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in this issue

Letter from the Editor

I am pleased to announce that Dr. Scott Freundschuh from the University of Minnesota-Duluth, has agreed to take over the editorship of *Cartographic Perspectives* beginning with the first issue of 2001. Scott will be *CP*s fourth editor. David DiBiase served beginning with the conception of the journal in 1989 to 1992. Sona Andews was editor between 1993 to 1996. I have served as editor since 1997 with the help of a number of guest editors. Jim Anderson will continue as Assistant Editor and will be invaluable in the transition. Scott will appoint his own Editorial Board and section editors. The outgoing editors wish the new team good luck on their endeavor.

This 36th issue of *CP* is the longest and most colorful ever published. With 100 pages, this issue reflects the fact that the rate of article submissions has increased over the past few years. All of the featured articles published in this

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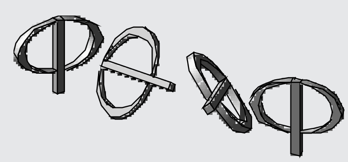

The cover design was created by Louis Cross. Louis is a cartographer and graphic artist with the Florida Resources and Environmental Analysis Center at Florida State University. He an active member of NACIS.

If you would like to submit covers for future issues of *Cartographic Perspectives* please contact Jim Anderson, Assistant Editor at the address listed above.

Note from the Editor: This essay was first presented at a plenary session at a conference of the International Cartographic Association in Ottawa, Canada, in August of 1999. Responses to the paper were offered by John Pickles and David Rhind. These will appear in the next issue.

Cartographic Futures On A Digital Earth

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Introduction

This paper is written with some trepidation, since I am not a cartographer, and would certainly not want to be perceived as trying to prescribe cartography's future. But the organizers of the conference have asked me to address the second part of the conference theme, "Touch the Past, Visualize the Future", and I hope what follows will be of some interest. It is written from the perspective of someone who cares greatly about the cartographic aspects of what we do, who like many of us grew to love maps at an early age, and who sees cartography as an indispensable part of any future for my own discipline of geography, and the broader enterprise that we variously know as geomatics, geoinformatics, or geographic information science.

The paper begins by introducing two broad trends that provide a context of vital importance for cartography: the digital transition, which began some decades ago but seems to dominate more and more of our vision of the future; and what appears to be an increasing interest in society generally in geography, the stuff of maps, and in all things geographic. These two themes come together in a discussion of how the digital transition will affect the production, dissemination, and use of maps; the institutions that manage and regulate those activities; and ultimately, the nature of maps themselves. This leads to the identification of a basic paradox between the increasing marginalization of cartography within the larger digital geographic enterprise, and the increasing need for good cartographic practice in visual communication, as more and more people are empowered by new technology to make maps. The final section of the paper discusses the concept of Digital Earth, a popular idea that seems to serve both as a conceptual framework for much of the preceding discussion, and as a 'moonshot' that can mobilize a substantial technical and scientific effort.

"This leads to the identification of a basic paradox between the increasing marginalization of cartography . . . and the increasing need for good cartographic practice in visual communication . . ."

The digital transition

The idea of communicating in code is as old as language itself, requiring only the establishment of standards within a community regarding the code's meaning. An even older code is the alphabet of four bases used to communicate genetic information between parent and offspring; incredible as it may seem, the entire architecture of the human body, and the instruction to a chick to begin pecking after 21 days of incubation, are somehow successfully coded in a permutation of A, C, G, and T. But the explosive growth of digital communication that has occurred in the past 30 years relies on several other factors besides a universal code of zeroes and ones. The code is readily processed at great speed by digital computers; it can be stored virtually indestructibly (although practice often falls well short of theory); modern standards include automatic error-checking; and it can be transmitted at close to the speed of light. Today, virtually all human communication-at-a-distance passes through a digital coding and decoding at some point. Telephones, FAX, written text, photographs, music, all have associated and generally accepted standards of coding in digital form. Only the mail remains as a predominantly analog method of communication, although most sorting of the packages themselves is now digital. In principle, the entire contents of a major research library in the form of printed text could now be digitized, stored on a device no larger than an average office, and made available to everyone connected to the Internet at a cost roughly comparable to that of a Boeing 747-400.

"Digital technology is already pervasive, but its impacts are only just beginning to be felt in the ways humans organize and conduct their activities."

Digital technology is already pervasive, but its impacts are only just beginning to be felt in the ways humans organize and conduct their activities. Take, for example, the case of geologic mapping. Figure 1 shows the stages of mapping from the work of the field geologist through to eventual use, storage in libraries, and archiving. Each person or group in the chain communicates with the next person or group: the field geologist gives notes and sketches to the cartographer, while the printer sends paper maps to the distributor and on to the library and user.

The first infection by the digital virus occurred among cartographers who were persuaded as early as the late 1960s that the time and cost of preparing and editing maps could be greatly reduced by adopting digital technology, initially by fixing simple encoders to the arms of plotters to capture locations, and later by replacing drafting tables by digitizers. Today, it is hard to find a single drafting pen in many map production operations and cartography classrooms. Then users began to demand digital product, because of the obvious potential of digital analysis and the simultaneous growth of geographic information systems (GIS) as analysis engines for map data. But this second round of infection had a more significant impact, since it created a new path that bypassed the traditional printing and dissemination arrangements. More recently, the World Wide Web strain of the digital virus has further infected the distribution function, as digital spatial data libraries (such as the Alexandria Digital Library, *alexandria.ucsb.edu*) and spatial data clearinghouses (such as the U.S. National Geospatial Data Clearinghouse, *www.fgdc.gov*) provided an alternative to the traditional library as a source of archived information.

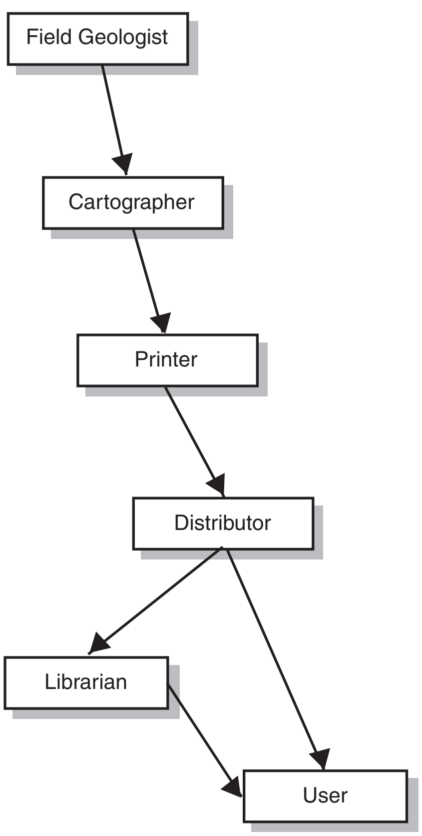

Figure 1. Schematic of the geological mapping process as communication.

Digital technology has yet to infect the work of the field geologist to a significant degree, although it is common today to find laptops at field sites. The sketches and field notes that a geologist passes to a cartographer are still largely in analog form, and suitable software for capturing and processing such information is still primitive. But the technology already exists to allow the field scientist to download images of a project area from the WWW, to annotate it digitally with sketches and notes, and to link digital photographs to field locations. Information technology in the field promises to improve greatly one of the most severe impediments to the various stages of communication shown in Figure 1, and one that underlies much of the subsequent discussion in this paper: the inability of the field geologist to communicate more than a small fraction of what he or she discovers in the field to the eventual end user, because of the highly restricted nature of the traditional communication channels. In the longer term, extensive application of information technology in the field promises to open up novel channels of communication. For example, it will be possible for field scientists to share information remotely as soon as it is collected or interpreted; to communicate directly with end users; and in the long run to bypass entirely the traditional stages of cartographic production.

In recent years, massive investments have been made in digital libraries, metadata (data about data, the digital equivalent of the catalog record), new search mechanisms, and other developments aimed at making it possible to find geographic data in the massive, distributed archives of electronic networks. Moreover, it seems clear that investments to date are tiny compared to what is to come, as the information economy heats up. Surfing the Web for data is providing an increasingly effective alternative to visiting one's local map librarian.

The digital transition is affecting the *geography* of map production as well, as the traditional arrangements break down or are modified by new technology and changing economics. Much cartographic software is now cheap and affordable, allowing anyone with a personal computer and access to the Web to make maps. Farmers with access to the technology of precision agriculture can build maps of their fields at much higher resolution than traditional soil maps, and can capture and compile detailed spatial information on inputs and yields using devices attached to harvesters and tractors. Local governments can rent vans equipped with GPS units, drive along every street, and produce street maps at higher accuracy and much lower cost than the traditional production arrangements of central governments. In short, changing technology and economics are moving map production from a system of unified central production to a local patchwork, and the old radial system of dissemination is being replaced with a complex network.

"The digital transition is affecting the geography *of map production as well . . ."*

In the early stages of the digital transition much use was made of the new technology to perform operations more quickly, at lower cost. But as the transition advances it is the operations themselves that come into question, along with the organizational structures and arrangements that evolved around them. The survivors in this world will be those who can think beyond past practices, and adapt quickly to new opportunities.

The stuff of maps

As a U.S. citizen I share what is now a widespread feeling of awe for the sublime geographic ignorance of many of my fellow citizens, and nowhere is this better revealed than in U.S. ignorance about Canada. Yet this is a period in political history of devolution of power down the geographic hierarchy. We are encouraged to think globally but act locally; increasing local autonomy makes it more and more difficult to achieve widespread consensus. There are new standards for teaching geography (Bednarz *et al.*, 1994), greater interest in travel, more interest in the diversity of places and less in standardization.

In the past few years many new services based on geographic information have appeared on the Web. Microsoft's Terraserver (*www.terraserver.com*) began as an effort to build and demonstrate a capability to serve information at a massive scale, with geographic data chosen as the content because it was cheap and comparatively unencumbered by issues of intellectual property. But Terraserver has been very successful as a pioneering effort to serve imagery to a vast population of users, many of whom had never had access to easy-to-use Earth imagery before. Microsoft's Home Advisor (*www.homeadvisor.com*) provides GIS-like services in the form of home listings and social data about surrounding neighborhoods. MapQuest (*www.mapquest.com*) is one of many sites offering maps, georeferencing, and optimal routing services.

"One of the greatest impediments to effective use of geographic data has been the inability to integrate information about a place."

One of the greatest impediments to effective use of geographic data has been the inability to integrate information about a place. Our traditional arrangements for production of geographic information emphasized horizontal uniformity; one government program produced all topographic maps, another all soil maps. These arrangements have been largely inherited by the digital world, so that one goes to one site to obtain an image (e.g., the MIT server of digital orthophoto quadrangles, *ortho.mit.edu*), and another site to obtain a topographic map, and still a third to obtain a soil map. It has been virtually impossible to approach a library, or the Web, and ask for all information about one place; and equally difficult to integrate such data once obtained because of variations in formatting and terminology, and positional inaccuracies.

The U.S. Geological Survey provides an interesting case in point. The traditional organization of the Survey into four divisions (with responsibilities for mapping, geology, water resources, and biological resources) has also determined the face it presents to the world as a source of information. Thus a user approaching the USGS Web site finds it much easier to obtain information about one theme for places, than information about many themes for the same place. The Survey's *Gateway to the Earth* project proposes to replace this external view by a more integrated one that will allow the user to find everything the Survey knows about a place. This idea of *place-based search* is already implemented to a degree in the U.S. Environmental Protection Agency's site (see the ZIP code search feature of *www.epa.gov*).

"This idea of place-based search *is already implemented to a degree in the U.S. Environmental Protection Agency's site."*

These place-based search mechanisms resemble what I have called a *geolibrary* (Goodchild, 1998), or a library that one can approach with the query *"What do you have about there?"* Place-based search has been very difficult in the traditional library for numerous reasons, but promises to be comparatively easy in a digital world, and provides yet another instance of how the digital transition is changing our arrangements for producing, disseminating, and using geographic information.

Geographic information and maps

But maps are only one form of expression of geographic information. Very broadly, one could define geographic information as information about well-defined locations on the Earth's surface; in other words information associated with a geographic *footprint*. But that definition fits guidebooks, photographs of landscapes, even pieces of music with geographic associations. Possession of a footprint is the minimal requirement for place-based retrieval. Maps, on the other hand, are:

"Very broadly, one could define geographic information . . . associated with a geographic footprint.*"*

Visual forms of geographic information, rather than textual, verbal, acoustic, tactile, or olfactory; though tactile maps have been developed to address the needs of the visually impaired.

Flat, requiring the Earth's surface to be expressed in a distorted manner.

Exhaustive, expressing a uniform level of knowledge about every part of the area covered by the map.

Uniform in level of detail, although no flat map can ever have a perfectly uniform scale.

Static, since a map once drafted and printed cannot be substantially changed.

Generic. The strong economies of scale in map production ensure that maps will be produced only when demand reaches a sufficient level. Thus maps tend to be produced to satisfy many uses and users simultaneously. They present a *shared* perspective that cannot be user-centered, and thus is almost always vertical.

Precise, few methods being available for display of uncertainty.

Slow, due to the lengthy time required for all of the different stages of production, as shown for example in Figure 1.

None of these constraints is inherent to geographic information, however, especially in a digital world that changes the economics of map production, provides the tools for interacting directly with information, and allows information to be compiled and delivered at electronic speed. In the digital world all information is expressed in bits, whatever its origins; it is stored in the same places, and transmitted using the same techniques. It does not matter to the Internet whether a 'bag of bits' represents text, an image, or a map. Thus we hear more and more about multimedia systems that handle data irrespective of the media on which they were traditionally stored in the analog world. The term *multi-valent document* (Phelps and Wilensky, 1996) refers to the ability to link images, text, sketches, notes, etc., that refer to the same subject, and to handle them as if they were a single unit. In this multi-media world, old arrangements based on the problems of handling different media will be challenged, and may be abandoned completely.

"It does not matter to the Internet whether a 'bag of bits' represents text, an image, or a map."

The paradox of contemporary cartography

It follows from the previous discussion that the map[2] is only one form of expression of geographic information in a digital world, competing with other forms on a playing field that is increasingly level. For example, flat views of the world and the distortions they embody must compete with orthographic views such as those provided by the current version of Microsoft's Encarta atlas. To the average citizen, working with and manipulating a digital globe may be far more straightforward and comprehensible than working with a digital Mercator projection; and children may be able to understand a globe more easily and at an earlier age than its projected version.

It is widely believed that geographic information systems are being absorbed into the information technology mainstream: that in the near future such standard applications as spreadsheets, e-mail, and word processors will include support for geographic information. The magazine *GIS World* recently changed its name to *GeoWorld*, to reflect "GIS's transition from a standalone technology to one benefiting from the integrated nature of today's spatial technologies and the enterprisewide solutions they offer." (Hughes, 1998). GIS has made it possible for anyone who can afford a basic personal computer and cheap software to display geographic information in the form of a map: By offering these functions through such common applications as Microsoft's Excel, software developers are now putting these tools into the hands of everyone, irrespective of their credentials and sensitivity to cartographic principles. In a world in which everyone can make a map, who needs the cartographer?

"It is widely believed that geographic information systems are being absorbed into the information technology mainstream . . ."

Only a few institutions have had the wisdom to elevate cartography to the status of a department. Instead, cartographers have historically found themselves rubbing shoulders with geographers or surveyors. Today, rapid growth in interest in geographic information systems and related fields has led to an emergence of new collaborations, under a variety of names: geomatics, geoinformatics, or geographic information science. Cartography finds itself a small part of a larger academic enterprise, and at the same time increasingly marginalized by the rapid spread of mapmaking tools.

"While a database makes the link between an object and its name explicit, the eye-brain system does this through complex rules of visual association that must be understood by the map designer and made the basis of map design."

Much of the attraction of GIS lies in its visual focus: colorful maps appear on the screen to be manipulated and explored by the user at the touch of a mouse. GIS communicates primarily through the visual channel, especially when used in efforts to influence public opinion and policy. But such communication is never simple and straightforward. Only one color can be assigned to each location in the visual field, which is then mapped through the optics of the visual system to the human retina. While a database makes the link between an object and its name explicit, the eye-brain system does this through complex rules of visual association that must be understood by the map designer and made the basis of map design. Map designers must devise complex and sophisticated rules to make it possible for a map to communicate more than one attribute of an object; and yet none of these rules are needed when information is communicated in other forms, such as through tables.

Despite this complexity, or perhaps because of it, a large number of the maps produced using today's software are simply awful. As David Rhind has been known to remark, GIS technology lets us produce rubbish faster, more cheaply, and in greater volume than ever before. Paradoxically, then, the world that is marginalizing cartography is also the world that needs cartographic principles and skills more than ever. It is also a world of unprecedented opportunities for cartography as the digital transition removes many of the inherent barriers and impediments of the traditional map, and makes communication of geographic information between people richer and more efficient than was previously possible. To restate the previous list, communication of geographic information need no longer restrict itself to the visual field; flatten the Earth; cover every part of an arbitrarily defined area that happens to include the area of interest in uniform detail; maintain a uniform level of detail and a vertical perspective irrespective of the content's focus; remain static irrespective of the acquisition of new information or change in the landscape; serve the interests of a large number of users to overcome high fixed costs; fail to reveal anything of its own inherent uncertainties; or take substantially longer than any other form of communication.

Digital Earth

"U.S. Vice President Al Gore . . . described an immersive environment that would allow its users to explore and learn about the Earth and its human and physical environments."

The term *Digital Earth* has a number of meanings. U.S. Vice President Al Gore, in the text of a speech, described an immersive environment that would allow its users to explore and learn about the Earth and its human and physical environments (the full text is at *www2.nas.edu/besr/238a.html*; a summary was delivered in Los Angeles in January 1998):

> "Imagine, for example, a young child going to a Digital Earth exhibit at a local museum. After donning a head-mounted display, she sees Earth as it appears from space. Using a data glove, she zooms in, using higher and higher levels of resolution, to see continents, then regions, countries, cities, and finally individual houses, trees, and other natural and man-made objects. Having found an area of the planet she is interested in exploring, she takes the equivalent of a 'magic carpet ride' through a 3-D visualization of the terrain. Of course, terrain is only one of the numerous kinds of data with which she can interact. Using the system's voice recognition capabilities, she is able to request information on land cover, distribution of plant and animal species, real-time weather, roads, political boundaries, and population. She can also visualize the environmental information that she and other students all over the world have collected as part of the GLOBE project. This

information can be seamlessly fused with the digital map or terrain data. She can get more information on many of the objects she sees by using her data glove to click on a hyperlink. To prepare for her family's vacation to Yellowstone National Park, for example, she plans the perfect hike to the geysers, bison, and bighorn sheep that she has just read about. In fact, she can follow the trail visually from start to finish before she ever leaves the museum in her hometown.

She is not limited to moving through space, but can also travel through time. After taking a virtual field-trip to Paris to visit the Louvre, she moves backward in time to learn about French history, perusing digitized maps overlaid on the surface of the Digital Earth, newsreel footage, oral history, newspapers and other primary sources. She sends some of this information to her personal e-mail address to study later. The time-line, which stretches off in the distance, can be set for days, years, centuries, or even geological epochs, for those occasions when she wants to learn more about dinosaurs."

Several principles and challenging ideas underlie this piece of technological fantasy. First, the immersive environment provides a very rich form of communication between the information store and the learner, unimpeded by the constraints of a single medium, and not limited to the visual channel or to the narrow concept of *map* defined earlier. Second, the vision mixes types of data that are readily communicated by *rendering* into something resembling their true appearance, such as topography and land cover, with other types that will have to be communicated symbolically. This second type includes information on population, health, or environmental quality. Cartographers are familiar with the problems of mixing these two types of data through their experience with symbolic enhancement of orthographic images. Other information mentioned in the speech is geographic only in the sense of having a footprint; the contents of newspapers and oral histories will have to be represented iconically, and their contents communicated in some appropriate way, since they are not geospatial and therefore cannot be mapped onto the Earth's surface.

". . . the immersive environment provides a very rich form of communication between the information store and the learner . . ."

More fundamentally, perhaps, DE embodies a novel metaphor for the organization of digital information and construction of user interfaces. The current generation of computer operating systems, such as Windows 98, makes use of the metaphor of the desktop, with its clipboards, filing cabinets, and briefcases, because this is the environment most familiar to office workers. This tradition goes back to work at the Xerox PARC laboratories in the 1960s, but came to dominate Microsoft operating systems only in the late 1980s with Windows. Yet the office is not a natural environment for thinking and learning about the surface of the Earth, and *office* is not the first thing that comes to mind when we think of Shackelton, or von Humboldt. Since all such information relates to some geographic location, it would be far more effective to use the Earth's surface itself as the organizing metaphor. For example, rather than look in a filing cabinet under Z, someone interested in Zimbabwe would find it much easier conceptually to reposition a digital globe to the right part of Africa (or to look up Zimbabwe in a digital rendering of the back-of-the-atlas gazetteer, and see the globe repositioned automatically). DE replaces the office with the Earth as the dominant user interface metaphor.

"More fundamentally, perhaps, DE embodies a novel metaphor for the organization of digital information and construction of user interfaces."

DE seems an appropriate focus for this discussion not because it is real (although several prototypes have appeared since the text of the speech was released), but because it provides a vision for the future communication of geographic information that reflects the removal of all of the impediments identified above. It also presents some very substantial challenges.

The range of scales implied is over at least four orders of magnitude, from a resolution of 10km that would be appropriate for rendering of the entire globe, to the 1m resolution needed to render a local neighborhood. Cartographers have long struggled with relationships between maps at different scales, but not over this large a range.

Perspectives in DE will be user-centered, whereas almost all cartographic tradition is focused on user-independent perspectives (vertical, with uniform detail). We know very little about how to vary resolution with distance for effective communication, although much work has been done on the necessary algorithms in computer graphics.

"We have little in the way of cartographic technique for indicating the presence *of information, rather than the content."*

As noted above, DE will have to mix rendering with symbolic and iconic representations. We have little in the way of cartographic technique for indicating the *presence* of information, rather than the content. New forms of representation of metadata are called for.

The speech implies that a DE environment would somehow know about and have access to some significant portion of the information that exists about a given place. This raises a host of interesting technical questions about information search and discovery in digital libraries, clearinghouses, and the WWW; institutional questions about quality assurance and credibility; and societal questions about privacy and intellectual property.

Although the child in this scenario enters an immersive, virtual environment, the principles of DE could be applied equally well to the conventional configuration of a user, keyboard, screen, and pointing device. Although the screen renders images in two dimensions, a user with the ability to manipulate rendered objects has no difficulty imagining the object as three-dimensional. But the conventional configuration clearly misses the potential for tactile communication.

Although the speech refers only to historic data, it is easy to imagine DE being used to communicate simulations of Earth processes that could help the child learn the principles of geomorphology or urban planning and growth; or help decision-makers deal with the projected impacts of current actions.

DE appears to have many attributes that qualify it as a suitable *moonshot*, a vision or rallying point for a rather ill-defined collection of disciplines and interests, comparable to the 1960 commitment to "put a man on the moon before the end of the decade." Moonshots like these are not grand challenges in the sense of fundamental unsolved problems for a discipline, but they can help to orient a community, such as the current community interested in geographic information, in pursuit of a common goal and the research problems that will have to be solved to reach it. Moreover, many of those solutions are likely to have benefits far beyond the immediate context of the moonshot.

CONCLUSION

A technology that began as a way of making large numbers of numerical calculations possible has turned into something that, if the pundits are to be believed, has the potential to reorganize much of what we do. Cartographers first felt that impact in the early 1970s when computers began to be used to reduce the production costs of paper maps. Since then, digital technology has affected almost all aspects of mapping, created an entirely new application in geographic information systems, facilitated many other new geographic information technologies, and spawned a new partnership of the mapping sciences known variously as geomatics or geographic information science.

"For the traditional cartographer, what began as a useful aid has turned into a monster . . ."

For the traditional cartographer, what began as a useful aid has turned into a monster, empowering virtually everyone with access to the tools that used to be the exclusive preserve of specialists. In a world in which everyone can make a map, who needs cartography? Or as Judy Olson titled her Presidential Session at the Association of American Geographers annual meetings in Charlotte in 1996, "GIS has killed cartography". But paradoxically, the need for good cartographic design is now stronger than ever.

Faced with this situation, it seems to me that a suitable strategy for visualizing the future while touching the past would have the following components:

(1) Establishment of clear principles underlying the communication of geographic information. Such principles should be independent of media and technology, and thus robust against a major technological transition such as the one we are currently experiencing. These would not be the principles of paper maps alone, or of digital displays alone, or of visual communication alone, but of the communication of geographic information from one person to another. Different communication channels and media would be represented through different parameters, constraints, and rules within this general framework.

(2) Anticipation of the full impact of the digital transition. It is hard to see the wood for the trees in times of fundamental change, and to think beyond the immediate impact of computerization on a single task. But in the long term, the world will reorganize itself according to principles such as those suggested in (1) that are truly fundamental. These include function, economics, and the basic forces that drive society, including the distribution of power and influence.

(3) Identification of a moonshot, an articulated vision of what communication of geographic information might mean at some point in the future. Without such a vision it is difficult to see how a prioritized agenda for cartographic research can emerge. Curiosity will always be around to drive research, as will immediate economic gain, but it is much more difficult to identify a clear sense of common purpose that can both drive research and appeal to potential sources of funding.

REFERENCES

Bednarz, S.W., N.C. Bettis, R.G. Boehm, A.R. DeSouza, R.M. Downs, J.F. Marran, R.W. Morrill, and C.L. Salter (1994) *Geography for Life; National Geography Standards*. Washington, DC: National Geographic Society.

Goodchild, M.F. (1998) The geolibrary. In S. Carver, editor, *Innovations in GIS 5*. London: Taylor and Francis, pp. 59–68.

Hughes, J.R. (1998) GIS World is now GeoWorld!. *GeoWorld* 11(11): 8.

Phelps, T.A., and R. Wilensky (1996) Multivalent documents: inducing structure and behaviors in online digital documents. *Proc. IEEE Int. Conf. System Sciences, University of Hawaii, Maui, HI, January.* http://www.cs.berkeley.edu/~phelps/papers/hicss96-abstract.html

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2. As used here, the term implies a paper product or its direct digital equivalent produced by scanning or digitizing; both are therefore subject to the constraints identified earlier.

The Nature of Creativity in Cartographic Design with Special Reference to the Barbara Petchenik Map Design Competition

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Every other year, the International Cartographic Association sponsors an international map design competition, for children 15 years old or younger, that coincides with its biennial congress. The competition promotes the creative representation of the world. The theme of the latest competition was "A World Map." The breadth and ambiguity of this theme does not convey information about its conceptual basis or the grounds upon which entries might be judged. In promotional material, words like "creativity" often appear but it is unclear what is meant in this cartographic context. In comparing what cartographers and art educators say about creativity, it is clear that there are perceptual skills and a body of principles of graphic design which cartographers can systematically apply to enhance creative map design particularly when specific problems are being addressed. This paper provides some background on these and other related questions and suggests ways that the Map Design Competition might provide more useful guidance for competitors and judges alike.

"Whatever creativity is, it is in part a solution to a problem."
–Brian Aldiss (1990), British science-fiction writer

INTRODUCTION

Every other year, the International Cartographic Association sponsors an international map design competition, for children 15 years old or younger, that coincides with its biennial international congress. To date there have been four competitions: Cologne (1993), Barcelona (1995), Stockholm (1997), and Ottawa(1999).[2] The competition, named in honor of Barbara Bartz Petchenik, aims to promote children's creative representation of the world, to enhance cartographic awareness, and to make children more aware of their environment. The ICA's Commission on Children and Cartography advises the ICA Executive on ways that the Competition can be improved and made more effective in achieving its aims. Any suggestions should, of course, have the understanding and support of cartographers in general because it is in their interest that the next generation of mappers become increasingly literate. Guidelines to the Competition set out certain technical requirements[3] and state the theme, most recently "A World Map", and for the 2001 Competition, "Save the Earth."

"The competition . . . aims to promote children's creative representation of the world, to enhance cartographic awareness, and to make children more aware of their environment."

Given the breadth and ambiguity of these themes, it is difficult to understand the conceptual basis of the Competition. In discussions about the Competition, words like "creativity" or "creative representation" often appear. But it is unclear what is meant in this cartographic context. Is it a spontaneous expression of one's feelings or a more deliberate attempt to present, in cartographic ways, certain ideas about the world, no matter how elementary? If it is the former, how do we begin to measure success? If it is the latter, then there is an opportunity to call attention to basic ideas about design and communication and to make use of them in acknowledging achievement. But it doesn't appear that this opportunity has been seized or even acknowledged.

Can it be that our concepts concerning communication, mapping, and geography are so complex and abstract that they cannot be made accessible to young children? I hope not. Have we assumed that teachers will already know these concepts and have ways of connecting them to the Competition? Perhaps. But I suspect that teachers do not have this knowledge, either of the concepts or the ways. The Petchenik Competition provides an opportunity 1) to help children work with their experiences of the world, 2) to inject into their experiences some concepts about graphic expression and creative design, and 3) to help us, as cartographers, decide what we want children to know about the nature and role of creativity in mapping. How do we introduce these ideas in classrooms? What specific tools should we be providing? This paper explores some of these questions and offers some suggestions, in addition to those I have offered in the past (Castner, 1990, Chapt. 5; 1995).

"Can it be that our concepts concerning communication, mapping, and geography are so complex and abstract that they cannot be made accessible to young children?"

CREATIVITY IN CARTOGRAPHY

Cartographers have long been interested in the relationship between art and cartography. In 1938, Erwin Raisz (226-228), for example, reveals our bias, when talking about maps in newspapers and periodicals, by stating "Unfortunately, they are made by artists and not by cartographers, and by their single desire to appeal to the eye they often violate every rule of good cartography." He continues by noting that:

> A charming type of artistic map is coming into fashion nowadays, which shows the roads leading to suburban homes. As these maps rarely show anything other than roads and landmarks, they may well be decorated with characteristic pictures and still serve their purpose. The preparation of this kind of map is a welcome *play* [my emphasis] for the cartographer's imagination between long hours of dry and precise work.

"Cartographers have long been interested in the relationship between art and cartography."

A fascinating contrast here in Raisz's vision of two kinds of cartographic practice, "a vision" which I hope is no longer representative.

Arthur Robinson (1953,12-13) considered two quite different questions concerning the relationship between art and cartography. The first is whether cartography is a legitimate branch of art. He answers by noting that "Prior to the last century the question never arose for cartography was very definitely an art . . . in which great emphasis was laid on fine pen and brush skill. Today [writing in 1953] a great many people still think of cartography as being an artistic calling, and it is likely that a considerable number of otherwise intelligent students shy away from it for fear they are 'not artistic.'" This led Robinson into his second question: What function does an artistic talent play in the making of a map? Robinson's answer was that ". . . there is no question that it [cartography] is a creative kind of endeavor which repays the effort by the satisfaction that comes from producing something that has never been done before. For every map is a different *problem* [my emphasis] requiring a new solution." But, more significantly, I think, he states that "Good judgment, based on principles, is the major requirement of design in cartography; and such judgment may be easily acquired in training." Thus creativity clearly has an intellectual component, based on principles and focused on a problem.

"Thus creativity clearly has an intellectual component, based on principles and focused on a problem."

Sixteen years later, Robinson and Sale (1969, 17-18) suggest what those principles are when they observe ". . . that as we learn more and more about communication that more of the principles and precepts of cartography are being based on understanding and less on individual aesthetic intuition." They go on to draw the parallel between the cartographer and the engineer, each of whom must study the characteristics of his building materials and know the ways of fitting them together so that the end product conveys the correct intellectual meaning to the user. This is the same idea as the symbol systems which the art educator Elliot Eisner (1980, 4) defines as:

> . . . the means through which personal images are transformed into public forms that can be shared with others. Thus becoming literate in the variety of symbol systems available in a culture is one of the major means through which those forms of thought we call human intelligence are fostered.

"Curiously, by the 6th Edition of the Elements, *Robinson and his co-authors (Robinson et al, 1995), no longer isolate the questions of art in cartography in either the index or the text."*

Surely, we can say this about cartographic communication systems as well.

In Robinson's collaboration with Barbara Petchenik (1976, 108f), the parallel is drawn between cartography and architecture where there is more of an aesthetic dimension. Yet, a building, like any utilitarian article, must be designed with primary attention to how it functions. Curiously, by the 6th Edition of the *Elements*, Robinson and his co-authors (Robinson et al, 1995), no longer isolate the questions of art in cartography in either the index or the text.

Meanwhile, Borden Dent (1985, 21) declares that: "The art in cartography is the cartographer's ability to synthesize the various ingredients involved in the abstraction process into an organized whole that facilitates the communication of ideas." Dent goes on to describe in some detail the nature of thematic map design, the abstracting processes involved (pp. 22-24), and activities that are associated with creativity (pp. 24-27). He defines creativity as ". . . the ability to see relationships among elements . . . Although there is no recipe for creativity, there appear to be certain activities shared by people considered to be great thinkers, scientists, or artists." He discusses what may be called the seven heuristics of creative design. Dent appears to consider these activities to be a useful part of any course in cartographic design. Similarly, Trifonoff (1999, 50-1) notes that many university level cartography courses already focus on artistic topics such as balance, harmony, symbols, and color.

"He defines creativity as '. . . the ability to see relationships among elements . . . '"

In summary, cartographers generally recognize a creative dimension to map design; one that can be enhanced through the knowledge of principles of graphic design and with heuristics that help designers organize their ideas about particular communication goals and become more creative in their designs. Clearly, whatever skills are used, they are aimed at a product that addresses some problem and is not merely decorative.

CREATIVITY IN ART EDUCATION

It is interesting to compare these comments with those of art educators speaking about creativity. Betty Edwards (1986, 2) confesses that "Creativity has been studied, analyzed, dissected, documented." However, she argues that: "To date, we still have no generally accepted definition of creativity – no general agreement on what it is, how to learn it, how to teach it, or if, indeed, it can be learned or taught."

A progressive view is expressed by Wachowiak and Ramsay. They state (1965, 2) that:

> Children are more inquisitive, more alert, and more discerning than we have been led to believe. Children with imagination, sensitivity, heightened perception, and vivid recall, who express their experiences and their reactions with a feeling ordered and disciplined by compositional structure and design, create *art*.

But for the majority of children, they continue, this sense of design, of composition, of order, and of an aesthetic form must be learned or "caught" from their teacher, their parents, . . . trips to art museums . . .

and so on. What then should we as teachers be "throwing" for our students to "catch" the message?

"What then should we as teachers be "throwing" for our students to "catch" the message?"

Wachowiak and Ramsay (1965, 5) go on to state that when the art period is

> . . . bogged down in a continuous demand for posters, signs, charts, stage decorations, table favors, and factually dominated dioramas, it is no longer a valid and meaningful art program. It is senseless to justify its inclusion in the elementary school curriculum on this basis. Either it has a body of vital subject matter and skills to be mastered or it hasn't; either it has merit as a unique avenue to mental, social, and personal growth through creative action, or it hasn't. We believe it has.

Curiously missing is any reference to improving the skills of graphic communication and visual perception, and of learning how to look with discrimination. This seems to provide a wide open door for cartographers to develop these curriculum areas. The Barbara Petchenik Competition may be one instrument for that.

The idea of innate creative skills in children is challenged by Elliot Eisner (1974, 7) who outlines seven myths of art education. The first myth is that "Children develop best in art if left to their own resources provided they have plenty of art materials and emotional support from the teacher." For Eisner, ". . . the skills needed for artistic expression are not acquired simply by getting older." (p. 8) They must be taught or learned through self instruction, i.e., practice and experiment. Betty Edwards (1986, 3-6) is more proactive when she describes three stages in the creative process and attacks the traditional belief about creative talent. Why, she asks, do we assume that a rare and special "artistic" talent is required for drawing? We don't make that assumption about other kinds of abilities – reading, for example. "What if we believed that only those fortunate enough to have an innate, God-given gift for reading will be able to learn to read?"

"The idea of innate creative skills in children is challenged by Elliot Eisner who outlines seven myths of art education."

Perhaps, Edwards asks, "artistic talent" has always seemed rare and out of the ordinary only because we expect it to be rare and out of the ordinary (1986, 7). Her experience has taught her that any person of sound mind can learn to draw and that the probability is the same for learning to read. The universality of creativity is echoed by Hirshberg who contends that "People treat creativity as something to deal with off-site, or down the hall with the odd people, the creatives. Creativity is not an element of human behavior that's limited to a certain kind of humanoid. Everybody has great potential." (Evarts, 1998). Can we cartographers not take heart in Edward's claim that:

> It is simply a matter of learning basic perceptual skills – the special ways of seeing required for drawing. Once these perceptual skills are learned, their use can be as varied [as creative?] as subsequent uses of basic language and arithmetic skills.

"It is simply a matter of learning basic perceptual skills – the special ways of seeing required for drawing."

She proposes that visual, perceptual skills are enhanced by training, just as the verbal and analytic skills are benefitted by education (Evarts 1986,8). Later, she is more specific in saying that "The rules and heuristics of drawing are broad enough to allow infinite variation – a necessary characteristic because the visual information 'out there' is infinitely variable and complex" (Edwards, 1986, 43).

Bruno Bettleheim (1980, 413) offers another perspective when he observes that:

> To the psychoanalyst, it is appalling how progressive education, and art teaching in particular, have responded to the insights of psychoanalysis. It is a response showing equal confusion about art teaching and about psychoanalysis. It is especially hard to see how art teachers came to harbor the notion that giving the unconscious 'free rein' can be of value, either as education, aesthetics, or therapy. Art teachers should know from their own creative efforts what tremendous discipline is necessary to achieve a significant work of art.

"'Art teachers should know from their own creative efforts what tremendous discipline is necessary to achieve a significant work of art.'"

On the discipline necessary for creativity, Sir Peter Ustinov puts it this way: "You need the ability to be alone with yourself to do the *hard work* [my emphasis] that creativity requires" (Goodale, 1999).

One aspect of discipline is noted by Wilson and Wilson (1982, 77) who state that "Children cannot produce drawings without the necessary information about objects, places, actions, and processes that they wish to draw." The Wilsons insist that children must be provided with a variety of images from which they can begin to *extract information* about the subject. Only from these can ideas for their own work emerge. They explain the process in this way:

> What artists and children do is to take existing cultural images and extend them, alter them, recombine them, place them in new contexts, and use them in new ways. Creativity is seldom achieved through the production of the utterly new but rather through taking those things which belong to the culture and using them in individual ways, resulting in images that are often novel and unique.

"'Creativity, as has been said, consists largely of rearraning what we know in order to find out what we do not know . . . Hence, to think creatively we must be able to look afresh at what we normally take for granted.' (Kneller, 1965 quoted by Edwards, 1986, 38)"

This seems to be a most succinct but useful definition for us to utilize. Another writer (Kneller, 1965 quoted by Edwards, 1986, 38) puts it this way: "Creativity, as has been said, consists largely of rearranging what we know in order to find out what we do not know . . . Hence, to think creatively we must be able to look afresh at what we normally take for granted."

