:Array = new Array ("___", "___");
11 var labelColumns:Array = new Array ("___", "___");
12 var binArray:Array = new Array ();
13 for (var i:int = 0; i < dataColumns.length; i++) {
14     var bin:Bin = new Bin (myCSVArray,dataColumns[i],labelColumns[i]);
15     binArray.push(bin);
16 }
17
18 var key:String = "___";
19 var lat:Number = 0;
20 var long:Number = 0;
21 var scale:Number = 1;
22 var myMap:AnimatedMap = new AnimatedMap(key,lat,long,scale,stage,binArray, dataColumns);
```

CodeBank 4 – Instantiating the AnimatedMap class.


```

1  import com.animation.CSVArray;
2  import com.animation.Bin;
3  import com.animation.AnimatedMap;
4
5  var fileName:String = "crimes.csv";
6  var latName:String = "latitude";
7  var longName:String = "longitude";
8  var myCSVArray:CSVArray = new CSVArray (fileName, latName, longName);
9
10 var dataColumns:Array = new Array ("temporalWeek");
11 var labelColumns:Array = new Array ("labelWeek");
12 var binArray:Array = new Array ();
13 for (var i:int = 0; i < dataColumns.length; i++) {
14     var bin:Bin = new Bin (myCSVArray,dataColumns[i],labelColumns[i]);
15     binArray.push(bin);
16 }
17
18 var key:String = "ABQIAAAAjhVwPC33U9Ph_NTg2AtD4RQs019z176na-d-7NF3sS6ek8haumCyfqzEBA";
19 var lat:Number = 38.895;
20 var long:Number = -77.000;
21 var scale:Number = 12;
22 var myMap:AnimatedMap = new AnimatedMap(key,lat,long,scale,stage,binArray,dataColumns);

```

CodeBank 5 – An example project filling in the parameters using the data from Table 1.

After entering in these parameters, you should be able to publish the file into the SWF format by selecting the **Publish** option under the **File Tab** along Top Menu Bar (or by pressing CTRL+ENTER).

CodeBank 5 shows the filled in code related to the dataset shown in Table 1. Here, only a single animation is created, using the temporalWeek and labelWeek columns. The published SWF file using this code is shown in Figure 4.

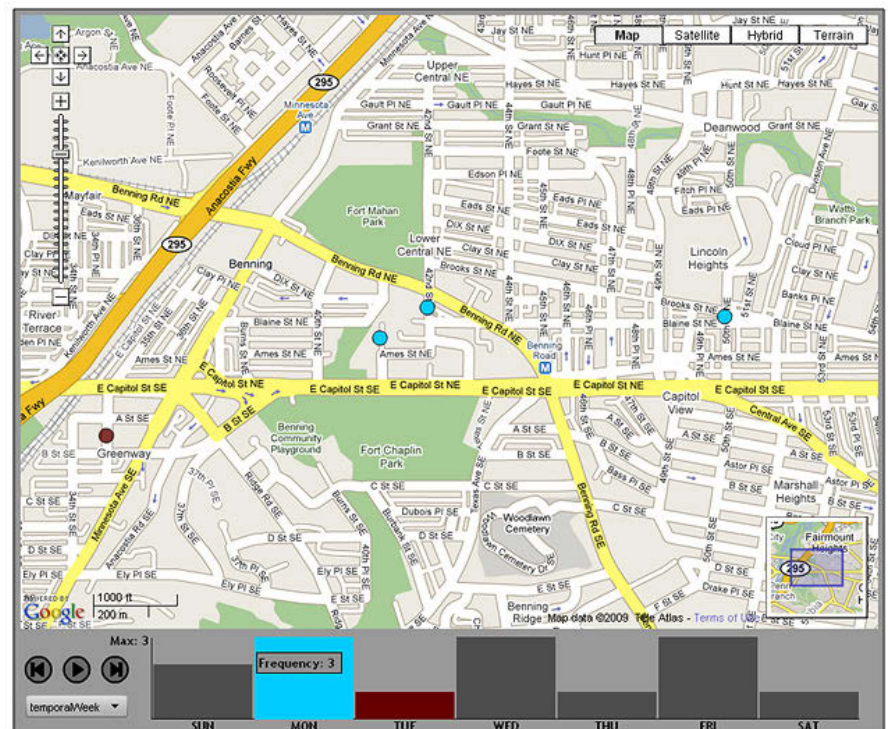


Figure 4 – The interface included by default

Cartography 2.0: For people who make interactive maps

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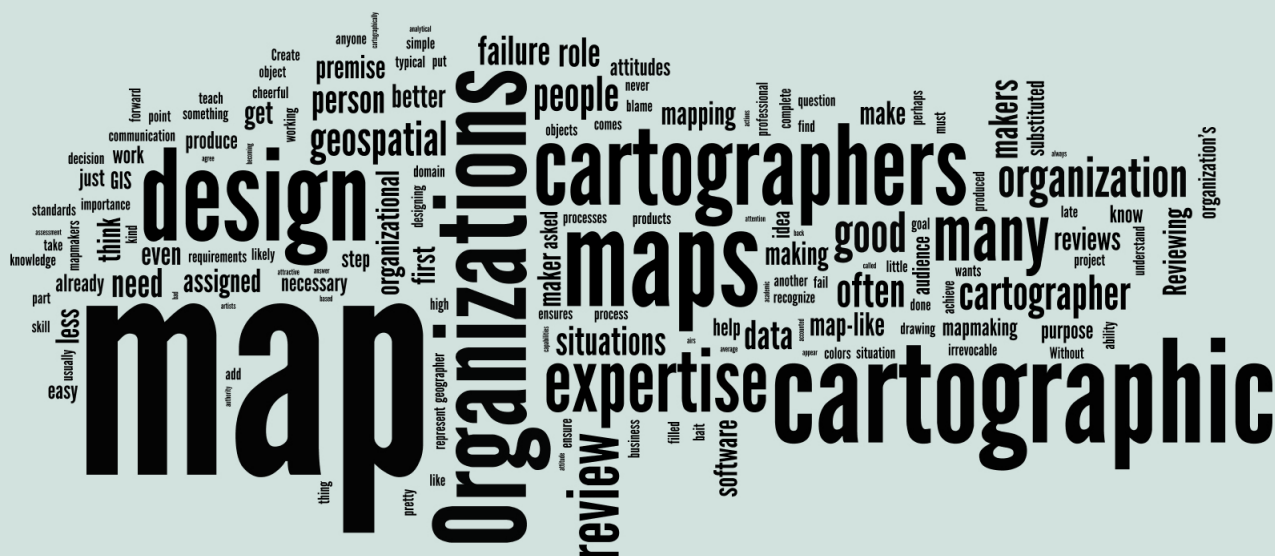
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Cartography 2.0 (<http://Cartography2.org>) is a free online knowledge base and e-textbook for students and professionals interested in interactive and animated maps. I (Mark) pitched the idea of doing an 'online textbook' to my co-authors because I knew that, as teachers, we were all frustrated with the inability of traditional textbooks to keep pace with the constant stream of new Web technologies. Further, we could not find any comprehensive online resources about web-based mapping that provided the same breadth and depth we've come to expect from a professionally produced textbook. The kind of knowledge that is needed to make dynamic maps spans many (traditionally separate) fields from computer science to education. While there are great books on all of these fields individually, none offered an answer to the basic question I've been asked many times: what's the important stuff I need to know about making great on-demand/interactive maps?