Another dimension of creativity is found in Eisner's fifth myth that art teachers should not evaluate children's art work. But, he contends, "Children respect thoughtful evaluation and criticism because it testifies to them that their teachers are taking them and their work seriously." (Eisner, 1974, 13). Similarly, his sixth myth is the belief that teachers should not attempt to talk about art since verbalization usually kills art. But Eisner (1974, 14) points out that the language used in criticism is not intended as a surrogate for the work but as pointers to illuminate the work and, thus, to better understand its structure *and how it works* [my emphasis, for this is something we have been studying with maps].

This brings us back to the question of the nature of creativity: Is it a spontaneous expression of feelings or part of a deliberate attempt to communicate a certain idea? What is the basis of its verbalization and criticism in the first instance? Clearly, cartographers have a body of concepts and principles which we can use in addressing specific questions. Thus any attempt to help children be creative with maps demands that children know something about these concepts and principles as tools of cartographic presentation.

"Clearly, cartographers have a body of concepts and principles which we can use in addressing specific questions."

Isabel Carley, an American pioneer in Orff Schulwerk, *Music and Movement for Children*, summarizes much of this by asking whether the creative processes that are scheduled nowadays in classrooms actually lead to creative thought, or whether they are simply shots in the dark, done for the sake of appearances? She wonders if the superficial use of "creative projects" does more harm than good, since it denies the basic seriousness of the endeavor – of purposeful design. She then declares: "There must be a definite problem with definite limits for which preparatory training has been so complete that the children can be allowed to solve the problem almost entirely by themselves, with help and guidance on call if they feel inadequate." (Carley, 1977). This approach, of course, calls for a different role for teachers, one that they may not be willing to take.

CREATIVITY AND THE PETCHENIK COMPETITION

What parts of this discussion are applicable to the Barbara Petchenik Competition? If we want our contestants to be creative, what does this mean? There appears to be some consensus among both cartographers and art educators that creativity has an important intellectual dimension, and it isn't just a matter of expressing one's feelings. Thus, to be creative, one must first be familiar with a variety of exemplars and models of the subject (in our case, maps and the earth) in order to be able to develop a new perspective upon them. Fortunately, there are recognizable skills and heuristics that can be applied to map design. There are also a variety of graphic guidelines for creating symbols which make appropriate contrasts in both quantitative and qualitative information. The principles so eloquently set out by Bertin (1973) are exemplary. Hence we have a significant basis for developing activities where these skills and guidelines can be applied to specific problems. In them, the selection and manipulation of graphic elements would have a communication purpose and not be chosen by whim.

This is reminiscent of the old saw saying that creativity is 90% perspiration and 10% inspiration. Graphically, problem solving (Samples, 1976, 76) is a combination of work and play as in Figure 1. Play, or metaphoric, nonlinear or lateral thinking, is the principal cognitive activity in starting to consider a problem, not waiting for some idea to strike. Rather it involves a systematic review of possible associations that one can make. As ideas and possibilities appear, more of the designer's time is spent working toward a solution, i.e. refining the image. This is a simple heuristic or rule for any kind of problem solving, including map design.

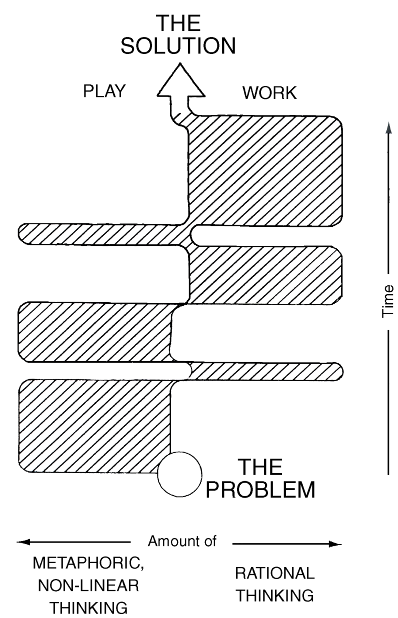

Figure 1. The two types of thinking involved in problem solving. From Castner (1990, 120) after Samples (1976, 76).

In terms of heuristics, the seven activities described by Dent (1985, 24) involve challenging assumptions, recognizing patterns, seeing in new ways, making connections, taking risks, using chance, and constructing networks. These are certainly ways of thinking that all map designers should aspire to master. But how do we start teaching them to children? One strategy is to give them problems with solutions that require them to think systematically about their cultural images or associations that relate to such abstract ideas as peace or a clean environment. In such tasks, specific objects like white doves or green plants and healthy animals provide graphic connections that allow a map or graphic design to carry a recognizable message. These objects become another design element or motif that is common to mapper and viewer alike. Such topics are often considered in our studies of map symbols, their design, and how they work in complex visual environments. This is particularly true for concept-related or associative map symbols which act as graphic metaphors (Castner, 2000a) .

"Thus, to be creative, one must first be familiar with a variety of exemplars and models of the subject (in our case, maps and the earth) in order to be able to develop a new perspective upon them."

The principles of graphic design are an example of what we can and should talk about in evaluating cartographic designs. Perhaps they should be a more visible part of the Petchenik Competition? We might also consider making the competition less competitive by adjudicating participants in light of such principles. In non-competitive festivals, for instance in music, the entrants receive commentary and insights about their creative efforts in terms of the principles of expression and communication in that medium.

Another way of generating topical motifs for a map competition is with map projections, one of our shared images of the earth itself. Traditionally, we think of various aspects of projections – equatorial, polar, and

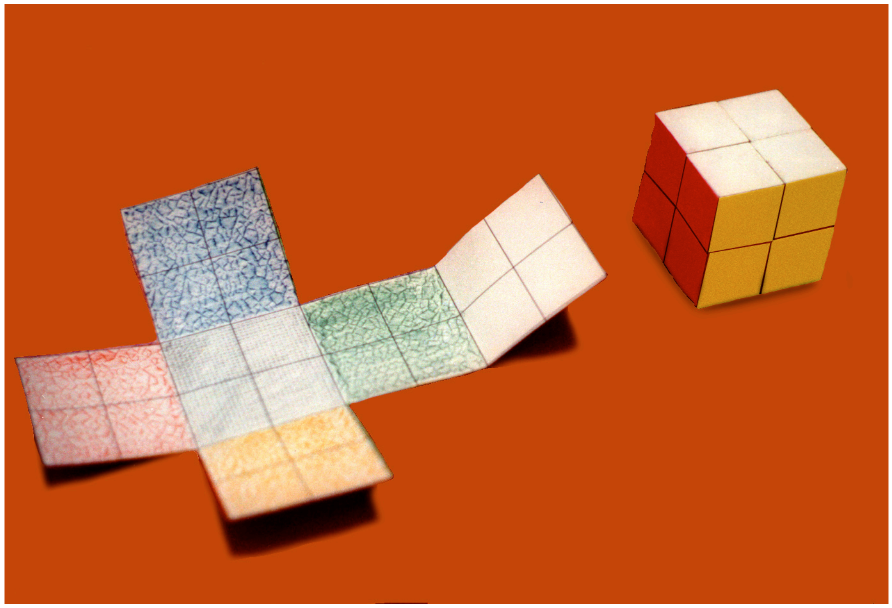

Figure 2. A stack of eight cubes and the unfolded box that would contain them.

oblique. This big idea, that we can create all sorts of images of the earth with a single projection by recentering or reorienting it, is missing from most discussions of map projections aimed at children (and perhaps at adults as well). In practical terms, this means we can center a projection on any place in the world, as with rectifying a globe, without changing the pattern of deformation of that projection. To get to this idea, there is a sequence of activities, as explained in a report on a school district in Wisconsin (Brinkman, 1997) where students are building math skills using spatial reasoning. The simplest example describes an eight-year-old trying to sketch how a box capable of holding some small wood blocks, stacked on her desk, might look if she could unfold it and lay it flat as in Figure 2. This simple transformation activity uses paper with one inch grid squares, the same size as the block facets. These researchers have found a strong positive connection between spatial reasoning or the ability to visualize, and doing well in mathematics.

"Recently, a group of second graders in this Wisconsin program performed as well or better than college honors students in an exercise to create two-dimensional representations of three-dimensional objects!"

As if that were not enough, these Wisconsin children are reported to be learning other useful skills. For example, students who develop their own ways of solving problems also learn the value of making conjectures and then finding ways of supporting them through math. In science, a firm foundation in spatial skills, e.g., visual exploration, seems to help children create and revise models, the principal way that scientists explain the world. Recently, a group of second graders in this Wisconsin program performed as well or better than college honors students in an exercise to create two-dimensional representations of three-dimensional objects! Here is further evidence that supports a useful collaboration between cartography and mathematics in schools.

"This approximation of the earth has six facets. Children can begin moving them around to create different 'map projections.'"

The only thing that prevents the eight year old, contemplating her stack of blocks, from making a map projection is having some shapes on the sides of her blocks. But that is easily remedied by drawing simplified continents on the stack of eight cubes as in Figure 3. We can identify the equator, two parallels, the poles, and 4 different meridional great circles. This approximation of the earth has six facets. Children can begin moving them around to create different "map projections." Coloring each facet with a different hue facilitates discussion. Some of you will recognize that the block pile is also a simple model of the color solid -- a concept easily

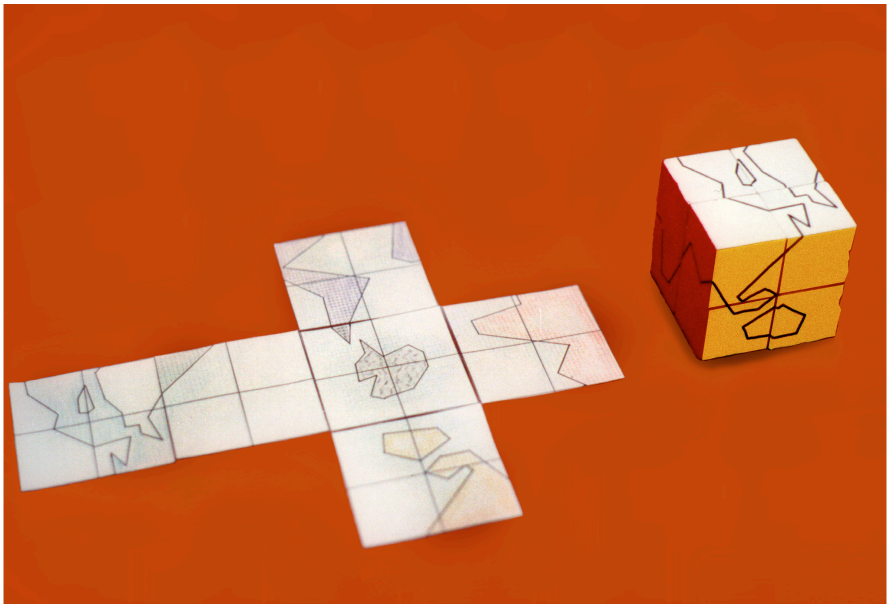

Figure 3. A stack of eight cubes with the simplified continents drawn on their sides. By transferring these outlines to the enclosing box (by tracing through to the opposite side), and unfolding it, one produces a map projection of the six facet cube.

associated with the globe and one which is useful in selecting colors for making qualitative and quantitative distinctions in mapping. It may also be advantageous to reinforce their understanding of the earth's graticule by using it in introducing concepts about color use.

A more complex, but more accurate approximation of the earth is, with one of the variations on Fuller's Dymaxion Air-ocean world map – a map on the 20 equilateral triangles of the icosahedron. It is one of the Platonic solids—the developable solids which have 4, 6, 8, 12 (in two versions), and 20 uniform geometric facets. Irving Fisher (1943) created another variant that the American Geographical Society has kindly granted the Commission permission for children to reproduce for use in the Competition. There is also a commercially available variation known as the game "Flight Lines."[4] Then there is the Guyou Projection (Snyder and Voxland, 1989) made up of 32 or 72 squares by Athelstan Spillhaus. They are marketed under the game name *Geodyssey*[5]. The relationship to the pile of 8 blocks is clearer with these squares than with the icosahedron, but this latter map produces a greater variety of outlines and is easier to manipulate.

"One strategy for the Petchenik Competition could be to provide children with manipulative projections, e.g., a set of such triangles or squares, which they could manipulate by hand to create their own projections of the world."

One strategy for the Petchenik Competition could be to provide children with manipulative projections, e.g., a set of such triangles or squares, which they could manipulate by hand to create their own projections of the world. Three obvious possibilities present themselves[6]: create a home-centered projection where your home country or continent is central to the rest of the surrounding world as in Figure 4; create a projection whose outline forms a shape that relates to the theme of the map, for example a map about dinosaurs as in Figure 5; or merge the image of the globe with some other element(s). One can easily discover such motif ideas in advertisements or political cartoons. The earth as cow, Figure 6, has been used in reference to the exploitation of the natural resources of Antarctica. The earth on the wings of a water bird, Figure 7, is an appropriate association for an air mail stamp. An "empty pocket" projection, Figure 8, suggests a bankrupt southern hemisphere. These and others like them are the kinds of associations that children should be able to make as part of their own "creative efforts."

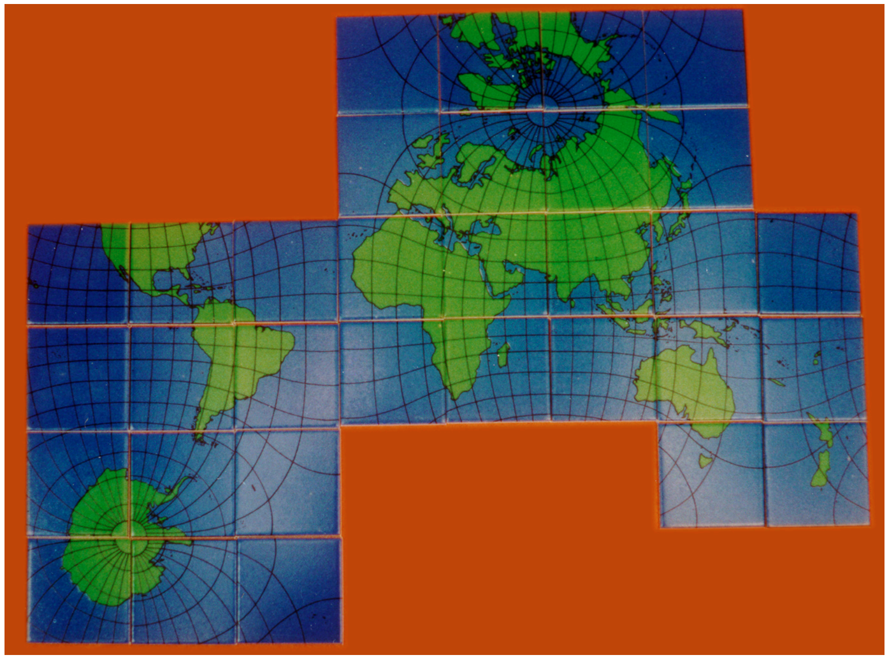

Figure 4. The world on the Guyou projection, on 32 squares, centered on Africa.

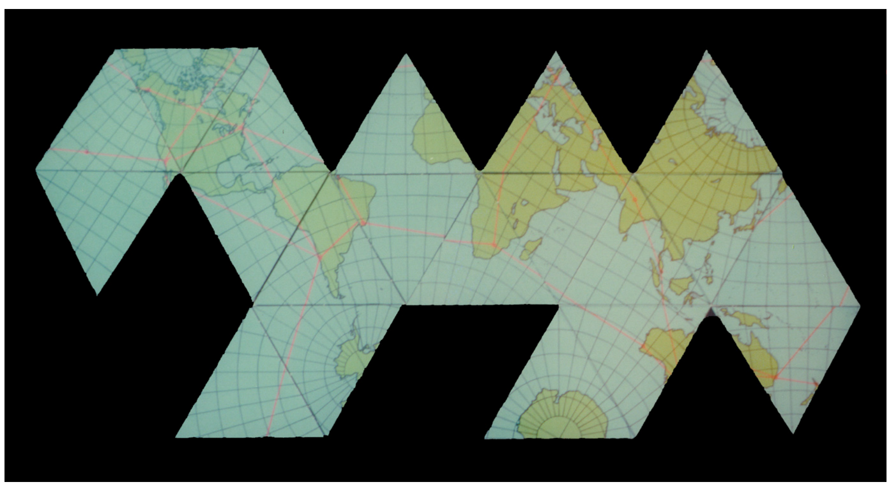

Figure 5. The "stegosaurus projection" showing the world on the icosahedron rearranged into the shape of a dinosaur.

CONCLUSIONS

This review of what cartographers and art educators have said about creativity suggests that map design is a problem-solving activity that can be applied to a number of concepts in graphic communication, and can utilize heuristics of design in order to create a map product which addresses a particular question. In this, map design is clearly a disciplined but creative activity and not simply a spontaneous expression of one's feelings. The Barbara Petchenik Competition represents a great opportunity to make teachers aware of concepts in graphic communication, concepts which we have found useful in constructing meaningful and creative maps; and to provide children with a problem-oriented activity in which to practice this applied form of problem-solving in creative ways, thus enlarging their ideas about or experiences in the world. Making unique images of the world with manipulative map projections is one example of a creative activity that 1) reinforces the mapper's knowledge of the major

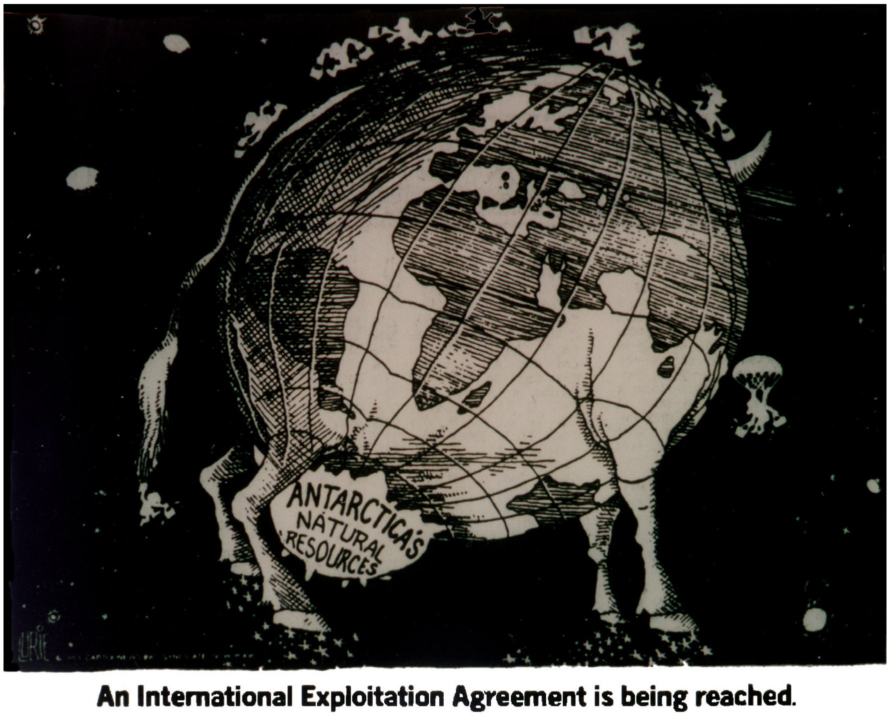

Figure 6. The earth as cow waiting to be milked of the natural resources of Antarctica.


Figure 8. The "empty pocket projection" suggesting, symbolically, the dire economic straits of southern hemisphere countries.

Figure 7. The world on the back of a water bird on a Peruvian air mail stamp.

features of the earth; 2) provides an opportunity to consider what culturally important motifs, whether in the map outline or the symbols used, can contribute to the map's message; and 3) allows the mapper to focus all these elements in their design on a specific theme or problem. With these skills, map design becomes a more useful tool for informing students and teachers alike about what "creative" map design can be.

BIBLIOGRAPHY

Aldiss, Brian. 1990. *Bury My Heart at W.H. Smith's*. Gordonville, VA: St. Martin's Press.

Bertin, Jacques. 1973. *Semiologie graphique*. 2nd ed. Paris: Gauthier-Villars.

Bettleheim, Bruno. 1980. Art and Art Education: a Personal View. In *Surviving, and Other Essays*, pp. 412-26. New York: Vintage Books.

Brinkman, Phil. 1997. Students Build Math Skills by Visualizing Problems. *The Christian Science Monitor*, Monday, November 24, 10.

Carley, Isabel. 1977. On Creativity. *Orff Echo*. 75-6.

Castner, Henry W. 1990. *Seeking New Horizons: A Perceptual Approach to Geographic Education*. Montreal & Kingston: McGill-Queen's University Press.

Castner, Henry W. 1995. *Discerning New Horizons: A Perceptual Approach to Geographic Education*. Pathways in Geography Title #13. Indiana, PA: National Council for Geographic Education.

Castner, Henry W. 2000a. *Can a Map Design Competition be Truly Geographic? How the Petchenik International Competition Can Contribute to Geographic Education*. Paper for presentation to the IGU Commission on Geographic Education, Kyongju, Korea, August 2000.

Castner, Henry W. 2000b. Manipulative Map Projections: What Can be Discovered from Their Classroom Use? Paper presented at the Annual Meeting, Canadian Cartographic Association, Edmonton, June, 2000.

Dent, Borden. 1985. *Principles of Thematic Map Design*. Reading, MA: Addison-Wesley.

Edwards, Betty. 1986. *Drawing on the Artist Within*. New York: Simon and Schuster.

Eisner, Elliot. 1974. Examining Some Myths in Art Education. *Studies in Art Education*, XV, #3, 7-16.

Eisner, Elliot (1980). "The role of the arts in the invention of man," *New York University Education Quarterly*, Spring, 2-7.

Evarts, Eric C. 1998. Management's Role in Fostering Creativity. *The Christian Science Monitor*, Thursday, 6 August, B3.

Fisher, Irving 1943. " A world map on a regular icosahedron by Gnomonic projection," *Geographical Review*, 33 (4), 605-619.

Goodale, Gloria. 1999. Interview/Peter Ustinov: Renowned Actor on Culture, Courage. *The Christian Science Monitor*, Friday 20 August, 20.

Kennedy, Stephen B. 1977. Why it is Important for Young Children to Experience the Arts? *Orff Echo*, IX, #2 Winter.

Kneller, George. 1965. *The Art and Science of Creativity*. New York: Holt, Rinehart and Winston.

Raisz, Erwin. 1938. *General Cartography*. New York: McGraw-Hill.

Robinson, Arthur H. 1953. *Elements of Cartography*. New York: John Wiley.

Robinson, Arthur H. and Barbara Bartz Petchenik 1976. *The Nature of Maps: Essays Toward Understanding Maps and Mapping*. Chicago: University of Chicago Press.

Robinson, Arthur H. and Randall Sale. 1969. *Elements of Cartography*. 3rd Edition. New York: John Wiley.

Robinson, Arthur H. et al. 1995. *Elements of Cartography*. 6th Edition. New York: John Wiley.

Samples, Bob. 1976. *The Metaphoric Mind: A Celebration of Creative Consciousness*. Reading, MA: Addison-Wesley.

Snyder, John P. and Philip M.Voxland. 1989. An Album of Map Projections. *U.S.G.S. Professional Paper* #1453.

Trifonoff, Karen M. 1999. Creativity, Art and Cartography in Geographic Education. *Cartographic Perspectives*, #33, Spring, 49-59.

Wachowiak, Frank and Theodore Ramsay. 1965. *Emphasis Art: A Qualitative Program for the Elementary School*. Scranton, PA: International Textbook Co.

Wilson, Marjorie and Brent Wilson. 1982. *Teaching Children to Draw: A Guide for Teachers & Parents*. Englewood Cliffs, NJ: Prentice-Hall.

NOTES

1. The author is currently Associate Chair of the International Cartographic Association's Commission on Children and Cartography.

2. Past entries of the Competition, archived at Carleton University, Ottawa, Canada, can be viewed at the web site <http://collections.ic.gc.ca/children>.

3. The rules and guidelines for the 2001 Competition can be seen at <http://www.icaci.org> or obtained from your national coordinator. For the United States, the coordinators are Leo Dillon, U.S. Department of State, Office of the Geographer, Washington, D.C. 20520-6510 at <ACl-dillo@us-state.osis.gov> and Adam Wolf, Montgomery College, Rockville, MD 20850 at <awolf@mc.cc.md.us>. For Canada, this is Erin Richmond, Department of Geography, University of Victoria, Victoria, BC V8W 3P5 or at <erinrich@uvic.ca>.

4. "Flight Lines", item #A006, is available from GeoLearning International Ltd., 244 North Main, P.O. Box 711, Sheridan, WY 82801, FAX (307) 674-6437 for $5.95 plus 10% for shipping and handling. Two games are necessary to get the complete 20 triangles as half the earth is on one side of ten triangles.

5. The Guyou projection on 32 squares comes as Geodyssey, item #A002 at $14.95. There is also a Deluxe version with the earth on 72 squares, item #A003, for $29.95. Add 10% for shipping and handling.

6. In a recent, in-depth study of manipulative projections (Castner, 2000b), the author describes eight quite different concept, skill or knowledge areas that can be accessed through work with manipulative projections.

A Case for Teaching Geographic Visualization without GIS

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This article argues for the value of teaching geographic visualization to non-geography majors by having them make maps manually, using punched mylar, colored pencils, and light tables instead of computer-based geographic information systems or mapping programs. The essay contrasts the experiences of attempting to teach principles of geographic visualization using ArcView GIS in an introductory human geography course and using manual methods in an upper-level research methods course in history. Several conclusions emerge: (1) using manual methods to visualize spatial information quickly gets students thinking geographically; (2) the ease of learning the fundamental concepts and techniques of geographic visualization using manual methods makes it possible to integrate visualization into courses outside the discipline of geography; (3) geographic visualization can tremendously enrich the study of history, prompting students to think in ways they might not otherwise; and (4) teaching visualization with mylar has distinct advantages for history courses because physical map layers reinforce the notion that places are palimpsests of change. Manual methods make it possible to teach geographic visualization at colleges and universities that have no geography department or GIS courses. Their use should be encouraged as an adaptable, inexpensive, effective way to promote geographic learning and geographic literacy in U.S. higher education.

KEYWORDS: geographic visualization, mapping, GIS, history.

"Among academics, geographic visualization is rapidly supplanting cartography as the key term for a range of methods, skills, and intellectual and aesthetic goals for rendering spatial data."

Among academics, geographic visualization is rapidly supplanting cartography as the key term for a range of methods, skills, and intellectual and aesthetic goals for rendering spatial data. The term appeals because it encompasses traditional and computer cartography as well as geographic information systems (GIS) and sweeps them all into the broad, fast-moving currents of scientific visualization. Geographic visualization makes intuitive sense to all generations of geographers and cartographers, whatever their personal skills and predilections, because geography is inherently a visual way of knowing.[1] Alan MacEachren and others have argued that scholars' new interest in visualization represents a technical and philosophical revolution. Visualizing spatial data is no longer simply making maps. It is now an exploratory tool for interrogating data, developing research hypotheses, "extracting patterns from chaos."[2] For all its technical sophistication, geographic visualization is also central to recent pedagogical and curricular developments that in some ways are returning geography to its empirical roots in mapping.

Geography departments across the country are creating courses in "geotechniques" or "geographical information," which include various combinations of training in fundamental geographic concepts, Web-based geographic information, geographic visualization, and GIS. There is now a firm curricular position for introductory courses that lay the groundwork for advanced study of geographic visualization and GIS, which are increasingly considered indispensible for geographers. These course sequences are proving popular among geography majors and other students, in part because of the job-market value of GIS skills. The greatest latent demand for learning about geographic information and visualization, however, lies outside of geography, in departments whose students are not exposed to geographic concepts and at institutions that have no geography program.

I will argue in this essay that fundamental concepts of geographic visualization can be taught without reference to GIS or computer technology. The barriers against entry into the worlds of GIS and high-tech geographic visualization remain very high at colleges and universities that have no geography department or other program that offers instruction in the technology. I encountered those barriers, like a Sunday jogger attempting a steeplechase, when I came to Wellesley College to teach an introductory course in geographic concepts and GIS in the fall of 1997.

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DIFFICULTY OF TEACHING GIS OUTSIDE A GEOGRAPHY DEPARTMENT

The course I was asked to design was intended to address three initiatives undertaken at Wellesley College shortly before I arrived. The first was a new quantitative reasoning (QR) requirement meant to ensure that every Wellesley student mastered elementary statistical concepts at some point in her four years of undergraduate education. My human geography course was to be one of several "QR overlay" courses in which students learned basic statistics in the context of a substantive field of study. I chose to focus the statistical content of the course on analyzing social inequality as represented in the 1990 U.S. population census. The second initiative was to promote the use of computer technology in classroom teaching, which I aimed to do by using ArcView GIS as a tool for visualizing census data and producing maps showing the results of simple statistical analyses. The third initiative was a diffuse interest in globalization, which certain members of the faculty and administration thought could be brought into focus partly through my activities on campus, including the courses I would offer in geography.

While the opportunity to introduce GIS was exciting, a number of factors made the challenge more difficult at Wellesley than it would be at some institutions. The fundamental problem was the lack of library and technical resources to support geographical studies and GIS, due to the College having eliminated its Geography major in 1965.[3] No Wellesley faculty used GIS in their teaching, though a few had begun to use it in their research by the late 1990s. Shortly before I came in 1997, the College acquired a site license for ArcView GIS, but its restrictions limited the program to a few library and classroom computers and provided minimal technical support. The course was also over-burdened with material, for the statistical and GIS component was to account for only one-third of course content, the remainder going to an orthodox introduction to human geography.

". . . fundamental concepts of geographic visualization can be taught without reference to GIS or computer technology."

In the course debut as Extradepartmental 110: Introduction to Geographic Concepts, I introduced ArcView in three take-home exercises that asked students to apply the skills they learned from tutorials in ESRI's *Getting to Know ArcView GIS*[4] to prepared 1990 census data at the tract level for Los Angeles. Most students sailed through the tutorials but found it much more difficult to use ArcView to interrogate the census data – as did I. I spent about one hundred hours preparing the data and creating the ArcView exercises. The students found ArcView to be an unwieldy and frustrating tool, largely, I believe, because I had not provided them with sufficient context and principles to understand the structure of GIS or its usefulness in analyzing social statistics. ("In my experience," geographic educator David DiBiase wrote recently, "students who are not provided with the clearest possible sense of the connection between principles

"The students found ArcView to be an unwieldy and frustrating tool, largely, I believe, because I had not provided them with sufficient context and principles to understand the structure of GIS or its usefulness in analyzing social statistics."

and practice are likely to conclude that principles are irrelevant."[5] The converse also holds true: students who do not understand principles are unlikely to be able to practice what they learn.) The site license restrictions also limited students' access to the program for homework assignments and class projects. It was not a happy experience for anyone, although enough of the students appreciated the inherent interest of GIS to encourage me to try again.

The second incarnation of the course, as Sociology 140: Geography and Society, was much more successful. I introduced ArcView after teaching several sessions on general concepts in statistical thematic mapping, which helped integrate the technology into the larger themes of the course and prepared the students to think critically about the data they used and the maps they produced. I also changed the assignments from individual take-home exercises to an exploratory Web-based team project in which only one of four self-selected groups of students used ArcView extensively. The project's purpose, to create a virtual geographical tour of Boston, also appealed to students' local interest. The ArcView group surprised themselves and the class by mastering GIS sufficiently to produce a series of compelling maps of neighborhood segregation and social inequality. Despite these improvements, the course still left students and me unsatisfied because the time given to teaching technology (which now included Claris Homepage as well as ArcView) short-changed conceptual content.

"I had not yet found a way to teach principles and skills of geographic visualization within the context of another subject."

FINDING THE ESSENCE OF GEOGRAPHIC VISUALIZATION

I had not yet found a way to teach principles and skills of geographic visualization within the context of another subject. A third opportunity to do so came in an upper-level research seminar in History called "Mapping the Past," offered in spring semester 1999. Applying geographic visualization to history holds special challenges because of the long-standing, often extreme bias of historians favoring narrative and textual documents over visual forms of analysis and representation. This "logocentrism" – the privileging of words and logic over images and perceptual apprehension – makes history one of the least visual of the humanities.[6] It also means that many undergraduate history majors complete their studies with no exposure to maps and no training in geographic concepts or the responsible use of visual documents. If any discipline is ripe for evangelizing the revelatory power of geographic visualization, it is history.

The substantive content of the course – the historical geography of New England and the region's cartogaphic history – was presented through traditional lectures, discussion, and student reports. The unifying concept of the course was that one can gain a rich and deep understanding of history by studying places as palimpsests of change, which geographic visualization can represent as serial images or layers that register change to a particular location. In applying geographic visualization to history, I stressed four points:

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1. Both abstract ideas and empirical data can often be presented most effectively in graphic form, particularly when one wishes to convey spatial location, the simultaneity of events, or the complexity of conditions or relations that extend over geographical space.
2. Geographical concepts such as distance and proximity, density and dispersal, and human-environment relations are important factors to understand in any historical situation and are often best understood when visualized.
3. To glean the historical information contained in maps one must learn how to read and interpret them, taking into account cartographic conventions and the map's intended audience and purpose.

4. Maps and other visual elements are no more authoritative or final than any other part of an author's selective presentation of historical information.

We explored these concepts while working toward two pedagogical goals:

1. Cultivating the habit of asking geographical questions of history and using graphic sources and methods to answer them;
2. Providing principles and techniques of geographic visualization that students could apply in a final project and easily transfer to any other class.

Cultivating geographical habits of mind focused on the points summarized in Table 1: using maps to locate places, as sources of data, and as the means of representing intellectual models, a sense of scale, and historic context. This goal was in some ways the more difficult of the two. Although more than half of the eighteen students in the class expressed a life-long interest in maps and history, none had previously used maps to study history and only a few had ever made a map.

The first step in developing new habits was to soften students' inhibitions about "being artists" and encourage them to experiment, to play with depicting historical ideas graphically. I began by trying to set an example, drawing on the blackboard at every opportunity, however bad the maps and diagrams.[7] As part of our discussion of William Cronon's regional history of Chicago, *Nature's Metropolis*,[8] students used historical maps of the city to find the location of districts and events that Cronon did not map and to discuss how the city has changed over the past 150 years. We examined Donald Meinig's cartographic diagrams of Turner's "frontier thesis."[9] In the third week I invited students to try their hand at sketching historical ideas, asking volunteers to draw graphic summaries of the social value of land among Native Americans and Puritans that Cronon presented textually in *Changes in the Land*.[10] The students' cartoon sketches prompted some laughter but also good discussion of complex social and spatial relations.

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The first graded assignment, to critique an historical monograph, asked for a conventional analysis of the text plus comments on the author's use or neglect of cartographic and photographic sources. Having heard me criticize Cronon for including only a handful of maps in *Nature's Metropolis*,[11] the students felt free to venture their own criticisms of what was, in almost every case, historians' and historical geographers' omission and missed opportunity to visualize important aspects of their narrative histories.

The second half of the course focused on the history of cartography in New England and how one can use maps as historical documents. The history of cartography section dealt mainly with J. Brian Harley's critical view of maps as socially constructed, historically embedded artifacts.[12] Some students were stymied by the complexity of the history of cartography, particularly the many variables one must examine to understand the historical context of a map's creation and use. But they were fascinated to learn that they could apply many of the same questions to maps that they were used to asking of written texts. The notion of invented traditions and how they were manifested and duplicated in maps made the deepest impression upon them.[13] This part of the course argued that no map should be used naively in research and that every map contains a wealth of historical meaning susceptible to extraction.

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Purpose	Comment
1. Geographical orientation	Use maps to locate places, boundaries, and features of the natural or human landscape.
2. Sources of data	Maps can provide absolute and relative values; spatial patterns and relationships; data on the volume and direction of flows of people, resources, information; and qualitative impressions of place and space.
3. Models and arguments	Cartographic representations can be powerful means of presenting arguments about spatial relationships or models of complex systems, environmental or social. One can critique others' cartographic arguments by analyzing their content, representativeness, symbolization, and design.
4. A sense of scale	Maps can quickly convey the geographic extent of a social or natural phenomenon, its relative concentration or dispersal, and the changing significance of spatial variables from place to place.
5. Historic context	Maps from the study period can help you and the reader envision a time and place, though this must be done with care. They can also be analyzed as artifacts that embody cultural conventions, the state of scientific knowledge, and the attitudes of those who made them.
6. Presentation	Spatial data are often most effectively presented in map form. Maps can carry exceptionally high data densities while communicating meaning clearly and efficiently.*

*Edward Tufte, *The Visual Display of Quantitative Information* (Cheshire, Conn.: The Graphics Press, 1983), 161-169.

Table 1. Using Maps in Historical Research

MAPPING THE PAST

In their final research projects, students were to conduct research on the historical geography of a place or historical event of their choice. Each paper had to include at least one original map that expressed the central metaphor of the layering of the past by using at least two mylar layers, in registration or in sequence, to represent change over time.

I chose to teach the students how to make maps on mylar, using colored pencils and a light table, for several reasons. First, my experience teaching ArcView GIS at Wellesley had convinced me that the technology's learning curve was too steep to include it in a course whose primary responsibility was to convey substantive content unrelated to GIS. Specifically, there was not enough time to teach the students enough GIS for them to use it in an independent project. Second, I expected that most of the source maps that students would be able to find in Wellesley's library would be paper rather than digital. Although growing numbers of historical maps and atlases are available on-line or on CD-rom, the great majority are still available only on paper.[14] I asked students to trace source material rather than scan it electronically to minimize differences between student projects and to give everyone the experience of duplicating and selecting spatial information by hand.

Third, mylar is cheap. With a $150 pedagogical grant from the College, I was able to purchase a pair of registration pins for each student and enough punched mylar to give each student five sheets, with extras for the ambitious. Students found their own colored pencils. They used a large light table in the Geology Department for compilation. This generated one of the unexpected benefits of using manual methods. Several students told me that this was the first time they had set foot in Wellesley's Science Center, a slightly forbidding place that they had assumed held no interest for them.

The final reasons for using manual methods were conceptual. Although maps in all media are made in layers, the physical separation of mylar sheets made the idea of history's layers concrete for students. The process of assigning different map elements and themes to individual mylar sheets reinforced the message that one must initially distinguish the various parts of the history of a place. Bringing them into registration powerfully made the point that places are complex, and that mapping spatial phenomena can reveal important, sometimes surprising juxtapositions. In their semester-end evaluations of the course and the project, almost all of the students said that the concept of layers had the greatest impact on their research and their view of history and place.[15]

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I taught two one-hour sessions on map-making techniques. These sessions were based on examples of historical map sources and discussion of the kind of thematic map that might be most appropriate for each student's project. Handouts told them how to make a graphic map plan, where to find cartographic sources, and how to cite them. I also demonstrated simple compilation techniques using base maps photocopied from sheet maps and historical atlases. I dismissed the issue of geodetic accuracy as too fine a point to worry about in this context, though I did emphasize the significance of knowing which map projections were used for small-scale base maps.

The final papers examined a wide range of topics that reflected students' diverse academic interests. Some students chose subjects that they had already studied in a history class but wished to look at from a fresh point of view. The most striking of these was a paper by Rebecca Harvell, a graduating history major who had previously written many papers on Native Americans but had never mapped the territories native peoples inhabited or where they were forced to relocate. Her cartographic reconstruction of the U.S. government's redefinition of the Sioux Reservation in 1851-1889, drawn largely from government documents, more than illustrated her paper. Nearly half of the paper directly addressed the four maps, which depicted the culmination of each distinct phase of government policy toward the Sioux (see Figure 1).[16] Making the maps, Rebecca told me, brought home the drama of federal and business interests' depredation of Sioux lands. The geographical narrative of the reservation's shrinking boundary encapsulated a complex story of conquest and defeat.

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Another history major, Rachel Hirsch, used the mapping of historical narrative and events to analyze military strategy. By mapping the geog-

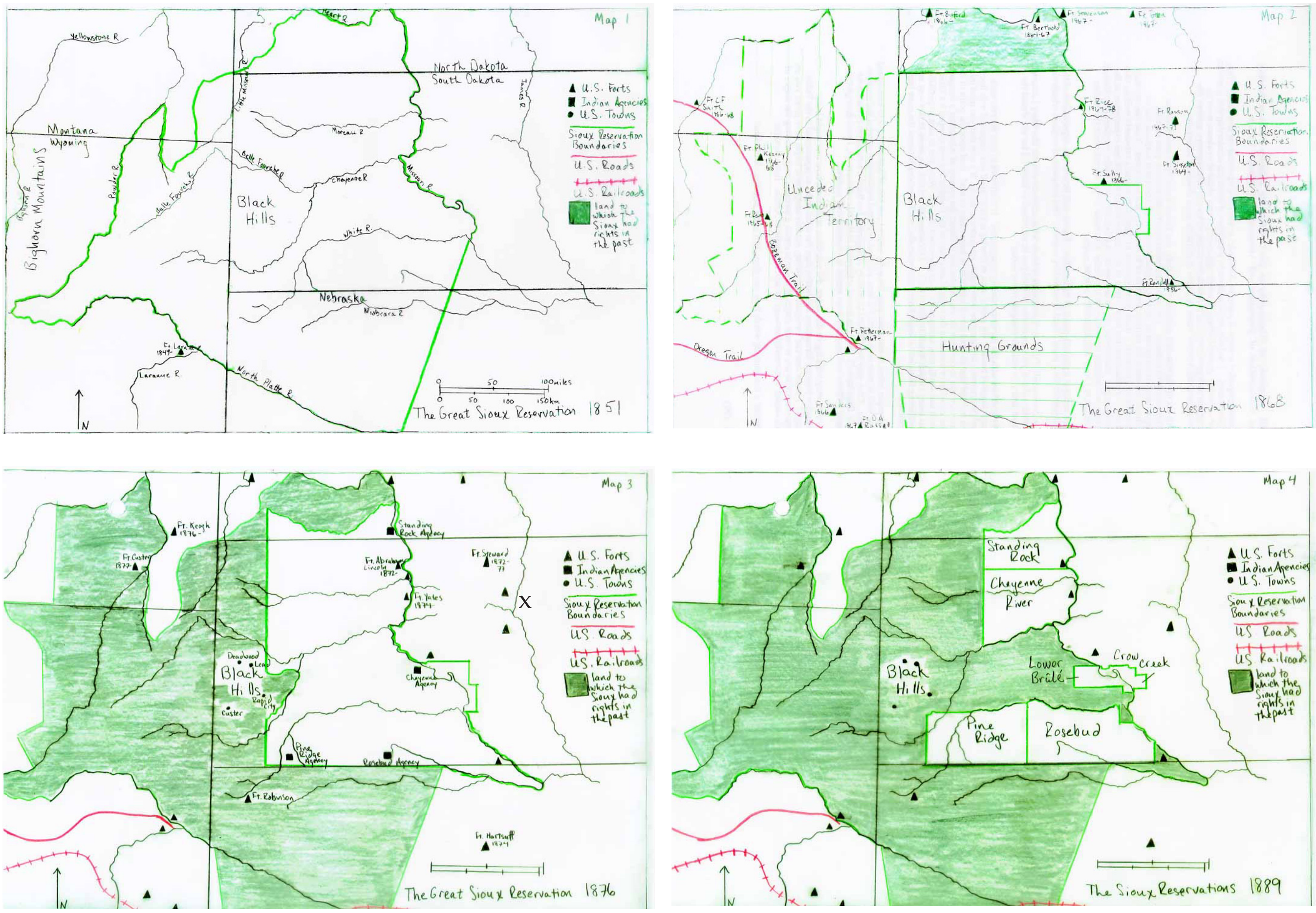

Figure 1. ***Containing the Sioux, 1851-1889***. *This series of maps by Wellesley College student Rebecca Harvell shows the shrinking domain of the Sioux people as the U.S. government established military control over former Sioux territory and secured mineral lands for private exploitation.*

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"For other students, mapping landscape provided a means of examining more abstract and emotional perceptions of place."

raphy in Xenophon's *Anabasis* alongside a map of Alexander the Great's military compaigns, she determined that the historian's geographic descriptions had influenced Alexander's strategy. Visualization enabled her to compare military routes and the sequence of events simultaneously. It also helped her imagine the physical topography and the difficulties it posed for Alexander and his opponents. The course convinced her to use methods of geographic visualization in her own teaching of history at a local high school.[17]

Some students found geographic visualization helpful in integrating information from various sources or discovering patterns within complex data. The former made mapping essential in psychology major Lindsey Clark's study of the relationships between Icelandic culture and the island's active geology. Linnea Noreen mapped population distribution against the historic development of parks and train lines in turn-of-the-century Seattle to analyze the forces driving urban planning in her home town. Sophie Parker, a biological sciences major taking her first history class, was overwhelmed by the volume of material she found on the construction of the Los Angeles aqueduct until she mapped it. She told me that seeing the aqueduct in its relation to Owens Valley farms and the subsequent explosion of Los Angeles' territorial extent snapped the story together.[18]

For other students, mapping landscape provided a means of examining more abstract and emotional perceptions of place. Anne Petz found that mapping the development of nineteenth-century tourism in Yellowstone National Park helped her understand the park's social construction as a tourist destination. It also helped structure her own fond recollections of time she spent in the park. Elizabeth Repass, a first-year student who is now pursuing an independent major in geography, used the process of mapping perceptions of eastern Washington state to test her own regional prejudices as a native of Seattle.[19]

Maps also proved to be important sources for several papers. Large-scale historical maps and photographs gave Margie Schnitzer her best material on the poorly documented saltworks of nineteenth-century Cape Cod and their relation to maritime industries and coastal tourism. Lia Shimada's study of physical bases for the mythical island identity of Glastonbury relied on British Ordnance Survey topographical maps and archaeological renderings of the site.[20]

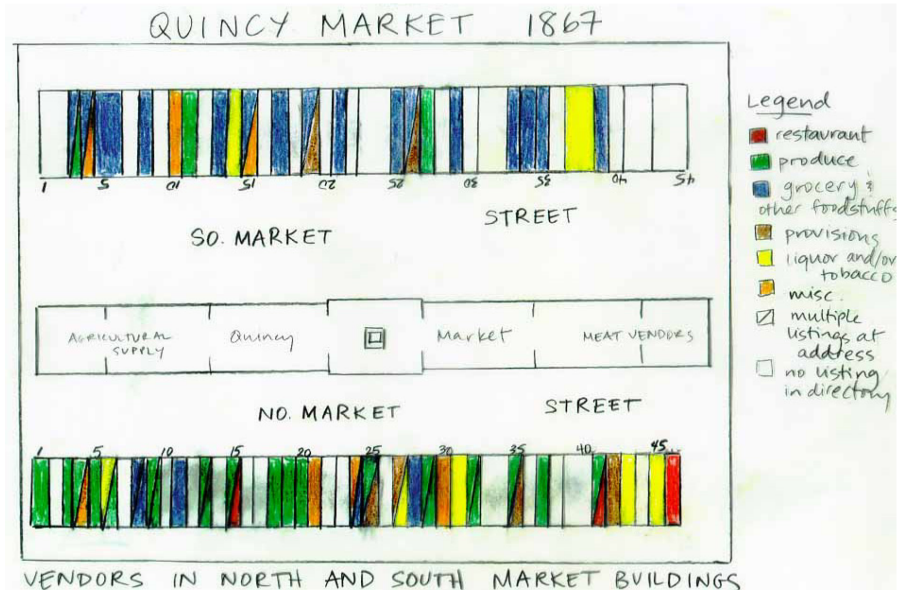
The most striking case of maps revealing crucial historical information came in the research of Amy Beltz, a senior majoring in history and Spanish. She was intrigued by comments a family friend had made about Oak Ridge, Tennessee, which gave her the impression that Oak Ridge and other nuclear reservations were strange and fearful places. Encouraged to explore this geographic concept, she researched the construction, population, nuclear production, social life, and journalistic representation of Oak Ridge, with comparisons to the Hanford nuclear reservation in Washington state. The turning point in her research came when she examined U.S.G.S. topographic quadrangles of the Oak Ridge and Hanford sites at various dates. The maps of Oak Ridge convinced her that reports that residents of Oak Ridge knew very little about the nuclear installations where they worked were probably true, given how well the facilities were hidden among the deep folds of the Appalachians. The maps also helped her understand the scale and geographical expression of the town's racial and social divides. Amy's greatest discovery, however, came when she compared Hanford quadrangles from the 1950s and 1960s to more recent maps. The earlier maps showed roads and railroads terminating abruptly where she knew nuclear facilities had been built. She had found stunning cartographic evidence of Hanford's top-secret status. Everything the maps revealed, Amy wrote in her evaluation of the project, was "essential to visualize, to understand, life with the bomb."[21]

"'Making the maps, plotting data, and then studying and comparing maps was a tool in my thought and writing process,' she wrote in her survey reply. She felt that making maps 'complicated' her view of history, which I found particularly heartening."

Nina Davis, a senior in Peace and Justice Studies with no prior background in history, was the one student to make maps from both archival records and field notes. For her study of the changing functions of Quincy Market, built on Boston's waterfront in 1824, she mapped the stall locations of Market vendors in 1867, based on detailed listings in the Boston city directory of that year. She then conducted a field survey of the Market's present-day retailers (see Figure 2). Because the footprint of the Market had not changed between 1867 and 1999, she was able to make a direct comparison of the Market's occupants and functions at two distant points in time. Nina's analysis of the site's historical uses was richly specific, illuminating changes in transport and trade and the social character of Quincy Market and its neighborhood. "Making the maps, plotting data, and then studying and comparing maps was a tool in my thought and writing process," she wrote in her survey reply. She felt that making maps "complicated" her view of history, which I found particularly heartening.[22]

"I was struck by how many of the students' findings were based on geographical data and how well they integrated graphic and textual analysis."

In most of the papers, geographic visualization was central to the conception of the study and to its presentation. I was struck by how many of the students' findings were based on geographical data and how well they integrated graphic and textual analysis. Most of the final projects showed that students had learned basic principles of geographic visualization



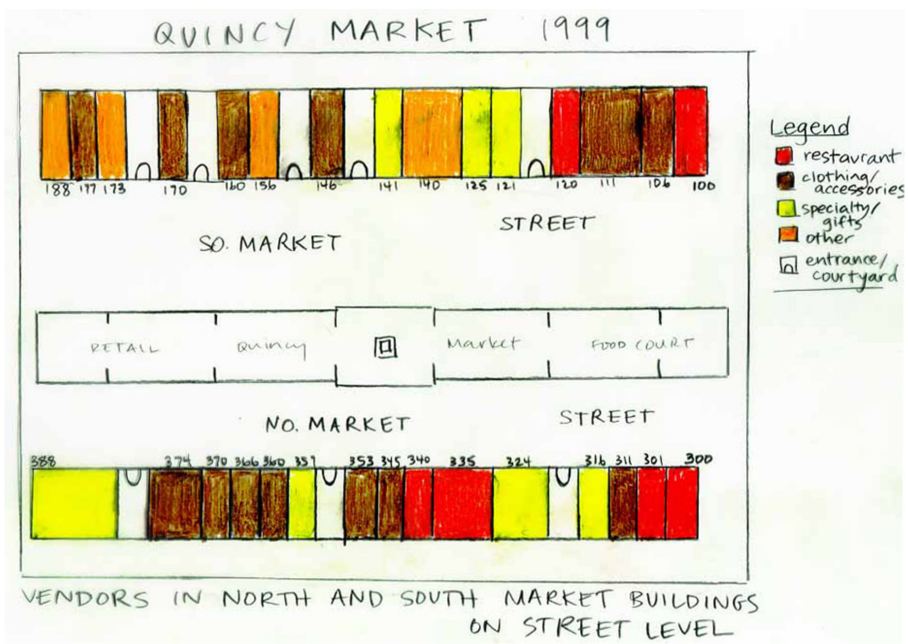


Figure 2. ***Changing Functions of Quincy Market, 1867 and 1999****. Wellesley student Nina Davis found that mid-nineteenth-century retailers in Boston's Quincy Market supplied the daily needs of city residents and the maritime industry. At the end of the twentieth century, the renovated Market's retailers catered to the tourist trade.*

"More importantly, most students had learned a great deal about their study area through the process of creating their mylar compilations."

and applied them creatively in an historical context. None had previously used or made maps as part of their college coursework, except for a few students who had studied geological maps in geology courses. All but one of the students who responded to a post-semester survey said the two short map-making sessions had provided adequate instruction, which the projects confirmed. More importantly, most students had learned a great deal about their study area through the process of creating their mylar compilations.

CONCLUSIONS

New paradigms and technological change tend to create advocates for the new and defenders of the old. In the now well-established GIS/geo-visualization revolution that is changing the practice and the very meaning of cartography, defenders of the old ways of making maps have been few and for the most part half-hearted. Teaching and scholarship in what used to be known as cartography is overwhelmingly being devoted to developing computer-enabled geographic visualization and to training a new generation of investigators to work in virtual environments.

I came to Wellesley College seeing myself as part of the vanguard. I was eager to impart GIS technology to students and to help the College incorporate GIS and geography into its curriculum for the long term.[23] The rude awakening of struggling to teach GIS without recourse to a well-equipped geography department forced me to think hard about how students could benefit most from a brief encounter with geographic visualization. Experience led me to conclude that many of the fundamental concepts that make geographic visualization so exciting can and perhaps should be taught with manual methods. Manual methods can be far less tedious than GIS; they can be used to interrogate many kinds of data, provided the data load is not too heavy; and they can be treated experimentally if one teaches map-making as a process of "graphic ideation" and information design rather than as a method of formal presentation.[24] Manual methods need not be limited to producing "single more-or-less optimal" maps, as recent criticism has implied.[25] Training in the most elementary draftsmanship can in fact facilitate visual brainstorming, doing "quick freehand drawings [that] may be created as part of the evolving enquiry for personal consumption."[26] Drawing from observation used to be part of the basic training of geographers and cartographers. That kind of visualization, a deeply creative act, is as old as Galileo's small sketches of the changing positions of Jupiter's moons.[27] Once learned, it is an easy, inexpensive, extremely portable method for visualizing spatial data and geographical ideas.

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One of the models for introductory geotechniques courses is David DiBiase's course, "Mapping Our Changing World" at the Pennsylvania State University.[28] DiBiase puts visualization at the heart of geographic education but draws back from teaching GIS at the introductory level. He argues that students need to master the conceptual content of geographic information, and understand the social contexts in which it is produced and consumed, before they learn a complex proprietary GIS package. DiBiase also sees a vast untapped market for introductory courses in geographic information that can satisfy the growing demand for "information literacy," particularly if they can avoid the logistical and financial problems of large computer-workstation laboratories.[29] While I agree with many aspects of his approach, I believe its emphasis on obtaining and manupulating geographic information via computer comes at the cost of instilling principles of graphicacy and critical thinking about graphic communication.

"While these methods cannot manage the chaos of large computerized data sets, they do clearly convey the principles that geographic visualization can raise questions, reveal patterns and relationships, and communicate meaning."

The students in my history class convinced me that geographic visualization is a tremendously powerful tool for studying the past.[30] Their excitment at encountering a genuinely different way of seeing the world – new because it called upon them to apply critical reasoning to what they see – renewed my conviction that a geographical perspective can invigorate any branch of learning. Manual methods make the revelation available to students in any discipline at any educational institution. Simple map-making and graphic ideation are exploratory tools that quickly get students thinking geographically and enable them to engage with many sources of spatial data. While these methods cannot manage the chaos of large computerized data sets, they do clearly convey the principles that geographic visualization can raise questions, reveal patterns and relationships, and communicate meaning.

NOTES

Thanks to Lizzy Repass, Miriam Neirick, Lia Shimada, Nat Sheidley, John Krygier, David DiBiase, and two anonymous reviewers for their valuable comments on an earlier draft of this essay. Julia Laurin helped prepare the maps for publication. The maps appear by kind permission of their authors, Nina Davis and Rebecca Harvell. I would also like to thank Wellesley College faculty, administrators, and staff for encouraging and supporting the teaching experiments discussed in this essay, particularly Lee Cuba, Jenni Lund, Eric Connally, Rajini Jesudason, Claire Loranz, Tom Cushman, and Guy Rogers.

1. John B. Krygier, "Envisioning the American West: Maps, the Representational Barrage of 19th Century Expedition Reports, and the Production of Scientific Knowledge," *Cartography and Geographic Information Systems* 24, no. 1 (1997), 28; Krygier, "Visualization, Geography, and Landscape: Visual Methods and the Study of Landscape Dereliction as a Process," Ph.D. diss. (The Pennsylvania State University, 1995). As Krygier points out, geographers of the critical school consider the visual emphasis of geography one of its great weaknesses and intellectual problems; for example, see, inter alia, Denis Cosgrove, *Social Formation and Symbolic Landscape* (Totowa, N.J.: Barnes and Noble, 1984); Derek Gregory, *Geographical Imaginations* (Cambridge: Blackwell, 1994); and the striking lack of visualization of any kind in the work of David Harvey.

2. Alan MacEachren and Mark Monmonier, "Introduction," in *Cartography and Geographic Information Systems* 19, no. 4 (1992), 197-200, quotation on p. 197. See also M. Visvalingam, "Visualisation in GIS, Cartography, and ViSC," in *Visualization in Geographic Information Systems*, edited by Hilary M. Hearnshaw and David J. Unwin (Chichester: John Wiley & Sons, 1994), 18-25 and Krygier, "Visualization," pp. 6-7. The best textbook representation of the paradigm shift is Terry A. Slocum, *Thematic Cartography and Visualization* (Upper Saddle River, N.J.: Prentice Hall, 1999).

3. Wellesley College Archives, Minutes of Academic Council, pp. 321, 390; Records of the Dean of the College, Academic Departments, Geology Department, Annual Report for 1964-1965 by Prof. Eiselen [geography], June 7, 1965. Joni Seager, now Professor of Geography at University of Vermont, taught a course on feminism and the environment in Wellesley's Women's Studies program in 1991. She was also a Fellow at the College's Women's Studies Center in 1984-1985. My two-year postdoctoral Mellon Fellowship, which ran from July 1997 to July 1999, was sponsored by three social science departments and informally involved several others.

4. Environmental Systems Research Institute, *Getting to Know ArcView GIS: The Geographic Information System (GIS) for Everyone* (Cambridge: GeoInformation International, 1997).

5. David DiBiase, "Rethinking Laboratory Education for an Introductory Course on Geographic Information," *Cartographica* 33, no. 4 (Winter 1996): 65.

6. Barbara Maria Stafford, "The Visualization of Knowledge from the Enlightenment to Postmodernism," in *Good Looking: Essays on the Virtues of Images* (Cambridge, Mass.: MIT Press, 1997), pp. 20-40. Evelyn Edson dates historians' ignorance of maps to the thirteenth century, when, she finds, very few historians "created and used maps as an adjunct to the writing of history . . . Some of the greatest historians of the Middle Ages . . . come

to us usually unillustrated and always mapless." *Mapping Time and Space: How Medieval Mapmakers Viewed Their World* (London: The British Library, 1997), 132.

7. Geographer Harm de Blij gave a marvellous demonstration of almost comically bad but conceptually brilliant geographic sketching during his keynote address to the New England Mapping Organization at Wellesley College, June 3, 1999. In half a dozen black-marker maps, drawn with apologetic haste on a flip chart, he rendered the maps that were milestones in his personal geographical awareness, including the wall map in his home in Holland on which his father plotted the advance and retreat of the Allies during World War II.

8. William Cronon, *Nature's Metropolis*: *Chicago and the Great West* (New York: Norton, 1991).

9. Donald W. Meinig, *The Shaping of America: A Geographical Perspective on 500 Years of History*, vol. 2, *Continental America, 1800-1867* (New Haven: Yale University Press, 1993), pp. 260-261.

10. William Cronon, *Changes in the Land: Indians, Colonists, and the Ecology of New England* (New York: Hill and Wang, 1983).

11. Cronon, now Frederick Jackson Turner Professor of History, Geography, and Environmental Studies at the University of Wisconsin-Madison, has engaged a cartographer to assist with his latest project, a history of Portage, Wisconsin and the great environmental thinkers associated with the town. Maps are playing an important part in his research for the project. Personal communication, Wellesley College, February 19, 1999.

12. J. Brian Harley, "Texts and Contexts in the Interpretation of Early Maps," introduction to *From Sea Charts to Satellite Images: Interpreting American History through Maps* (Chicago: University of Chicago Press, 1990), pp. 3-15; Harley, "Deconstructing the Map," *Cartographica* 26, no. 2 (1989), pp. 1-20; Matthew H. Edney, "Cartography without Progress: Reinterpreting the Nature and Historical Development of Mapmaking," *Cartographica* 30, nos. 2 & 3 (1993), pp. 54-68.

13. Martyn J. Bowden, "The Invention of American Tradition," *Journal of Historical Geography* 18 (1992), pp. 3-26; Eric Hobsbawm, "Introduction: Inventing Traditions," in *The Invention of Tradition*, edited by Eric Hobsbawm and Terence Ranger (Cambridge: Cambridge University Press, 1983), pp. 1-14; Martyn Bowden, lecture on the invention of New England, Wellesley College, February 22, 1999.

14. Interview with David Cobb, Director, Harvard Map Collection, Harvard University, Cambridge, Mass., July 21, 1999.

15. Student evaluation questionnaires for History 369, May 1999; survey of students by mail, June-August 1999, to which eleven of eighteen course members replied.

16. Rebecca Harvell, "The Reduction of the Sioux Reservation from 1851 until 1889," final paper, History 369, Wellesley College, May 1999.

17. Rachel Hirsch, "Geography as the Catalyst for Military Problem Solv-

ing: An Examination of Xenophon and Alexander," final paper, History 369, Wellesley College, May 1999; personal communications, August 4, 1999 and April 14, 2000.

18. Lindsey Clark, "Fire and Ice: Geology in the Layers of Icelandic Culture"; Linnea Noreen, "Seattle: The City on a Hill"; Sophie Parker, "Urban Water Imperialism in Turn of the Century Los Angeles: The Conception and Creation of the Los Angeles Aqueduct." Final papers, History 369, Wellesley College, May 1999; Sophie Parker, personal communication, May 8, 1999.

19. Anne Petz, "Yellowstone National Park: The Formation of a Place in American Culture"; Elizabeth Repass, "The Space Is Huge and Empty." Final papers, History 369, Wellesley College, May 1999.

20. Margie Schnitzer, "The Nineteenth Century Saltworks of Cape Cod"; Lia Shimada, "Glastonbury: England's Invisible Island." Final papers, History 369, Wellesley College, May 1999.

21. Amy Beltz, "A Landscape of Fear: Oak Ridge, Tennessee," final paper, History 369, Wellesley College, May 1999; signed form, "Survey of Students in History 369," received July 18, 1999.

22. Nina Davis, "Boston's Quincy Market: Changes in Function and Meaning, 1826-Present," final paper, History 369, Wellesley College, May 1999; signed form, "Survey of Students in History 369," received July 20, 1999.

23. Some members of the administration and faculty of Wellesley College remain interested in reinstating geography and in teaching GIS, but constraints on faculty hiring have put the idea indefinitely on hold.

24. Michael Wood, "The Traditional Map as a Visualization Technique," in *Visualization in Geographic Information Systems*, p. 14. Edward R. Tufte remains the American master of information design, although he has given little critical attention to the design of geographic information. See Tufte, *The Visual Display of Quantitative Information* (1983); *Envisioning Information* (1990); and *Visual Explanations: Images and Quantities, Evidence and Narrative* (1997), all from Graphics Press, Cheshire, Conn.

25. Alan M. MacEachren and Mark Monmonier, "Introduction," pp. 197, 198. See also Alan M. MacEachren, "Visualization in Modern Cartography: Setting the Agenda," in MacEachren and D. R. Fraser Taylor, eds., *Visualization in Modern Cartography* (Oxford: Pergamon Press, 1994), pp. 1-12. Similar views dominate the geographic visualization literature.

26. Wood, "Traditional Map," p. 14.

27. Peter Haggett, *The Geographer's Art* (Cambridge: Blackwell, 1990); Edward Tufte, *Envisioning Information* (Cheshire, Conn.: Graphics Press, 1990), pp. 96-98.

Erwin Raisz was a compulsive drawer, filling scores of notebooks with graphic observations and plans for cartographic productions. He was also an intensely visual teacher, from training students to be draughtsmen in his introductory geography course to drawing longitudinal cross-sections of regional landscapes, freehand, on long rolls of art paper by way of outlining his lectures -- and requiring students to take graphic notes. "One Hundred Years of Art and Science in Cartography: An Exhibit of Manuscript Drawings, Maps, Journals, and Publications of Erwin Raisz, Harvard's Most Prominent Mapmaker," at Harvard Map Collection, Harvard University, January-July 1999; Erwin Raisz, *General Cartography* (New York: McGraw-Hill, 1948), esp. chaps. 4 and 5; Joseph Garver, "Plainly Visible Patterns," *Mercator's World* 4, no. 5 (1999), pp. 32-39; Phillip Muehrcke, "Maps in Cartography," *Cartographica* 18, no. 2 (1981), pp. 1-41.

28. Web site for the course on the Internet at http://www.gis.psu.edu/geog121/home.html, accessed 17 May 2000.

29. DiBiase, "Rethinking Laboratory Education," p. 62. DiBiase presented the promising results of the first course in his on-line GIS certificate course (a module based on his classroom teaching of a conceptual introduction to geographic information) in "Customizing GIS Software for Distance Learning," annual meeting of the Association of American Geographers, Honolulu, Hawai'i, March 26, 1999.

30. Cartographer Keith Clarke and classics scholar Adele Haft drew similar conclusions from teaching a course at Hunter College that combined training in cartography and lectures on the intellectual history of cartography with analysis of the geography embedded in works of literature. Telephone interview with Keith Clarke, University of California-Santa Barbara, May 16-17, 2000.

A View From On High: Heinrich Berann's Panoramas and Landscape Visualization Techniques for the U.S. National Park Service

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The late Heinrich Berann, from Austria, was generally regarded as the most accomplished panoramist of all time. During the decade before his retirement in 1994, Berann painted four panoramas for the U.S. National Park Service (NPS) that demonstrated his genius for landscape visualization. This paper examines the widely admired, but little understood, vocation of panorama making, with emphasis on Berann's NPS pieces, concepts, and techniques. Explanation is offered about how the panorama for Denali National Park, Alaska, was planned, compiled, sketched, and painted—starting from a blank sheet of paper. Berann's techniques for landscape manipulation are then analyzed, including his unorthodox habit of rotating mountains and widening valleys, and his unique interpretations of vertical exaggeration. His graphical special effects used for portraying realistic environments are reviewed. The paper finishes with illustrations that compare Berann's panoramas to digitally-generated landscapes.

INTRODUCTION

The world lost one of its most gifted and prolific mapmakers when Heinrich Berann, the renowned Austrian panoramist, passed away December 4, 1999, at the age of 83. Intended as a tribute to Berann, this article discusses his work for the U.S. National Park Service (NPS), emphasizing in particular his artistic techniques and contributions to three-dimensional (3D) landscape visualization.

". . . the panoramas of Heinrich Berann harken back to the era of Bierstadt and Moran by depicting the park landscapes in an idealized manner."

A rich partnership

Artists and the lands under NPS stewardship have had a long association. During the nineteenth century, Albert Bierstadt and Thomas Moran heightened public awareness about the landscapes of the American West with paintings that portrayed nature in an exalted and romantic light. The interest generated by their art and other influences eventually led to land-protection legislation and then to the formation of the NPS. A century later, the panoramas of Heinrich Berann harken back to the era of Bierstadt and Moran by depicting the park landscapes in an idealized manner.

"He retired in 1994 after painting Denali's Mount McKinley, the highest peak in North America—a fitting magnum opus to cap a brilliant career."

After first contacting Heinrich Berann in 1972 to explore the possibility of creating park panoramas, the NPS began its formal association with him in 1987 with the publication of the North Cascades panorama. This was followed by panoramas of Yosemite (1989), Yellowstone (1991), and Denali (1994). During his 50-year career, Berann painted more than 500 panoramas. However, his NPS panoramas are noteworthy for their exceptional quality. Berann, the world's foremost panoramic artist, was near the end of his career and at the height of his artistic prowess when he painted the world-class landscapes of these four U.S. National Parks. He retired in 1994 after painting Denali's Mount McKinley, the highest peak in North America—a fitting magnum opus to cap a brilliant career.

Panoramas and cartography

Panoramas are a unique variety of map that transcends the boundary between cartography and art. They are beautiful, enjoy widespread popularity with the public, and are excellent pictorial devices for visualizing landscapes—especially ski areas, for which the panorama has become the de facto cartographic standard. Despite this, the creation of panoramas has been eschewed by the mainstream cartographic community because of the highly specialized skills needed for their production and, to a lesser extent, concerns about their relaxed accuracy. Cartography's lack of interest in panoramas is hardly surprising considering the discipline's emphasis during the last several decades on the quantitative and theoretical aspects of map making. There simply has been a dearth of cartographers with the needed artistic skills and temperament to create panoramas. Thus, the business of panorama creation has been largely relegated to artists who have an affinity for landscapes, such as Berann. Ironically, the artists who create panoramas tend not to consider themselves cartographers—they prefer to be called panoramists instead—despite the fact that they graphically portray spatial relationships on the Earth's surface. The number of active panoramists world-wide is rather small. Probably, most panoramists live in Austria, where, as of 1998, seven people painted panoramas on either a full or part-time basis (Vielkind, 1998).

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Cartographers have not been entirely absent from panorama making, however. Hal Shelton, now retired from the U.S. Geological Survey, painted the elegant panorama "Colorado: Ski Country U.S.A." and numerous ski-area maps in the 1960s. Other cartographers studied with Berann himself, including James Robb, University of Colorado at Boulder, and Michael Wood, University of Aberdeen, Scotland. Wood painted the "Whisky Trail" and several other panoramas of the Scottish Highlands. In Switzerland, Arne Rohweder (Karto Atelier) and, in the U.S., Pete Powers (Terragraphics) are among the few trained cartographers who actively produce panoramas today.

The general schism between cartographers and panoramists—exceptional cartographer-panoramists notwithstanding—may be ending thanks to computers. Powerful microprocessors, abundant geo-data, and sophisticated graphical software programs now permit cartographers (and many others) to create 3D landscape visualizations that resemble panoramas. Moreover, interest in 3D mapping is growing rapidly and enjoying a renaissance, apparently because of the rapidly evolving discipline of multimedia cartography. Today's cartographic researchers studying interactive spatial environments assume that 3D presentation is a superior method for visualizing many forms of geographic data, including landscapes. Because 3D landscapes are less abstract than their two dimensional (2D) counterparts, they are thought to be easier to visualize, especially by the growing numbers of people with limited map reading skills or the time needed to study maps.

"Today's cartographic researchers studying interactive spatial environments assume that 3D presentation is a superior method for visualizing many forms of geographic data, including landscapes."

As more multimedia cartographers rely on 3D map presentation, questions inevitably arise about optimizing the design of 3D landscapes. Careful examination of Heinrich Berann's work answers or gives insights into some of these questions.

ABOUT BERANN

Berann's lifestyle, ethos, and artistic training have roots in a former era. To appreciate fully Berann's panoramas—especially amidst a digital revolution and in a new millennium—it behooves cartographers to know something about the man and his traditional qualifications for interpreting landscapes graphically.

A brief biography

Heinrich Caesar Berann was born in 1915 in Innsbruck, Tyrol, Austria. Living in proximity to inspiring alpine landscapes exerted a lasting influence on his later development as a panoramist (*Figure 1*). All of his panoramas, even of foreign areas, tend to depict mountains in a style reminiscent of the Alps. Berann came from a family of artisans, and his grandfather was an art teacher. In spite of this, Berann's father initially objected to his son's artistic aspirations. This forced Berann to learn painting through self study (Troyer, 1999). From 1930 to 1933 he attended design school in Innsbruck and worked as a graphic illustrator during the economic depression of the 1930s. After World War II army service, Berann continued his art training in Vienna. He studied sculpture with Gustinus Ambrosi and anatomical art with Dr. Wirtingen. He never studied cartography, however.

"All of his panoramas, even of foreign areas, tend to depict mountains in a style reminiscent of the Alps."

From 1952 until his death in 1999 he lived and worked in Lans, Austria, a small village near Innsbruck. Berann was married for 32 years to his first wife, Ludmilla, who died in 1974. In 1991, Berann married his longtime friend, Mathilde, who died unexpectedly in 1993. After this devastating blow Berann lost all desire to continue working as a commercial panoramist, and his health declined. His retirement years were devoted to painting fine art and listening to music (Schutzler, 1999). Berann is survived by daughters Angela and Elisabeth.

Berann's commercial career started with the production of non-panoramic tourist posters of the Tyrol and Grossglockner regions of Austria, and these exhibit the art-deco influences of the period. His first panorama, produced in 1934, commemorated the opening of a mountain pass road near Grossglockner and won first prize in a competition. Winning the prize awakened Berann to the possibility of becoming a career panoramist—despite the vow he made as a youth "never to paint mountains" (Troyer, 2000). In 1937 he painted a panorama showing a tourist railroad in the Jungfrau region of Switzerland. During the next five decades Berann painted hundreds of panoramas, most depicting his native Alps, and he gradually improved his artistic style. His earliest panoramas were highly stylized compared to his later work, especially the distinctive treatment of clouds, which he perfected while on military duty in Norway and north-

"His first panorama, produced in 1934, commemorated the opening of a mountain pass road near Grossglockner and won first prize in a competition."

Figure 1. (left) Heinrich Berann in his studio, Lans, Austria. (right) Berann's emblem: "The Balance."

ern Finland during WWII (Troyer, 1999). Although Berann did not invent the panorama—bird's eye views of cities and recreational areas have been common since the late eighteenth century—he has set the highest standard to emulate.

"Although Berann did not invent the panorama—bird's eye views of cities and recreational areas have been common since the late eighteenth century—he has set the highest standard to emulate."

Fine art

As his career as a panoramist burgeoned, Berann also pursued his interest in fine art. His artistic expression often touches on religious themes and tends toward the baroque. Many of his pieces revel in the human form, especially female nudes, while other works are more abstract and splashed with vibrant color (see Hörmann, 1995, for examples). A deliberate symmetry exists between Berann's passion for fine art and his pragmatic career as a panoramist, something he acknowledges by his choice of a personal emblem, which he calls "the balance" (Troyer, 1999; *Figure 1)*

Balance emblem or not, Berann's dual career was not an entirely neat and compartmentalized package. His prowess as a panoramist clearly benefitted from his passion and inborn artistic ability: similar skills are required for putting forms to paper, be they nudes or mountains. Cross fertilization occurred between his vocations. Berann's fine art pieces became less impressionistic and more detailed later in his career because of the influence of cartography (Troyer, 2000). In 1963 Berann visited Nepal to prepare for painting the Everest panorama. There he came into contact with Hinduism, which had a profound and lasting influence on his art (Garfield, 1992), although he remained Roman Catholic in his religious beliefs. Conversely, the religious influence in Berann's art is very evident in his distinctive depiction of the sky on panoramas. The arcing cloud formations on panoramas are a manifestation of Berann's fascination with the "circle of life," a theme that pervades his fine art (Troyer, 2000).

"A deliberate symmetry exists between Berann's passion for fine art and his pragmatic career as a panoramist, something he acknowledges by his choice of a personal emblem, which he calls 'the balance' (Troyer, 1999)."

Berann's dichotomous artistic output—commercial panoramas and high-minded fine art—reflects the divisions within the modern art community as a whole. The study, "Most Wanted Paintings," by the Russian emigré art team of Vitaly Komar and Alexander Melamid, helps put Berann's work into a wider context. To date, they have conducted public opinion polls in 14 countries to learn about our likes and dislikes in paintings. Their polls purport to represent about one-third of the Earth's population and all segments of society. Not surprisingly, the picture that emerges from this democratic sampling of humanity contradicts the tastes of the art establishment; abstract art, modernism, nudes, religious themes, and paintings containing messages were least popular. By contrast, there was an overwhelming cross-cultural preference for large-format, tranquil, realistic landscapes dominated by blue (Komar and Melamid, 1999). The world at large, it seems, is predisposed to like panoramas.

"The arcing cloud formations on panoramas are a manifestation of Berann's fascination with the 'circle of life,' a theme that pervades his fine art."

Selected career milestones

1934 Produces his first panorama, of Grossglockner, Austria's highest peak. Painted in sepia tones, it bears little resemblance to his more colorful later work.

1956 Paints a panorama of Cortina, Italy, for the Winter Olympic Games, the first of his many Olympic panoramas. Berann painted panoramas of his hometown, Innsbruck, Austria, for the 1964 and 1976 Winter Olympics, for which he was awarded the Austrian Olympic Medal.

1963 Begins a profitable association with the National Geographic Society that yields two exquisitely detailed panoramas of the Mount Everest area.

1966 Completes his largest map ever, of the ocean floor, for the U.S. Navy and Columbia University in collaboration with Bruce Heezen and Marie Tharp (Lawrence, 1999). Bathymetry is depicted in simulated 3D with cast shadows on a Mercator world map. He also paints ocean-floor maps for the National Geographic Society.

1967 Completes a panorama spanning the length of the Alps viewed from the north. It is compiled with the help of a Perspektomat, a Swiss-produced mechanical device similar in design to a pantograph. Finding the Perspektomat troublesome to operate and less efficient than compiling by hand, Berann never uses it again. (Vielkind, 1998)

"The term 'panorama' was coined in 1792 by Robert Barker, who devised a series of six paintings of the London skyline, showing a 360-degree view from the roof of a tall building."

1973 The Austrian Ministry of Education and Art bestows on him the title of "Professor."

1986 Painted a small-scale panorama of Germany requiring 3,000 hours to complete. It is followed by other small-scale panoramas of Europe (1989), North America (1991), and southern Africa (1994). Rollers were used to advance the paper to paint these individual panoramas, which are about two meters in length. Berann claims not to have looked at each completed piece until the end of the roll (Troyer, 2000).

1987 A panorama of the North Cascades is his first for the U.S. National Park Service.

1990 The President of Austria presents Berann with the Austrian Cross of Honor for Science and Art.

1994 Retires after completing the panorama of Denali National Park.

WHAT IS A PANORAMA?