As a response to that question, I thought I would try to distill what I knew into an open, online resource and share my experiences of making web-based maps over the past 15 years. Of course, it soon became clear I needed

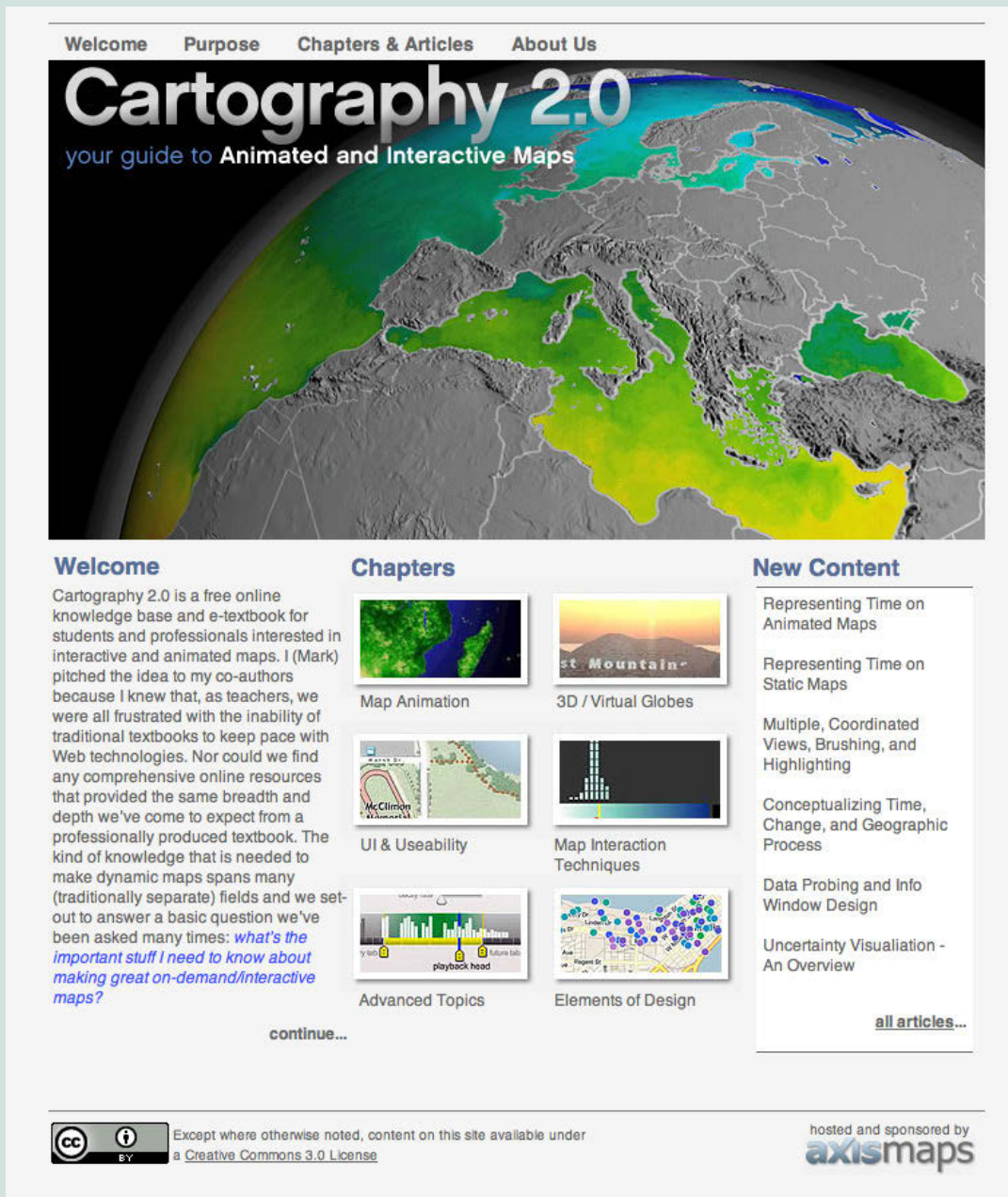


Figure 1: Cartography 2.0 web site

help from my friends! The initial Cartography 2.0 team is myself, Anthony Robinson, Rob Roth, and Ben Sheesley, each of whom brings expertise in different areas of cartography. Axis Maps (axismaps.com) is the primary supporter of this effort and is hosting and maintaining the site for us.

The task we set ourselves was simple: If we only had 30 minutes to share everything we know about topic X, what would we talk about, what would we demo, and what advice would we offer?

From what we could see, at least five basic problems that are encountered when publishing material about emerging mapping technology:

1. **SPEED:** The world of Web-based mapping is evolving at light speed and textbooks are at least two or three years out-of-date by the time

they reach students. That is a lifetime online (e.g., Google Maps is only four years old!) and rapidly emerging areas like location-based services and crowd sourcing—which are profoundly re-shaping and expanding our notion of ‘mapping’—are terms that weren’t even coined when today’s textbooks were being written. No doubt, the next big thing(s) are happening now, as you read this.

2. **LEARNING DEMANDS ‘LIVE’ EXAMPLES:** Static screen captures of animated and interactive maps are a very poor substitute for the real thing. Imagine trying to share the joy of using Google Earth with two or three black-and-white screen captures? It is critical that people can get their hands on real working examples if they want to learn how to make great dynamic maps and understand how people use them. In the classroom, we assign URLs like an English teacher assigns novels; to become an expert in a field you have to immerse yourself in the works of that field. A CD-ROM insert in a textbook separates content from examples and is just as old as the book itself. The Web is “in the wild,” and we have to venture into it to understand it. (Fellow cartographer Rob Edsall has been saying this for years.)
3. **BUILDING TWO-WAY LEARNING:** Most of the mapping projects we’ve been involved with require input from a handful of people with a wide array of domain expertise. Ensuring that we tap into the knowledge base of this diverse group is essential for complete success of the project, but often is simply not feasible. What is needed with Cartography 2.0, then, is a way to facilitate an interactive learning community where folks post questions, comments, and links in response to our own contributions (i.e., a community where everyone is allowed to interact with each other). This idea is nothing new in online education and these kinds of ‘learning communities’ are at the very heart of the Web 2.0 ethic.

In both subtle and apparent ways, our university classrooms are already two-way learning communities. Despite our best efforts to stay on top of things, we have found that our students are routinely ahead of us on emerging concepts and technologies. In this way, our students act to keep us current, while we act to synthesize this input and integrate the state-of-the-art into extant frameworks, removing from our lecture notes what is now outdated. We expect a similar reciprocity with the learning community implemented in Cartography 2.0, where everyone plays the role of both teacher and student.

Material can be constantly updated and revised as the world of mapping moves forward and outward.

4. **CONSTANT UPDATES:** The great thing about online publishing is that material can be constantly updated and revised as the world of mapping moves forward and outward. There are now sophisticated technologies for identifying what is new on the Web. Many power Web users spending much of their time online in a content reader that stitches together numerous RSS feeds (i.e., real-time updates) from previously identified sources of interest, rather than actually seeking out new sources of information. This is a primary reason why Wikipedia is the most commonly referenced resource for encyclopedic knowledge: it

is hands down the most current. While Wikipedia may not always be the most accurate resource—and is undeniably used as a battle ground for competing ideologies with misinformation purposefully posted—it is definitely the most current resource for quickly changing fields. We hope that Cartography 2.0 can act as a similar resource for subjects cartographic. As new applications, strategies, and theories are released, they can be immediately disseminated to the readership. While this initial pass may not be complete or accurate from a textbook perspective, these rough edges can be softened over time through active discussion and iterative content updates.

5. **EXPENSIVE:** We firmly believe (as do many) that the era of the \$150 textbook is coming to an end. While this is sad for our friends working in publishing houses, it is a boon for authors who now have others means for reaching—and indeed, creating—their audience. Authors are able to eliminate much of the overhead (and editorial red-tape) that consumes that \$150 price tag.

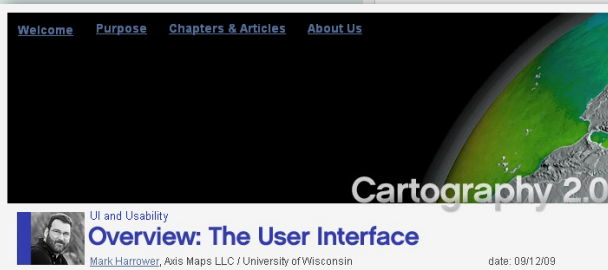
Digital publishing is a boon for readers too, as they are now able to find and access content more easily and also embed content into a larger web of ideas (e.g., StumbleUpon, Digg, del.icio.us). Simply put, removing the financial barrier means that more people can access educational material about dynamic mapping, which not only means that more people can make dynamic maps, but that more people can construct great dynamic maps that better serve the needs of the targeted user audience. This, in turn, will generate a larger group of people who can contribute to Cartography 2.0, (hopefully) generating a positive feedback loop.

Please have a look at Cartography2.org and let us know what you think and send us a note if you'd like to see any other material. New material is added to the site continuously, so please subscribe to our RSS feed. Our goal is to continue to bring in contributors and have the site grow over time far beyond these initial topics and articles. Cheers!

As new applications, strategies, and theories are released, they can be immediately disseminated to the readership.

Case Study in Selecting a Map Font

Despite the vast number of fonts available to choose from, we've found that only a few serve our purposes well and therefore we tend to return to them over and over again. Officina (both *Officina Sans* and *Officina Serif*) is one such font (a font family, really) that we've found to be highly versatile, employing it on everything from map user interfaces to printed reference maps. It was originally designed by Erik Spiekermann as a robust font for business correspondence, including memos, faxes, photocopies, and other documents output at course resolutions. A number of design characteristics, drawn from the list above, make it an ideal candidate for maps appearing on screen. Officina has a tall x-height, wide apertures and large counters, as seen in the letters 'c', 'a', and 'e', for example. Serifs are blocky and square in shape, and strokes are consistently strong, having low contrast. By design, Officina is also a relatively narrow type family (considerably narrower than Trebuchet MS but not as condensed as Arial Narrow, for example), which makes it effective in high density labeling scenarios.