The term "panorama" was coined in 1792 by Robert Barker, who devised a series of six paintings of the London skyline showing a 360-degree view from the roof of a tall building. The paintings were arranged on a curved surface surrounding the viewer to give the illusion of being immersed within the scene. Barker's display was a success, and similar panoramas quickly became a popular novelty during the early-to-mid nineteenth century throughout Britain and France (Oetterman, 1998). Today, the Cyclorama at Gettysburg National Military Park, Pennsylvania, is one of the last surviving traditional panoramas in the U.S. Created in 1884, it is a 360-foot-long circular oil-on-canvas painting depicting Pickett's Charge, the decisive moment in the Battle of Gettysburg. Barker's original concept for the panorama is also recognizable today in cyberspace. Apple Computer's QuickTime VR and similar applications enable users to navigate cylindrical 360-degree photographs and computer-generated 3D scenes, which are displayed on a flat computer screen instead of an encircling curved surface.

"A Berann panorama, consisting of a single flat image, does not fit the original concept of the panorama developed by Barker. However, over time, the definition of a panorama has broadened."

A Berann panorama, consisting of a single flat image, does not fit the original concept of the panorama developed by Barker. However, over time, the definition of a panorama has broadened.According to *Webster's New World Dictionary*, a panorama is:

1. a) a picture or series of pictures of a landscape, historical event etc., presented on a continuous surface encircling the spectator; cyclorama

> 1. b) a picture unrolled before the spectator in such a way as to give the impression of a continuous view 2. an unlimited view in all directions 3. a comprehensive survey of a subject 4. a continuous series of scenes or events; constantly changing scene.

F.J. Monkhouse's *A Dictionary of Geography* defines the term as:

> An outline sketch of a piece of country as viewed from some prominent point, covering a considerable horizon distance, emphasizing foreground, middle-ground, and background detail. It is an essential part of field sketching. Various geometrical methods can be used. A panorama can be drawn in the field (preferably) from a contour map.

Although the above definitions describe Berann's work, albeit in a limited manner, Berann's panoramas are much more than simple field sketches. They treat the viewer to an "impression of continuous view" and impart a dynamic quality via atmospheric graphical effects that belie the static medium—paint on paper—upon which they are presented. Berann's panoramas defy classification as completely one genre or another. Instead, a hybrid, they occupy the misty borderlands between photographs, fine art, cartography, and the real world observations of viewers—a fact that only adds to their allure. By describing his work as "exact like a map and visual like a photograph" and, "more colorful, clear, and three dimensional than satellite images" (Stern, 1987), Berann supported the analogy of the panorama as a hybrid.

"Berann's panoramas defy classification as completely one genre or another. Instead, a hybrid, they occupy the misty borderlands between photographs, fine art, cartography, and the real world observations of viewers . . ."

Sometimes the multi-disciplinary heritage of panoramas creates confusion about their identity. When panoramas are viewed from very low elevations they become less map-like and more characteristic of landscape paintings. Several well-known panoramas by Berann approach this nebulous threshold, including Denali and the Everest panoramas for the National Geographic Society. More problematic still, Berann's panorama of "Reit im Winkl," in the Bavarian Alps, clearly crosses into the realm of landscape painting. It depicts an otherwise typical panorama from a hillside vantage point that includes trees and pathways in the foreground (see Berann and Graefe, 1966, for example). Rather than exclude such low-elevation views from the panorama family, cartography should perhaps follow the example of remote sensing which accepts images taken from all elevated platforms, whether on the Earth's surface or in the sky.

Each Berann panorama is distinctive, but all share common characteristics. They are framed within a rectangular border, show terrain in perspective with simulated three dimensionality (2.5D), contain a horizon and sky, depict detailed surface features, and give uncommonly strong emphasis to artistic presentation and natural realism. When combined, these characteristics yield a final product that is much more than the sum of its parts. Something truly magical happens. Readers feel drawn into the panorama as if they were flying high above the land. Alpine peaks project skyward, haze veils distant valleys, and storm clouds gather on the horizon, lending energy to the environment. The effect can be mesmerizing. And while a panorama often brings to the viewer intense visual pleasure, it also delivers a subtle yet more valuable gift. The preternatural topography in a panorama, artistically enhanced to minimize the disorder and distractions of nature, permits the reader to understand the land better.

"The preternatural topography in a panorama, artistically enhanced to minimize the disorder and distractions of nature, permits the reader to understand the land better."

PRODUCTION OVERVIEW: DENALI

Traditional panorama preparation is undoubtedly one of the most difficult cartographic endeavors. Besides artistic talent, the panoramist must possess the ability to read 2D topographic source materials and translate this information into a graphical 3D representation that a lay audience can understand. That panoramas usually portray the most complex mountain topography only adds to the difficulty. Great amounts of time are required to complete a piece. It took Berann an average of six months to complete a large panorama while he worked concurrently on smaller projects (Vielkind, 1998). His NPS panoramas sometimes took several years to complete because of the time needed for planning and thorough reviews.

"The preparation of a panorama begins modestly enough with paper, pencil, and topographic maps for reference. Then the process becomes much more involved."

Planning

The preparation of a panorama begins modestly enough with paper, pencil, and topographic maps for reference. Then the process becomes much more involved. The following section explains the process for creating the panorama of Denali National Park, Alaska.

Berann held discussions with the NPS about the geographic coverage and best direction from which to view Denali. Herwig Schutzler of R.R. Donnelley Cartographic Services (now MapQuest.com, Inc.), which was then a commercial contractor for the NPS, served as our German-speaking intermediary and project consultant. He also had a central role developing the three other NPS panoramas. Through Schutzler, the NPS told Berann that the panorama had to show: Mt. McKinley (also referred to as Denali) and the other major peaks of the central Alaska Range; the highway and railroad leading to the east entrance of the park (where the visitor center, hotels, and park headquarters are located); and the 137-kilometer-long road leading to Wonder Lake in the interior of the park. Altogether the planned panorama would show nearly the entire 24,000-square-kilometer extent of the park, an area slightly larger than Wales, U.K. The decision was made to view Denali from the southeast up the Susitna River valley to match the view most visitors see on their approach to the park from Anchorage. The southern flank of the Alaska Range contains the longest glaciers, most distinctive topography, and an area greater than the abrupt northern side. Also, the relatively narrow (but quite high) Alaska Range trends in an arc that opens to the southeast and forms a natural amphitheater for framing a northwest-oriented panorama.

"Ironically, the exceptional clarity of Washburn's photographs, which lacked normal amounts of atmospheric haze because of the extreme altitude, made it difficult for Berann to gauge distances when compiling the panorama."

Initial sketch

Berann next went to work on the initial pencil sketch that he would submit to the NPS for approval before he began painting. Referring primarily to contour maps, he sketched the terrain of the park to appear in 3D. He did this without the aid of computers or mechanical devices. On a sheet of paper he lightly drew radiating lines from a central observation point high above the Susitna River. These lines establish the field of view and serve as guides for sketching the terrain in perspective.

In drawing the initial sketch, Berann also referred to oblique aerial photographs, which were essential for the accurate depiction of vegetation, mountain textures, cultural features, and other surface details. While he sometimes drew field sketches from a helicopter, this was not possible for the Denali project because of Berann's advanced age, the remoteness of the park, and prohibitively expensive travel costs. Instead, Berann relied heavily on oblique aerial photographs taken by Bradford Washburn, honorary director of the Boston Museum of Science, who has dedicated much of his career to mapping and photographing Mt. McKinley (Washburn and Roberts, 1991). Ironically, the exceptional clarity of Washburn's photographs, which lacked normal amounts of atmospheric haze because of the extreme altitude, made it difficult for Berann to gauge distances when compiling the panorama (Troyer, 2000). Berann also referred to Washburn's superbly detailed topographic map of Mt. McKinley, produced in a collaboration with the National Geographic Society, Swiss Foundation For Alpine Research, and the Swiss Federal Office of Topography, that featured realistic depictions of cliffs, scree slopes, and glacial moraines.

The initial pencil sketch of Denali, when it arrived, was not what the NPS had envisioned, even though it was well crafted and drawn exactly according to our instructions *(Figure 2).* The Alaska Range itself occupied only 35 percent of the total area and, worse still, the entire foreground of the panorama was occupied by flat uninteresting land not even inside the park boundary. Vincent Gleason, then chief of the NPS Division of Publications, made a wise decision that salvaged the project: he asked Berann to crop away two thirds of the sketch, thereby focusing the scene on Mt. McKinley

"The initial pencil sketch of Denali, when it arrived, was not what the NPS had envisioned, even though it was well crafted and drawn exactly according to our instructions."

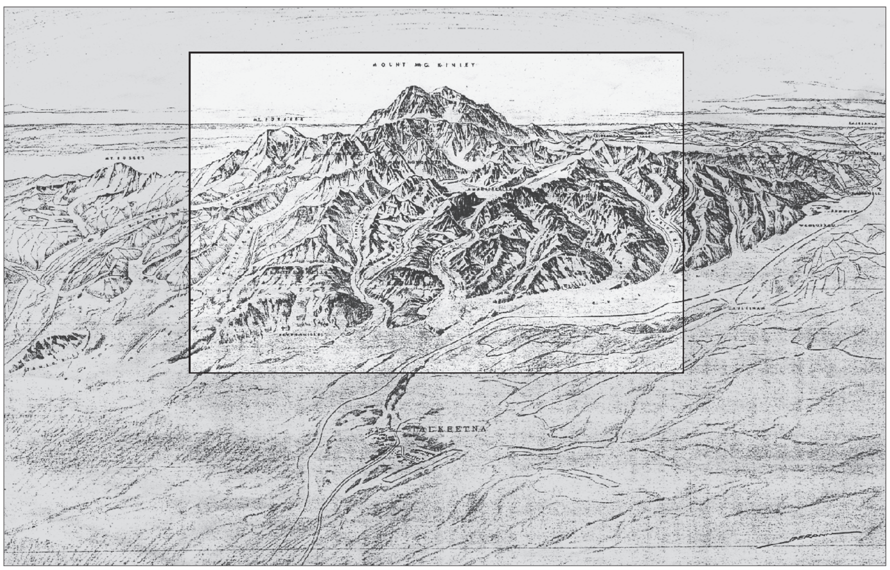


Figure 2. The initial pencil sketch showed nearly all of the Alaska Range and Denali National Park. The NPS asked Berann to crop the sketch to include only the area within the highlighted box.

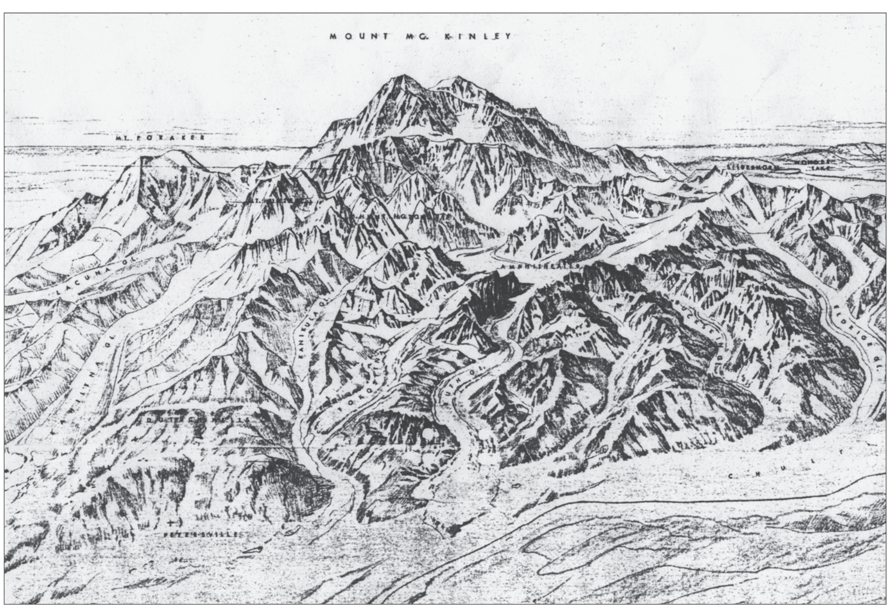


Figure 3. Detail from the cropped initial sketch centered on Mt. McKinley.

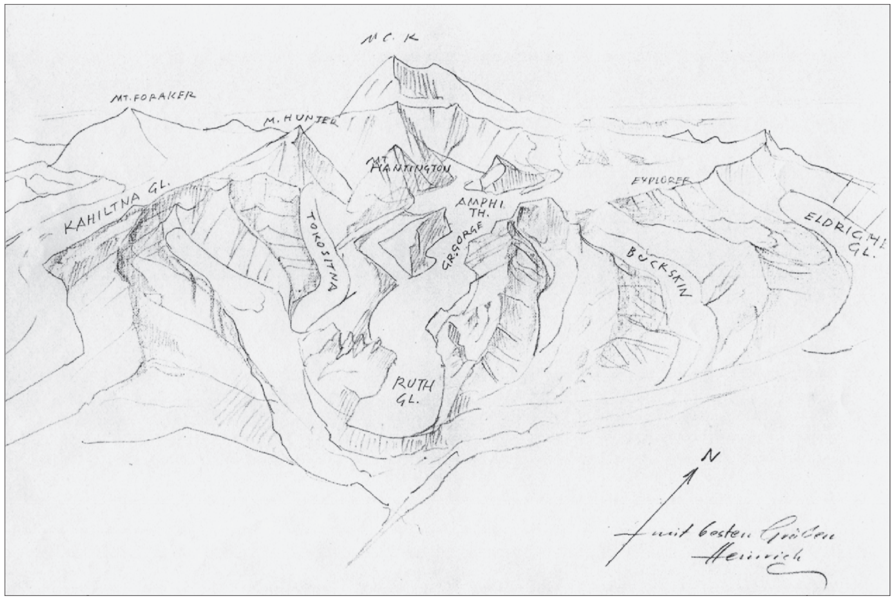


Figure 4. Berann altered the alignment of Kahiltna Glacier (left side) in the rough final sketch. (See Figure 3 for comparison.)

and its immediate environs *(Figure 3).* Berann then produced another quick sketch to confirm the new viewing parameters—and reconfigured selected topographic features along the western (left) margin *(Figure 4).*

Painting

Painting metamorphosed Denali from a mechanical drawing into a beautiful landscape. Berann painted the final panorama on a fresh sheet of heavy, coarse-grained white paper. First, he re-sketched the terrain for the entire panorama lightly in pencil with less detail than the initial pencil sketch. Painting was mostly done in gouache and tempera, which are opaque water-soluble paints, and generally progressed from top to bottom (background to foreground) in a patchwork fashion. Berann would complete one section of terrain, for example, a ridge between two glaciers, before proceeding to the next. This production approach allowed Berann to make localized tonal adjustments on-the-fly as the entire panorama progressed. Also, a section-by-section approach to production undoubtedly gave him a gratifying series of minor accomplishments during the arduous months of painting *(Figure 5).* Tissue paper, with a hole cut out of the center for access, was used to protect the panorama surface while he painted other sections (Wood, 2000).

"The color of the land and sky are complementary and were chosen carefully to create a sense of depth."

The application of Denali's colors occurred in four general stages. In the first stage, light washes were applied over the penciled line work to give basic color and shape to landforms. An airbrush was used to fill in the unadorned blue sky, which appears abruptly lighter near the horizon and becomes gradually lighter in value from right to left. The color of the land and sky are complementary and were chosen carefully to create a sense of depth. Clouds are nearly absent from Denali's sky because of the prevalence of white already on McKinley's snow-crowned summit. In the second stage, dark colors were applied to shadowed slopes with broad brush strokes to develop further the structure of landforms. Next, lighter pigments were used to paint highlights and surface details, and greens were used to depict forest and tundra vegetation. In a surprising touch, some highlights were lightly applied with a large, dry brush, with the stroke trending perpendicular to the slope of the land. This emphasized the fractured alpine texture. For the final stage, the difference between dark mood colors (shadows and forests) and light mood colors (clouds, atmospheric haze, and water glints) was stressed. Rivers and the few roads that existed were painted in last with a fine brush. The Denali panorama reveals no trace of its underlying pencil compilation. It was printed in process color at 100 percent of original size and measures 74 x 99 cm.

LANDSCAPE MANIPULATION

This section describes the techniques Berann used to manipulate landscapes. To most readers, the process of viewing a Berann panorama seems like a random series of happy discoveries. Your eyes move from one feature to another, lingering occasionally in places that attract your interest, and then, perhaps, your focus widens to regard the sweep of the entire landscape. However, your visual journey through a Berann panorama is not entirely a matter of choice and chance. The physical structure of the landscape has been altered to create pathways that subtly guide you to selected features of significance.

Many of Berann's techniques for manipulating landscapes were unorthodox. He often would take questionable liberties (at least from a cartographic perspective) with geographic reality for the convenience of telling a panorama's story. Whether or not you agree with his techniques, knowing what can be done is valuable for understanding the problems associated with 3D landscape presentation in general.

"Many of Berann's techniques for manipulating landscapes were unorthodox. He often would take questionable liberties with geographic reality for the convenience of telling a panorama's story."

Perspective

Perspective provides the framework for building a panorama and governs how much of the world the viewer will see *(Figure 6).* In general, Berann used more perspective on small-scale scenes than on large-scale scenes. Increasing the amount of perspective increases the field of view, thereby compressing more background information into the finite width of the panorama. Use of perspective enhances realism, unless applied excessively, in which case it tends to pinch background areas unnaturally. Large-scale panoramas employ very little perspective, for the purpose of moving background features closer to the viewer (Garfield, 1992). For example, Berann minimized perspective on the Yosemite panorama to accentuate the lofty peaks along the Sierra Nevada crest, which would be indistinguishable if greater amounts of perspective were used. He compensated for the lack of optical perspective by exaggerating other graphical cues—cloud formations converge toward a false vanishing point, and the differing foreground and background colors enhance aerial perspective. On the North Cascades panorama, on the other hand, Berann used more perspective to pull peripheral landmarks, such as Mt. Rainier, the city of Seattle, and Vancouver Island, into the scene.

"The cartographic convention of north orientation is not a major factor for determining the orientation (or viewing direction) of large-scale panoramas."

Orientation

The cartographic convention of north orientation is not a major factor for determining the orientation (or viewing direction) of large-scale panoramas. None of Berann's NPS panoramas is oriented due north: North Cascades is oriented to the southwest, Yosemite to the east, Yellowstone to the south, and Denali to the northwest. Berann's goals when selecting orientation were to maximize the visibility of important local features and to show the broader geographic context. When depicting alpine mountains in the northern hemisphere, such as the Alps or North Cascades, he often used southwest orientation. Looking southwest reveals northeast mountain faces, which tend to be steeper, more distinctive, and more glaciated. Prevailing southwest winds transport summit snows to these lee slopes, which also get less direct sunlight.

Berann preferred the view from lowlands toward highlands. In fact, most of his panoramas have a lofty mountain range as the backdrop. On large-scale panoramas, viewers tend to become disoriented when looking from highlands toward lowlands, despite our real-world familiarity with downhill vistas from mountain peaks. This phenomenon received prominent attention during the controversial court martial of the U.S. pilot who clipped the cable of a ski gondola in the Italian Alps in 1998, tragically killing 20 people. The legal defense team for the pilot presented a digital fly-through animation, which was shown on CBS national television news in the U.S., to demonstrate the difficulties of judging elevation when traveling downhill through a narrow mountain valley (Visual Forensics, 1999).

"On large-scale panoramas, viewers tend to become disoriented when looking from highlands toward lowlands, despite our real-world familiarity with downhill vistas from mountain peaks."

Berann sometimes added twist (skewed orientation) to his scenes to show topographic features with cultural importance that otherwise would be outside the field of view. This is evident in two NPS panoramas: Yosemite was skewed to the north to include Hetch Hetchy Reservoir, the site of a landmark conservation-versus-development battle in the early nineteen hundreds; and the North Cascades was skewed to the south to include Mt. Rainier—the defining landmark for the millions of people who live in Seattle and the Puget Sound lowlands (see Appendix A for illustration).

Projection plane

Cartographically speaking, Berann did not accept that the Earth is flat, even on large-scale panoramas. He added curvature to the projection plane (the theoretical flat base upon which 3D terrain projects upwards) to enhance viewing. On a typical 3D scene with a low-elevation view, the horizon is visible, and the landscape looks realistic, but tall features in the foreground obscure the background. Conversely, high elevation views show background terrain better, but, without the horizon, they look too much like conventional maps.

"The end result is a panorama that combines the best of both worlds: the foreground and middleground appear map-like while the background appears realistic, complete with a horizon and sky."

To solve this problem Berann emulated the view as seen from an airplane *(Figure 7).* From high above the Earth, the horizon is always visible, yet when you shift your eyes downward the view gradually becomes less oblique and more planimetric. To bring this effect to a panorama, Berann tilted the projection plane toward the viewer and, from a point about two thirds of the way into the scene, added convex curvature to flatten the horizon. The end result is a panorama that combines the best of both worlds: the foreground and middleground (where the important information resides) appear map-like while the background appears realistic, complete with a horizon and sky (Patterson, 1999).

Berann's manipulation of the projection plane is most evident on small-scale panoramas, such as his 1986 view of Germany, in which the relatively low relief tends not to obscure the base. In fact, on small-scale panoramas Berann compiled all foreground and middleground information directly from printed maps, drawing topography in an axonometric fashion that transitions to true perspective deeper in the scene. The dual compilation method, although much easier to execute than a panorama based entirely on true perspective, sometimes appears unrealistic and forced where the axonometric map abruptly changes to the perspective background. The problem is most pronounced on continental panoramas that show the Earth's curved horizon.

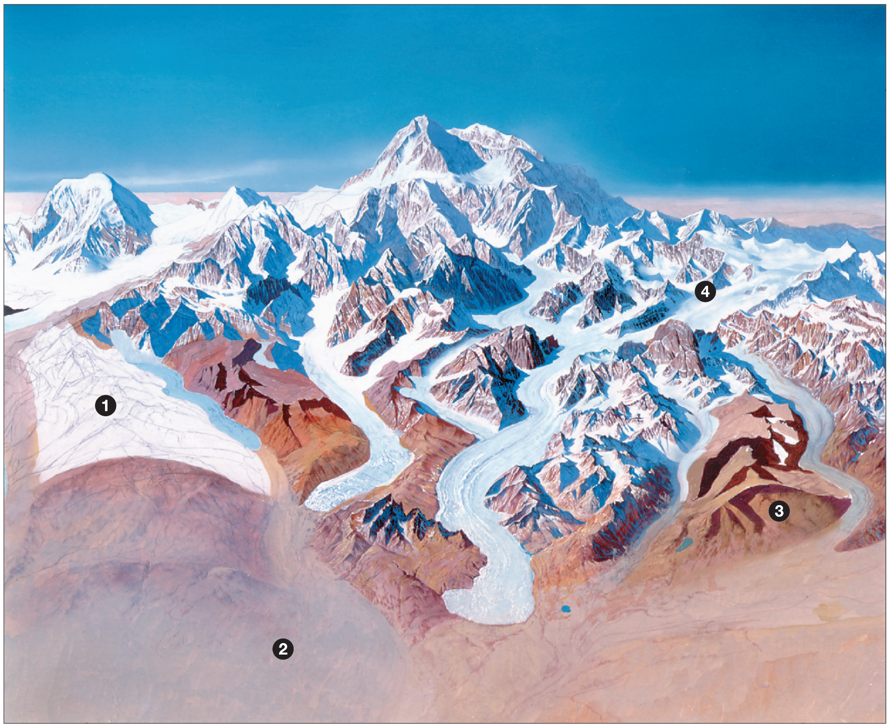


Figure 5. Denali painting in progress: 1) Rough pencil sketch, 2) Light base colors, 3) Shadows, and 4) Final details.

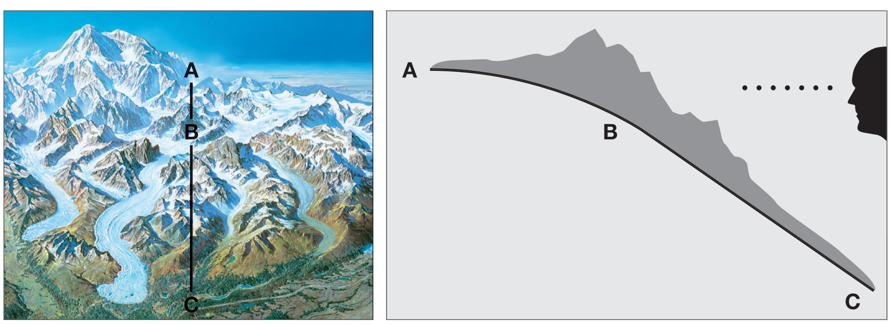


Figure 7. (left) Looking directly into a panorama. (right) The profiled illustration shows how Berann tilted and curved the projection plane, depicted by line ABC.

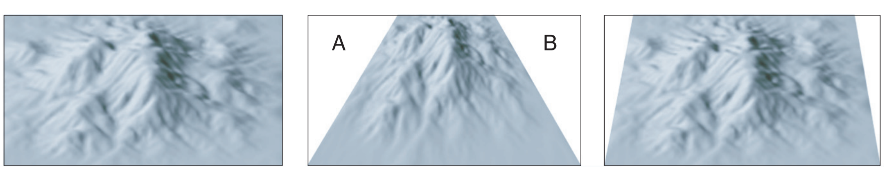


Figure 6. Perspective—finding the perfect fit (Illustration on the left). A hypothetical landscape shown without perspective. It fits nicely into a rectangular format, but looks somewhat artificial. Background features appear too large (Middle illustration). Excessive perspective convergence requires additional terrain to be shown in the empty corners, shown at A and B, thus increasing the amount of work and possibly including distracting or competing area. Background features are compressed (Illustration on the right). Berann typically used modest amounts of perspective, especially on large-scale scenes.

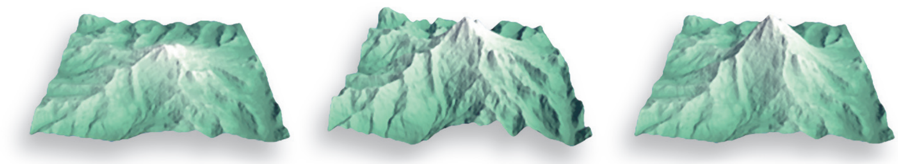


Figure 8. Selective vertical exaggeration. (left) A computer-generated view of Mt. Baker, Washington, shown with about 2:1 vertical exaggeration. The summit appears somewhat flat. (middle) Vertical exaggeration increased to about 4:1, but now Mt. Baker appears indistinct because of visual competition from the surrounding terrain. (right) Mt. Baker with 4:1 vertical exaggeration applied only to the summit. The surrounding terrain is shown with 2:1 vertical exaggeration.

Vertical exaggeration

"Berann departed from mapping tradition in his use of selective vertical exaggeration and/or resizing to accentuate important landmarks."

Panoramas need vertical exaggeration to depict terrain so it approximates our anthropocentric expectations. For example, because an upright human's vantage point is about 2 meters above the Earth's surface, even a 100-meter high hill appears significant to us. However, on many small and medium-scale 3D maps, without vertical exaggeration that same 100 meter high hill would barely appear. On Berann's panoramas, vertical exaggeration typically ranges from 1.5:1 to 4:1, depending on the scale and local relief. Small-scale panoramas with low local relief generally display more vertical exaggeration than large-scale panoramas with high local relief.

Berann departed from mapping tradition in his use of selective vertical exaggeration and/or resizing to accentuate important landmarks *(Figure 8).* For example, the Denali panorama uses about 2:1 vertical exaggeration throughout the scene, with additional exaggeration applied to the summit of Mt. McKinley. The summit is shown about two times larger in all dimensions (x,y, and z) than the surrounding terrain. By increasing the overall size of Mt. McKinley, Berann avoided the problem of "spiking" that results when too much vertical exaggeration alone is applied to exceptionally tall summits with limited surface area—the Matterhorn would typify this type of mountain.

"On a summer panorama more exaggeration would be applied to crags to emphasize the scenery that presumably attracts summer visitors."

Carrying the concept of selective vertical exaggeration still further, Berann sometimes varied the vertical exaggeration between elevation zones, depending on the purpose of the panorama and the season of the year *(Figure 9).* For example, on a winter ski area map, more vertical exaggeration would be applied to the sloping base (where chair lifts and lodges are located) than to the craggy precipices above. On a summer panorama more exaggeration would be applied to crags to emphasize the scenery that presumably attracts summer visitors (Garfield, 1992).

Berann also liked to emphasize background features in a panorama to show terrain that would normally be too small and distant to comprehend.

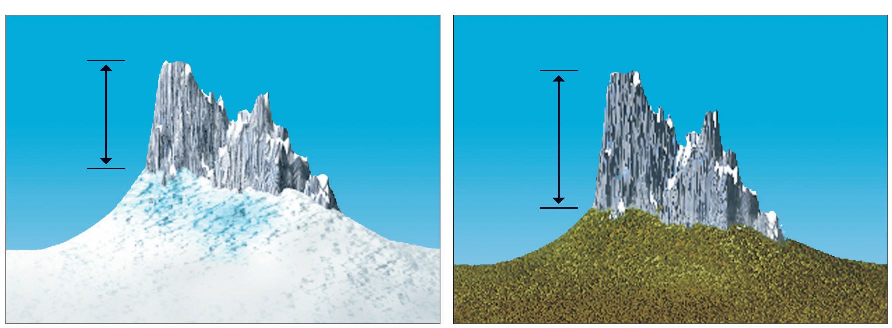


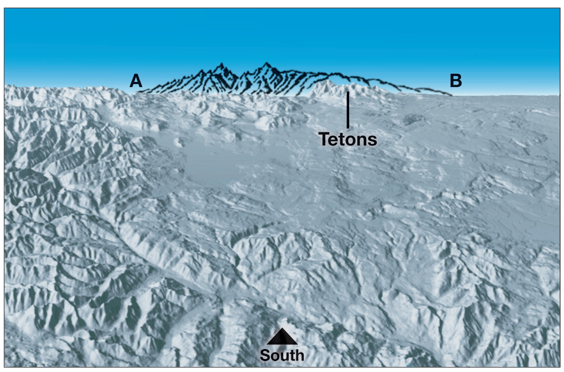
Figure 9. Seasonally-adjusted vertical exaggeration. (left) The winter image emphasizes the gentle lower slopes. (right) The summer image emphasizes cliffs at the expense of lowlands. Both images are computer generated.

The Yellowstone panorama is a good example. It shows the greatly enlarged Teton Range along the southern horizon, establishing a familiar geographic context and adding graphical interest to the otherwise flat horizon.

Rotating reality

The Teton Range also illustrates Berann's very controversial technique of selectively rotating the orientation of mountains and other topographic features within a panorama. Cartographic standards aside, there are compelling reasons for such adjustments. Regardless of how carefully a panoramist chooses the orientation, perspective, and vertical exaggeration, usually a few important landmarks will not appear as clearly as they should. In the southward looking Yellowstone panorama, for example, the north-south trending Teton Range appears as an insignificant nub on the horizon. To make the panorama more meaningful, Berann turned the entire Teton range 55 degrees to show the familiar east face that has appeared in countless photographs *(Figure 10).* Because the distant Tetons are used merely as a

"Regardless of how carefully a panoramist chooses the orientation, perspective, and vertical exaggeration, usually a few important landmarks will not appear as clearly as they should."



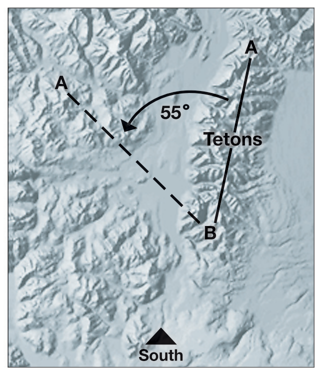


Figure 10. (left) A digital representation of Berann's Yellowstone panorama. In this south-oriented view, the north-south trending Teton Range appears insignificant. (right) The map shows how Berann rotated the Tetons, shown by line AB, 55 degrees to present a more recognizable portrayal of the range on the panorama.

reference landmark, not unlike a north arrow on a conventional map, their rotation may not be the breach of cartographic ethics it otherwise would seem. Berann wisely applied selective rotation with greater discretion for primary landmarks. For example, in the Denali panorama the summit of Mt. McKinley has been rotated approximately 20 degrees to the east to distinguish between Mt. McKinley's hard-to-discern North and South Peaks.

Moving mountains

Berann would rearrange and reposition terrain to improve legibility, especially in areas with a concentration of human-made features. One favored technique was to widen narrow mountain valleys notorious for obscuring details within their innermost recesses. Compared to the area shown on a map, Berann widened Yosemite Valley by 220 percent to portray a clearer view of the roads, campgrounds, lodges, and famous landmarks confined to the limited space. Berann also applied a slight straightening to the bends in Yosemite Valley—to look past El Capitan and the other monoliths otherwise obscuring the valley floor. Other terrain movements are done only to improve the graphic composition. In the North Cascades panorama, for instance, the distant Olympic Mountains were dragged about

"One favored technique was to widen narrow mountain valleys notorious for obscuring details within their innermost recesses."

80 kilometers to the south (left) to align with the upper Skagit River valley, thus creating a visual axis through the center of the scene (see Appendix A for illustration).

Generalization

"Although one distant mountain range may look like another, Berann went to great efforts to capture their signature characteristics."

"Berann lavished attention on the smallest features in a landscape."

"Foreground generalization tends to direct the viewer's eye slightly deeper into the scene, where the most important information can be found."

Considering how much time is spent making a panorama appear realistic, an inevitable question arises: why not just use an oblique aerial photograph instead? The answer is "generalization." Aerial photographs typically show too much and/or inappropriate detail. How many tourist map sponsors would agree to show unsightly clearcut forests, power lines, or landfills? Oblique aerial photographs also have visibility limits. For example, Berann's 1986 panorama of Germany depicts an area more than 800 kilometers in length, well beyond the range of low-altitude aerial photographs. (The maximum line of sight ever observed on the Earth's surface is 370 kilometers.) Moreover, high-altitude aerial photographs and oblique satellite images are inadequate for depicting regions with low relative relief, such as in Germany, without vertical exaggeration.

Panorama generalization is accomplished by manipulating the complexity of the underlying topography and/or surface textures representing vegetation, rocks, etc. Much to Berann's credit, it is very difficult to detect generalization by comparing his panoramas to topographic maps and 3D computer models—at least for terrain in the foreground and middle ground. In the background areas Berann was selective in the quantity and quality of terrain that is shown. Although one distant mountain range may look like another, Berann went to great efforts to capture their signature characteristics. For example, on the Yellowstone panorama, individual peaks in the far-away Tetons are recognizable despite their stylized depiction and the liberal use of atmospheric haze.

As discussed earlier, Berann sometimes selectively exaggerated the size of important landmarks. This creative license was done at the expense of adjacent or intervening terrain because only a finite space exists on a printed sheet. The sacrificed terrain is usually not omitted but minimized in its extent and functions to bond or connect the more important components of the landscape. On landscapes lacking distinctive topographic features, such as Yellowstone's Central Plateau, Berann had a particularly difficult time selecting which features to emphasize (Troyer, 2000).

Much of the apparent detail in a Berann panorama derives from the surface texture and detail that is painted on top of the structural landscape itself. The base topography, derived from topographic maps, is often rather generalized. Berann painted subordinate topographic details (microforms), such as the clefts on a cliff face, by referring to oblique aerial photographs. Detail accentuates a scene's important foreground features and diminishes gradually toward the background. Additional detail applied to well-known landmarks alerts the reader to their importance. Berann lavished attention on the smallest features in a landscape. Cultural features such as roads, dams, and buildings are exaggerated in scale and painted so as to be recognizable. On the Yellowstone panorama, for example, the Old Faithful Lodge, as shown, would be 1.2 kilometers long when compared to a map. Berann also greatly exaggerated the size of waterfalls and Yellowstone's famous geysers by emphasizing their billowing plumes of mist and steam *(Figure 11)*.

The intuitive progression of less detail to more detail from background to foreground does not always apply. Careful inspection of the Yellowstone and Denali panoramas reveals that the level of detail increases normally from background to foreground, except in the very closest areas (the

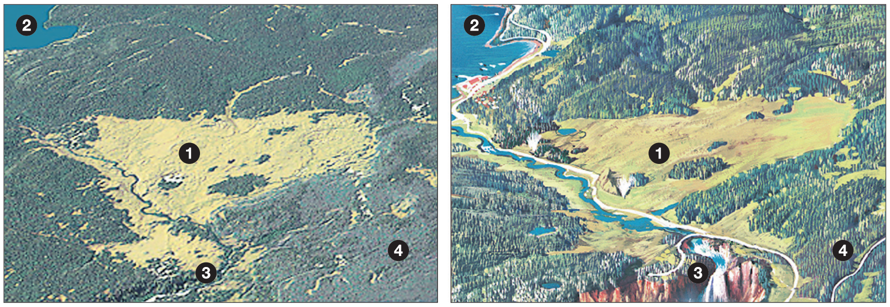


Figure 11. Surface detail comparison, Hayden Valley, Yellowstone National Park. (left) A color-enhanced Landsat satellite image draped onto a DEM. (right) Detail from Berann's panorama. The numbered features are: 1) Hayden Valley, a large meadow dotted with trees and geysers; 2) Yellowstone Lake; 3) Lower Yellowstone Falls; and, 4) Damage from a 1988 forest fire is visible only on the more recent Landsat image.

bottom edge), which are more generalized. On Denali, foreground generalization is most pronounced in the left and right corners. Foreground generalization tends to direct the viewer's eye slightly deeper into the scene, where the most important information can be found. It also accentuates perspective by suggesting motion blur, the same effect one would experience by flying into the scene in a high-speed aircraft.

"The aerial-perspective effect is evident on many of Berann's early panoramas, which show valleys with minimal detail compared to the richly textured mountain peaks above."

Berann's NPS panoramas are noteworthy for their apparent lack of generalization on the vertical axis between elevation zones. For the preparation of map shaded relief, Eduard Imhof noted how the aerial perspective effect could enhance three-dimensionality by portraying lowlands softer and with slightly less detail than highlands (Imhof, 1982). Aerial perspective is a graphical technique based on the real-world observation that landscape features farther away from the viewer appear less distinct than those in the foreground. The aerial-perspective effect is evident on many of Berann's early panoramas, which show valleys with minimal detail compared to the richly textured mountain peaks above. Later in his career, however, as his artistic skills became more sophisticated and his topographic depictions more realistic, Berann became less reliant on aerial perspective. By the time the NPS panoramas were created he was able to apply equal amounts of detail in lowland and highland areas without compromising three-dimensionality.

ENVIRONMENT

Much of the visual appeal of a panorama derives from the carefully crafted environment that interacts with the structural landscape. This section outlines some of Berann's preferred special effects and graphical flourishes.

Color

Berann loved color and used it abundantly and with casual confidence. In 1991, Berann spoke about his work at the "Mapping for Parklands" symposium sponsored by the NPS. To paraphrase him: "I make a beautiful panorama by adding a little bit of color here, another bit of color there . . . dah-da, dah-da, dah-da." That easy. Surprisingly, he relied heavily on saturated primary colors. Fiery oranges illuminate mountain peaks, cliff faces glow in shocking pink, and deep blue shadows etch the slopes, occasionally accented with bright red (Wood, 2000). Amazingly, they all come together to form a harmonious natural landscape. The key to Berann's success, of course, is his use of complementary colors, applied with small loose brush strokes, sometimes pointillistically in forested areas.

"Surprisingly, he relied heavily on saturated primary colors."

Two standardized color palettes were used, one for winter scenes and the other for summer. The winter palette relied on a limited range of colors—the grays, whites, blues, and deep forest greens that characterize high mountain areas worldwide. Berann used it mostly to paint winter sports areas. He used the richer and more vital summer palette for the NPS panoramas—except for the high-elevation areas of Denali, which exhibit the winter palette. Within the summer palette, color would be selected according to real-world conditions and to achieve graphical effect. For example, the highest peaks within a scene were generally the lightest, often because of snow, and were highlighted with reds and oranges reminiscent of alpenglow. By contrast, the lowlands, which are warmer climatically, were dominated by forests depicted in dark greens, a visually recessive color. Depth within a scene was enhanced by using cool blues to portray background terrain and warmer hues for foreground features (Garfield, 1992). This is another example of the aerial perspective effect applied to the horizontal plane, which mimics the view one sees from a high peak in which blue haze veils distant features and more saturated hues gradually become evident in the foreground.

"Depth within a scene was enhanced by using cool blues to portray background terrain and warmer hues for foreground features."

The summer palette did not always work successfully. Berann developed it for portraying the well-watered and manicured landscapes of his native Alps in early summer. It translates poorly to semi-arid environments, such as Yellowstone. The garish yellow-green Berann used for the meadows, while perhaps characteristic of the Alps, is incongruous in the Yellowstone region. Berann's earliest panoramas made abundant use of yellow-green for depicting meadows (a color choice that was hampered by the poor color reproduction technology of the day, a situation that often frustrated Berann), but it is less apparent on his later work and does not appear at all on Denali, even though vast tracts of grassy tundra spread before the mountain.

"Front-left illumination more closely approximates cartographic conventions and, therefore, would seem to be the preferred illumination source for panoramas."

Illumination

Panorama illumination differs from the conventions used for cartographic relief shading. In cartography, the preferred light source usually originates in the northwest or upper left when the map is north oriented. This selection helps to minimize relief inversion, an optical illusion that causes mountains to look like valleys and vice versa. However, when upper-left illumination is used on a panorama, the slopes facing the viewer are cloaked by shadows obscuring foreground detail.

Illumination from the front left or right usually works best for panoramas. Front-left illumination more closely approximates cartographic conventions and, therefore, would seem to be the preferred illumination source for panoramas. Berann's NPS panoramas generally support this idea, except that Yosemite is illuminated from the front-right. Berann's preference for front-left illumination is not as evident in his non NPS work, however, which seems just as apt to use illumination coming from the front and right. Front-right illumination is especially prevalent in small-scale continental panoramas and ocean bottom maps, the most map-like work of all Berann's productions. Curiously, these maps look splendid and do not suffer from relief inversion despite the use of illumination that usually dooms 2D shaded relief. Apparently 3D landscape maps are more tolerant of variable illumination sources than conventional 2D relief maps—a subject deserving more attention from cartographic researchers.

"To select the illumination direction, Berann would consider several factors and judge their interaction with the topographic characteristics of a panorama."

To select the illumination direction, Berann would consider several factors and judge their interaction with the topographic characteristics of a panorama. His foremost consideration was to position the light source as perpendicular as possible to major trends in the topography because this would emphasize the contrast between illuminated and shadowed slopes, thus enhancing three-dimensionality. He would also study slope and aspect for the purpose of bathing gentle slopes in illumination and limiting dark shadows to abrupt slopes with limited area. These effects maximized legibility throughout the panorama. For panoramas containing a sizable water body, Berann preferred that the light originate from the direction of the sea (Garfield, 1970). Pragmatism may have also influenced how Berann chose the illumination direction. For example, reconnaissance flights are usually scheduled for cloud-free mornings when light originates from the southeast, so it was much easier for Berann to use the southeast illumination imbedded in the aerial photographs, if these were his references, than to recalculate illumination from another direction. Also, illumination within a panorama is not rigidly constant. Sometimes it appears that Berann uses secondary illumination sources to give local units of terrain better definition, or perhaps he was accounting for reflections from adjacent slopes or ambient light. In general, the lighting within his scenes suggests sun elevations typically encountered during early to midmorning or mid- to late-afternoon.

"Berann's penchant for selecting an illumination source based primarily on graphical considerations sometimes resulted in lighting seldom if ever encountered in the natural world."

Berann's penchant for selecting an illumination source based primarily on graphical considerations sometimes resulted in lighting seldom if ever encountered in the natural world. For example, some of his panoramas of the Alps look from northwest to southeast and use illumination coming from the front and left. This azimuth places the midmorning sun in the northeast quadrant of the sky—a geographic impossibility even during the summer solstice. Moreover, some of his panoramas contain morning sun (judging by the light direction) that casts golden illumination across the landscape while convective cumulus clouds form on the horizon, creating an ambience more typical of late afternoon lighting. Nevertheless, these panoramas look convincingly normal, and few viewers would notice or even care about the meteorological discrepancies.

"Berann used cast shadows liberally to enhance natural realism, with minimal detrimental effect, although some detail is sacrificed."

Cast shadows

Cast shadows—the shadows thrown by high topographic features across lower areas—are steadfastly avoided in 2D shaded relief to lessen confusion in narrow valleys (Imhof, 1982). Otherwise, the shadows project onto illuminated slopes and make the drainage lines appear out of register with the shaded relief. Once again, however, the rules of conventional cartography do not apply to panoramas. Berann used cast shadows liberally to enhance natural realism, with minimal detrimental effect, although some detail is sacrificed.

To place cast shadows, Berann had to calculate how irregular shadow profiles would project on irregular adjacent slopes. This is an amazing visualization feat. Some cast shadows are shown with crisp edges while others merge diffusely with their surroundings to create a somber mood. The shadows typically result from a relatively low-altitude illumination source to heighten the overall dramatic effect. As with illumination, Berann varied slightly the placement, length, orientation, and intensity of cast shadows within a panorama, depending on the presentation requirements of localized terrain *(Figure 12).* Despite the small variations, all cast shadows appear natural and consistent within the scene, probably because complex terrain makes light and shadow patterns difficult to gauge. Berann painted the cast shadows with dense neutral or cool colors that serve to balance the warm colors on illuminated slopes.

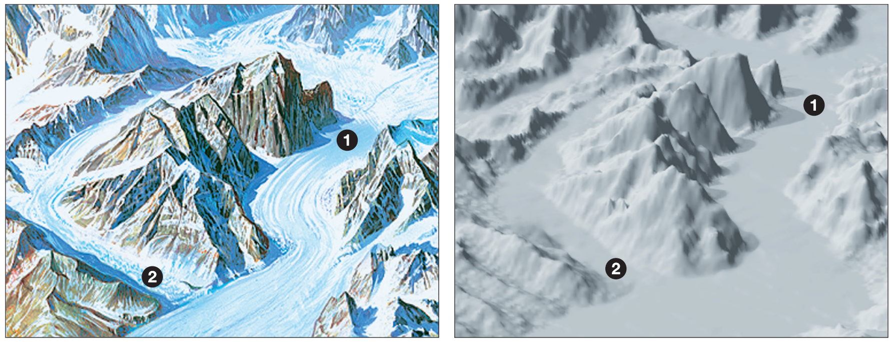


Figure 12. Cast shadow comparison, Ruth Glacier, Denali National Park. (left) Detail from Berann's panorama of Denali. (right) A computer-generated scene using approximately the same lighting as Berann's panorama. At (1) the size and orientation of the cast shadows are similar, but at (2) the cast shadow appears on the panorama, but not on the computer image. Berann probably shifted the light source locally at (2) toward the front and left.

"Berann's water surfaces are always tranquil, interrupted occasionally by rippling zephyrs and the wakes from boats."

Water surfaces

Shimmering water bodies are a hallmark of Berann's panoramas. Believing that water bodies are a significant component of the landscape, he typically exaggerated their size (Wood, 2000). The appearance of water surfaces is determined by sun elevation and azimuth, clouds, wind gusts, adjacent terrain, and depths. Berann's water surfaces are always tranquil, interrupted occasionally by rippling zephyrs and the wakes from boats (Troyer, 2000). Colors range from dark blues in narrow mountain-surrounded bays to light blues in open water. On top of the blue, Berann airbrushed white sun glints, in places with an intensity that suggests radiating energy. The effect is to highlight selected lakes, bays, and other water surfaces in a highly individualistic fashion. (Oblique satellite images and aerial photographs show sun reflections to be much more uniform.) In general, his depiction of water surfaces tends to minimize the influence of surrounding terrain. Cast shadows rarely mar the water surface, even within fiord-like embayments, and reflected mountain sides appear only as subtle hints. Rivers are depicted in dark blue, while rapids and waterfalls are shown in bluish white.

"When traveling with Herwig Schutzler, he would occasionally stop, point at the sky, and exclaim: 'there are Berann clouds.'"

Atmosphere and clouds

Clouds distinguish Berann's panoramas from all imitators. Paradoxically, they add natural realism to scenes, yet from nowhere on Earth do clouds appear quite as they do in Berann's work. Their ethereal perfectionism almost certainly derives from his background as a painter of religious art. According to Berann, the sky gives a panorama its "voice" (Stern, 1987). Berann also found inspiration for cloud depictions in his everyday observations of nature. When traveling with Herwig Schutzler, he would occasionally stop, point at the sky, and exclaim: "there are Berann clouds" (Schutzler, 1999).

Although related stylistically, Berann's cloudscapes all appear different from one another *(Figure 13).* Yellowstone features backlit storm clouds emerging through the western haze. Yosemite shows a tempest clinging to its northern peaks and high altitude cirrus clouds converging toward an unseen vanishing point, suggesting motion. Because clouds occupy the most distant areas, cloud shadows tend to interact only with landforms near the horizon. Sky and clouds occupy the top one-third of Berann's panoramas, which conforms to the sky-to-land ratio of classic European landscape photography and is commonly used for postcards and calendars. Within a pan-

Figure 13. Sky comparison.

orama, however, this is a generous allocation of space devoted to a feature whose primary function is ornamental. To place greater emphasis on the landscape itself, the sky in the printed NPS panoramas has been cropped so that it occupies 20 to 25 percent of its total visible area.

The shades of blue in the sky determine the color of background haze, which in turn determines the depth of a scene. Extra haze sometimes fills the deepest valleys, enhancing the aerial-perspective effect. On the North Cascades panorama, the discerning viewer will notice an unusual atmospheric phenomena, similar to a rainbow, where the sun strikes morning valley haze over Lake Chelan (see Appendix A for illustration). Berann used greater amounts of mist and haze in middleground areas on his panoramas of the Alps, a humid environment, compared to his NPS pieces of the drier western United States. His panorama of Cortina d'Ampezzo in the Dolomites of Italy shows a towering thunderstorm with an anvil-shaped crown, arguably the most distinctive and imposing of all cloud types, but one seldom depicted by Berann (see Berann and Graefe, 1966, for example). Moreover, the fluffy cumulus clouds so typical of summer skies are conspicuously absent from Berann's panoramas, perhaps because

"The shades of blue in the sky determine the color of background haze, which in turn determines the depth of a scene."

their languid appearance would contribute minimal dynamic energy to a scene.

Berann's most memorable panoramic sky was painted for the Valais Water Authority, a region in Switzerland including the Matterhorn. On this project Berann was free for once from the dictates of the tourist industry, which invariably insisted on showing sunny skies to attract visitors. Left to his own devices, he painted a melancholy sky with ragged dark clouds and thunderbolts, giving the scene a sense of apocalyptic foreboding (see Garfield, 1992, cover illustration, for example).

"Within a typical Berann panorama, the color of the sky varies in value from top (darker) to bottom (lighter) and from left to right depending on the illumination source."

Within a typical Berann panorama, the color of the sky varies in value from top (darker) to bottom (lighter) and from left to right depending on the illumination source. Clouds are absent or rare on snow-covered winter panoramas to minimize the dominance of white. The Denali panorama shows this preference, although a careful inspection will reveal a few wispy clouds emerging from behind the flanks of Mt. McKinley. On most panoramas, clouds are placed at varying altitudes, ranging from fogs, mists, and storm clouds that brush the Earth's surface to streaks of cirrus high overhead. With theatrical drama, Berann typically placed roiling storm clouds along the margins, where they appear to be moving away from the center of the panorama. The effect is to reveal a landscape to the audience the way opening curtains reveal a stage *(Figure 14).*

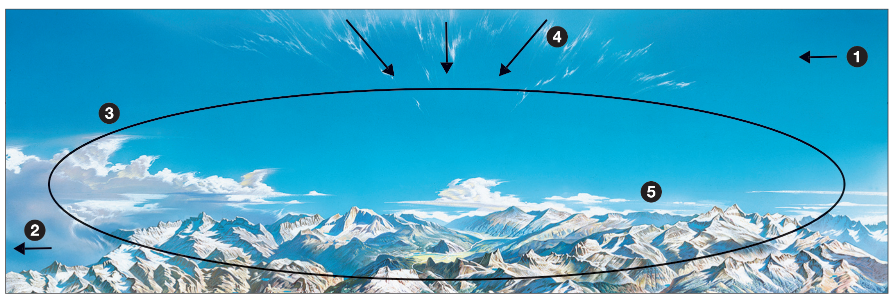


Figure 14. Berann's skies are more than just a pretty picture. 1) Illumination originating from the right directs the viewers eyes to the left as the sky dome becomes progressively darker. 2) The closest and lowest clouds are placed at the left margin, creating a frame for the scene. They are moving away from the source of illumination, a typical characteristic of Berann's skies. 3) Uplifting storm clouds dissipate into arcing tendrils, suggesting an oval that focuses the viewer's eyes toward the center. 4) Cirrus clouds converge toward a distant vanishing point to reinforce perspective. 5) The horizon usually contains the most distant clouds, if any are shown at all.

CONCLUSION

The National Park Service has not published a panorama since Berann's retirement in 1994. Berann's absence is only one factor. Vincent Gleason, who initiated the NPS panorama program, retired shortly after Berann, and since then limited resources have all but eliminated new panorama projects from consideration. This is a pity considering the wealth of exceptional NPS landscapes that could benefit from panoramic depiction. Canyonlands, Glacier Bay, Grand Canyon, Rocky Mountain, and Waterton/Glacier are just a few of the excellent candidates. Vincent Gleason had hoped that Wrangell/St. Elias National Park would become the next NPS/Berann collaboration (Schutzler, 1999). Geographically spectacular, as big as Switzerland, and straddling the roadless mountains along the Alaska/Canada border—the park is quite difficult for the public to visit.

"For more than 40 years Heinz Vielkind served as Berann's apprentice, gradually honing his panoramic skills until his work can barely be differentiated from the work of the master himself."

Berann's departure from panorama production is sorely missed. However, he made careful preparations to ensure that his legacy endures. For more than 40 years Heinz Vielkind served as Berann's apprentice, gradually honing his panoramic skills until his work can barely be differentiated from the work of the master himself. When it comes to panorama production, Heinz

Vielkind is a talented disciple of Heinrich Berann. Furthermore, Berann's legacy is likely to continue beyond Vielkind, who for the last seven years has been training his own apprentice. Vielkind has licensed the Berann name and trademark signature, which he modified *(Figure 15).* His business, Panoramastudio Vielkind, operates from a spacious studio in the university district of Innsbruck and appears to be flourishing. New varieties of projects undertaken include a panorama of Russia spanning 11 time zones that simultaneously shows the Sun rising in the east and setting in the west, and a bird's-eye view of a palace complex and zoo in Vienna.

In keeping with the master/apprentice tradition, Vielkind produces his panoramas in exactly the same manner as Berann—entirely by hand. How much longer this tradition will continue remains to be seen, especially now that 3D software and digital terrain models allow landscapes to be modeled with relative ease. Heinz Vielkind is in an excellent position to make the switch to digital panorama production. Next door to his panorama studio he operates a digital video editing business equipped with the latest technology. For now, his panorama and video businesses are completely separate, but it would seem to be only a matter of time before Heinz melds his operations to create an innovative new class of panoramas.

Figure 15. Heinz Vielkind now uses Berann's signature, but with a tiny "NF" (nachfolger—"successor" in English) added to the trailing swoosh.

Digital applications

In the meantime, the NPS has begun producing 3D landscape visualizations in-house using graphical software applications. These 3D products include geologic diagrams, large-scale views of historical sites depicting buildings and vegetation, globes, and perspective maps derived from Digital Elevation Models (DEMs). Digital landscape visualizations, although not nearly as beautiful as Berann's panoramas, meet or surpass most publication standards, and can be produced quickly and inexpensively when compared to traditional production. In addition, digital products can be easily reused for multimedia applications, thereby amortizing production costs over several projects.

"Besides his prolific legacy of panoramic art, Berann's other gift to the cartographic community is a better understanding of 3D landscape visualization, seen through the eyes of an accomplished traditional artist."

Besides his prolific legacy of panoramic art, Berann's other gift to the cartographic community is a better understanding of 3D landscape visualization, seen through the eyes of an accomplished traditional artist. Some of Berann's 3D visualization techniques are used by the NPS for digital

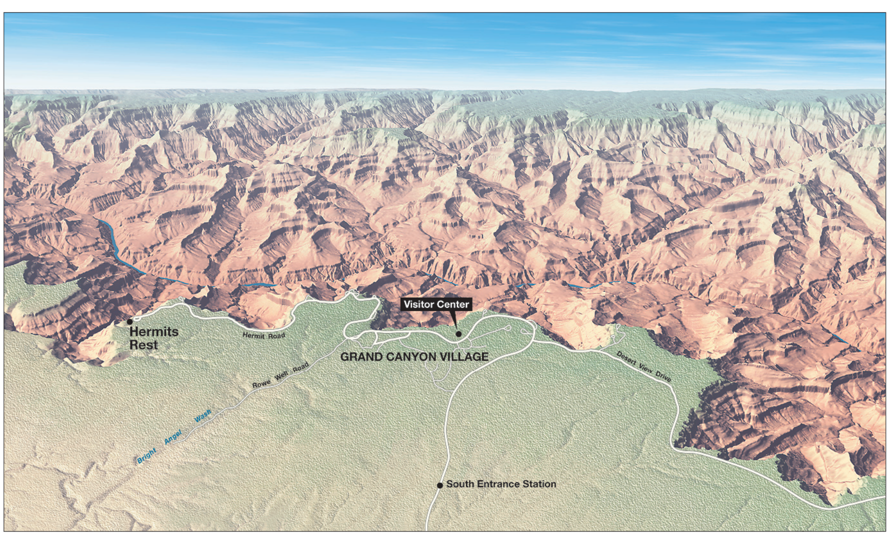


Figure 16. The receding horizon in this digital view of the Grand Canyon was created by curving the projection plane from front to back—a visualization technique pioneered by Heinrich Berann.

production. For example, Berann's idea about modifying the projection plane of a panorama—tilting the foreground closer to the viewer and curving the background to disappear over the horizon—can be accomplished with digital tools, yielding scenes that are more legible and natural looking than default "flat world" output from 3D applications. *(Figure 16)* Even Berann's meticulous attention to land-surface detail is digitally emulated by combining DEMs, draped imagery, bump-mapped textures, and ray-traced rendering.

Today's 3D software applications have diminished the requirement that an aspiring cartographer/panoramist possess manual artistic skills. Nevertheless, the success of a 3D landscape visualization still rests on design choices made by the cartographer, which, unlike inborn artistic ability, can be learned. As cartography continues to be transformed by the digital revolution, we are fortunate to have Heinrich Berann's panoramas as an inspiring lesson.

ACKNOWLEDGMENTS

I am very grateful to the many people who provided advice and assistance. I owe special thanks to Herwig Schutzler, who was Berann's friend, for sharing his personal insights, contacts, and large collection of Berann memorabilia with me. Schutzler was the source for the images showing the progressive work on Denali. The photograph of Berann wearing his special vest and the illustration of his balance emblem were used with the permission of Elisabeth Troyer, Berann's daughter. Shoko Fujita-Ehrlich translated a portion of Garfield's text from Japanese to English, text which, ironically, was originally written in English.

OBTAINING BERANN'S NPS PANORAMAS

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REFERENCES

Berann, Heinrich C. 1991. Mapping for Parklands Symposium. National Park Service. Harpers Ferry, W.Va., (oral translation by Herwig Schutzler).

Berann, H.C. and Graefe, H.A. 1966. *Die Alpen im Panorama.* Verlag Wolfgang Weidlich, Frankfurt, 205 p.

Garfield, Terry. 1970. The Panorama and Reliefkarte of Heinrich Berann. *Bulletin of the Society of University Cartographers.* Vol. 4, No. 2, Liverpool, pp. 52-61.

Garfield, Terry. 1992. *Panoramas Berann's World: From the European Alps to the Himalayas* (text in Japanese). Jitsugyo no Nihon sha (publisher), pp. 104-111.

Hörmann, Lia. April-May, 1995. Die Welt Des H.C. Berann. *Die Tirolerin.* Innsbruck, pp. 188-195.

Imhof, Eduard. 1982. *Cartographic Relief Presentation.* de Gruyter, Berlin, New York, H.J. Steward (edited by), 389 p.

Komar, V. and Melamid, A. 1999. *Komar & Melamid: The Most Wanted Paintings on the Web.* (website) http://diacenter.org/km/index.html

Lawrence, David. 1999. Mountains Under the Sea. *Mercator's World.* Vol. 4, No. 6.

Monkhouse, F.J. 1965. *A Dictionary of Geography.* Edward Arnold, London, 334 p.

Oetterman, Stephan. 1998. *The History of the Panorama: History of a Mass Medium.* Zone Books, New York, 497 p.

Patterson, Tom. 1999. Designing 3D Landscapes. *Multimedia Cartography.* Springer-Verlag, Berlin, W. Cartwright, G. Gartner, M. Peterson (edited by), pp. 217-229.

Schutzler, Herwig. 1999. MapQuest.com. (personal communication).

Stern Magazine TV Guide, Childrens Supplement. December, 1987. Neue Perspektiven.

Troyer, Matthias. 1999. The World of H.C. Berann. (website) http://www.berann.com

Troyer, Elisabeth and Gerhard. 2000. (personal interview with Berann's daughter and son-in-law)

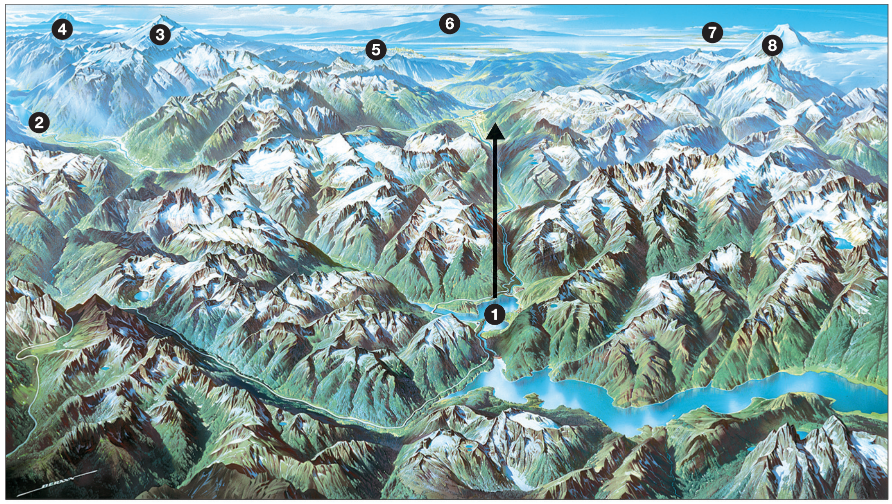
Vielkind, Heinz. 1998. Panoramastudio Vielkind. Innsbruck. (personal interview)

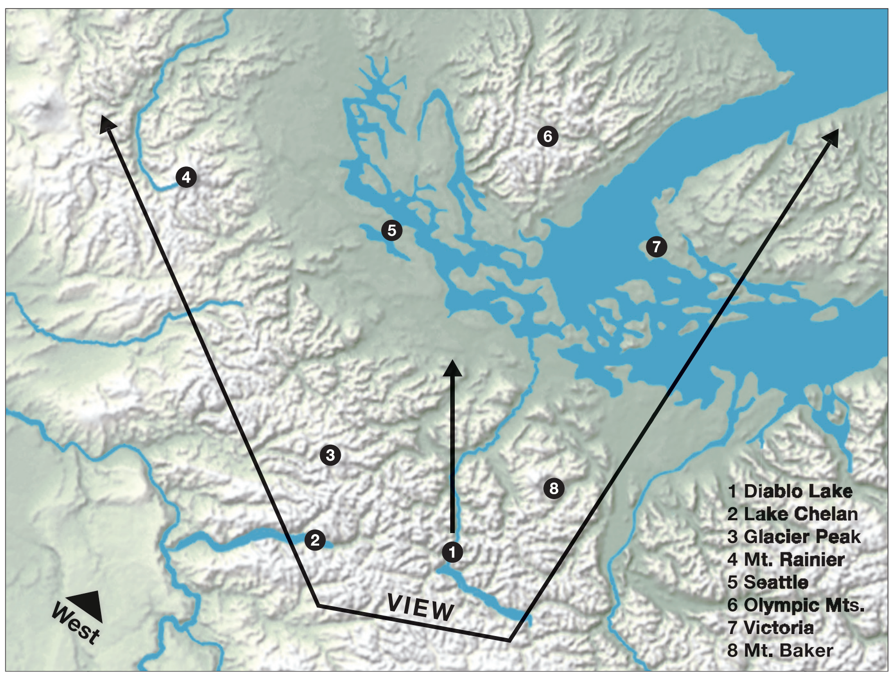
Visual Forensics. 1999. (Website) http://visualforensics.com/Current_Work/Aviation_Law/aviation_law.html

Washburn, B. and Roberts, D. 1991. *Mount McKinley: The Conquest of Denali.* Abrams, New York, 206 p.

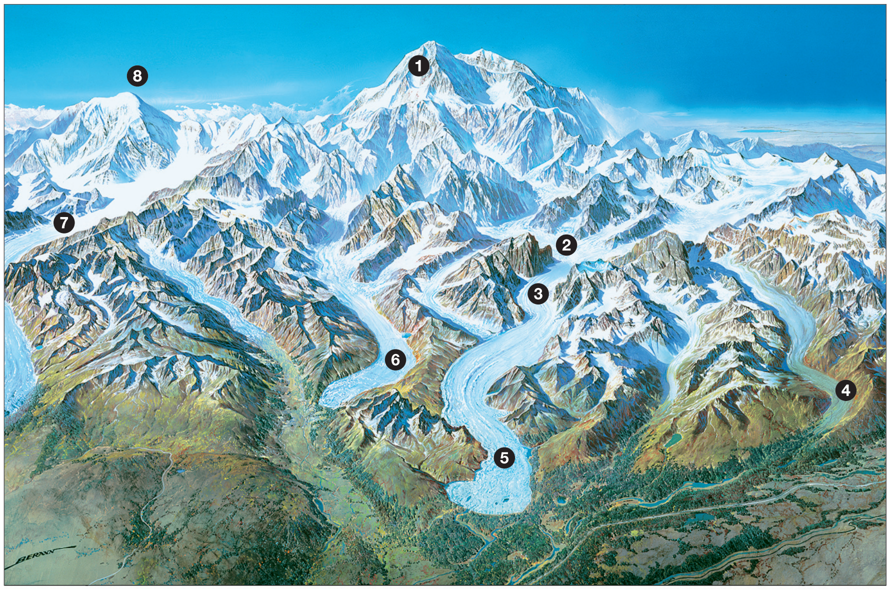
Wood, Michael. 2000. Heinrich Berann and his Methods—A Past Student's Reflections. *ICA Mountain Cartography 2000 Workshop.* Rudolfshütte, Austria.

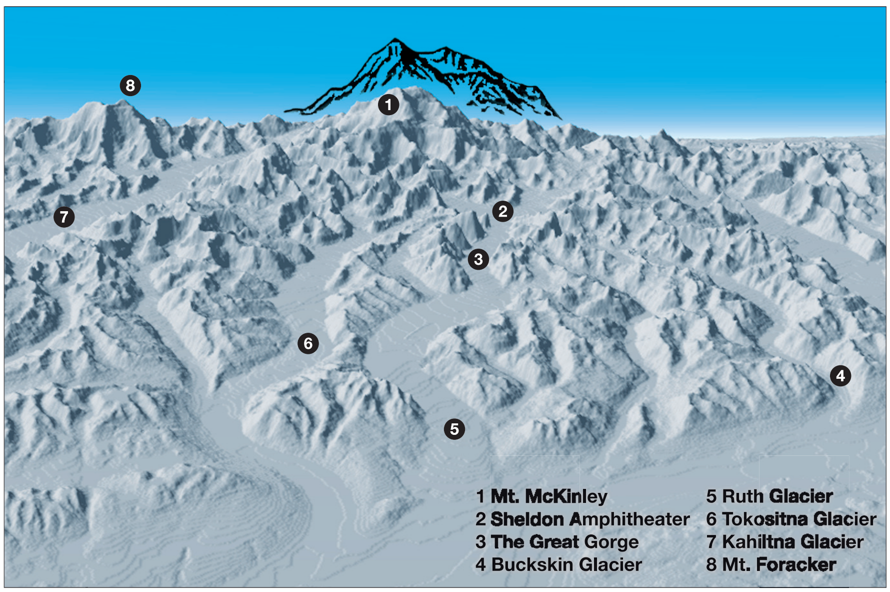
APPENDIX A
BERANN'S PANORAMAS COMPARED TO DIGITAL LANDSCAPES





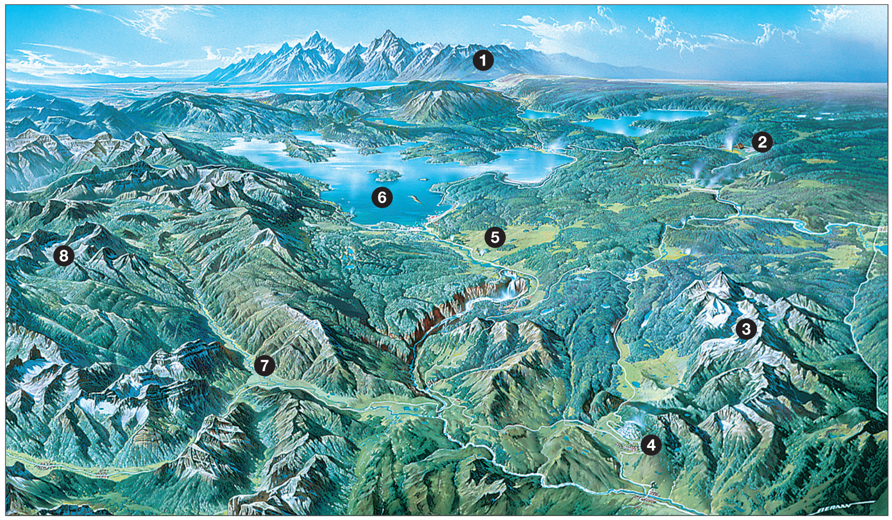
North Cascades National Park
Digital source: GTOPO30

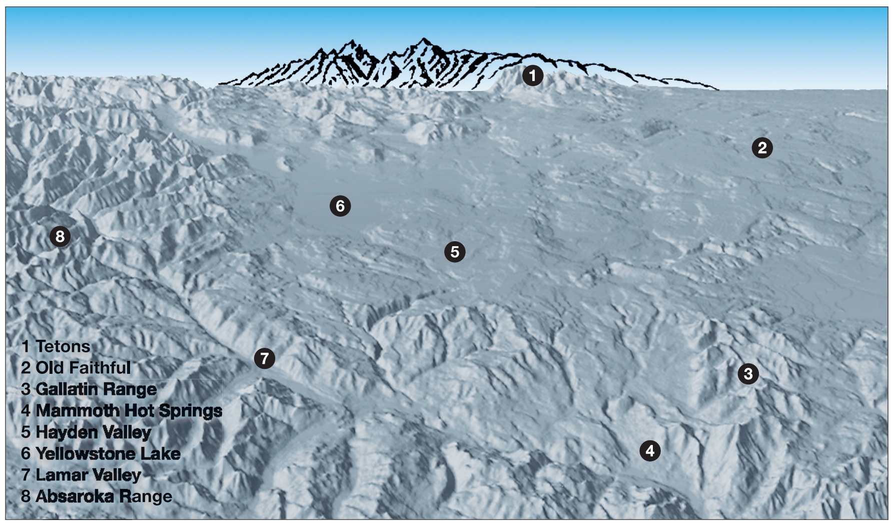




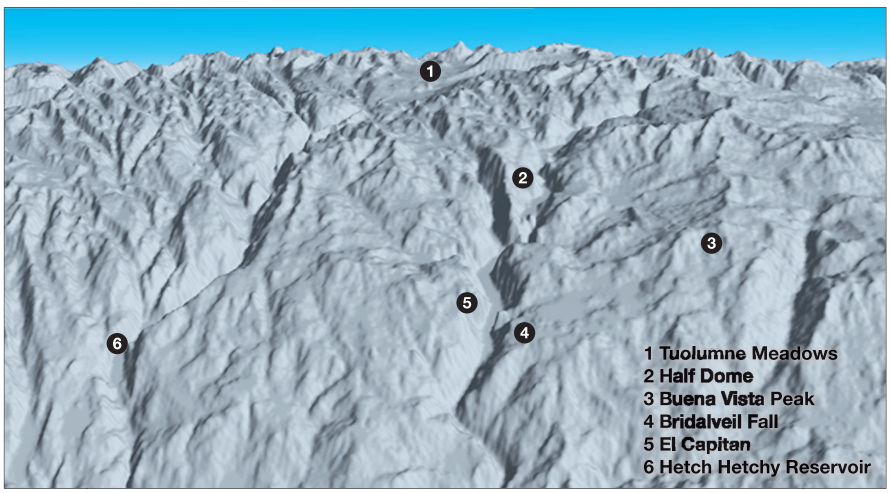
Denali National Park
Digital source: 1:63,360-scale USGS DEMs

Mount McKinley summit detail, Denali National Park
Digital source: 1:63,360-scale USGS DEMs

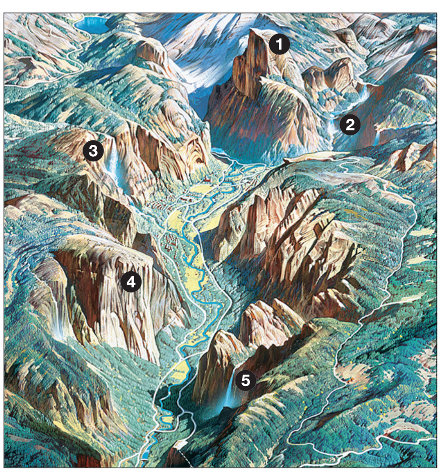


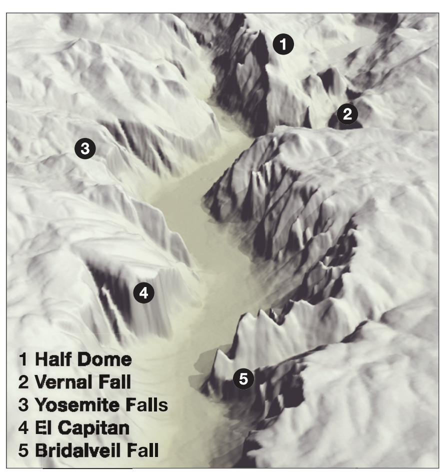


Yellowstone National Park
Digital source: Downsampled 1:24,000-scale USGS DEMs



Yosemite National Park
Digital source: 1:250,000-scale 90 meter USGS DEMs





Yosemite Valley detail, Yosemite National Park
Digital source: 1:24,000-scale 30 meter USGS DEMs

Poems Shaped Like Maps: (Di)Versifying the Teaching of Geography, II

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This paper is about poems shaped like maps. It presents a brief history of visual poetry, beginning with the ancient Greek *technopaignia* and culminating in the concrete and experimental map-poems of the latter half of the twentieth century. After outlining some resemblances between concrete poetry and maps generally, the paper focuses on nine works spanning nearly forty years: from "Geographica Europa" by Eugen Gomringer, a founder of concrete poetry (1960), to "Manhattan" by Howard Horowitz, a professional geographer and poet (1997). Because these poems *are* maps, and because visual poetry resembles cartography in its graphic form, these playful map-poems offer a delightfully eccentric way to teach how maps—like/as poems—are generalized, simplified, and selective views of the world. This paper will tell their stories.

Keywords: poetry about maps, map/geography education, visual poetry

A BRIEF HISTORY OF VISUAL POETRY

Visual poetry may have begun when Simias of Rhodes designed his delightful *technopaignia* ("games of skill") in the multicultural Hellenistic world of the third century BCE. Simias shaped the lines of his verse into the pattern that illustrated his subject. "Wings of Love" (*Pteryges Erotos*), for example, takes the form of paired wings to describe the birth and powers of Eros, the winged god of love (*Greek Anthology* 5:128-29). Whatever inspired Simias to create his quirky "games of skill," they—like all works of visual poetry to this day—make the poetic experience inseparable from the visual.

"Because these poems are *maps, and because visual poetry resembles cartography in its graphic form, these playful map-poems offer a delightfully eccentric way to teach how maps—like/as poems—are generalized, simplified, and selective views of the world."*

Since the *technopaignia*, visual poetry has displayed an array of guises. Latin poets, like Pubilius Optantianus Porfyrius in the 4th century CE, not only adapted the Hellenistic fashion to their own verse but created a new style of pattern poetry. This particular type of *carmen figuratum* ("shaped poem") employed evenly spaced letters of verse to form a rectangular space on which acrostic lines (*versus intexti*, "woven verses") were marked out. Manuscripts highlight these additional messages by using contrasting colors (such as red), enlarged letter-size, and outlines of figures. During the Middle Ages, the Merovingian writer Venantius Fortunatus and the ninth-century Abbot of Fulda, Hrabanus Maurus, featured Christian symbols like the cross and the figure of the crucified Christ in their *carmina figurata* (see Peignot 1978, figs. 30 and 35).

During the tenth-century, the *technopaignia* were collected in the fifteenth book of the *Anthologia Graeca* ("Greek Anthology"). Its printing, along with that of Maurus' *De laudibus sanctae crucis* ("In Praise of the Holy Cross") in 1501, spawned the flowering of pattern poetry during the 16th and 17th centuries. "Easter Wings," by the metaphysical poet George Herbert, is perhaps best known (see Grimm 1989, figs. 21-22, pp. 35-39). But other popular shapes included labyrinths, roses, musical instruments, hearts for wedding poems, and coffins for funereal verse (see Higgins 1987; Adler and Ernst 1987). Although pattern poetry languished for the next two centuries, it revived at the beginning of the 20th when the French poets Stéphane Mallarmé ("Un coup de dés"/"A Toss of the Dice," 1897) and Guillaume Apollinaire (*Calligrammes*, 1918) revolutionized the relationship between visual poetry and art (Seaman 1981, 1-28, 117-200; Adler and Ernst 1987, 233-253). Then, after World War II, the international movement known as "Concrete Poetry" drew upon the graphic arts to create types of patterns never before seen. Among the most playful is the poem shaped like a regional map.