Three basic questions underpin the development of all interactive mapping systems; if you want to make an interactive map, consider the following 3 questions:

- (1) **what type** of interactivity is needed (*kind of control*),
- (2) **how much** interactivity is needed (*degree of control*), and
- (3) how should this interactivity be implemented (*method of control*)?

WHY THIS MATTERS: This section will help you to answer those questions and will encourage you to develop a careful, objective approach to each map you make so that (1) you don't waste your time or your employers money on bad ideas, and (2) you can increase the chances that your maps will work once they are released into the wild.

Many of us, more often than we'd like to admit, have felt the sting of showing people our work only to have them confused by what we thought was a great user interface, or worse, see them underwhelmed by our work (I remember cringing once upon hearing "so, um, I can't click on anything...I just pan and zoom?"). While you can't hit a home run every time, you'll sleep better knowing your map is both useful and easy to use. In order to get to that cartographic Nirvana, though, we're going to have to take a journey through the related fields of *Human Computer Interaction* and *Interface Design* (and here). Much of this might be old-hat to you, and at the very least if you've used software or the Web for even a few minutes then you'll certainly recognize much of the advice and insights in this chapter. The pros know making good maps in the 21st century requires knowing a lot about stuff that seems way beyond the borders of 'cartography'. The user interface, and how people work with your map—a field called *usability*—is critically important.

Five things all designers should always remember:

- #1: No matter how great your data or mapping skills are, if your user interface (UI for short) is opaque and cryptic your map will fail. Period.**
- #2: Don't try to be too clever.** UI's that 'show-off' should be avoided; for example, despite having been tried numerous times over the past 15 years, there are still homepages that make it really hard to find the buttons and content and you spend a lot of time hunting around and clicking on stuff and nothing happens (well, expect for the rapid departure of most anyone over the age of 14). **Bad UI designs don't make your work 'edgy' and 'cool', it just makes it annoying.**
- #3: We live in a mouse-happy-culture where folks won't wait long.** This problem is only getting worse as people now expect amazing maps and applications to work instantly. At let's be honest, we're all guilty of this. I know I often give-up on content that was taking 'too long' to load...maybe even after just 2-3 seconds. Our willingness to hang-in there is low especially if we didn't pay anything to be there in the first place; our time is the only cost with being there, so we try to save it accordingly. Bottom line: **If your map is underwhelming, boring, or hard to use, folks will leave pretty quickly.**
- #4: Don't design for yourself:** I don't really care, nor does the person writing your paycheck, if you think the map and UI are the coolest thing ever. Unless you're going to buy a hundred thousand copies of the map, check your ego and realize that not all of your good ideas will work and everyone, even seasoned pros, can benefit from some feedback (aside: You can always tell when an author becomes big enough they no longer feel the need for an editor - it always shows). **Design for your audience, not yourself or your friends.** What's wrong with our friends? Well, they likely have similar tastes and skills and are not likely to be a representative sample and more importantly, they're your friends and don't want to hurt your feelings and may feel the need to sugarcoat feedback. I've had to redo large pieces of a project when it became clear our approach wasn't going to fly with the users. It's frustrating

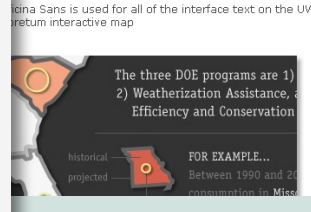
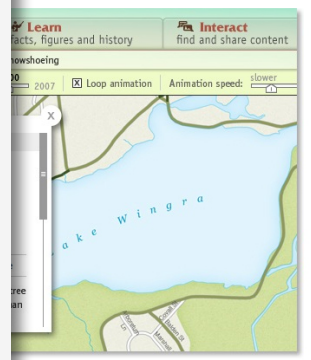


Figure 2: Cartography 2.0 Examples

Small-scale map datasets of the world do exist, but they have their problems. For example, most are crudely generalized—Chile’s fjords are a noisy mess, the Svalbard archipelago is a coalesced blob, and Hawaii has disappeared into the Pacific two million years ahead of schedule. They contain few data layers, usually only a coast and country polygons, which may not be in register. The lack of good small-scale map data is not surprising. Large mapping organizations that release public domain data, such as the US Geological Survey, are not mandated to create small-scale map data for a small user community that includes mapmaking shops, publishers, web mappers, academics, and students—in other words, typical NACIS members. Natural Earth Vector fills this oft-overlooked but important niche.

COLLABORATION

Natural Earth Vector is a collaboration of many volunteer NACIS members. Nathaniel Vaughn Kelso and Tom Patterson began working on the project in late 2008. Following the path of least resistance, the idea was to repurpose existing data that we already had as an integrated world dataset at three map scales. The 1:50 million and 1:110 million-scale data comes from bases developed by Dick Furno and additional staff at the *Washington Post* for quick turnaround newspaper mapping. The *Washington Post* Legal Department kindly granted us permission to use these data. The kernel for the 1:10 million data was a compilation by Patterson for the “Physical Map of the World,” consisting of coastlines, rivers, lakes, and physical feature labels. Expanding and improving on this foundation has been our chief activity. The core team has now grown to include Tanya Buckingham, who coordinates data attributing by Ben Coakley, Kevin McGrath and Sarah Bennett at the University of Wisconsin Cartography Lab; Dick Furno as populated places guru; Nick Springer as the website developer; and Lou Cross as NACIS liaison. A cast of consultants, many regulars on the Cartotalk.com discussion forum, is assisting with place names for various world regions. They include Leo Dillon, Hans van der Maarel, Will Pringle, Craig Molyneaux, Melissa Katz-Moye, Laura McCormick, Scott Zillmer and fellow staff at XNR Mapping. Work continues apace on Natural Earth Vector as we write this article.

Large mapping organizations that release public domain data are not mandated to create small-scale map data. Natural Earth Vector fills this niche.

DATA FOR CARTOGRAPHY

We developed a world base map data suitable for making a variety of visually pleasing, well-crafted maps. Unlike other map data intended for scientific analysis or military mapping, Natural Earth Vector is designed to meet the needs of mainstream production cartographers. Maximum flexibility was a goal. For example, Natural Earth Vector comes in ESRI shapefile format, the Geographic projection, and WGS datum, which are de facto standards for vector geodata.

Neatness counts with Natural Earth Vector. The carefully generalized linework maintains consistent, recognizable geographic shapes at 1:10m, 1:50m, and 1:110m scales. As Natural Earth Vector was built from the

ground up, you will find that all data layers align precisely with one another. For example, where rivers and country borders are one and the same, the lines are coincident.

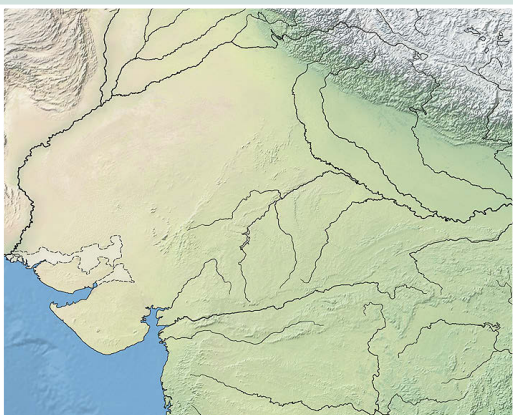
Natural Earth Vector, however, is more than just a collection of pretty lines. What lies beneath the surface, the data attributes, is equally important for mapmaking. Most data contain embedded feature names, which are ranked by relative importance. Up to eight rankings per data theme allow easy custom map “mashups” to emphasize your map’s subject while de-emphasizing reference features.

Other attributes facilitate faster map production. For example, width attributes assigned to rivers allow you to create tapered drainages with ease. Assigning different colors to contiguous country polygons is another task made easier thanks to data attribution.

OTHER KEY FEATURES:

- Vector features include name attributes and bounding box extent so you know the Rocky Mountains are larger than the Ozarks.
- Large polygons, such as bathymetric layers, are split for more efficient data handling.
- Projection friendly—vectors precisely match at 180 degrees longitude. Lines contain enough data points for smooth bending in conic projections, but not so many that processing speed suffers.
- Raster data include grayscale-shaded relief and cross-blended hypsometric tints derived from the latest NASA SRTM Plus elevation data and tailored to register with Natural Earth Vector.
- Optimized for use in web mapping applications, such as Google or Yahoo, with built-in scale attributes to direct features to be shown at different zoom levels.

1:10 MILLION DATA LAYERS



Vector coastlines and drainages register with Natural Earth 2 raster data.

GEOGRAPHIC LINES

Polar circles, Tropical circles, International dateline, and Equator

GRATICULES

1-, 5-, 10-, 15-, 20-, and 30-degree increments

GLACIATED AREAS

Polygons derived from DCW, except for Antarctica derived from MOA. Includes name attributes for major polar glaciers.

ANTARCTIC ICE SHELVES

Derived from 2003–2004 MOA. Reflects recent ice shelf collapses.

BATHYMETRY

Nested polygons at 0, -200, -1,000, -2,000, -3,000, -4,000, -5,000, -6,000, -7,000, -8,000, -9,000, and -10,000 meters. Created from SRTM Plus.

RIVERS

Ranked by relative importance. Includes name and line width attributes.

LAKES

Ranked by relative importance, coordinating with river ranking. Includes name attributes.

LAKE CENTERLINES

Segments for creating continuous rivers without reservoir and lake interruptions. Don't want minor lakes? Turn on their centerlines to avoid unseemly data gaps.

COASTLINE

Ocean coastline, including major islands. Coastline is matched to land and water polygons.

ISLANDS

Additional small ocean islands ranked to three levels of relative importance.

REEFS

Major coral reefs from WDB2.

URBAN POLYGONS

Derived from 2002-2003 MODIS satellite data.

POPULATED PLACES

Point symbols with name attributes. Includes capitals, major cities and towns, plus significant smaller towns in sparsely inhabited regions. We favor regional significance over population census in determining rankings.

COUNTRIES

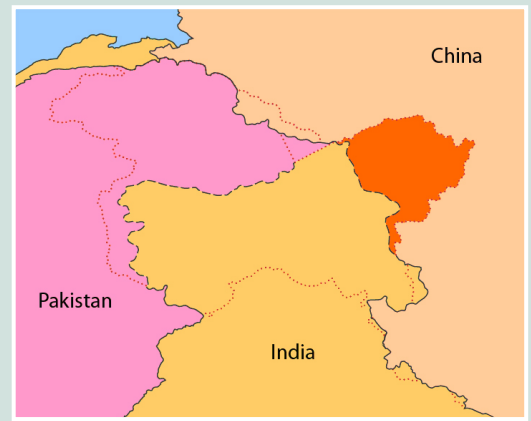
Matched boundary lines and polygons with names attributes. Includes disputed boundaries and areas, breakaway regions, subnational territories, dependencies, and transnational cultural regions.

PACIFIC NATION GROUPINGS

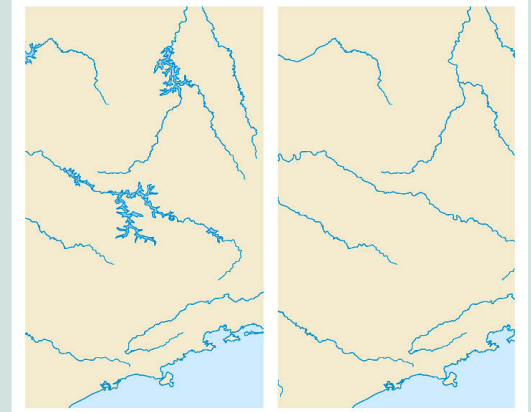
Boxes for keeping these far-flung islands tidy.

WATER BOUNDARIES

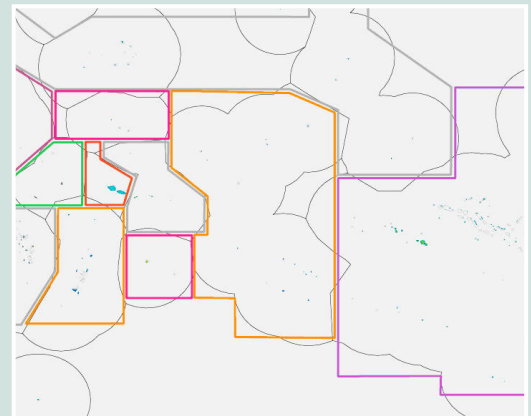
200-mile nautical limits, plus disputed, treaty, and median lines.



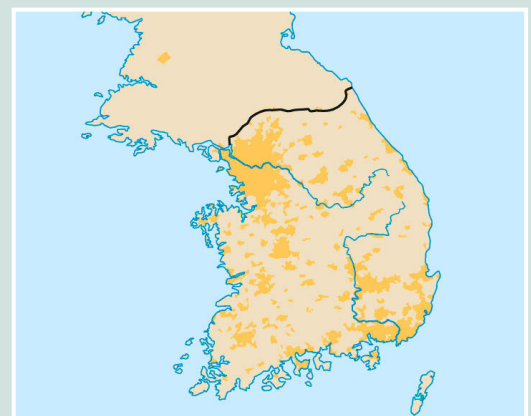
Disputed boundaries, Kashmir region.



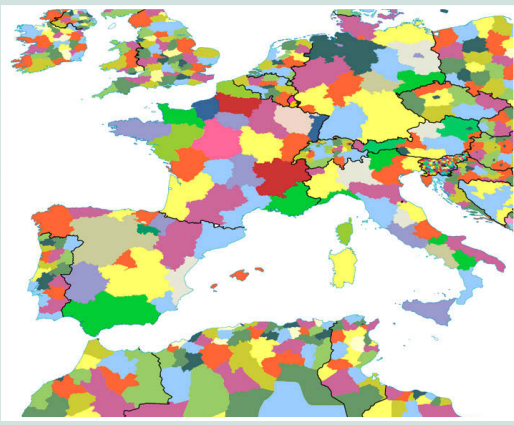
Brazil drainages with reservoirs (left) and without (right).



Pacific nation boundaries.



Urban areas, Korean Peninsula.



First order administrative areas.

FIRST ORDER ADMIN (PROVINCES, DEPARTMENTS, STATES, ETC.)

Internal boundaries and polygons for all but a few tiny island nations. Includes names attributes and some statistical groupings of the same for smaller countries.

PHYSICAL FEATURES

Polygon and point labels of major physical features.

DATA DEVELOPMENT

Since Natural Earth Vector is for visual mapmaking, we prepared the base layers in Adobe Illustrator in conjunction with Avenza MAPublisher import and export filters. Illustrator offered us flexible tools for editing lines and polygons, organizing data on layers, and inspecting the final data in a map-like form. A variety of third-party plug-in filters and scripts, some written by Kelso, were essential for linework generalization and other tasks.

World Data Bank 2 was the primary vector data source that required significant modifications. For example, we found that the entire West Coast of the United States was about seven miles west of its true position and adjusted it accordingly. Slight adjustments to river positions better matched them to shaded relief derived from recent satellite data. For Antarctica, we completely abandoned World Data Bank 2. Here, the coast, glaciers, and ice shelves derive from 2003-2004 NASA Mosaic of Antarctica, a MODIS product. We also updated the data to reflect recent ice shelf collapses.

Contributors from around the globe researched additional feature names beyond those original to Patterson's Physical Map of the World. Attributing the data was performed in Arc GIS by the team at the University of Wisconsin.

FUTURE ACTIVITY

We regard the initial release of Natural Earth Vector as a starter dataset that will be periodically updated. With any project as complex as this, flaws and omissions are bound to emerge, requiring our attention. One proposal is to form a Natural Earth map data committee to incorporate information and coordinate updates from users, perhaps using a Wiki model. Rivers, lakes, and first-order admin are components still in need of refinement. Possible data for future updates include transportation (roads and railroads), time zones, and terrestrial hypsography. If you have ideas for Natural Earth Vector, please drop us a line.



Downloads

Data themes are available in three levels of detail. For each scale, themes are listed on Cultural, Physical, and Raster category pages.

Natural Earth is the creation of many [volunteers](#) and is supported by [NACIS](#). It is free for use in any type of project. [Full Terms of Use](#)

Large scale data, 1:10m



[Cultural](#) [Physical](#) [Raster](#)

The most detailed. Suitable for making zoomed-in maps of countries and regions. Show the world on a large wall poster.

1:10,000,000
1" = 158 miles
1 cm = 100 km

Medium scale data, 1:50m



[Cultural](#) [Physical](#) [Raster](#)

Suitable for making zoomed-out maps of countries and regions. Show the world on a tabloid size page.

1:50,000,000
1" = 790 miles
1 cm = 500 km

Small scale data, 1:110m



[Cultural](#) [Physical](#)

Suitable for schematic maps of the world on a postcard or as a small locator globe.

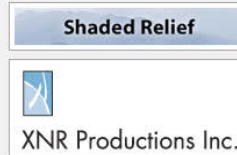
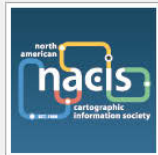
1:110,000,000
1" = 1,736 miles
1 cm = 1,100 km

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[Staff Login](#)

3. A high-level person within an organization asks me to review maps created by a person who is not a geographer or a cartographer. To the mapmaker, the goal, too often, is to produce a “map-like object: when a real story-telling map has been called for. (It’s never quite that simple, but that is the average of these situations.) These are the most frustrating situations—nobody should ever find themselves in this position, as these map reviews represent organizational failure at “many” to “all” levels.