"After World War II, the international movement known as 'Concrete Poetry' drew upon the graphic arts to create types of patterns never before seen. Among the most playful is the poem shaped like a regional map."

Prior to the mid-20th century, there are virtually no maps in/as visual poetry. Two examples reveal the nature and paucity of the evidence. An Italian manuscript of the 9th or 10th century depicts Aratus' poem *Phaenomena,* a Greek masterpiece of the 3rd century BCE and the oldest systematic account of the classical constellations. "Aries" typifies the twenty figures illustrating the manuscript [Figure 1]. At the bottom, in Latin, Cicero's verse translation of the *Phaenomena* locates the constellation in the night sky. Above the verses, the story of the Golden Ram ("Aries") is recounted by Hyginus' enduring, if sophomoric, second-century manual of astronomy known as the *Fabulae*. What distinguishes this manuscript from others illustrating the constellations is that Hyginus' *words* have been shaped into the figures of Aries, Pisces, or Perseus. However inaccurate, these figures are nonetheless maps of the constellations (see Stott 1995, 40-41; Whitfield 1995, 35).

The second example is Simon Bouquet's pattern poem "Mappemonde" (1572), shaped like the world-globe on a stand [Figure 2]. Stitched together from classical Latin verses, the self-congratulatory panegyric describes how magnificently Bouquet, a Parisian official, orchestrated the entrance of Charles IX into his city in 1571 (see Peignot 1978, fig. 59). Particularly chilling is that "Mappemonde" was printed the same year that the Saint Bartholomew's Day massacre took place. Sanctioned by Charles himself, it claimed the lives of 3000 Huguenots in Paris alone. Yet Bouquet's "Mappemonde" offers only the suggestion of a map (see also Peignot 1978, fig. 69). Despite the unheard of proliferation of maps and atlases from Bouquet's time on, despite the fact that John Donne's ecphrastic map-poems and Jan Vermeer's paintings of maps and globes were seventeenth-century creations—I can find no evidence of visual poetry shaped like regional maps of the earth until the concrete poets come along.

CONCRETE POETRY AND ITS RELATION TO MAPS

Before turning to our map-poems, we may ask how prominent concrete poets and critics define their art. According to Mary Ellen Solt, "the concrete poet seeks to relieve the poem of its centuries-old burden of ideas, symbolic reference, allusion and repetitious emotional content; of its servitude to disciplines outside itself . . ." (Solt 1968, 8). German poet Max Bense adds: "Sentences are not the aim of concrete texts. What is to be created are ensembles of words which as unities represent a verbal, vocal and visual sphere of communication—the three-dimensional language object, and this three-dimensional language object is the carrier of a specifically concrete aesthetic message" (*Konkrete Poesie International,* 1965: quoted in Solt 1968, 74; trans. Irène Montjoye Sinor). For Eugen Gomringer, founder of concrete poetry and the first poet featured in this paper, "concrete poetry in
general . . . hopes to relate literature as art less to 'literature' and more to earlier developments in the fields of architecture, painting, sculpture, industrial design—in other words to developments whose basis is critical but positively-defined thinking" (*33 konstellationen* 1960: quoted in Solt 1968, 70; trans. Irène Montjoye Sinor).

For our purposes, Howard McCord may offer the most compelling analogy. A poet who often refers to maps in his verses (e.g., McCord 1968), McCord regards the *map* as a splendid metaphor for concrete poetry (McCord 1977, 74):

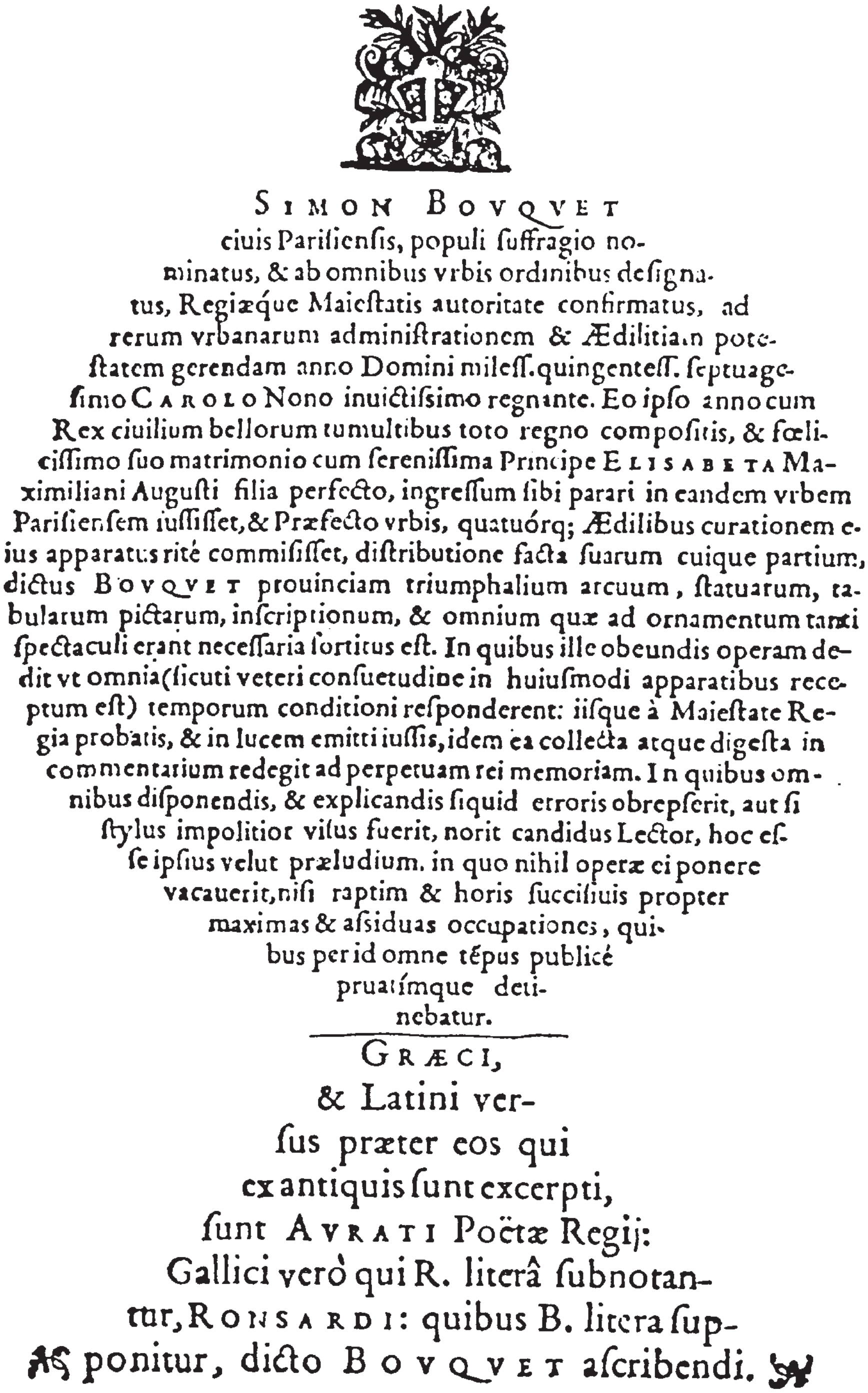
> The page is a map on which the articulation of consciousness can be charted, and the serial flow we associate with prose can be gathered into clusters and islands of words which reveal the individual's voice and vision, even his philosophical stance, more accurately than a line broken by a general rule imposed.

"'The page is a map on which the articulation of consciousness can be charted, and the serial flow we associate with prose can be gathered into clusters and islands of words which reveal the individual's voice and vision, even his philosophical stance, more accurately than a line broken by a general rule imposed.'"
–Howard McCord–

We have only to look at the map-poems illustrated in this paper to see that the relationship between maps and concrete poetry goes even deeper.

A concrete poem resembles a map in being viewed as an artifact or object. The emphasis on its physical material and on its spatial appearance and meaning goes far beyond the normal juxtaposition of white page and lines of text. Neither horizontality nor even linearity are mandatory. In concrete poetry, the reduction of language to a word or fragment is similar to the reduction of landscape to map elements: both processes involve selectivity and generalization, simplification and concentration. If the poem uses words at all, the words tend to be nouns, as on maps where

Figure 1: Anonymous, "Aries," ninth- or tenth-century. From an Italian manuscript in The British Library: Manuscript Harley 647, folio 2v (image size approximately 5 x 5 inches). The constellation Aries is a map created from Hyginus' description of the Golden Ram. Reproduced in Carole Stott, 1995, Celestial Charts: Antique Maps of the Heavens, *London: Studio Editions, 40. Reprinted by permission of The British Library.*



SIMON BOVQVET
ciuis Parisiensis, populi suffragio no-
minatus, & ab omnibus vrbis ordinibus designa-
tus, Regiæque Maiestatis autoritate confirmatus, ad
rerum vrbanarum administrationem & Æditiliam pote-
statem gerendam anno Domini miless.quingentess. septuage-
simo CAROLO Nono inuictissimo regnante. Eo ipso anno cum
Rex ciuilium bellorum tumultibus toto regno compositis, & fœli-
cissimo suo matrimonio cum serenissima Principe ELISABETA Ma-
ximiliani Augusti filia perfecto, ingressum sibi parari in eandem vrbem
Parisiensem iussisset,& Præfecto vrbis, quatuórq; Ædilibus curationem e-
ius apparatus rité commisisset, distributione facta suarum cuique partium,
dictus BOVQVET prouinciam triumphalium arcuum, statuarum, ta-
bularum pictarum, inscriptionum, & omnium quæ ad ornamentum tanti
spectaculi erant necessaria sortitus est. In quibus ille obeundis operam de-
dit vt omnia(sicuti veteri consuetudine in huiusmodi apparatibus rece-
ptum est) temporum conditioni responderent: iisque à Maiestate Re-
gia probatis, & in lucem emitti iussis, idem ea collecta atque digesta in
commentarium redegit ad perpetuam rei memoriam. In quibus om-
nibus disponendis, & explicandis siquid erroris obrepserit, aut si
stylus impolitior visus fuerit, norit candidus Lector, hoc es-
se ipsius velut præludium. in quo nihil operæ ei ponere
vacauerit,nisi raptim & horis succisiuis propter
maximas & assiduas occupationes, qui-
bus per id omne tẽpus publicé
priuatímque deti-
nebatur.

GRÆCI,
& Latini ver-
sus præter eos qui
ex antiquis sunt excerpti,
sunt AVRATI Poëtæ Regij:
Gallici verò qui R. literâ subnotan-
tur, RONSARDI: quibus B. litera sup-
ponitur, dicto BOVQVET ascribendi.

Figure 2: Simon Bouquet, "Mappemonde: Bref et sommaire recueil de ce qui a été faict de l'ordre tenue à la joyeuse et triomphante entrée de...Charles IX," 1572 (Édition consultée: Paris). This "map-poem" celebrates the triumphant entrance of Charles IX into Paris. Reproduced in Jérôme Peignot, ed., 1978, du Calligramme. *Paris: Sté Nlle des Éditions du Chêne Peignot, fig. 59. Courtesy of Jérôme Peignot.*

place-names predominate. Ideally, the concrete poem—like/as a modern map—reflects our scientific and technological achievements, decreased production costs, and the availability and democratization of information. What has been said of Earle Birney's concrete verse applies to concrete poetry generally: it is "a poetry for modern man, a poetry which is accessible, immediate, and alive, which is not maimed by the machine, but is liberated by it" (Zenchuk 1981, 115).

"Ideally, the concrete poem—like/as a modern map—reflects our scientific and technological achievements, decreased production costs, and the availability and democratization of information."

Finally, the concrete map-poem came of age in the 1950s and 1960s, a time when road maps were free and maps appeared not only in classrooms but in favorite works of fantasy and science-fiction. During World War II, war maps had been published in popular magazines, including *Time* and *Fortune*; cartographers like Richard Edes Harrison had offered readers unusual and disturbing perspectives of the world (see Harrison 1944; Mandell 1996); and the film *Casablanca* (1943) had used a scrolling map to give viewers the sensation of flying over war-torn Europe and North Africa. The explosion of maps in fiction and visual poetry from the 1950s on has been paralleled by the proliferation of maps described in "conventional" poetry and represented in the visual arts—most notably, in the works of Guy Debord, Jasper Jones, and Saul Steinberg (see Steinberg 1976; Storr 1994; Bianchi and Folie 1997).

"The map is even an overlooked art in the study of visual poetry as a whole."

Yet in all the studies about concrete poetry, there is a neglect of the map-poem as a distinctive type. Even those most articulate in defining concrete poetry omit cartography when considering concrete poetry's relation to other fields besides literature. The map is even an overlooked art in the study of visual poetry as a whole. Consider Reinhold Grimm's incisive work on pattern and iconic poems in his "Poems and/as Pictures" (Grimm 1989). Grimm criticizes Gisbert Kranz for excluding photography from the arts enumerated in his seminal works, *Das Bildgedicht in Europa* (1973) and *Das Bildgedicht* (1981). Yet Grimm is otherwise satisfied that Kranz's list "encompass[es] the totality of art" even though maps are notably absent (Grimm 1989, 6). One reason is certainly the virtual absence of maps in/as visual poetry prior to the mid-20th century. But, as Denis Wood might argue in his *Power of Maps*, there are other factors to consider as well (Wood 1992). Until very recently, most people have regarded maps as mirrors rather than interpretations of reality. And modern cartography tends to emphasize the scientific and technical aspects of mapmaking over the artistic.

"Poets continue to make concrete and other experimental map-poems even after the 'demise' of the movement in the 1970s and the fall of the Berlin Wall in 1989."

Poets continue to make concrete and other experimental map-poems even after the "demise" of the movement in the 1970s and the fall of the Berlin Wall in 1989. Among the nine poems presented here, one has appeared recently in *The New York Times* (Horowitz) and at least three have been anthologized in major collections (Birney, Gomringer, Morgan). While most of the poems stand alone, Kostelanetz's "The East Village" comprises eleven map-poems (1970-71), Nichol's "Man in Lakeland" was "found" with the twelve-page "In Lakeland" (1978), and Muldoon's "[Ptolemy]" is one of two graphics in his lengthy narrative poem entitled *Madoc: A Mystery* (1990). Other concrete map-poems certainly exist, but I've selected these particular works because of their variety, reproducibility, and appeal—as well as the importance of their poets.

"If one aim of concrete poetry is simplification and transparent meaning, the poems you'll see deserve the designation 'dirty'—not 'vulgar' so much as 'shapeless,' 'obscure,' and 'requiring lots of study.'"

All these poems are tantalizing puzzles demanding the reader/viewer's active participation. Although they have an immediate impact, not one is readily comprehensible. If one aim of concrete poetry is simplification and transparent meaning, the poems you'll see deserve the designation "dirty"—not "vulgar" so much as "shapeless," "obscure," and "requiring lots of study" (Davey 1971, 62-63). Yet explanations, if present at all in anthologies and studies of concrete poetry, are brief. My intent in this paper, part of a book I'm writing on maps in twentieth-century poetry, has been not only to collect these map-poems and present them chronologically, but to tickle out their layers of meaning and, if possible, uncover both their geographical and cartographical inspirations/counterparts.

NAMES MISPLACED ON THE MAP

Eugen Gomringer, Bolivian-born Swiss and father of concrete poetry, designed "Geographica Europa" in 1960 (see Peignot 1993, 223; Millán and Sánchez 1975, 183). This poem is a sketch-map of Europe showing names of cities and countries spelled, for the most part, in their native languages [Figure 3]. But the names are not in their proper geographical positions: Rome, for instance, appears in capitals at the center of the map. Political boundaries and powerful cities like London, Paris and Moscow are notably absent. Could the message of this enigmatic concrete map be "your interest is my interest"?

"Could the message of this enigmatic concrete map be 'your interest is my interest'?"

After World War II, many Europeans rejected nationalism and strove for unity. Only two years before Gomringer composed "Geographica Europa," the European Common Market (or European Economic Com-

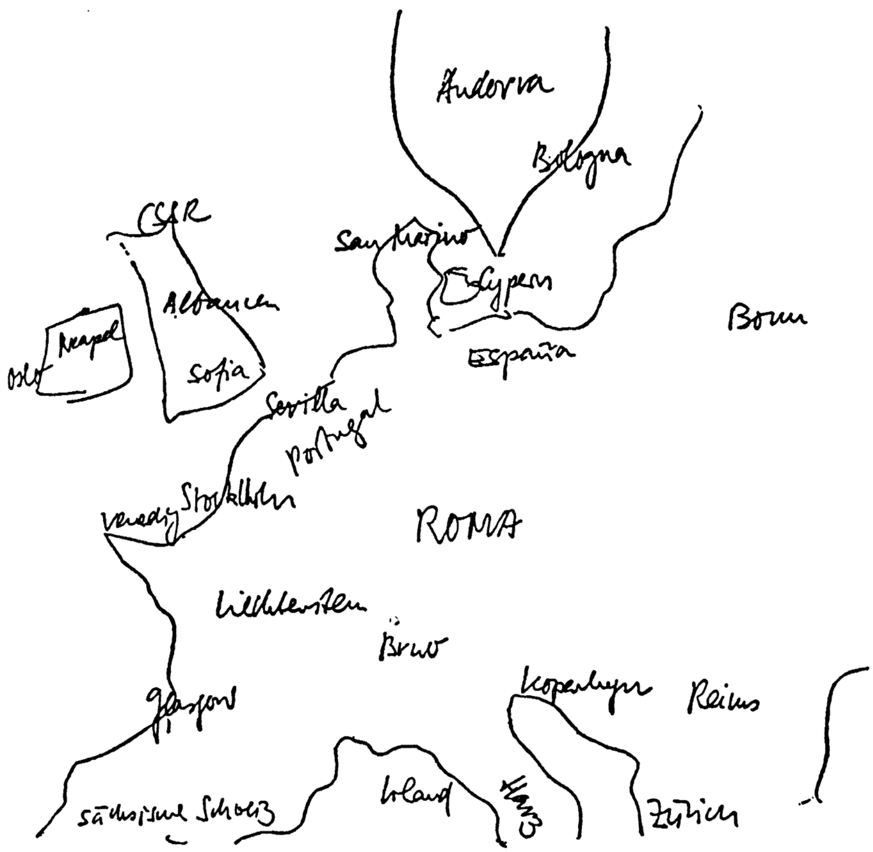


Figure 3: Eugen Gomringer, "Geographica Europa," 1960. This enigmatic map-poem features misplaced labels. Reproduced in Jérôme Peignot, ed., 1993, Typoesie, *Paris: Imprimerie nationale, 223. Courtesy of Jérôme Peignot.*

munity, EEC) was established to promote both the economic and eventual political union of the member countries. Some of these are represented on the sketch-map (France by Reims; Italy by Neapoli, Bologna, and Venice/ Venedig; West Germany by Bonn). Rome's central position becomes clear once we recall that the Treaty of Rome brought the Common Market into existence in 1958. But the Treaty of Rome failed to unite Europe. Within a year, two other economic organizations were competing with it: (1) the European Free Trade Association (EFTA), whose members included Great Britain (represented on the map by Glasgow and Cyprus), Norway (Oslo), Portugal, Sweden (Stockholm), and Switzerland (Zurich, Lichtenstein); and (2) the Council for Mutual Economic Assistance, which coordinated economic policy among the communist nations, including Albania, Bulgaria (Sofia), Czechoslovakia (Brno), East Germany (Harz, Sächsische Schweiz), and the Soviet Union (CSSR). The communist states represented on Gomringer's map-poem were also members of the Warsaw Treaty Organization (1955), the rival defensive alliance to NATO (1949), which, in turn, numbered many who later joined the EEC and EFTA. Gomringer also has included unallied nations, like Spain (España, Sevilla) and the independent kingdoms of Andorra and San Marino. In other words, his 1960 map-poem seems to combine the European hope for a unified landmass and the ideological divisions of the Cold War. Perhaps the juxtaposition of Europe's natural coastlines with man's imposed cities and scrambled place-names also reveals what Gomringer calls the concrete poet's "ability to conform to the demands of communication today which obeys the laws of the sciences of nature and of sociology" (Peignot 1993, 222).

". . . his 1960 map-poem seems to combine the European hope for a unified landmass and the ideological divisions of the Cold War."

IS IT A MAP OR A BIRD?

On the 21st of December 1965, Edwin Morgan—Scottish poet and professor of English at the University of Glasgow—designed his "Chaffinch Map of Scotland." He included the poem in *The Second Life* (Morgan 1966, 38), his first important collection and the winner of the Cholmondeley Award for Poetry. Since then "A Chaffinch Map of Scotland" has appeared in several of his own collections (Morgan 1968, 52; 1982, 161; 1990, 179) and in important anthologies of concrete poetry (Bann 1967, 169; E. Williams 1967).

As the title indicates, Morgan employs a map-like form to celebrate both Scotland and the chaffinch, a brightly colored seed-eater that resides year-round in Scotland [Figure 4]. He suggests Scotland's shape—particularly its irregular breadth and deeply indented coastline—by varying the length of his lines, the insets of his margins, and the spaces between words or word-clusters. The poem's "stanzas" likewise reproduce Scotland's physical division into three regions: the Highlands, the Central Lowlands, and the Southern Uplands extending to the English border.

But instead of place-names, Morgan's map-poem explodes with bird-names for the European chaffinch. "Chaffie," "shelly" and the "ch-"/"sh-" variants advertise the bird's preferred diet; "finch" is onomatopoetic (Warrack [1910] 1965; MacLeod 1990). The poem, in other words, is a *dialectical* map. According to Morgan, each of the words is a Scottish regional name placed in order of its "actual geographical distribution" (E. Williams 1967, n.p.). Bird lovers will recognize Morgan's parodic tribute to bird guides like Peter Clement's *Finches and Sparrows*. Here is how Clement describes "the local variations and dialects" of the chaffinch call (Clement 1993, 166):

". . . instead of place-names, Morgan's map-poem explodes with bird-names for the European chaffinch."

> [It] is a distinctive, almost metallic "pink", "spink" or "chink", uttered as either a single or a double note . . ., also a loud "wheet", "whit", "tsip" or "tsirrup" . . . and a thin high-pitched or wheezing "eesse"; in flight a characteristic quiet "tap", "chap" or "tsup" note . . .

Morgan has varied his poem's rhythms and sound-combinations to mimic the chaffinch's melodious song, even the characteristic double-plosive ending "brichtie." Of the poems examined here, Morgan's is most successful at linking the visual image with "sound poetry," another type/aspect of concrete poetry.

"The poem, in other words, is a dialectical *map."*

"The Chaffinch Map of Scotland" also recalls several cartographic traditions. The title contains a pun on "chaffinch"/"half inch" (E. Williams 1967). This is Morgan's spoof on the large-scale British Ordnance maps, whose precursor was William Roy's mid-eighteenth-century manuscript survey of Scotland. Closer to the poem in playfulness is Robert Dighton's *Geography Bewitched! or, a droll Caricature Map of Scotland*, which represents the country as a hunchback clown sitting on a rock (Bowles and Carver,

The Chaffinch Map of Scotland

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Figure 4: Edwin Morgan, "A Chaffinch Map of Scotland," 1965. This playful dialectical map displays the geographic range of Scottish names for the bird. Reproduced in Edwin Morgan, 1990, Collected Poems, *Manchester: Carcanet, 179. Courtesy of Carcanet Press Limited.*

London, c.1794; see Rose 1981, 63, and Hill 1978, 44-45). But the cartographic inspiration for “A Chaffinch Map of Scotland” is undoubtedly the bird-range maps in guides like *Finches and Sparrows*. We can imagine Morgan trampling around his beloved Scotland with a bird-guide firmly tucked under his arm.

MAPS, HISTORY, AND “DIRTY” POETRY

Earle Birney, one of Canada’s most beloved and highly-awarded writers, created “up her can nada” to observe his nation’s centenary in 1967 (Birney 1971; 1975, 2:159; cf. Bayard 1989, fig. 12). This poem is a sketch-map of Upper Canada, Ontario’s official name from 1791-1841 [Figure 5]. Birney’s immediate inspiration was a special exhibit, *The Discovery and Mapping of Upper Canada* (1967), on display at Toronto’s Royal Ontario Museum while he was writer-in-residence at the University of Toronto. With its eye-catching red and black letters, Birney’s poem is a playful masterpiece of concrete poetry caricaturing historical and economic maps of the province. In the center, “up her can nada” is surrounded on all sides by aliens and aggressors. To the west lies the “unknownterritory” of Manitoba; to the east, “the hostile territory” of Lower Canada, present-day Quebec; and to the south, “Northern Limits of Civil Lies Asian & Trapshooting for incoming missilesss” identifies the US-Canada border. Filled with playful stereotypes, this map-poem is nevertheless a penetrating analysis of the complexity of Ontario, and of Canada itself.

> *“With its eye-catching red and black letters, Birney’s poem is a playful masterpiece of concrete poetry caricaturing historical and economic maps of the province.”*

The lettering “UP HER CPRAN NADA” from bottom-to-top simulates the flow of the long northern Ontario rivers, which travel from south to north before spilling into the bays. The word-segments of the title seem stranded, a problem not uncommon for mapmakers attempting to stretch the six letters of “Canada” across the enormous landmass. As early as 1656, Nicolas Sanson’s map of New France divided “NADA” from “LE CA” (“Le Canada ou Nouvelle France,” Paris: Pierre Mariette; see Goss 1993, 152). Birney follows suit. At the top of his map, in the sub-Arctic tundra of the Hudson Bay’s southwest shore, “NADA” evokes the Spanish word “nothingness.” Among the whimsical derivations for the name “Canada” is “Aca nada!” (“There’s nothing here!”), an expression of disgust by the early Spanish explorers who found nothing but ice and snow. The “Can” of the title appears as “CPRAN” on the map, an allusion to the role of the CPR, or Canadian Pacific Railway, in uniting Ontario to the rest of newly confederated Canada. “Up *her* can nada” alludes to “Her Majesty the Queen”: either Victoria, who oversaw Canada’s conversion from colony to nation, or Elizabeth II, Queen of Great Britain and Canada since 1952—both of whom are loved by Ontario’s overwhelmingly “British” majority. And the irreverent title unequivocally categories the poem as “dirty” concrete poetry.

> *“. . . the irreverent title unequivocally categories the poem as ‘dirty’ concrete poetry.”*

But Birney’s map-poem shows the modern boundaries of Ontario rather than those of Upper Canada. Given the tensions between Ontario and Quebec, the small, red-lettered “canada” appears like a broken promise of harmony. The poem also reflects Birney’s anti-Americanism. Cold-War paranoia between the US and the USSR resulted in the proliferation of missiles aimed over Canada by both superpowers, and inspired the “incoming missilesss” Birney has placed on the eastern Canada-US border of his map. During the 1950s, three radar “fences” had been built on Canadian soil to detect airborne objects and to protect the striking forces located mainly in the US. While Birney was composing “up her can nada,” American involvement in the north reached its peak even as thermonuclear ballistic missiles were rendering the early warning system obsolete. Closest geographically to the eastern Canada-US is the Pinetree Line, which “was intended to cover the most likely enemy approaches between Labrador and the Great Lakes”

> *“Given the tensions between Ontario and Quebec, the small, red-lettered ‘canada’ appears like a broken promise of harmony.”*

(Henrikson 1990, 17; see map in Loughlin 1958, 136-37). Birney's whimsical "missilesss" barely conceals his abiding fear of atomic annihilation.

The poet from western Canada uses "up her can nada" to take jabs at Ontario as well. The broken lettering of "VI RTUe is our only shield," pokes fun at its pretensions while playing upon the rich geological underpinning known as the Canadian Shield. In contrast to the Huron and Cree on Birney's map, the quarter of Canada's population living in the "Golden Horseshoe" on the western shores of Lake Ontario receives the anonymous and uncomplimentary designations "moronia" and "UncontrolTrontonia"—the latter a play on the urbanites' tendency to swallow the initial "o" in the name of their provincial capital, Toronto. These terms spell out the metropolis' mindless excesses, most notably its taxes and pollution. Birney highlights his message by printing "Uncontrol," "pollutional," and "sewage development system" in bold red letters and by making the Great Lakes resemble lower intestines evacuating waste into the St. Lawrence.

Finally, Birney's use of red and black distinguishes "up her can nada" from the other concrete map-poems we're examining. More expensive to reproduce, "up her can nada" tends to be reprinted entirely in black (e.g., Birney 1975, 2:159; Bayard 1989, fig. 12). Yet precedents exist not only in concrete poetry and poster art, but in the *carmina figurata* of medieval poets like Venantius Fortunatus and Hrabanus Maurus (see Peignot 1978, figs. 30 and 35). Birney, a professor of medieval literature and creative writing at the University of British Columbia from 1948-1965, was certainly familiar with manuscripts of these pattern poems and their contrasting red and black letters. In what may be the original draft of "up her can nada," Birney used pencil, pen and magenta ink to replicate this venerable practice. According to Edna Hajnal of the Thomas Fisher Rare Book Library of the University of Toronto (e-mail, January 2000):

"Birney's use of red and black distinguishes 'up her can nada' from the other concrete map-poems we're examining."

> A map of Ontario [is] drawn in pencil on a piece of paper, 4 1/2 x 5 3/4 inches, with the outline of the province traced over with magenta ink and pen. The Great Lakes are outlined with magenta ink and pen. No neighboring territories are shown as the map almost fills the paper. Most of the lettering is in pencil, and few of the words are similar to those in the printed text. The upper right hand corner has printed in upper case letters with pink pencil "up her can nada."

And Birney himself applauds modern technology for making the printed versions of his concrete poetry so unique (Nesbitt 1974, 107):

> I accept the best technology of the world I live in, which allows my publisher to offset my poems straight and crooked, slanting like rain or curving like balloons, and to print them in black, green, red, or whatever colour of ink I choose for a word on a page.

WHAT SHAPE IS YOUR STATE?

John Hollander, a prolific American poet and critic, included "A State of Nature" in his 1969 collection *Types of Shape* (Hollander 1969, 15; 1991, 24). Looking like a map of New York State, this concrete poem recalls the Iroquois who roamed throughout the area before the European settlers imposed the political boundaries that we now recognize as "real" [Figure 6]. Hollander contrasts the Iroquois' "state of nature" with our western artifice, their physical world with our intellectual forms, their "descriptive" language with the name we've given so unimaginatively to both city and state. In the second edition of *Types of Shape*, Hollander explains the inspiration for his map-poem (Hollander 1991, xxii):

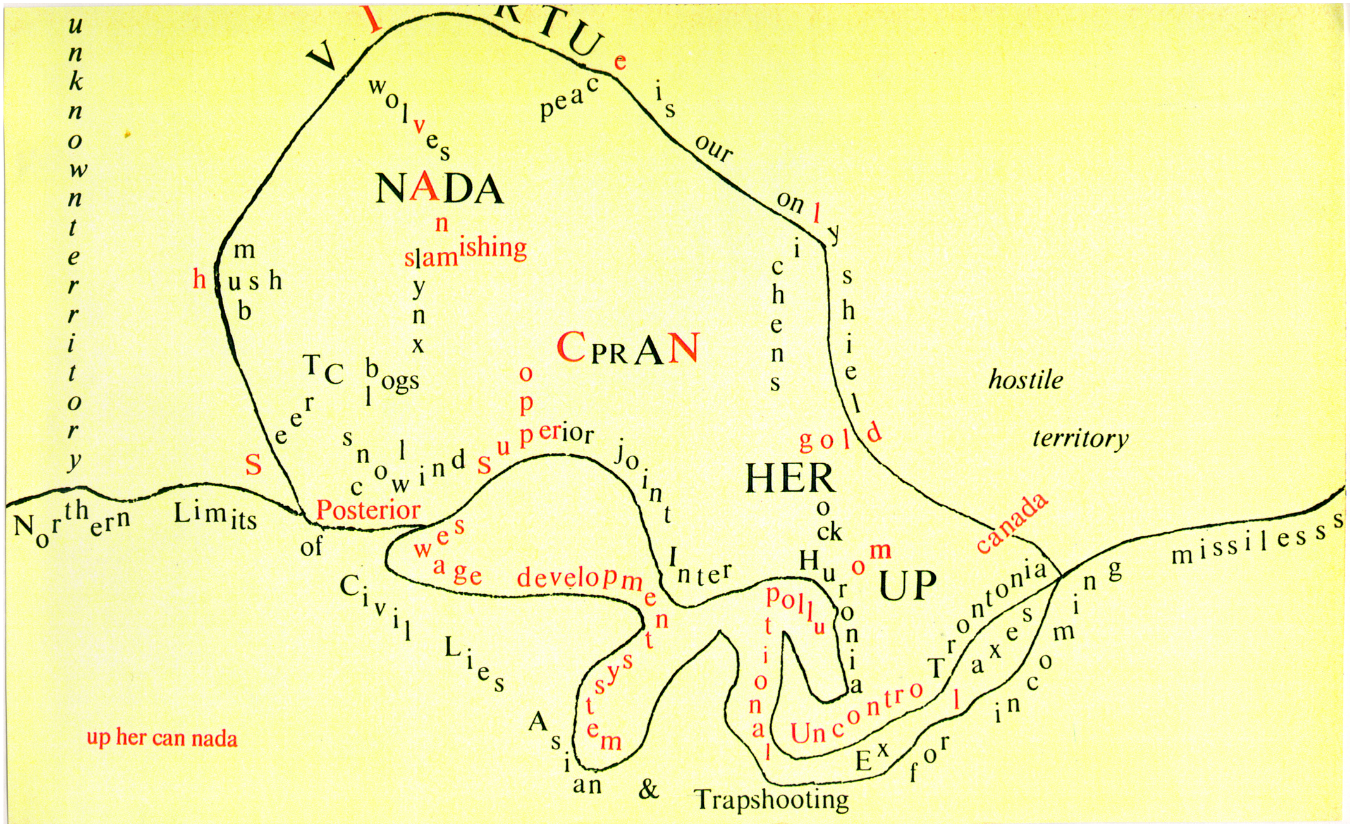


Figure 5: Earle Birney, "up her can nada," 1967. This sketch-map shows the boundaries of present-day Ontario; but its title and details also allude to Upper Canada, the official name of Ontario from 1791-1841. Reproduced in Earle Birney, 1971, rag and bone shop, *Toronto: McClelland and Stewart, n.p. Courtesy of Wailan Low, executor of the estate of Earle Birney.*

"A jigsaw puzzle of the forty-eight states I had as a child cut the pieces along state lines, so I always had a strong sense of the 'shape' of the various states."
–John Hollander–

> A jigsaw puzzle of the forty-eight states I had as a child cut the pieces along state lines, so I always had a strong sense of the "shape" of the various states. My own New York seemed to be both broken hatchet and T-bone steak. This poem is not about New York, however, but about nature and convention (both natural boundaries like rivers and lines drawn by surveyors are equally binding as legal borders); also, I have always felt that the Algonquian descriptive terms by which so many geographic features of the American Northeast are named haunt us (who don't even know a few simple roots . . .) like ghosts.

"A State of Nature" is the most traditional of the concrete map-poems examined so far. Like the ancient Greek *technopaignia* and their baroque offspring, the lines of Hollander's poetry conform to the shape of the physical objects (adze, steak, New York State) described by his words. The resemblance is not coincidental. The A. Bartlett Giamatti Professor of English at Yale University, Hollander is particularly fond of seventeenth-century pattern poetry and often shapes his poems into concrete figures. But Hollander can be playful too. As the poem tapers off to the southeast, the words "a city" mark the spot where New York City now stands.

NEIGHBORHOODS AS POETIC MAPS

Richard Kostelanetz, a New York City-born writer, critic and editor, was searching for a new way of producing visual poetry (Kostelanetz 1993, 43-44):

> . . . I wanted to get away from the centered space and single perceptual perspective of my earlier work. Since my mind tends to be more inven-

Some broken
Iroquois adze
pounded southward
and resembled this
outline once But now
boundaries foul-lines
and even sea-coasts are
naturally involved with
mappers and followers of
borders So that we who grew
up here might think That steak is
shaped too much like New York to be real And like
the shattered flinty implement whose ghost lives
inside our sense of what this rough chunk should
by right of history recall the language spoken by
its shapers now inhabits only streams and lakes and
hills The natural names are only a chattering and mean
only the land they label How shall we live in a forest of
such murmurs with
no ideas but in
forms a state
whose name
passes
for
a city

Figure 6: John Hollander, "A State of Nature," ca. 1969. This map-poem is shaped like New York State (as well as an adze and a steak). Reproduced in John Hollander, 1991, Types of Shape, *2nd ed., New Haven: Yale University Press, 24. Courtesy of Yale University Press.*

> tive with materials than imaginative about events, I chose a familiar subject: the neighborhood in which I then lived. As my theme was the variousness of the individual side streets, each having its own characteristic spatial qualities, its own details and its own sounds, I devoted one page of language and space to each block. I thought of hiring a professional calligrapher to redo my peculiar handwriting, but her single sample reminded me too much of the rigors of linotype and *that* was precisely what I was trying to avoid. Once again, the best solution was letting the work reveal my own hand.

In 1970-71, Kostelanetz designed "The East Village," a map-poem more detailed and intimate than any we have examined [Figure 7]. Kostelanetz begins with an overview of the area he will map as "individual side streets" on the remaining ten pages (Kostelanetz 1974, 1993, [63-73]). This first poem shows the core of the East Village, extending from St. Mark's Place (Eighth St.) south to Fourth Street, and from Third Avenue east to First. West is on top to emphasize the area's relation to Greenwich Village, simply known as "*the* Village." During the 1960s, artists and intellectuals moved east from the Village to the adjacent part of the Lower East Side, which they subsequently renamed the "East Village." Kostelanetz's text-blocks or legends employ a map's multiple perspectives to imitate the disordered pattern of urban life. The top-down text recounts the area's unique history, architecture and cultural diversity. Only one phrase is critical ("Dog-shitted streets"). But turn the map upside down, and several terse phrases accost us: "Spare change?"; "Fast Food Invasions,"; "High rates of unemployment/welfare." Adjust the map so that St. Mark's Place is on top and Kostelanetz's own opinions become obvious: "perceptible tensions, but little violence"; "too much to hear, too much to see, too much

"Kostelanetz's text-blocks or legends employ a map's multiple perspectives to imitate the disordered pattern of urban life."