4. Another cartographer asks me to review a map. This is usually rewarding and therefore won’t be discussed any further.

The common threads in the first three situations are: it’s already too late and there was no geographer involved. Organizations that do not recognize the need for cartographic design; that cartographic design is a skill (at the very least); and that some other kind of geospatial expertise cannot be substituted for cartographic design will, to some degree, fail in their mapmaking endeavors. The main reason for this failure is that cartographic design enforces the premise of a map, which is a product, with a purpose, for a defined audience. Without that premise, organizational support for cartography is under-represented.

A second failure is that somewhere the decision to use a map loses focus, and the purpose the map is to serve, is lost. For example, I hear, ‘we need a map; something pretty to get the people’s attention,’ or ‘a picture is worth a thousand words, and a map will be even better; so add a map.’ When a map’s role is objectified and equated to bait, the likelihood of a good, useful, map resulting is not high, and that is probably because given such a diminished role, the need for cartographic design is immediately seen as overkill.

THE NATURE OF ORGANIZATIONS UNDERESTIMATING WHAT IT TAKES TO CREATE A GOOD MAP

Too often, the first two situations described above have the same premise as the third: no cartographer or even geographer is involved, but some kind of geospatial domain expertise and a good attitude are present, which organizations reward. Although, logically expertise from another domain cannot be substituted for cartographic expertise, organizations don’t think that way; frequently, to an organization any expertise is better than no expertise. In fact, many organizations are happy to fail forward, so to speak, meaning that if they penetrate the market soon enough, even a failure can be profitable. If that substituted expertise comes in a cheerful, ready to work form, then the map is likely to never fully reflect the capabilities or intentions of the organization.

To add complexity to this issue, not all cartographers are design cartographers. There are production cartographers, statistical cartographers, analytical cartographers, self-taught intuitive cartographers, academic cartographers, and the list goes on. Graphic artists with no geographic

education are not design cartographers; many would say not cartographers at all. My point isn't to define what a cartographer is, but simply that many cartographers are not design cartographers, and organizations that regularly create maps need a design cartographer. My contention is that in too many organizations this role of a design cartographer is needed but not filled, or sometimes filled based on mistaken identity.

REVIEWING AN UNDER-DESIGNED MAP IS NO SUBSTITUTE FOR CARTOGRAPHIC DESIGN

Illegible, unfocused, faulty maps and map-like objects made by mapmakers who don't know what they don't know pervade too many geospatial organizations. How did anyone get the idea that having data and a GIS would equate to easy mapmaking? That is, of course, rhetorical; mapping software and GIS software companies have for decades marketed the drawing of geospatial data as being equivalent to a map. The idea that mapmakers must have cartographic expertise and that mapping software will not make cartographic decisions for the person at the computer isn't even in the proverbial fine print.

Less than optimal software defaults for map symbols and missing cartographic functionality are not to blame—that is to say, poorly trained or unsuspecting mapmakers will blame anyone but themselves. I agree with them: they were set up for failure. The more important question is: How does the professional cartographic community help organizations understand when cartographic design is necessary? Further, how can that assistance be tailored to help these organizations establish not just recognition, but implement business processes that ensure mapping is done right or identify the risks of not leveraging all the necessary cartographic expertise?

How does the professional cartographic community help organizations understand when cartographic design is necessary?

That gets back to how I introduced this piece: my being asked to review maps. When a mapmaker of insufficient ability has already been assigned to make the map it is usually too late to save the map with a well-intended review. Organizations move forward—with the assigned cartographer, the implication is that the planning phase for the project is complete, and the risk assessment failed to include the prospect of the map not working well due to a lack of cartographic design.

The idea of reviewing a map is easy; I who occasionally teach cartography in workshops and others who teach in classroom settings certainly emphasize the map review as an essential part of the map making process. In hindsight, perhaps we have overemphasized the review and under-stressed the importance of cartographic design. One theory as to why, is that reviewing is relatively easy, and often does not require an extensive investment in time. Cartographic design is a less widely understood role that is difficult for the cartographically uninformed project managers to put on a schedule, so it is much less likely to be accounted for in the typical organization's business processes.

EXPECTATIONS NEED TO BE RAISED

How is it that so many people doing geospatial work know so little about communication methods for their industry's knowledge? Since the ability to recognize a good map from a bad map is a trainable skill, why haven't more people learned it? Maybe it has something to do with the possibility that people put on airs that they understand what they're looking at when it comes to a map, that simple and ubiquitous communication device. Perhaps it is just being helplessly drawn to the pretty colors and haloed text with transparency? Describing a cultural deficiency is one thing, determining what is to be done about it is of far more importance.

Cartographers and geographers design maps to tell stories. In terms of storytelling, drawing GIS data on the screen and optionally printing is too often dangerously close to silence. Too many people, making the maps I review, think mapmaking is a chore. "Draw the data, pick some colors, turn on labels... is it over yet? Why are there so many options... why is this so complex?" With such thoughts in the foreground of map makers' minds, is it any wonder that so many map-like objects get produced? To think I implied earlier that cheerful mapmakers with good attitudes could be a problem; the point is that organizations, in order to successfully produce maps must have people with map making expertise assigned to the task of designing and making maps.

Every organization that produces maps needs a cartographic champion. That person ensures that purpose, audience, design, and review are part of the organizational practices for map creation. That person has authority from the organization to take the necessary actions to ensure their organization's maps meet the organization's requirements by setting standards for map content and quality. Further, that person keeps a little cartographic knowledge from becoming a dangerous thing, by ensuring that map reviews are most typically like the fourth situation I enumerated at the outset, and energizes the map makers to achieve the organizations mapping standards.

How is it that so many people doing geospatial work know so little about communication methods for their industry's knowledge?

CONCLUSIONS

To answer the title question, it's after the first irrevocable step has been taken without a cartographer or geographer. Too often a de-facto irrevocable first step is not having a codified process for designing and producing maps. I think this often stems from the thought-leadership of organizations not realizing that maps are products, and those products represent the organization. Organizational attitudes that instead look at maps as bait, decorations, or that including maps of any sort to enhance their perceived credibility are unnecessarily risking their mission or goals.

cartographer but rather illustrates a model where the public's volunteered geographic information is both available and useful to expert and novice alike. Empowering the public to take certain courses of action based on the a newfound way of displaying spatial data in a way that they didn't know was possible.

In this paper we aim to illustrate the benefits of user-generated qualitative data and user participation and control of the mapping process. Specifically, we relate examples of how the role of the cartographer has changed from map creator – to map facilitator. We further describe two case studies illustrating new methods for implementing a “shared” cartography between experts and non-experts — methods that both aid community research and provide participants with the means to improve their community through the creation and use of maps. The case studies, in Madison and Mt. Horeb Wisconsin, focus on implementing web-based collection tools for the purpose of mapping the qualitative environment navigated by the residents.

BACKGROUND

Participatory mapping is a relatively nascent field, originating from debates between human geographers and GI scientists. From these debates a series of new research avenues have developed. These avenues overlap and build upon one another, creating a landscape where each subsequent development is not only rooted in the previous, but often takes only small steps away from the earlier models.

Public Participation GIS (PPGIS):

The oldest of the methods was the outcome of a gathering of social theorists and GIS practitioners, who developed a social critique of GIS, in Friday Harbor, Washington in 1993 (Sheppard 2005). Concurrently, GIS software became easier to use, removing the requirement of programming and providing a graphical user interface resembling more common software. This confluence of events opened up GIS for both wider adoption but also wider exposure to social and qualitative uses of GIS. However, Tulloch (2008) differentiates PPGIS from other methods as having a primary focus of providing access to data – not necessarily the creation of data by non-experts as in later models. From these beginnings, other emphases have evolved, (e.g., Neogeography, Volunteered Geographic Information, GIS/2).

Volunteered Geographic Information (VGI):

Goodchild (2007) coined the term VGI to describe this process of creation and dissemination of geographic data by individuals. Much like the new Internet ideas of Web 2.0 and user generated content; VGI offers the same opportunities for geographic information. The process produces results that provide unverified local scale information. However, without this process these results would otherwise go unnoticed. Tulloch (2008) focuses his description of this method on the collection of user created data, differentiating it from the PPGIS focus of access to data. Despite the differences, Tulloch goes on to state VGI is likely best served as a subset of PPGIS.

*Volunteered
Geographic
Information (VGI)
is the creation and
dissemination of
geographic data
by individuals*

The speed with which changes are coming, however, requires that these fields adapt and mature quickly, or risk extinction.

GIS/2:

“A more equitable, accessible and empowering GIS” (Miller 2006), describes the closely related method of GIS/2. GIS/2 has similar origins to VGI; users can add data to overall datasets and provide insights that are missed otherwise. Miller points out that Google Maps has provided a more open format, which allows non-expert users to interact with the map, providing an early framework for a GIS/2. The constant evolution of new features of Google Maps, including things like My Maps which has now removed the programming barrier, has provided a technological framework for the implementation of both this model as well as later models, such as VGI.

We are in the midst of an exciting period of change, these developing specialty areas continue to reach more people, and will continue to empower communities with spatial representation of data. The following case studies focus on a two versions of these methods, both seeking to encourage localized representation of place.

VGI IN PRACTICE – PARTICIPATORY PHOTO MAPPING AND SAFE ROUTES

Before VGI was coined and while GIS/2 was (and still is) subject to multiple definitions, Stephen Matthews conducted a geo-ethnographic study that serves as a precursor to some of these ideas (Matthews et al. 2005). Matthews used GIS for non-numeric data and combined the resulting maps with ethnographic research to provide a detailed picture of the lives of the low-income families in his study. Using these ideas as a launching point, it becomes clear that qualitative data and maps can coexist and this has been illustrated in numerous cases (Dennis Jr 2006; Knigge and Cope 2006; Kwan and Ding 2008).

Building upon a desire to incorporate more qualitative techniques into a spatial framework, Participatory Photo Mapping (PPM) was created. With the goal of supporting young people as change agents, PPM leveraged ideas from community mapping, geo-ethnography and PPGIS (Dennis Jr et al. 2009). By extending these ideas to include visual images and narratives, the hope was to increase the power of the product — and ultimately to extend these analyses to a multi-methodological framework.

PARTICIPATORY PHOTO MAPPING

Participatory Photo Mapping (<http://www.la.wisc.edu/ppm/>) was developed to support community-based environmental assessment, action planning and policy development in the realm of health and place (Dennis Jr et al. 2008). PPM emerged from earlier work in community-based qualitative GIS (Dennis Jr 2006) and incorporates participatory practices from community mapping, photo elicitation and action research. Participants create photographs and narratives communicating their routine experience of their neighborhoods. Mapping these images and stories in a GIS helps communities plan actions to build a more health-supportive environment in which to live.

PPM was created and implemented during the Youth Mapping for Safe and Healthy Neighborhoods Initiative (Dennis Jr et al. 2009). The process involved groups of two to three young people, together with a member of the research team, equipped with a GPS receivers and cameras documenting the local environment. The children were asked to take pictures that communicated their experiences, especially places that held significant meaning for them. The images and the GPS tracks were then downloaded and imported into ArcGIS using the GPS PhotoLink plug-in, and the results were layered over an aerial photograph and presented to the children (Figure 1). During the presentation the entire group added their comments to photos. This process allowed multiple interpretations of places to be represented. For example, comments about the local park included descriptions ranging from “fun” to “scary.”

The overarching theme from each PPM project has been the ability to expose the local experiences and concerns in each location.

Since this 2006 study, PPM has been utilized in a number of settings. The overarching theme from each PPM project has been the ability to expose the local experiences and concerns in each location. These local insights are often overlooked at all but the micro scale. In a community on the north side of Madison, Wisconsin, children on a PPM walk independently took multiple images of power lines just weeks after falling power lines had electrocuted two people waiting for the bus in a storm. These images revealed a fear shared by many local children that would have otherwise gone unnoticed. Similarly, many mobile basketball hoops were documented, representing settings for physical activity that do not exist on any published maps. These types of local experiences, coupled with a geographic representation, provide large-scale insights through a version of VGI.

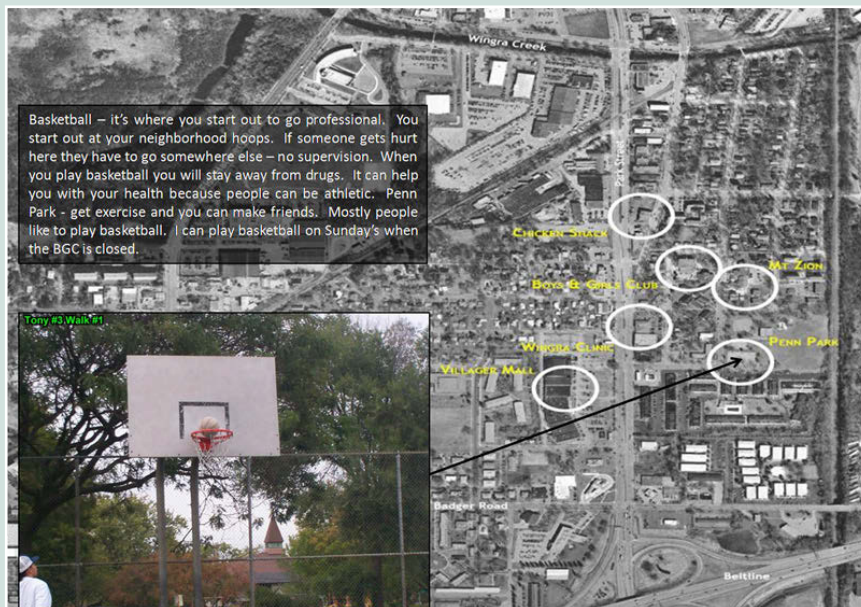


Figure 1 - Integration of Map, Photograph and Dialogue from PPM.

MT HOREB

Multiple PPM studies have been conducted since the initial PPM project was conducted on the south-side of Madison. Most of these have served

the purpose of supporting people in small geographies, but none have extended the method — with one exception. The community of Mt. Horeb Wisconsin, a village of roughly 6,000 people, was the site of a PPM project in the spring of 2008. This project was an extension of Activate America’s “On the Move” project conducted concurrently in Mt. Horeb. As a result of those partnerships it was suggested that PPM work be used in a Safe Routes to School effort — a PPM that would extend to include user generated and user controlled map content beyond photographs to include comments and edits left by the participants.

Residents of Mt. Horeb volunteered to lead “Walking School Buses” and were asked to draw their intended route on a large poster sized map. The Walking School Bus consisted of a parent volunteer leading children in a group walk to school. An overview of these routes appears in Figure 2. Once the routes were mapped they were digitized in a GIS and converted into KML. The KML was then loaded into Adobe Flex using the Google Maps API for Flash/Flex. The routes, PPM images and safety information (such as crosswalks with crossing guards, roundabouts and stoplights) were included in this interface. The route content for the map was generated by community and school members. After the mapping occurred discussions with community stakeholders began to discuss transferring ownership of the upload and editing of map content to members of the Mt. Horeb community.

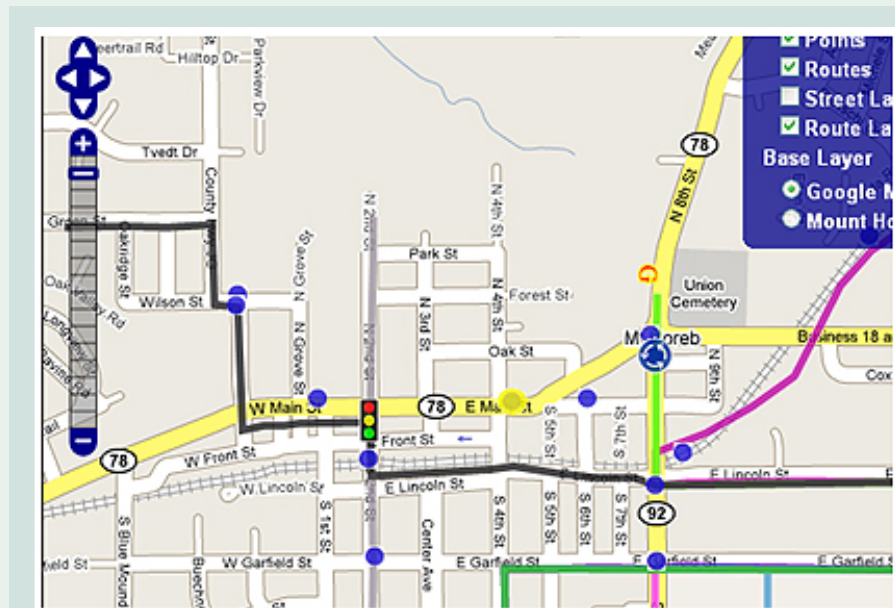


Figure 2 – Mt. Horeb Safe Routes Interactive Map with Walking School Bus Routes Encoded in Color.