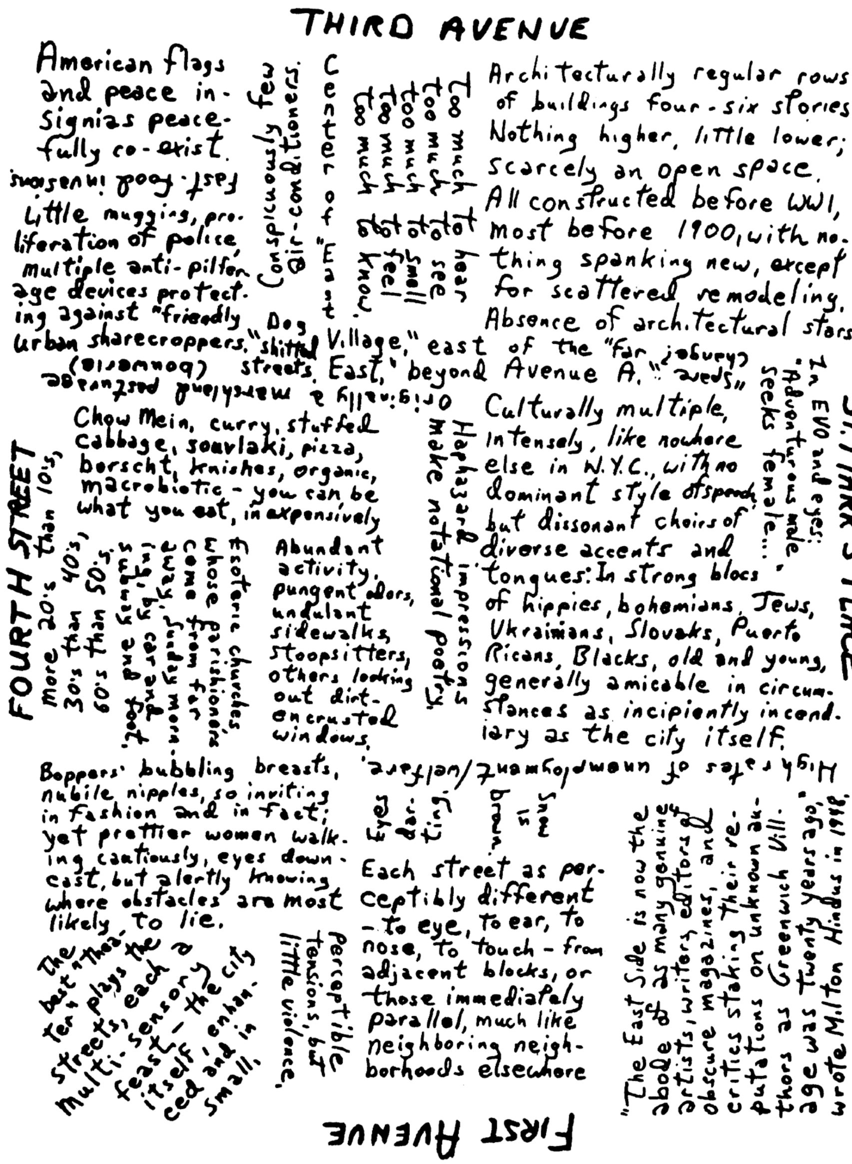


Figure 7: Richard Kostelanetz, "The East Village," 1970-71. This map-poem is an overview of the core of the East Village: from St. Mark's Place (Eighth Street) south to Fourth Street and from Third Avenue east to First. RICHARD KOSTELANETZ: "Third Avenue" copyright © 1993 by Richard Kostelanetz. Reprinted from WORDWORKS: POEMS SELECTED AND NEW *by Richard Kostelanetz, with the permission of BOA Editions, Ltd.*

to smell, too much to feel, too much to know"; and, most aptly, "haphazard impressions make notational poetry."

"Kostelanetz's map-poems are endearing permanent records of a vibrant period in his neighborhood's radical history."

Each single-block poem centers on the street itself rather than on the block of buildings extending between two streets. At first the viewer may be confused, since the same street name appears on both sides of the map-poem [Figure 8]. But closer examination reveals that Kostelanetz is offering the perspective of a pedestrian rather than the bird's-eye view of a mapmaker. To indicate the narrowness of Seventh Street, for example, he angles—from bottom to top—the direction of the words he has placed in the middle of the page: "Once the street sweepers leave and parking regulations end, the available places are swiftly occupied; and at night, empty ones can rarely be found."

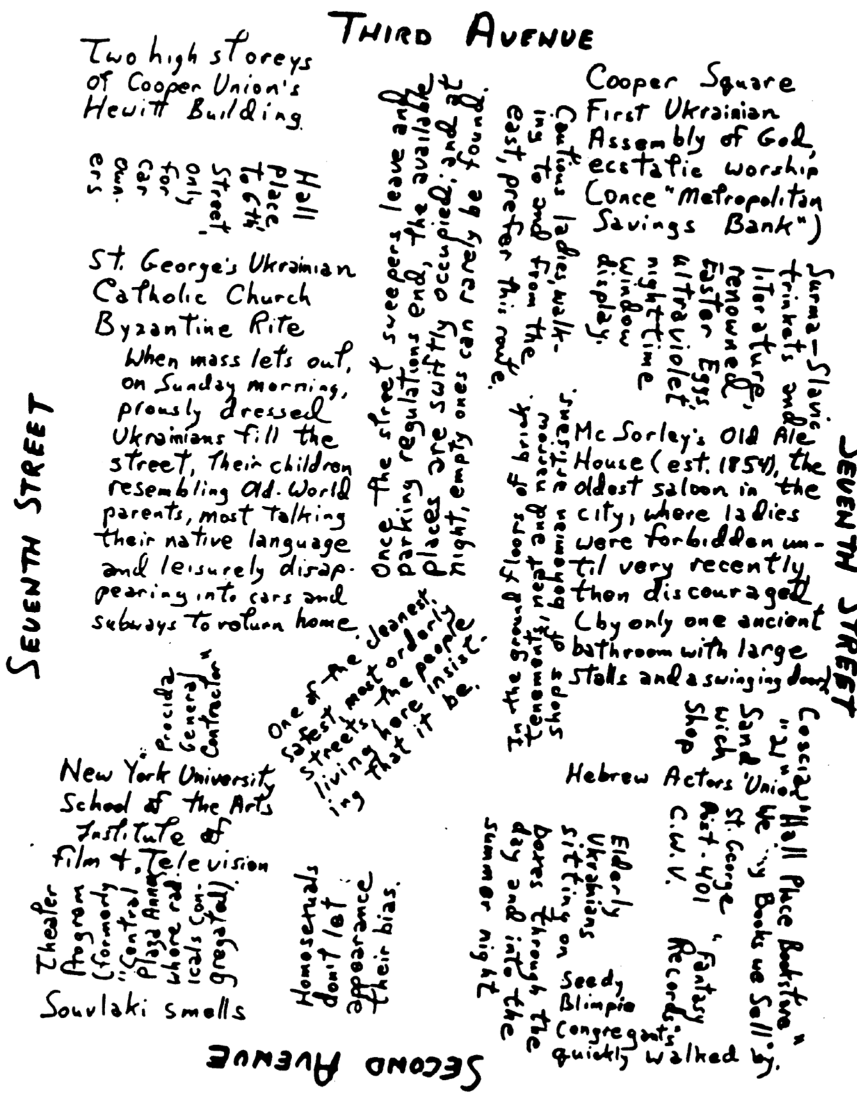


Figure 8: Richard Kostelanetz, "The East Village," 1970-71. This map-poem depicts an "individual side street," namely Seventh Street between Third and Second Avenues. Adele J. Haft: "Third Avenue" copyright © 1993 by Richard Kostelanetz. Reprinted from WORDWORKS: POEMS SELECTED AND NEW by Richard Kostelanetz, with the permission of BOA Editions, Ltd.

Kostelanetz's map-poems are endearing permanent records of a vibrant period in his neighborhood's radical history. Many buildings have disappeared along with the hippies; among them, the famous Fillmore East Theater. But amazingly, most of the places on Seventh Street between Third and Second Avenues still remain, though Surma has changed its name to The Ukrainian Store and New York University has made a dorm of the building where Spike Lee did his graduate studies in film. A Sanborn insurance map presents this neighborhood on a similar scale (Sanborn 1920/1973, vol. 2, pl. 18), its pasted "updates" appealing as much for their texture as for their historical value [Figure 9]. But the map's focus is on building materials, access routes, and fire retardants. Missing are the people whom Kostelanetz's map-poems bring to life: "the cautious ladies" and "elderly Ukrainians." The visual appearance of his map-poems allows us to enter vicariously into the space and time he has mapped. But his language and poetry remind us that we can hear, smell, and even taste these

"The visual appearance of his map-poems allows us to enter vicariously into the space and time he has mapped. But his language and poetry remind us that we can hear, smell, and even taste these places as well."

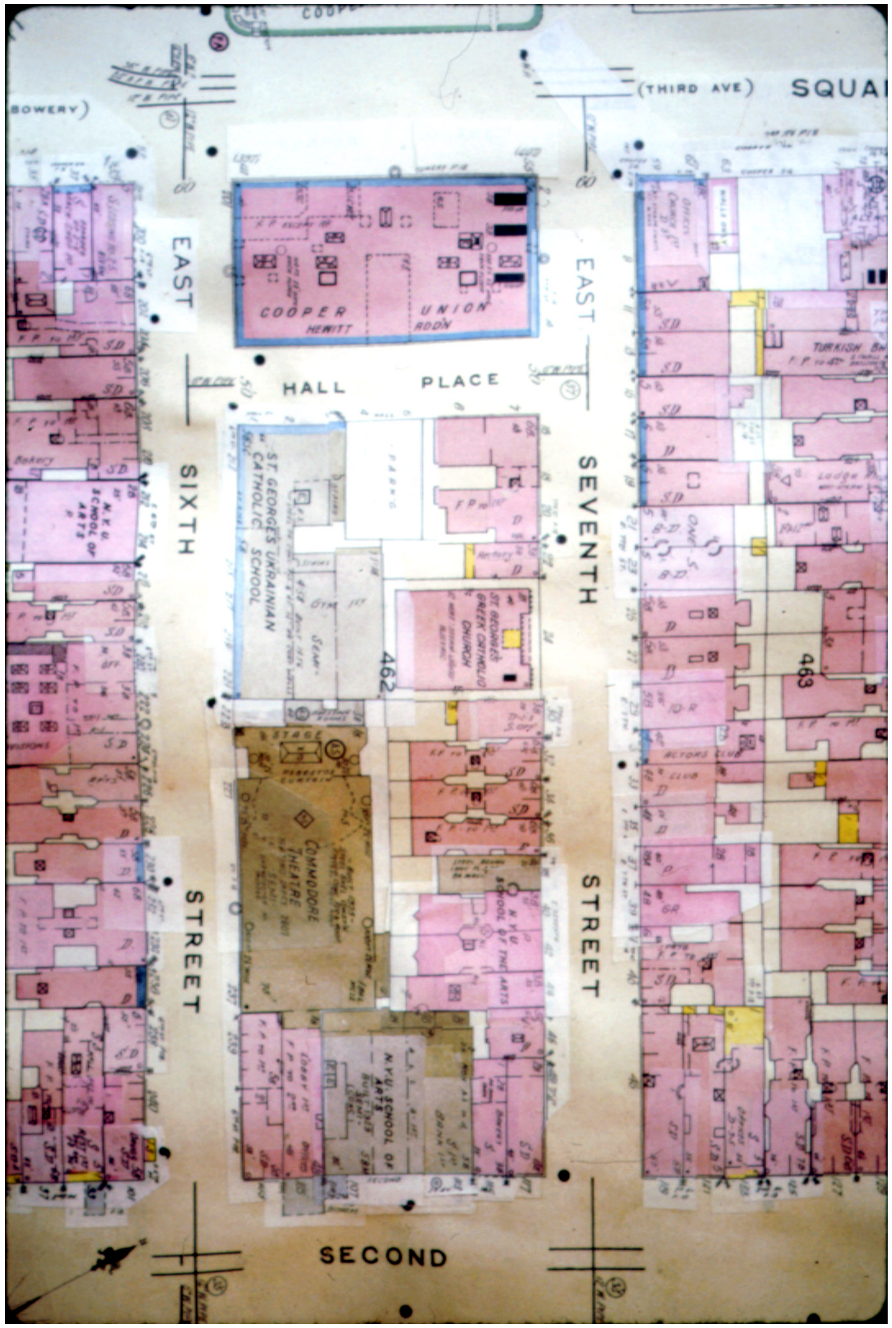


Figure 9: Sanborn Map Company, Untitled insurance map of the block facing Seventh Street between Third and Second Avenues, 1920, updated 1973 (original scale: 50 feet = one inch). Reproduced in Sanborn Map Company, [1920] 1973, Sanborn Map Company Insurance Maps: The City of New York, Borough of Manhattan, *New York: Sanborn Map Company, Vol. 2, Pl. 18. Copyright 1973 The Sanborn Map Company, The Sanborn Library, LLC. All Rights Reserved. This Sanborn Map™ has been reproduced with written permission from The Sanborn Library, LLC. All further reproductions are prohibited without prior written permission from The Sanborn Map Library, LLC. I photographed this map courtesy of the Map Division, The New York Public Library—Astor, Lenox and Tilden Foundations.*

places as well. "The East Village" provides an alternative map for exploring a historic and beloved neighborhood.

WHOSE HEAD *IS* THAT MAP?

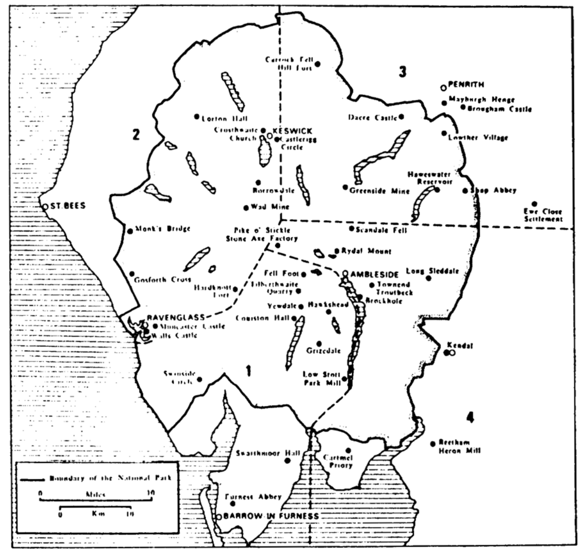
bpNichol, Canada's most famous concrete poet, "found" his related poems "Man in Lakeland" and "In Lakeland" during May of 1978 on a journey with Steve McCaffery to the English Lake District (McCaffery and Nichol 1979, section III) [Figure 10]. When I first saw "Man in Lakeland," I wondered briefly if the head was a portrait of Nichol or his traveling companion; and next, whether it might represent Samuel Taylor Coleridge or his close friend William Wordsworth, the Romantic poet who celebrated his attachment to the Lake District in his "Description of the Scenery of the Lakes," written during Coleridge's stay in 1809 (Wilkinson 1810, introduction). Nichol refers to Wordsworth twice in his twelve-page poem "In Lakeland," and reprinted editions of Wordsworth's revised *Guide through the District of the Lakes in the North of England* (1835) were certainly available to him (e.g. Wordsworth 1952). But it turns out that Nichol found his poems in another guidebook entirely.

He provides the clue at the end of "In Lakeland," where he writes: "Excavated/ Ambleside to London/ May 8 to 12th 1978/ From Robert Gambles'/ Man in Lakeland." We discover Nichol's source as soon as we open Robert Gambles' *Man in Lakeland: 2,000 Years of Human Settlement* (Gambles 1975). The map in Nichol's "Man in Lakeland" exactly reproduces the one illustrating the title page and back cover of Gambles' book. The *Man in Lakeland* map represents the Lake District with the boundaries of the National Park outlined in black [Figure 11]. Playing with the mapped figure and the ambiguity of the word "man," Nichol has copied the "head," removed all the place-names and most of the lakes, then connected a few remaining lines and dots to create the hairline and collar of his portrait. It is the silhouette not of an individual but of the National Park—imaginary lines seen only on a map. As a map-poem, "Man in Lakeland" is a quirky pun.

Nichol "found" his extended poem in Gambles' book as well. Not only does he break "In Lakeland" into four parts and numerous subsections to correspond to the four geographic regions and "more than three dozen representative sites" on Gambles' tour (Gambles 1975, back cover), but every word and phrase is lifted from the guide. Consider Nichol's eulogy to Hans Arp, the Dadaist and concrete artist who influenced him ("In Lakeland": part IV, subsection 8):

> the central theme
> the efforts of ordinary men & women
> to create a living culture
>
> Kurt Schwitters
> Barbara Hepworth
> Hans Arp
>
> the blacksmith
> the wheelwright
> the stone waller
> it is on their shoulders that we stand

Arp's appearance in this list derives entirely from Gambles' description of the Abbot Hall Art Gallery in Kendal. "Local children," Gambles informs us, "are encouraged from time



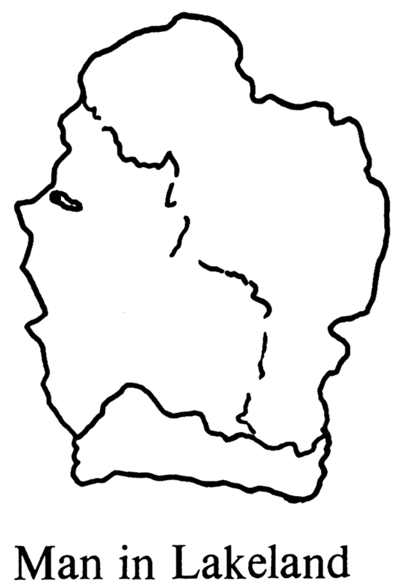
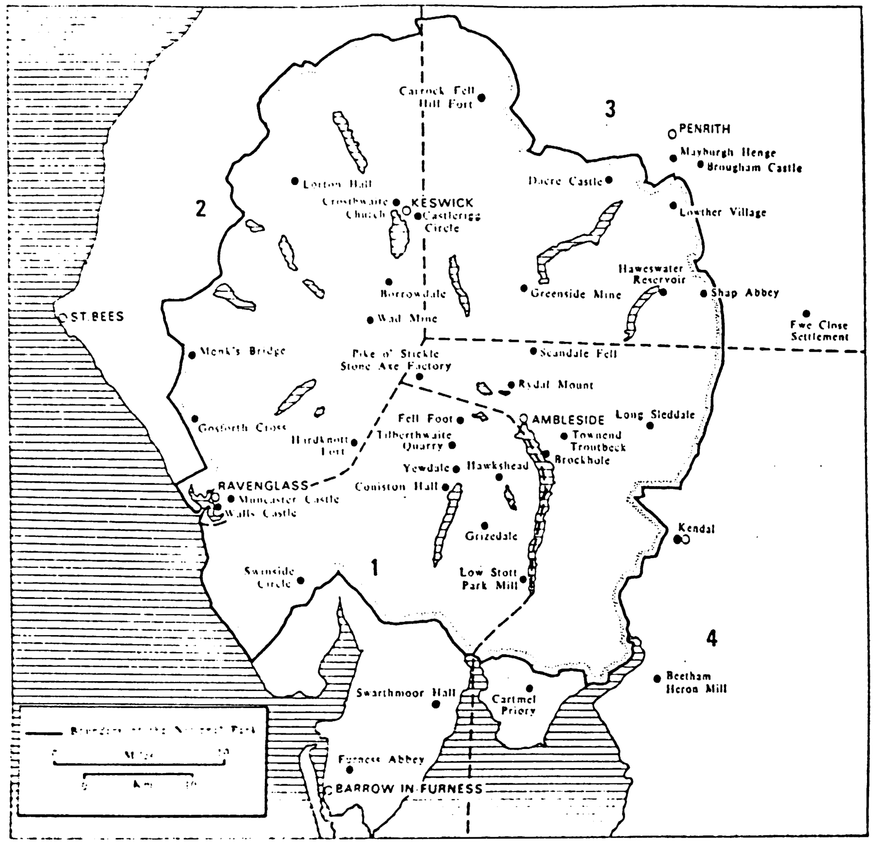


Figure 10: bpNichol, "Man in Lakeland," 1978. The head is the silhouette of the National Park represented on the map. Reproduced in Steve McCaffery and bpNichol, 1979, In England Now That Spring, *Toronto: AYA Press, n.p. Courtesy of the estate of bpNichol.*



Man in Lakeland

2,000 Years of Human Settlement

This book looks at the history and form of human settlement in Lakeland by examining more than three dozen representative sites (shown on the map above). It is not intended to be either a detailed study of the sites referred to or a comprehensive catalogue of the many places of historic interest to be found in or near the National Park, but rather a reflection on aspects of the life and work of mankind in this region. It was conceived in the hope that it might enable the visitor to Lakeland to gain a better appreciation that here men and women have lived and worked, and have cajoled and joined with Nature to serve the purposes of human progress.

Figure 11: Robert Gambles, Untitled map of the Lake District National Park in England. Reproduced on the back cover of Robert Gambles, 1975, Man in Lakeland: 2,000 Years of Human Settlement, *Chapham, North Yorkshire: Dalesman. Photo reprinted courtesy of Dalesman Publishing Company Limited.*

to time to exhibit their own work in these delightful rooms, a short step away from the art of Kurt Schwitters, Barbara Hepworth and Hans Arp" (Gambles 1975, 124).

bpNichol has played the archaeologist, "excavating" Gambles' *2,000 Years of Human Settlement*, then reassembling the fragments as lines of poetry. Yet for all that, the Lakeland poems remain the endearing personal tributes of a poet smitten by the Lake District and inspired by its literary past.

A SCI-FI MENTAL MAP

The Irish poet Paul Muldoon has included a deceptively simple sketch-map "[Ptolemy]" in his *Madoc: A Mystery*, a narrative poem that plays with past poetic fashions (Muldoon 1990, 46) [Figure 12]. A glance at a detailed map of Pennsylvania reassures us that towns with the unlikely names of Athens and Ulster actually do exist on the Susquehanna River just a few miles south of the New York border. But there are problems regarding scale, the placement of Athens, and the courses of the Chemung and Susquehanna. What's up?

Unlike the other map-poems, Muldoon's is part of a mystery. One of only two graphics in *Madoc: A Mystery*, the map is a fragment of a character's memory: a mental map, quite literally. Muldoon names this character "South," a fictional descendant of the English poet laureate Robert Southey, who composed the epic poem *Madoc* between 1789 and 1805. In the sci-fi opening to Part II, South fails to get himself and a coded message out of prison, and is subjected to a retinal scan that photographs his thoughts. The sketch-map and the prose poems surrounding it are these "photographs." Muldoon distances himself from any charge of over-simplification or inaccuracy by conceiving of his map as the memory of a traumatized and dying man.

"One of only two graphics in Madoc: A Mystery*, the map is a fragment of a character's memory: a mental map, quite literally."*

The bracketed titles indicate South's peculiar way of ordering his thoughts. He subconsciously pairs each memory with the name of a Western philosopher from Thales to Stephen Hawking. In South's mind, the confluence of the Susquehanna and the Chemung is so conflated with that of the Nile's main distributaries, the Rosetta and the Damietta, that the Pennsylvania rivers appear to assume their courses. The map of the Nile, in turn, triggers the name of Claudius Ptolemy, the great second-century geographer from Alexandria, Egypt, who had a profound effect on Renaissance exploration and mapping—in part because he radically underestimated the distance west from Europe to Asia. Manuscripts of Ptolemy's *Geography* contain a map of the Nile, which South's mental map superficially resembles (see Ptolemy [1478] 1966). But Muldoon intends his sketch not to mimic a particular Ptolemaic map but to convey the memory's associative and generalizing nature.

The detail of the Ptolemaic map emphasizes the selectivity of Muldoon's. Why the Susquehanna? Why has Muldoon included only Athens and Ulster, when equally suggestive names like Milan and Ghent appear in the area encompassed by his map? Here we must turn to the rest of Muldoon's text. *Madoc: A Mystery* is an elaborate puzzle based on the question, "what if?" *What if* the English poets Coleridge and Southey, pursuing their plans of 1795, had emigrated to North America and established on the banks of the Susquehanna their utopian community of pantisocrats, who believed in "equal rule for all"? The poets knew of others who were flocking to its banks during the late 18th century, including the idealistic freethinkers Joseph Priestly and William Cooper, father of James Fenimore Cooper (Holmes 1989). Although the poets never did emigrate to the Pennsylvania towns, both Ulster and Athens were open to settlers after the expulsion of their Indian population (Craft 1878; Murray 1908). Ulster's name is reminiscent of Muldoon's native North Ireland, while "Athens" triggers the image of the Athenian philosopher Plato, author of the utopian views that helped mold those of Coleridge and Southey. *What if* the obscure Welsh prince Madoc had discovered America three hundred years before Columbus, as John Dee claimed to Elizabeth I in his "Title Royall

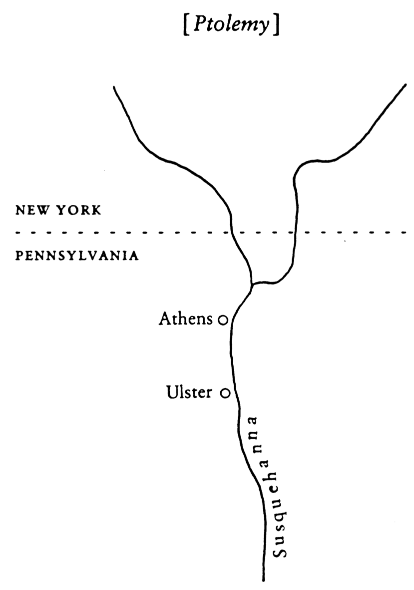


Figure 12: Paul Muldoon, "[Ptolemy]," ca. 1990. This poem looks simple but turns out to be a complex mental map. "Ptolemy" from MADOC: A MYSTERY *by Paul Muldoon. Copyright © 1990 by Paul Muldoon. Reprinted by permission of Paul Muldoon, Faber and Faber Limited, and Farrar, Straus and Giroux, LLC.*

to...foreyn Regions" and its accompanying map of October 1580 (French 1987, 197; see G. Williams 1979, pl. 2, and Dee 1580)? *What if* the Welsh explorer John Evans had found what he was searching for (Muldoon 1990, 84 and 114), namely Madoc's lost descendants among the reputedly "white" Mandan Indians living beside another river-fork in what is now North Dakota (G. Williams 1979)? Although 1796-97 saw the failure of his personal quest to find the illusive "Welsh Indians," Evans' maps were used by Meriwether Lewis and William Clark at the beginning of their 1804-6 expedition (Moulton 1983; W. Wood 1983). *What if* Southey had enslaved and brutalized his Cayuga allies, leaving Coleridge to wander off in search of a new supply of hallucinogens and, eventually, to stumble upon Lewis and Clark? *What if* the Native Americans, whom the British considered to be as "wild and primitive" as the Irish, had rebelled against the European colonists and become victimizers in turn? After all, Muldoon has admitted in an interview that *Madoc: A Mystery* "is a poem about the failure of Ireland as a state" (Keller 1994, 21).

Muldoon's richly symbolic map-poem turns out to be open to as many layers of interpretation as history itself. It is no wonder that this highly imaginative poet and director of creative writing at Princeton University has just been elected to the chair of Professor of Poetry at Oxford University.

A MAP AS CROWDED AS MANHATTAN

Last, we come to Howard Horowitz, the only (bio)geographer among our concrete poets and a professor of environmental studies at Ramapo College. Horowitz spent a year-and-a-half designing "Manhattan" (Howard Horowitz, telephone conversation with the author, 10 September 1997) and even sent the poem to Raven Maps in California, where Stuart Allan and Lawrence Andreas helped set the words into a map of Manhattan. Then, in 1997, off the piece went to the *New York Times* (Horowitz 1997) [Figure 13]. Filling an entire page in the August 30th Op-Art section, Horowitz's "wordmap" takes the shape of Manhattan Island, where he attended high school. Like Hollander's "State of Nature," "Manhattan" is a traditional concrete poem that examines New York and its earliest inhabitants. But whereas Hollander restricts himself to a single theme—the differences between ourselves and the Native Americans who preceded us—, Horowitz celebrates the amazing variety and diversity of the island. Though concerned with a particular "bioregion," his work is also a delightful poetic advertisement for Manhattan.

"Though concerned with a particular 'bioregion,' his work is also a delightful poetic advertisement for Manhattan."

Horowitz packs his map with descriptions of Manhattan's physical geography. "Lava was injected in veins of rock and coagulated to form Palisade cliffs"; "the bedrock sparkles with mica [and] bears the weight of midtown"; "Minetta Brook wetlands became lots in Greenwich Village." He pays tribute to the island's cultural attractions ("medieval unicorn tapestries grace the Cloisters") as well as to its buildings and institutions ("the lion-flanked public library was once a reservoir"). People loom large on Horowitz's map: from the Algonquians to "the Dutch, then English, African, Irish, . . . Filipino, and all"; from "a sweatshop horror, 146 locked-in women lost their lives in the Triangle Shirtwaist fire" to "Fidel speak[ing] at the U.N."; from notables like Boss Tweed, Emma Lazarus, and Fiorello [La Guardia] to "kids splash[ing] around a hydrant as lovers embrace on a Riverside Park bench." Like Kostelanetz's map-poem, "Manhattan" explodes with food ("ribs at Sylvia's") and sounds ("the roar of the El[evated]," "grand opera at the Met"). Horowitz doesn't ignore the high rents, especially in the former artists' enclaves of Soho and TriBeCa, nor the "rush-hour traffic . . . stalled on the Triborough Bridge." Yet his own love-affair with Manhattan is evident throughout. He recalls "songbirds alight in leafy woods as a turtle lays eggs/ near a pond in Central Park";


The island's tip
was sliced by a ship
canal that tamed the
Spuyten Duyvil shoals,
but severed Marble Hill
from Inwood. Medieval
tapestry unicorns grace
the Cloisters; a flag-
pole and stockade mark
old Fort Tryon. Lofty
crags overlook the
broad Hudson River
as bedrock & history
anchor the Heights to
the George Washington Bridge. Walk east
toward the Bronx across High Bridge;
gaze to the south
from Sugar Hill,
where trumpeters
and tap dancers
stepped up into
the sun. Ages ago
Iapetus (an older
Atlantic Ocean)
closed; the kiss
with Africa heated
a melting pot. Lava
was injected in veins
of rock and coagulated
to form Palisade cliffs.
The legacy of Algonquian
life is hidden in our place
names and our meals. The new-
comers (first the Dutch, then
English, African, Irish, German,
Italian, Jewish, Chinese, Greek,
Ukrainian, Armenian, Puerto Rican,
Pakistani, Cuban, Dominican, Haitian,
Filipino, and all) have shed blood in a
thousand places, but millions live. Legends
of Gotham: Father Knickerbocker, Boss Tweed,
Emma Lazarus, Fiorello, the roar of the El,
the blizzard of '47, Giants at the Polo Grounds.
Offshore, barges ply swirling brown water near
North River sewage pipes, as striped bass and
shad swim up "the river that flows both ways" : a
tidal reach of the sea all the way up to Albany.
Brownstone, bodega, ball court & bus stop: on warm
nights in Harlem, noisy streets and quiet rooftops.
Kids splash around a hydrant as lovers embrace on a
Riverside Park bench and rush-hour traffic is stalled on the Triborough Bridge.
Some uptown options: gospel choir on Sunday, sooty
Grant's Tomb, hiphop the Apollo, ribs at Sylvia's,
law at Columbia, mangos in El Barrio, peace garden
in the Cathedral, rowboat on the Meer, pub-crawl the
West Side, listen to poetry at the 92nd St. Y, nosh at
Zabar's, spiral up the Guggenheim, tour Gracie Mansion.
Songbirds alight in leafy woods as a turtle lays eggs
near a pond in Central Park. Grand museums flank the
green with dinosaur bones and Egyptian tombs. When it
snows, we ramble out to Sheep Meadow & the Great Lawn;
in sunshine, to Strawberry Fields, the Lake, & the Zoo.
Buy hot dogs from pushcarts near Madison boutiques, or
hear grand opera at the Met. Step down to the world of
subways. (Take the A train, ride the Lexington line,
or change at 59th Street for the IRT. Catch the F out to Queens.)
Gneiss but full of schist, the bedrock sparkles with
mica. It bears the weight of midtown: skyscrapers
at Columbus Circle, Fifth Avenue, and Park Avenue.
Attend concerts at Carnegie, ice skating shows at
Rockefeller Center, Mass at St. Patrick's Cathedral.
Our eyes are drawn up to a blue slice of sky as
vertical walls enclose us. 100 gridlocked taxis honk
at police blockades as Fidel speaks at the U.N.
Revelers jam Times Square on New Year's Eve, to
jostle and sing as the ball drops. Buses come in
(the Lincoln Tunnel) to Port Authority, trains to Grand Central. The
lion-flanked public library was once a reservoir;
we love the Art Deco classic Chrysler spire. From
Hell's Kitchen walk to Broadway, buy tickets for
"Showboat" or "Cats"—hey, the Knicks won at the
buzzer in the Garden! See Macy's float parade, then
gape from atop the Empire State, where mighty Kong
took a fall. Diamond jewelers join fur-clad window
shoppers as herds of jaywalkers cross against the
light in the Garment District. Graffiti-scrawled
boards near the Flatiron Building enclose pits
of unconsolidated sediment Consolidated Edison
must dig. Workers repair Gramercy Park cables,
reroute Chelsea steam pipes, plug a burst main
flooding streets by Union Square. (Tap water
flows down from the Catskills in deep tunnels;
garbage is hauled to a landfill at Fresh Kills.)
The riverfront was filled for barnacle-crusted
piers, and Minetta Brook wetlands became lots
in Greenwich Village. A sweatshop horror: 146
locked-in women lost their lives in the Triangle
Shirtwaist fire. Watch skateboard demons cavort
among panhandlers as old men play chess near the
arch in Washington Square. N.Y.U. students, art
film fans, coffee drinkers, & East Village poets
crowd smoky joints on Saturday night; some cross
(the Holland Tunnel) back out to New Jersey. Cheap gallery space
is a memory in SoHo; cast-iron lofts rent high,
as do TriBeCa warehouses. A bag lady seeks warmth
huddled over a sidewalk grate on the Bowery, where
Stuyvesant's farm once spread in old New Amsterdam.
The original steal (this island, traded for $24 in
beads) lies plastered in myth and concrete, obscured
like the African Burial Grounds. A Lower East Side
delicatessen sells good chicken soup; enjoy zuppa di
pesca at the Festival of San Gennaro, or bird's nest
soup in Chinatown. Marchers to City Hall cross the Brooklyn Bridge
to demonstrate, as tourists at South Street Seaport
eat lunch with a view. The Fulton Fish Market is
mobbed before dawn. Precambrian stocks bond the
upper crust with solid foundations below the
Trade Towers, Trinity Church and Wall Street.
Ferryboats to Staten Island, Ellis
Island, the Statue of Liberty,
and Governor's Island
depart from wind-
swept docks
at Battery
Park.

Figure 13: Howard Horowitz, "Manhattan," 1997. This map-poem mimics what it describes: it puts too much into too small a space. Reproduced in the Op-Art section of The New York Times, *Saturday, 30 August 1997. Courtesy of Howard Horowitz.*

his participation in a 1962 march across the Brooklyn Bridge for racial integration of the school system; and even his one-time commute from his native Queens ("change at 59th Street for the IRT"). Nowhere does he sound more like a New Yorker than when he writes "we love the Art Deco classic Chrysler spire," or "hey, the Knicks won at the buzzer in the Garden!" And all the time, he is urging us to "tour," "buy," "nosh," "hear," "enjoy."

"The lines of Horowitz's narrative simulate the horizontal grid of the city streets, even as the 3000 (or so) letters of the map-poem mimic the congestion of buildings and the 'herds of jaywalkers.'"

The lines of Horowitz's narrative simulate the horizontal grid of the city streets, even as the 3000 (or so) letters of the map-poem mimic the congestion of buildings and the "herds of jaywalkers." To divide the borough into the neighborhoods he describes, Horowitz emphasizes the island's irregular shape as well as the relative locations of its tunnels and bridges. Discrepancies are inevitable. To give the poet space to list the riches of the island's southern tip, the Brooklyn Bridge appears as far north as the Williamsburg. Abandoned are the avenues' vertical grid, Broadway's erratic slash, and even Central Park—clear indications of narrative clarity overriding cartographic accuracy. For Horowitz, using words to pinpoint places was easier when he composed from top to bottom than from right to left. Yet lines like "grand museums flank the green with dinosaur bones and Egyptian tombs," show his success in "placing" the American Museum of Natural History to the west of the Metropolitan Museum of Art.

"New Yorkers live in a world of maps, from the comic maps that once graced the covers of New Yorker Magazine *to the ubiquitous bus and subway maps carried by commuters and tourists."*

New Yorkers live in a world of maps, from the comic maps that once graced the covers of *New Yorker Magazine* to the ubiquitous bus and subway maps carried by commuters and tourists. But whereas most of these maps make the island extend due north-south, Horowitz—true to his profession—shows the actual geographical orientation of Manhattan. Yet Horowitz uses some of the enduring stereotypes that Saul Steinberg immortalized in his map parodying of New Yorkers' view of the world (Steinberg 1976). Horowitz's text mentions New Jersey and the other four boroughs of New York City; his ferries, buses, and trains break out of Manhattan. But they don't connect the printed island to anything else. Instead, the poem seems to float on the paper, like the island itself on the Hudson, Harlem and East Rivers. Tunnels and bridges end in the blank white space of the *terrae incognitae* surrounding the island. As a visual poem, Horowitz's "Manhattan" captures most Manhattanites' self-image as well as almost everyone else's assumption that Manhattan *is* New York City. His map resembles just what it describes: it squeezes too much into too little space.

CONCLUSION

This paper offers a novel way of turning students on to maps. Concrete map-poems are fun, both to look at and to puzzle over. They also seem simple. Even students who feel artistically or technologically "challenged" feel that they can create their own. Like mental maps, these map-poems emphasize how individually we relate to space and encourage us all to leave some sort of graphic tribute to a place that has affected us profoundly.

"Concrete map-poems are fun, both to look at and to puzzle over. They also seem simple."

There are other valuable lessons as well. In terms of map design, "Manhattan" brings up issues of selectivity: what needs to be included on a map, and why? "Geographica Europa" implies that cities and countries have relationships to one another that transcend their relative sizes, locations, and distances on a map. "The East Village" reminds us that most maps appeal to one sense only, our sight; yet knowledge of place embraces its smells, sounds, and tastes—the ways that a place makes us feel. "Man in Lakeland" highlights the resemblance between a man's head and the boundaries of a national park. Despite its humor, however, the found poem employs a time-honored trick of associating an abstract form with a familiar object, like Eratosthenes' characterizing the shape of countries by geometric shapes or Strabo's describing the inhabited world as shaped like a *chlamys*, the Macedonian cloak (Strabo 2.1.22-23 and 2.5.6; see Aujac 1987, 156-57). "up her can nada" is the most adventurous typographically. With its combination of line-art and type, its variations in the spatial layout of letters and words, its different type sizes, stylings and colors—the design of Birney's poem involves some of the same issues that mapmakers confront when lettering their base-maps.