During the efforts to determine who within the local community would maintain and manage the map content our team began to encounter resistance. Politics between the school district and the village made for a delicate balancing act. Concerns over liability and unfettered access to edit the map also created issues. Ultimately, the community stakeholders decided that the map should not provide open access for editing and update of content. Rather, the map would be moderated by volunteers and content

would flow through the moderator to prevent a situation like Goodchild describes where “antisocial elements recognize and exploit vulnerabilities” by creating fictitious landscapes or adding defamatory information (Goodchild 2007). While not the optimal solution, having community stakeholders act as the moderators, the community still owns the map, and controls map updates.

This shift to community ownership of both the map and its geographic information illustrates the changing role of the cartographer. In most PPM cases to date, the cartographic product was still produced by experts, more or less in situations resembling common cartographic production. The Mt. Horeb case changed the role of the cartographer from one of final map production as in the earlier PPM cases, to one of map production for the purpose of data gathering at the beginning of the project, both by including Google base maps, but also by placing data production and update on the community participants. Here, the cartographer becomes more of a guide, building a template for the look and feel of data, representing the initial interface and providing support and training. Almost in the role of a software developer — but with a specific focus on the map and the layout of the tools, the cartographer is no less important than in the PPM examples — rather the role has just changed.

The shift to community ownership of both the map and its geographic information illustrates the changing role of the cartographer.

TAKE-AWAYS

Both PPM and extensions of PPM like the Safe Routes project highlight the needs for cartographic expertise, but also the changing role that cartographers are playing. Despite leveraging Google Maps, the design of the map elements still requires the same cartographic design principles to aid in understanding. The cartographer in this model is no longer purely designing for communication of ideas, but rather is truly aiming for the sharing of information and ideas between parties — particularly between citizens, decision makers and researchers.

CHANGING TECHNOLOGY

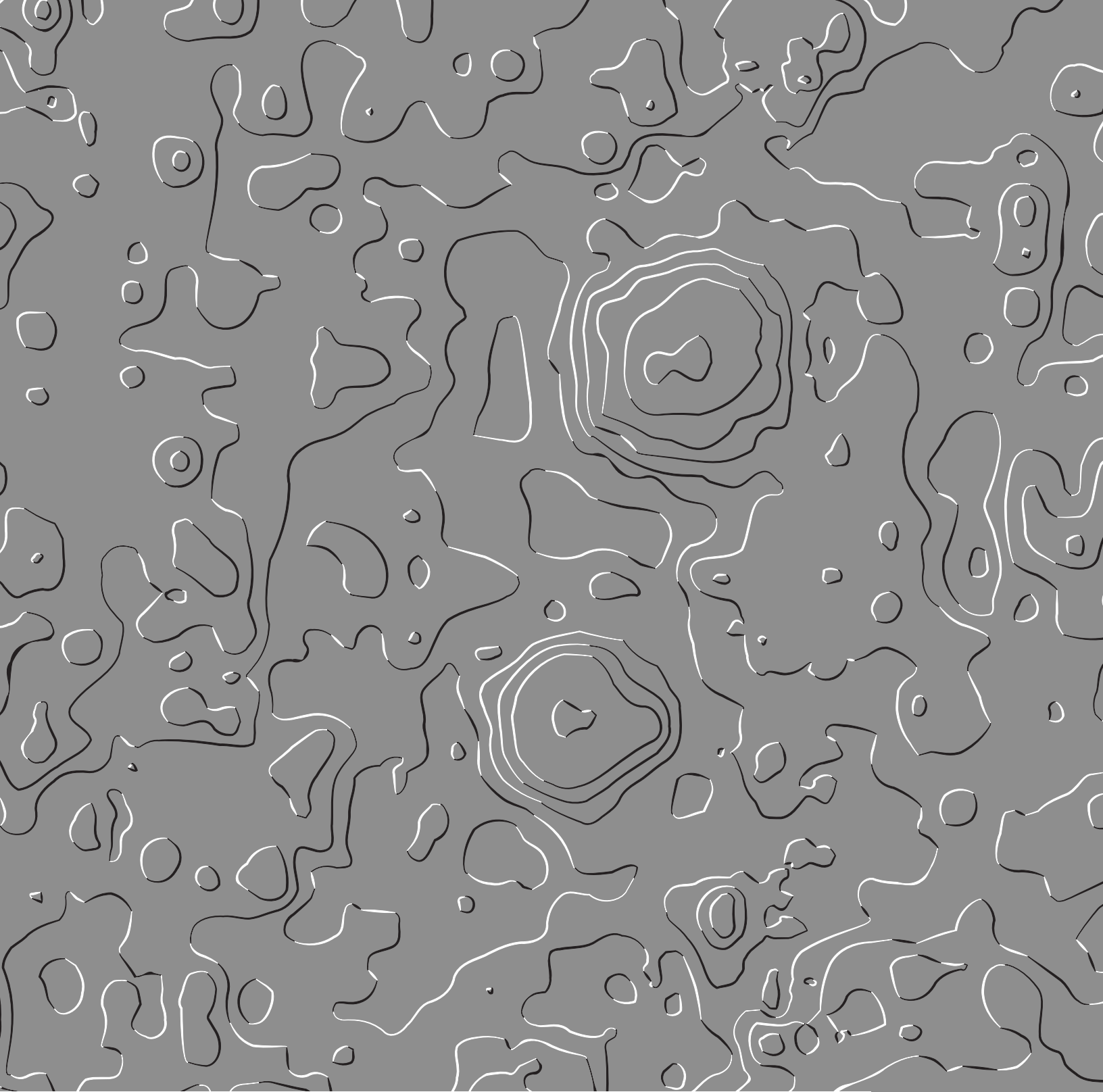
The continuing diversification of cartography leads to some challenges when it comes to defining the field. Changing technologies (such as Google Maps) as well as new branches of GIScience (such as VGI) require cartographers to remain nimble and ready to evolve. Ultimately the question becomes — who is a cartographer? Is it Google hackers, people trained in design and projections, computer scientists, ordinary citizens, or is it a mix of all of these depending on both the intended map output but also the intended utility of the map. This is the unanswerable question — the definition is changing so rapidly, between GPS enable cameras to new and diverse programming languages, that the answer is difficult to pin down. Ultimately, we may find that there is no one good answer to this question. The era of the cartographer deciding what data should appear on a map and remaining the authority over the map has ended—geographic information is in the wild and cartographers need to jump on board to help guide the revolution.

CONCLUSION

PPGIS, VGI, PPM are methods and techniques that are all part of the transition of many things: GIS, public consumption of spatial information, the content and output cartographers create, and the role of cartographers. This milieu of uncertainty however doesn't alter the fact that sound cartographic training, mixed with a flexible framework, allows for a solid grounding going boldly forward into a new world of spatial information. Cartographers and cartography are still necessary for the work they have long performed, but they are also critical in empowering people to make their own maps. These maps have the potential to give a voice to the unspoken, a home to the unmapped, and most importantly to help people use and understand maps to make decisions.

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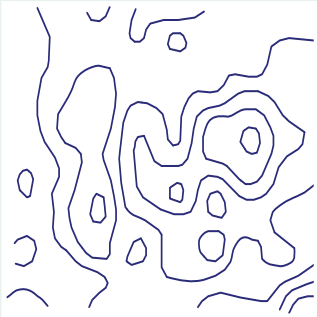
The Moon—is a map of the middle latitudes of the Earth's Moon uses a stylized technique called illuminated contours, popularized by Kitiro Tanaka, to present relief features and topography. Alternating dark and light lines have been placed according to an imagined light source placed at the north-west corner of the image giving the impression of three dimensional relief.

Hillshading with Illuminated Contours

Kevin J. McGrath | kjmcgrath@wisc.edu

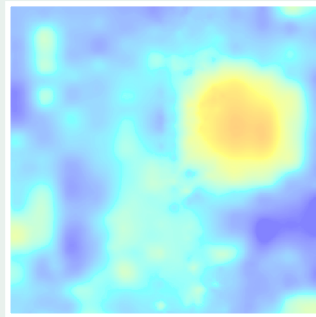
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FEATURED MAP



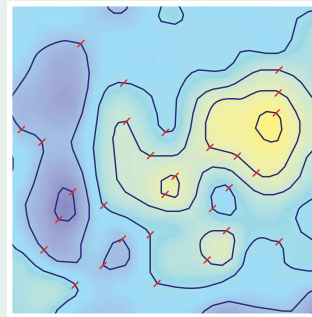
DIGITAL ELEVATION MODEL (DEM)

A Digital Elevation Model of the Moon was used to generate 1 km contours which were generalized to match final scale.



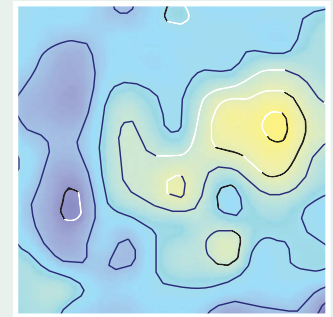
HYPSOMETRIC TINTING OF DEM

The DEM was then colored by elevation (hypsometric tinting) to preserve information on the direction of slope to be used later the process. A diverging color ramp was chosen to facilitate quick understanding of changes in topography and the direction of slope between any two contours



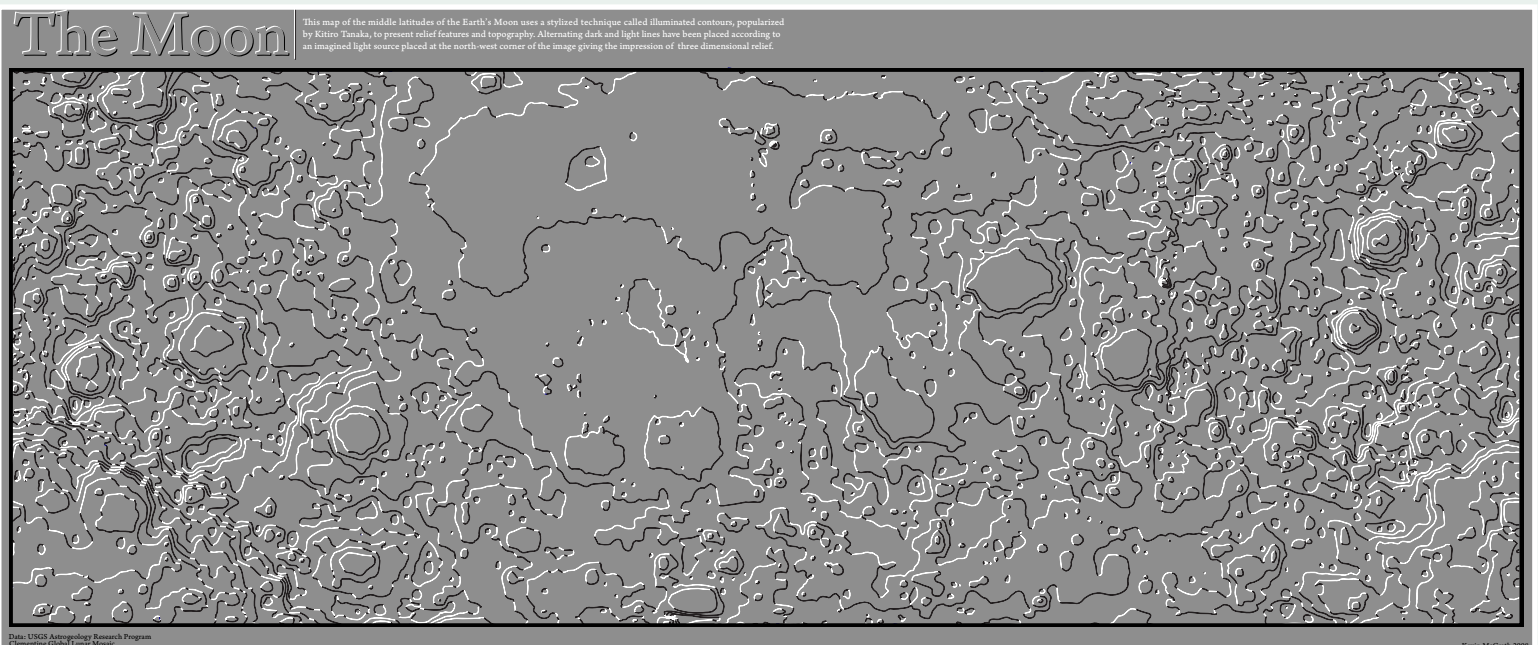
CUTTING AT TRANSITION POINTS

The contour lines were then manually cut at “transition points” where an imaginary light source from the upper left portion of the image would no longer bathe that slope in light but would leave it in shadow.



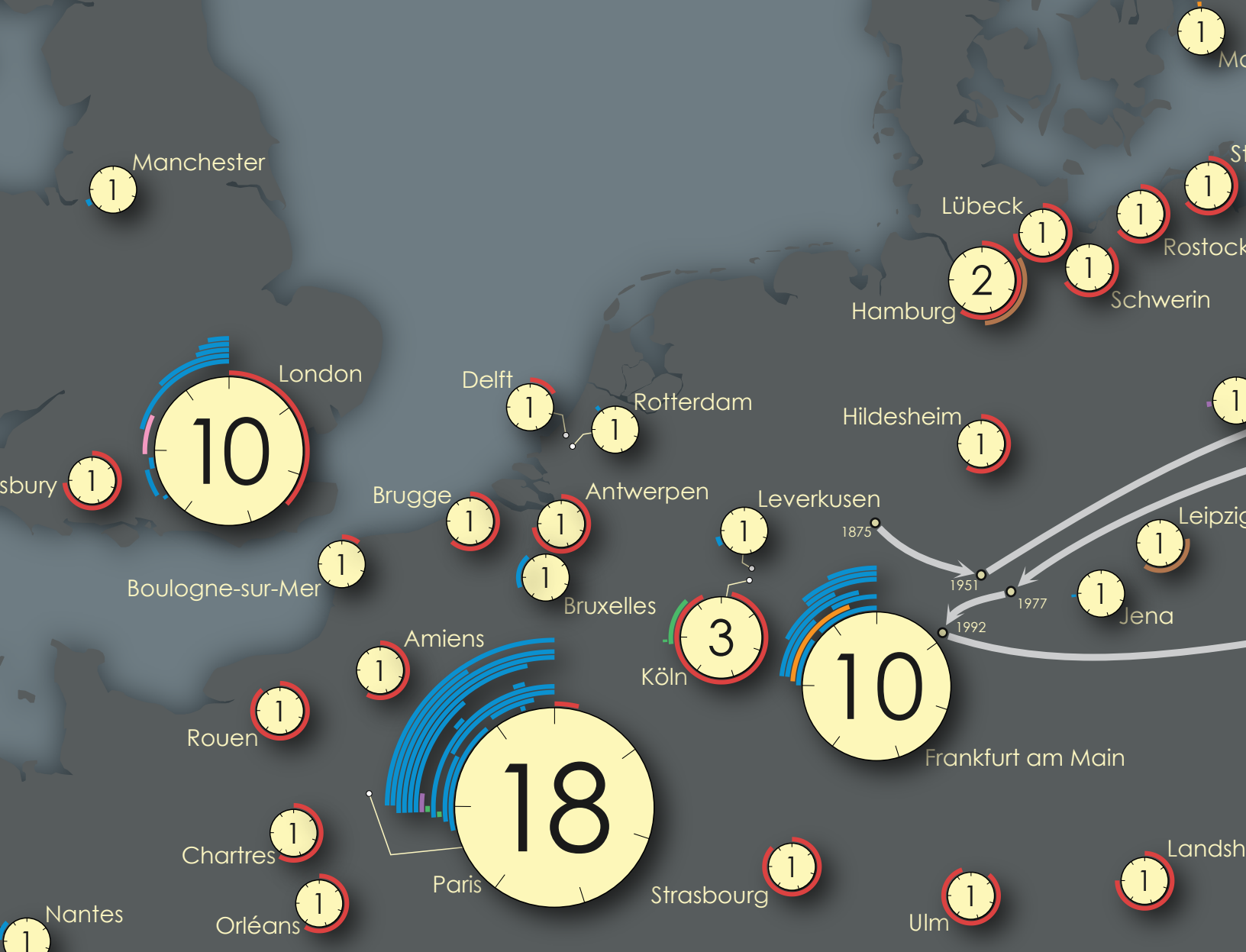
APPLICATION OF COLORED STROKE

The illusion of relief was achieved by manually selecting and applying a colored brush stroke to clipped portions of the contours between “transition points.” (Black stroke for shadows and white for sunlight, informed by the slope preserved in the colored DEM).



THE EFFECT

The addition of a dark grey background completes the process and helps to strengthen the illusion. Note that the illusion is most powerful from a distance.



Rising Skyline - The Tallest Buildings in Europe, 1875–2007

Tall buildings are major feats of engineering, showing off to the world the industriousness, economic might, and technical prowess of the people who built them. As such, competitiveness and a desire for prestige have been major factors driving their construction. Medieval cities competed for the largest and tallest churches to glorify God and themselves. Early in the Cold War, Stalin ordered the construction of some of the tallest buildings Europe had ever seen in order to avoid embarrassment at how Moskva’s skyline compared to that of capitalist cities. More recently, the growing wealth of Turkey and Russia has led to a spate of new highrises which demonstrate their increasing economic clout. Building higher continues to be a way for one group of people—a city, a state, a corporation—to show off to others. This map shows the location of each of the one hundred eighteen buildings that, at some point between 1875 and the end of 2007, were ranked among the thirty tallest in Europe.

Increasing Data Density with Multivariate Symbols

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FEATURED

MAP