The map-poems also invite discussion of more "conventional" types of maps. "A Chaffinch Map of Scotland" plays on bird-range maps and Ordnance surveys, and could be used to introduce zoomorphic maps like Georg Braun's 1574 world map, which is "transubstantiated into the very flesh of the Holy Roman Imperial eagle" (Whitfield 1994, 76-77). "State of Nature" alludes to geographical jigsaw puzzles, descendants of the "dissected maps" created during the 18th century to teach children geography (Hannas 1972 and 1980). "[Ptolemy]" is a mental map demonstrating one mind's unique associative powers; but the map-poem can just as easily accompany discussion of maps as diverse as Ptolemy's map of Africa, John Dee's 1580 map of the Northern Hemisphere, or the John Evans' maps utilized so well by Lewis and Clark.

"The map-poems also invite discussion of more 'conventional' types of maps."

"'State of Nature' alludes to geographical jigsaw puzzles, descendants of the 'dissected maps' created during the 18th century to teach children geography."

Other concrete map-poems could be added to those examined here. Among those illustrated in major collections are "Three Ripples in the Tuckasegee River" by American poet Jonathan Williams (in Bann 1967, 156), "an island poem" by Czech poet Vladimir Burda (in Bory 1968, 35), "Week-end" by Italian poets Michele Perfetti and Vitantonio Russo (in Millán and Sánchez 1975, 161), and "Africa" by Juan Davilla Freire (in Peignot 1993, 297). Those who wish to immerse themselves completely will find further riches in the work of American poet Charles Olson (*The Maximus Poems*) and of bpNichol himself (e.g., *The Martyrology*, book 5). But another paper will have to tell their stories.

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REFERENCES

Adler, Jeremy, and Ulrich Ernst. 1987. *Text als Figur: Visuelle Poesie von der Antike bis zur Moderne.* Weinheim: VCH.

Aujac, Germaine, et al. 1987. "The Growth of an Empirical Cartography in Hellenistic Greece." In *The History of Cartography, vol. 1: Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, ed. J. B. Harley and David Woodward, 148-160. Chicago: University of Chicago Press.

Bann, Stephen, ed. 1967. *Concrete Poetry: An International Anthology.* London: Magazine Editions 13.

Bayard, Caroline. 1989. *The New Poetics in Canada and Quebec: From Concretism to Post-Modernism.* Toronto: University of Toronto.

Bianchi, Paolo, and Sabine Folie, eds. 1997. *Atlas Mapping: Künstler als Kartographen, Kartographie als Kultur.* Wein: Verlag Turia + Kant.

Birney, Earle. 1971. *rag and bone shop.* Toronto: McClelland and Stewart.

—. 1975. *The Collected Poems of Earle Birney.* 2 vols. Toronto: McClelland and Stewart.

Bory, Jean-François. 1968. *Once Again*. Translated by Lee Hildreth. New York: New Directions Books.

Chernow, Barbara A., and George A. Vallasi, eds. 1993. *Columbia Encyclopedia*. 5th ed. New York: Columbia University Press.

Clement, Peter. 1993. *Finches and Sparrows.* Illustrated by Alan Harris and John Davis. London: Christopher Helm.

Craft, David. 1878. *History of Bradford County, Pennsylvania.* Philadelphia: L. H. Everts and Company.

Davey, Frank. 1971. *Earle Birney.* Toronto: Copp Clarke.

Dee, John. 1580. Spherical Map Projection of Part of the Northern Hemisphere. British Library: Cottonian MS Aug. 1.1, art. 1.

French, Peter. 1987. *John Dee: The World of an Elizabethan Magus*. London: Ark Paperbacks.

Gambles, Robert. 1975. *Man in Lakeland: 2,000 Years of Human Settlement.* Chapham, North Yorkshire: Dalesman.

Goss, John. 1993. *The Mapmaker's Art.* New York: Rand McNally.

The Greek Anthology. [1918] 1995. Translated by W. R. Paton. 5 vols. Loeb Classical Library. Cambridge: Harvard University Press.

Grimm, Reinhold. 1989. Poems and/as Pictures: A Quick Look at Two and a Half Millennia of Ongoing Aesthetic Intercourse. In *From Ode to Anthem: Problems of Lyric Poetry*, eds. Reinhold Grimm and Jost Hermand, 3-85. Madison: University of Wisconsin Press.

Hamilton, Ian, ed. 1996. *The Oxford Companion to Twentieth Century Poetry.* New York: Oxford University Press.

Hannas, Linda. 1972. *The English Jigaw Puzzle, 1760-1890.* London: Wayland Publishers.

—. 1980. When Maps Were . . . Cut into Pieces. *The Map Collector* 12 (September):18-21.

Harrison, Richard Edes. 1944. *The Fortune Atlas for World Strategy*. New York: Alfred A. Knopf.

Henrikson, Alan K. 1990. The North American Perspective: A Continent Apart or a Continent Joined. In *NATO After Forty Years,* eds. Lawrence S. Kaplan et al., 3-32. Wilmington, Delaware: Scholarly Resources Books.

Higgins, Dick. 1987. *Pattern Poetry: Guide to an Unknown Literature.* Albany: State University of New York Press.

Hill, Gillian. 1978. *Cartographical Curiosities.* London: British Museum Publications.

Hollander, John. 1969. *Types of Shape.* New York: Atheneum.

—. 1991. *Types of Shape.* 2nd ed. New Haven: Yale University Press.

Holmes, Richard. 1989. *Coleridge: Early Visions.* New York: Viking Press.

Horowitz, Howard. 1997. Manhattan. *The New York Times*, 30 August, Op-Art section.

Keller, Lynn. 1994. An Interview with Paul Muldoon. In *Contemporary Literature* 35.1 (Spring):1-29.

Kostelanetz, Richard. 1974. *I Articulations.* New York: Kulchur Foundation.

—. 1993. *WordWorks: Poems Selected and New.* Brockport, New York: BOA Editions.

Kranz, Gisbert. 1973. *Das Bildgedicht in Europa: Zur Theorie und Geschichte einer literarischen Gattung*. Paderborn: Schoningh.

—. 1981-87. *Das Bildgedicht: Theorie, Lexikon, Bibliographie.* 3 vols. Cologne and Vienna: Bohlau.

Loughlin, J. L., and V. J. Kelly. 1958. Map of Canadian Radar Fences. *National Geographic* (July):136-37.

McCaffery, Steve, and bpNichol. 1979. *In England Now That Spring*. Toronto: AYA Press.

McCord, Howard. 1968. *Longjaunes His Periplus.* Illustrated by George Nama. Santa Cruz: Kayak.

—.1977. Two Notes on Poetic Rhythms. In *Language and Style* 10.2 (Spring):73-78.

MacLeod, Iseabail, et al. 1990. *The Scots Thesaurus.* Aberdeen: Aberdeen University.

Mandell, Mel. 1996. World War II Maps for Armchair Generals. *Mercator's World* 1.4:42-45.

Millán, Fernando, and Jesús García Sánchez, eds. 1975. *La escritura en libertad: Antología de poesía experimental*. Milan: Alianza Editorial.

Marsh, James H., ed. 1988. *Canadian Encyclopedia.* 2nd ed. 4 vols. Edmonton: Hurtig Publishers.

Morgan, Edwin. 1966. A Chaffinch Map of Scotland. In *Joglars* 3 (Providence, Rhode Island):38.

—. 1968. *The Second Life: Selected Poems.* Edinburgh: Edinburgh University Press.

—. 1982. *Poems of Thirty Years.* Manchester: Carcanet.

—. 1990. *Collected Poems.* Manchester: Carcanet.

Moulton, Gary E., ed. 1983. *Atlas of the Lewis and Clark Expedition*. Lincoln: University of Nebraska Press.

Muldoon, Paul. 1990. *Madoc: A Mystery*. London: Faber and Faber.

Murray, Louise Welles. 1908. *A History of Old Tioga Point and Early Athens, Pennsylvania.* Wilkes-Barre: Rader Press.

Nesbitt, Bruce, ed. 1974. *Earle Birney.* Critical Views on Canadian Writers, 9. Toronto: McGraw-Hill Ryerson.

Peignot, Jérôme, ed. 1978. *du Calligramme.* Paris: Sté Nlle des Éditions du Chêne.

—, ed. 1993. *Typoesie.* Paris: Imprimerie nationale.

Ptolemy, Claudius. [1478] 1966. *Claudius Ptolemaeus: Cosmographia, Roma 1478.* Reprint, Amsterdam: Theatrum Orbis Terrarum.

Rose, Dennis. 1981. *Life, Times and Recorded Works of Robert Dighton (1752-1814).* Salisbury, Wiltshire: Dennis Rose.

Royal Ontario Museum. 1967 [May-December]. *Discovery and Mapping of Upper Canada: An Exhibition Held at the Canadiana Department*. Toronto: Royal Ontario.

Sanborn Map Company. [1920] 1973. *Sanborn Map Company Insurance Maps: The City of New York, Borough of Manhattan.* 12 vols. New York: Sanborn Map Company.

Sanson, Nicolas. 1656. *Le Canada, ou Nouvelle France*. Engraved by I. Somer. Paris: Pierre Mariette.

Solt, Mary Ellen. 1968. *Concrete Poetry: A World View.* Bloomington: Indiana University Press.

Steinberg, Saul. 1976. Untitled cover. *The New Yorker*, 29 March.

Storr, Robert. 1994. *Mapping*. New York: The Museum of Modern Art.

Stott, Carole. 1995. *Celestial Charts: Antique Maps of the Heavens.* London: Studio Editions.

Strabo. *Geography.* [1917] 1997. Translated by Horace Leonard Jones. 8 vols. Loeb Classical Library. Cambridge: Harvard University Press.

Urban, Dieter. 1987. *Digitale Wortbilder: Digital Word-Pictures.* Kassel: Edition Reichenberger.

Warrack, Alexander, ed. 1965. *Scots Dictionary.* University of Alabama Press.

Whitfield, Peter. 1994. *The Image of the World: 20 Centuries of World Maps.* San Francisco: Pomegranate Artbooks.

—. 1995. *Mapping of the Heavens.* London: British Library.

Williams, Emmett, ed. 1967. *An Anthology of Concrete Poetry.* New York: Something Else Press.

Williams, Gwyn A. 1979. *Madoc, The Making of a Myth: The Legend of the Welsh Discovery of America.* London: Eyre Methuen.

Wood, Denis, with John Fels. 1992. *The Power of Maps.* New York: Guilford Press.

Wood, W. Raymond, ed. 1983. *Atlas of Early Maps of the American Midwest.* Springfield: Illinois State Museum.

Wordsworth, William. 1810. Description of the Scenery of the Lakes. In Joseph Wilkinson, *Select Views of Cumberland, Westmoreland and Lancashire*. London: R. Ackermann.

—. 1835. *A Guide through the District of the Lakes in the North of England.* Kendal: Hudson and Nicholson.

—. 1952. *A Guide through the District of the Lakes in the North of England.* Edited by W. M. Merchant and illustrated by John Piper. Bloomington: Indiana University Press.

Zenchuk, J. B. 1981. Earle Birney's Concrete Poetry. In *Perspectives on Earle Birney: Essays Delivered at the Earle Birney Symposium, York University, October 1980,* 104-129. Downsview: Ontario: ECW Press.

map library bulletin board

The Osher Map Library and Smith Center for Cartographic Education

Yolanda Theunissen, OML Curator Matthew Edney, OML Faculty Scholar

The Osher Map Library and Smith Center for Cartographic Education (OML), the only separately established rare map library in northern New England, is located on the ground floor of the Glickman Family Library on the Portland campus of the University of Southern Maine. A relative newcomer to the field, OML celebrated its fifth anniversary in 1999 with a number of special programs and exhibitions. *Worldly Treasures: A Fifth Anniversary Celebration*, an exhibition highlighting recent gifts and acquisitions, illustrates the breadth and scope of the collection. This exhibition may be viewed on the OML website (http://usm.maine.edu/maps/exhibit7).

OML's three areas of responsibility are reflected in its physical space. Visitors enter through the exhibition gallery which functions as a cartographic museum. The core of OML's operations—its reference and research component—is housed in its reading room. An adjacent seminar room accommodates classes using OML's rare materials. Offices, a work room, and vault complete the eight-room suite.

The cartographic collections were formed from two major gifts, the first from the late Lawrence M.C. and Eleanor Houston Smith, and the second from Dr. Harold L. and Mrs. Peggy L. Osher. Other generous gifts from several individual donors, notably Professor Peter H. Enggass and Tony Naden, have substantially augmented the collections. The combined collections currently contain approximately 30,000 maps as separate sheets or bound in books and atlases, and include many fine examples of original maps, atlases, geographies, and globes spanning the years from 1475 to the 1900s. In addition to geography and cartography, there are works on related fields such as cosmography, astronomy, and navigation. While the collections are global in scope, they emphasize the discovery, exploration, and mapping of North America with a focus on northern New England and the Canadian Maritimes. Through gifts and acquisitions, OML is assembling a comprehensive collection of Maine maps from the colonial period to the present in all available formats: manuscript, print, photocopy, micro-film or fiche, and digital image. This compilation will serve as the foundation for a cartobliography of printed maps of Maine from 1600 to 1900. Access to these collections is primarily through checklists available in the reading room. An ongoing project is to catalog all the collections through OCLC/Worldcat. They are also available online through the local Maine state online catalog "URSUS" (http://ursus.maine.edu).

The rare materials are supplemented by many facsimile maps and atlases in reprint editions, together with a reference collection containing monographs and journals on the history of cartography, carto-bibliographies, regional histories, and exhibition catalogs. This growing reference collection, totaling some 1,200 volumes, is fully catalogued on URSUS and OCLC/Worldcat.

To ensure OML's ability to support the academic curriculum, the University of Southern Maine appointed a "faculty scholar" to interpret the maps for instructional use. Professor Matthew H. Edney, author of *Mapping an Empire: The Geographical Construction of British India, 1765-1843* (Chicago, 1997) and coeditor of volume 4 of *The History of Cartography*, has held this position since September 1995. Each year he teaches three courses developed specifically around the collections. These courses range from introductory level, such as *Maps: Knowledge, Technology, Society, Culture*, to graduate seminars, such as *Mapping New England*. Prof. Edney also produces OML's web site which has drawn praise from the educational community for its content and design (see *Mapline* no.88/89 [Fall 1999]). Since 1996, over 55,000 visitors have viewed the web versions of OML's exhibitions (http://usm.maine.edu/maps).

Each semester a number of faculty in Anthropology, Geography, History, Art, English, and Romance Languages bring their classes to OML for seminars led by Prof. Edney and the OML staff. In addition to the Curator and Faculty Scholar, the OML staff consists of the Rare Book Cataloger (Albert A. Howard), Cartographic Associate (George S. Carhart), and Administrative Assistant (Tami Christopher).

OML has hosted and co-ordinated several academic conferences. In October 1994 it presented the symposium *Mapping the World* as part of its opening celebration. Two years later, in October 1996, OML hosted the 36th annual meeting of the Society for the History of Discoveries (SHD). On June 1-2, 2000 the North East Map Organization (NEMO) held its annual meeting at OML. The Harvard Map Collection and OML will co-host the 20th International Conference on the History of Cartography from June 14-21, 2003 with programs in Cambridge and Portland.

As an integral part of a comprehensive urban university, and in keeping with the donors' wishes, OML is committed to sharing its collections with a broad, public constituency by means of exhibitions, publications, lectures, conferences, and other special events. The foundation for these outreach programs are OML's exhibitions. Two or more new exhibitions are mounted each year, based mainly on OML holdings but drawing as needed on other archives and libraries. To date OML has produced a dozen exhibitions and hosted two traveling exhibits.

OML has enjoyed a productive relationship with print and broadcast media including Maine Public Television and local commercial television stations. The library has provided appropriate images for historical productions and a number of its exhibitions have been the basis of feature programs. Working closely with the University's media relations staff, OML has publicized major acquisitions such as the Columbus Letter and important historic maps.

The current exhibition, running from April 2000 to January 2001, is *Charting Neptune's Realm*, displaying four centuries of nautical mapping from the early explorers to contemporary satellite imagery. Future exhibitions will explore road maps, colonial settlement and historic archaeology, and urban mapping. Facsimile versions of three exhibitions have traveled to historical societies, public libraries, and campus galleries throughout Maine. Since 1997 all exhibitions are preserved on the worldwide web.

Around each exhibition, OML stages public lectures and develops age-appropriate interpretive guides and activities for elementary and high school students. A grant from the Davis Family Foundation has enabled OML to produce educational guides and activities for *Charting Neptune's Realm*. OML staff present these K-12 activities through group tours from area schools. It also loans out classroom "teaching kits" and coordinates in-service workshops for teachers.

To assist OML in support of these various activities and programs, the *Osher Library Associates* was formed in 1990. Thanks to the generosity of this friends group, OML has been able to publish a series of posters, checklists, and catalogs to accompany its exhibitions. For membership information, please contact the OLA's Secretary/Treasurer, Dr. Alf Jordan, at 156 West Elm Street, Yarmouth, ME 04096 (ajordan1@maine.rr.com) or OML at 207-780-4850.

OML's users do not comprise the traditional constituency of special collections, i.e., doctoral and post-doctoral researchers. Rather, it has developed a diversified clientele including university students (primarily at the undergraduate level) and users generally found in large urban public libraries such as para-legal researchers, home schoolers, genealogists, advertisers and graphic designers, foundations, and amateur and professional historians. OML is currently building links to relocated retirees who constitute the fastest growing demographic group in southern Maine through the University's newly established Senior College. What will the future bring? It's hard to say right now but, based on OML's first five years, it is bound to be both interesting and rewarding.

Charting Neptune's Realm: From Classical Mythology to Satellite Imagery

Everyone is familiar with maps and the information they contain, but few are conscious of the nautical chart with its special characteristics and iconography. In the absence of land, one piece of water looks like any other, leading one to ask, "what is there that can be delineated on the vast, trackless ocean?" The charts in this exhibition attempt to answer this question of how to "map" the ocean beginning with examples of 16th century sea charts created by European mariners and concluding with satellite imagery of the space age.

The Osher Map Library and Smith Center for Cartographic Education opened a free, public exhibition on nautical charts on Tuesday, April 4, 2000. The exhibition continues through January 11, 2001. Titled *Charting Neptune's Realm: From Classical Mythology to Satellite Imagery*, it examines the special iconography mariners have developed over the centuries to depict the ever changing conditions of the oceans caused by changes in winds, currents, depth, sea surface temperature, and other transitory features. The maps on display illustrate the challenge to understand and document these illusive powerful phenomena.

As European mariners left their familiar coasts in the sixteenth and seventeenth centuries to venture forth into the limitless seas and oceans, they brought back their observations of the earth's fluid envelope. These discoveries could not be explained by classical Graeco-Roman constructs and required re-thinking this new information about winds and currents into a body of knowledge we today call the science of oceanography. The collective experience of seafarers when linked with advances in chemistry and physics, produced new interpretations of the world. This knowledge of the sea grew from several simultaneous lines of investigation, sometimes overlapping, sometimes containing large gaps, and even on occasion contradicting one another. But through the centuries one goal remained constant and undiminished: bringing order out of chaos. Given expression in the form of cartography, these graphic images reveal more succinctly than the written word, and is grasped more quickly by the mind, humanity's search for, and knowledge about the watery sector of our globe the ancients called Neptune's Realm.

The charts displayed in this exhibition are drawn from the cartographic collections of the Osher

Map Library which holds some 30,000 rare maps dating back to 1475. It is located on the first floor of the Glickman Family Library 314, Forest Avenue, Portland, Maine. Exhibition hours are from 12:30 to 4:30 pm, Tuesday, Wednesday, and Thursday; 6:00 to 8:00 pm Wednesday and Thursday; and 9:00am to 1:00pm on Saturday. It is recommended to call ahead at 207.780.4850 for any changes in schedule or to make group tour arrangements. Or visit the Osher Map Library's Web site at http://www.usm.maine.edu/maps

This depiction of Neptune by the 18th century French artist Francois Boucher is the frontispiece from the 1774 edition of Jean Baptiste Nicolas Denis d'Apres de Mannevilette, Le Neptune Oriental *which gives sailing directions from France to the East Indies. Courtesy of the Osher Map Library of the University of Southern Maine.*

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cartographic techniques

Using Remote Sensing Imagery to Texturize Layer Tinted Relief

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Combining layer tinting or "painting" with relief shading has proven to be a very effective method for portraying the landscape. Additionally, the "painted relief" is important in providing a backdrop for maps designed for land management and resource planning at the Bureau of Land Management's Oregon State Office. Figure 1 illustrates a typical "painted relief" image (color image can be viewed at http:\\ www.or.blm.gov\gis). This article introduces a technique that gives cartographers a new capability of adding visual texture to maps, by combining layer tinted relief with a modified Digital Elevation Model (DEM) using SPOT or Thematic Mapper imagery or Digital Ortho-photography. This texturizing method has greatly enhanced the "painted" relief maps in communicating detailed land-cover features. The result is not only more informative, but also very visually exciting because of the tactile appearance. This technique has been particularly useful in showing patterns of recent forest management activities in the Northwest. Figure 2 illustrates the same area as Figure 1, but with landscape patterns texturizing the surface. The techniques described here specifically uses ESRI Arc/Info software, but the general methodology could be applied using other mapping software.

A step by step flow through the process of "texturizing" painted relief with land-cover patterns derived from SPOT satellite imagery using Arc/Grid and Arc Macro

Language programming is covered in this paper. The inputs needed for the processes presented here are a SPOT satellite image and a digital elevation model that cover the same area.

Extract Land Cover Textures and Patterns from Imagery

The first step in texturizing "Painted Relief" is to derive fundamental land-cover patterns from satellite imagery. In this example, SPOT panchromatic imagery is used as shown in Figure 3. One simple way to capture land-cover patterns is to perform a binary classification of the image based on the mean image value. The result is a map with two classes, a dark class which consists of all pixels where the value is less than the mean, and a light class where all the pixel values are greater than the mean. In this densely forested area, as shown in Figure 4, light values are usually indicative of recent forest harvest activities. Dark values are forested areas. More sophisticated schemes should probably be used in order to be more truly reflective of human activity, but for the purposes here, this will suffice.

Lower Elevation values in Disturbed Areas

To begin this step, a Digital Elevation Model (DEM) of the study area is needed. The procedure here is to lower elevation values in the DEM according to the lighter classes, which represent forest harvest activities. The depth of this subtraction should be about the average tree height, which in this area is about 20 meters. This depth value should be less if you need the land cover patterns to be less obvious, and more if you want extreme exaggeration. Subtracting the patterned area from the Digital Elevation Model can be performed in ArcGrid using the CON function as shown here:

```
Pattern_elv = CON(Two_class_
image
eq 1,DEM – 20,DEM)
```

Where:
Pattern_elv is the output image; Two_class_image is the reclassified SPOT image and DEM is the Digital Elevation Model of the study area.

The function lowers all areas of the DEM by 20 meters where the two-class image was equal to 1; all other areas remain the same. Alhough probably not apparent in a graphic of the gray-scale image of the Pattern_elv, (so they are not presented here), this process creates depressions in the DEM which will emphasize and emulate the clearings created by forest harvest activities.

Create a Gray-scale Relief Image

Create a gray scale relief image using Pattern_elv, which was created in the previous step. Use the ArcGrid HILLSHADE function to do this. The syntax is show below:

```
Hill_img =
HILLSHADE(Pattern_
elv,345,65,#,1.2)
```

The Hill_img, shown in Figure 5, displays the simulated illumination of the sun at an azimuth of 345 degrees and a solar altitude of 65 degrees, taking shadows into account and exaggerating the vertical 120 percent. Notice how the areas of disturbance now appear to have dimension. In some mapping applications only a gray-scale or monochromatic image is sought. When that is the case, then the areas of disturbance should be lightened at this point and the process will be completed. To lighten areas of disturbance use the ArcGrid CON function with this syntax:

```
Finalhill = con(Two_class_im-
age eq 1,hill_img + ( (255 – hill_
img) * .2),hill_img)
```

Where: Finalhill is the output map; Two_class_image is the reclassified SPOT image; and hill_img is the hillshade image created in the preceding step.

This function will lighten all areas of surface disturbance by 20 percent of the difference between the existing value and white (255). The results of this process are shown in Figure 6.

Lighten Areas of Disturbance on GIS Theme Category image

If just painted relief is desired, a GIS theme is needed to direct the colorization of the relief image. In this example, the DEM was categorized into 500 foot categories using the ArcGrid RECLASS function and an elevation category lookup table. The colors are assigned to each class via an ASCII color lookup table. The image is displayed in ArcInfo grid with the GRIDPAINT command. The syntax for these processes is as follows:

```
Elev_cat = RECLASS(DEM *
3.28089,elev.lut)
GRIDPAINT elev_cat value
identity nowrap color.lut
```

Where:
Elev_cat is the output of the RECLASS function; DEM is the elevation data for the study area; 3.28089 is a meters to feet conversion factor; elev.lut is a reclass table which converts 500 foot ranges of feet to a unique class number. Color.lut is an ASCII lookup table that relates elevation category number to red green and blue values to create colors.

The result of this process is shown in Figure 7. Keep in mind that other themes such as vegetation, soils, surface ownership, etc., could be used instead of elevation categories.

The next step is to lighten areas of disturbance on the GIS theme image according to the two class binary image. Because of the use of color, both the output image and its color map must reflect this lightening process. To perform this process, an Arc Macro Language (AML) program was written and used. This AML, ADD_HIGHLIGHT.AML calls the ArcGrid CON function:

Cat_cut = CON(two_class_image eq 1,elev_cat + 100,elev_cat)

Where:
Cat_cut is the output; two_class_image is the two class SPOT image, and Elev_cat is the elevation category map.

The AML process creates new unique class numbers by adding 100 to every elevation class whenever the two-class image was equal to 1. This creates a numerical offset so the original color and its lightened color can be tracked in the image. To create the colors for the new categories, the program reads the color lookup table for the elevation category map, adds that information to the INFO database system, then calculates a new color for value + 100. That creates a new color value that is 50 percent lighter than the original value. The program writes out a new color lookup table for the output image. The output of this process is shown in Figure 8.

Build Final Texturized Painted Relief Image

The final texturized painted relief image, shown in Figure 2, is created by combining the "Elevation categories with patterns image" shown in Figure 8 with the "Textured relief image" shown in Figure 5. As in the previous step, this process is fairly complex so an AML was written to perform the process. The NEWRELIEF.AML uses the ArcGrid COMBINE function to create a unique class for every combination of classes in the two input images. The AML loads the color maps from each input image into the INFO system, and finds the average of the color values of the inputs for each unique class. A new ASCII color lookup table is written to a disc file. This file and the output image can be used with the ArcGrid GRIDPAINT command to display the new image to the screen or hardcopy device.

Conclusions

The above example explains how satellite imagery can be used to enhance and improve painted relief images for cartographic purposes. The process can be extended to include as many themes as needed to create a beautiful and striking map product. The AML programs used here, plus other related AMLs and information on painted relief can be downloaded from the Bureau of Land Management, Oregon State Office website at www.or.blm.gov\gis.

Jeffery S. Nighbert has been a geographer with the Bureau of Land Management for over 20 years and is currently the Senior Technical Specialist for Geographic Information Systems (GIS) at the Oregon State Office in Portland. He has extensive experience in GIS and holds an M.A. in Geography from the University of New Mexico.

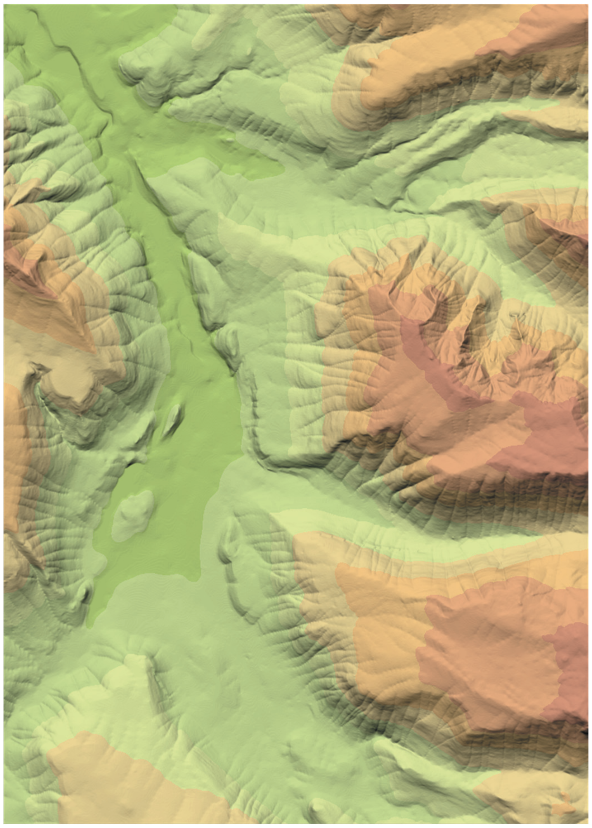

Figure 1. Typical "Painted" Relief.

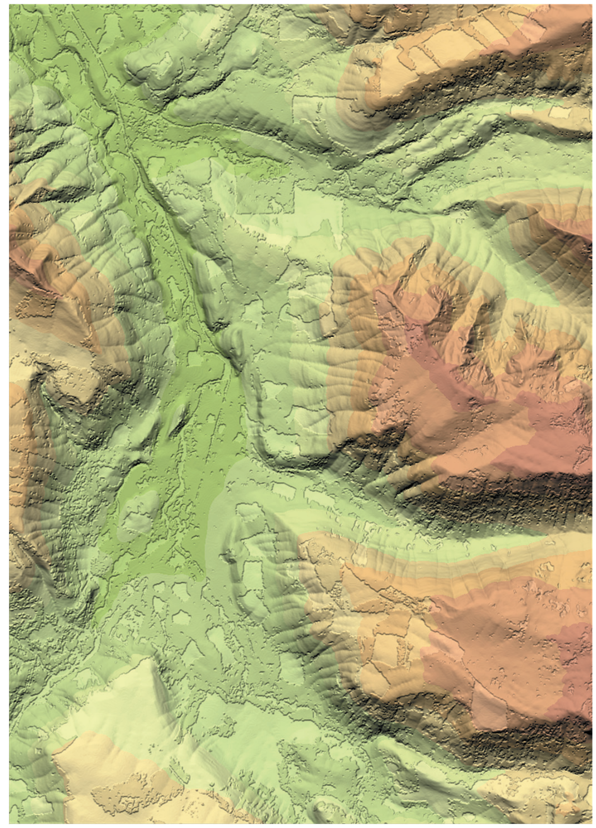

Figure 2. "Texturized Painted" Relief.

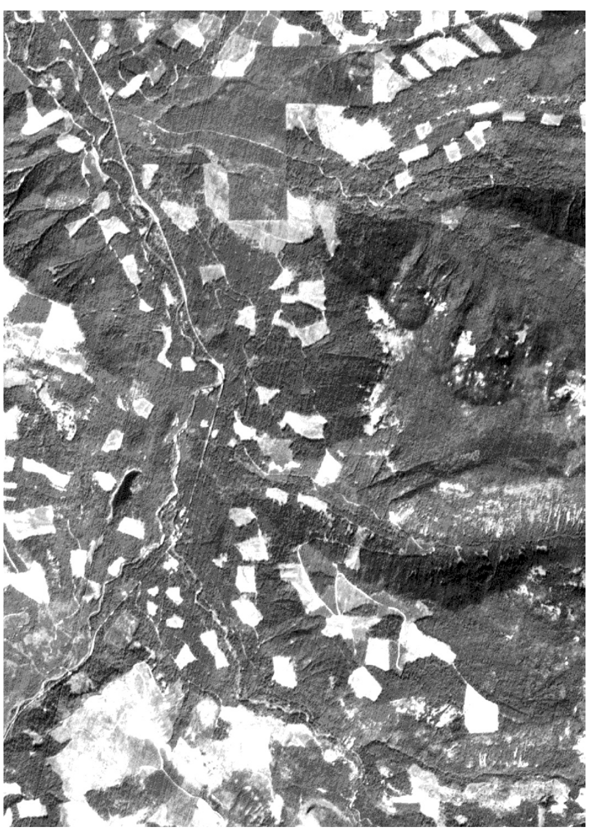

Figure 3. Panchromatic Spot Image.

Figure 4. Two Class Classification.

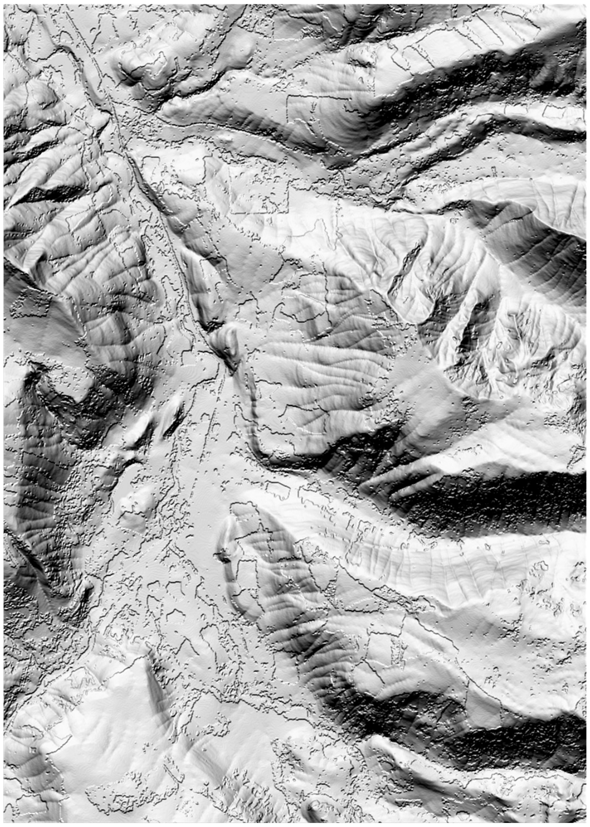

Figure 5. Textured Relief Image.

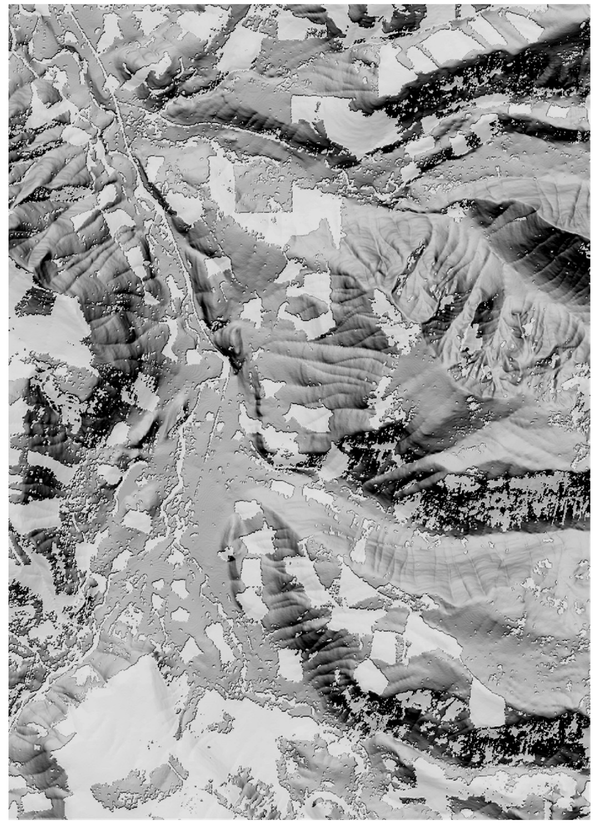

Figure 6. Textured Image with "lightened" areas.

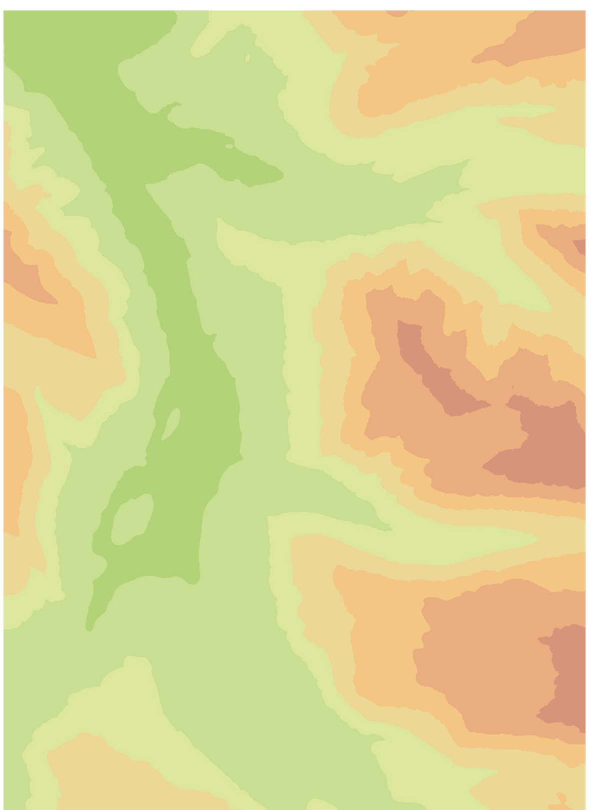

Figure 7. Elevation Category Image.

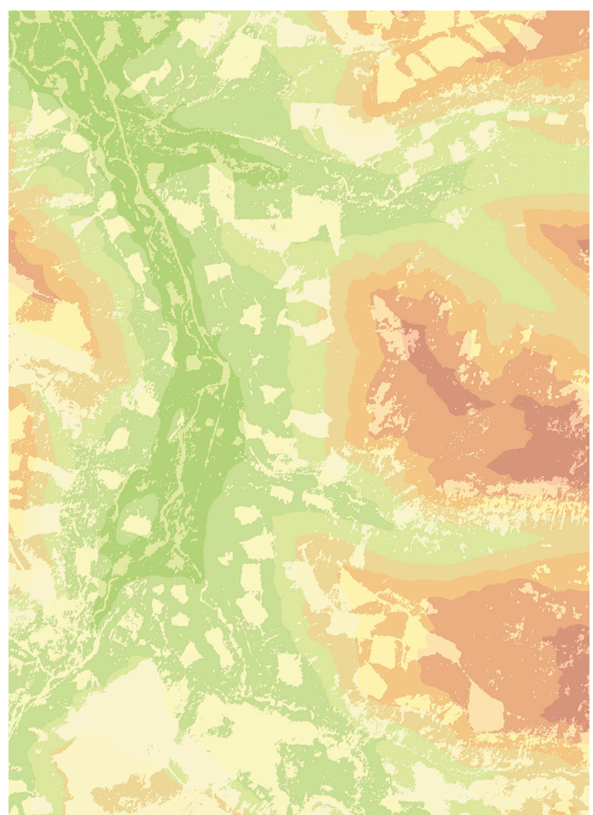

Figure 8. Elevation Categories with patterns.

nacis news

NACIS and Mark Monmonier, the guest editor of CP 35 would like to thank the following individuals who served as referees:

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John Hutchinson
John Pound

Letter from the Editor
(continued from page 1)

issue include color illustrations as well. We hope to continue publishing at least one color issue every year.

Finally, we were saddened to hear of the death of Borden Dent, a member of our Editorial Board. Borden, chair of the Department of Geography at Georgia State University and best known for his textbook entitled Thematic Cartography, died of complications from an operation at the age of 62 on August 17, 2000. I enjoyed working with Borden on the Board. His reviews of articles were always concise and to the point. CP will miss his service. Cartography will miss a great teacher and scholar.