Table of Contents

Articles

Pursuing the Cheyenne: Mapping Tribes, Trails, the 1857 Expedition and the Battle of Solomon's Fork
By George F. McCleary, Jr. 3

Preserving Maps in Quantity: The Experience of the New York State Historic Map Preservation Project
By David Y. Allen 29

Computers and Geographic Information Access
By Daniel O. Holmes 37

Book Reviews

Historical Atlas of Texas
By Peter B. Ives 49

The Mapping of the Great Lakes in the Seventeenth Century: twenty-two maps from the George S. and Nancy B. Parker Collection
By Jon L. Walstrom 51

The Atlas of Pennsylvania
By Rich Boardman 53

Milepost 28
Forthcoming Events 55
Index to Advertisers 52
Information for Contributors 56
From the editor ...

Serving as Meridian's first editor has been a privilege and a wonderful learning experience. Working for the last three years with its dedicated, hardworking staff and helpful, distinguished editorial board and consulting editors has been a pleasure. Looking back, we can all take more than a little pride in having published four issues of an attractive and informative journal, and one which has claimed a place in the growing field of cartographic and geographic information dissemination and management.

With the appearance of this issue, it is gratifying to see the range of articles widen to include papers on a cartographic imagery storage and retrieval system, a map conservation project, and the preparation of maps to illustrate a book. Unfortunately, pieces in the previous three issues were weighted too heavily toward historical topics. To be sure, historical matters continue to be important and will possibly even dominate the journal's pages, but papers on a variety of subjects are required to satisfy the needs of Meridian's diverse readership. Let me take this final opportunity to remind you, our readers, that a steady flow of contributions is vital to maintaining and improving the quality of Meridian.

I am delighted to welcome George F. Mc Cleary, Jr. as Meridian's new editor. Dr. Mc Cleary is no stranger to our readers: he has been a consulting editor since the journal's inception as well as the writer of two review articles, plus a major piece in the current issue. I formally offer our thanks for his past contributions and extend him our best wishes as new editor. He may be reached at: Department of Geography, 213 Lindley Hall, University of Kansas, Lawrence, KS 66045-2121 (phone: 913 864-5143).

Philip Hoehn

ADVERTISING STATEMENT

Meridian accepts advertising of products or services as it improves communication between vendor and buyer. Meridian will adhere to all ethical and commonly accepted advertising practices and reserves the right to reject any advertisement deemed not relevant or consistent with the goals of the Map and Geography Round Table.

Enquiries should be addressed to David A. Cobb, Advertising Manager, Map & Geography Library, University of Illinois, 1408 West Gregory Drive, Urbana, Illinois 61801. Phone 217 333-0827.

REVIEWS

Publishers are invited to send review copies of their books, maps and other items to the review editor: Brent Allison, Map Library, S76 O.M. Wilson Library, University of Minnesota, Minneapolis, Minnesota 55455. Manuscripts of reviews should be addressed to the review editor. Readers wishing to review materials for Meridian are invited to write the review editor indicating their special areas of interest and qualifications.

SUBSCRIPTIONS

Meridian is published twice yearly. To subscribe, or to change an address, please write to Christine E. Kollen, Subscription Manager, Map Collection, University of Arizona Library, Tucson, AZ 85721. Subscription rates are $20.00 for individual, ($25.00 foreign); $25.00 for an institution, ($30.00 foreign). Individuals must prepay, institutions may be billed. All foreign subscriptions must be paid in U.S. dollars. Make your check payable to ALA/MAGERT.

MERIDIAN
A Semi-annual Journal of the Map and Geography Round Table

© American Library Association

MERIDIAN

EDITOR
Philip Hoehn
The University of California, Berkeley

PRODUCTION MANAGER
Donna P. Koenig
University of Kansas

SUBSCRIPTIONS MANAGER
Peter L. Stark
University of Oregon

ADVERTISING MANAGER
David A. Cobb
University of Illinois

REVIEW EDITOR
Brent Allison
University of Minnesota

EDITORIAL BOARD
Ralph E. Ehrenberg
Library of Congress
Alice C. Hudson
New York Public Library
Mary L. Larsgaard
University of California, Santa Barbara
Robert S. Martin
Louisiana State University
Charles A. Seavey
University of Arizona
Stanley D. Stevens
University of California, Santa Cruz

CONSULTING EDITORS
Helen Jane Armstrong
University of Florida
Tony Campbell
The British Library
Larry Carver
University of California, Santa Barbara
Michael P. Conzen
The University of Chicago
Edward H. Dahl
National Archives of Canada
Larry Cruse
University of California, San Diego
John B. Garver, Jr.,
National Geographic Society
Francis Herbert
Royal Geographical Society
Robert W. Karrow, Jr.
The Newberry Library
George F. McCleary, Jr.
University of Kansas
Barbara B. McCorkle
Yale University
John T. Monckton
J.T. Monckton Ltd., Chicago
Gary W. North
United States Geological Survey
Nancy J. Pruett
Sandia National Laboratories, Albuquerque
Norman J.W. Thrower
University of California, Los Angeles
Alberta Auringer Wood
Memorial University of Newfoundland
Frances Woodward
University of British Columbia
Pursuing the Cheyenne
Mapping Tribes, Trails, the 1857 Expedition and the Battle of Solomon’s Fork
By George F. McCleary, Jr.

Cheyennes and Horse Soldiers is a story about the Cheyennes, a military expedition which pursued them, and the battle which resulted. The group of student cartographers (they eventually became The Map Associates) in the Department of Geography at the University of Kansas engaged in a creative process with the work’s author, William Y. Chalfant, to produce historical maps which would illustrate his text. The project saw an unusually lengthy author-cartographer interaction, as well as challenges of data gathering, map compilation, and design. The maps which resulted exemplify a genre of historical cartography and raise questions about the accuracy of maps which are used simply to illustrate works of this type.

The Cheyenne—they called themselves the Tsistsistas, a western branch of the Algonquian-speaking people, moved to the plains from lands east of the Mississippi River. Adjusting continuously to pressures from stronger tribes, they, with the acquisition of the horse in the mid-eighteenth century, abandoned their semi-nomadic activities—agriculture, pottery-making, and living in fixed villages, and became nomadic buffalo hunters. For several centuries, they shared with the Arapahoes a large area of present-day Kansas, Nebraska, Colorado, Wyoming and the Dakotas. A gradual southward shift reduced contacts with the Crows, and brought them into contact with Kiowas, Comanches and Plains Apaches, who eventually became friends and allies (Gassow, 1974 discusses this migration in detail; see, also, Grinnell 1915). Roaming within what appeared to be seemingly unending plains, filled with buffalo and antelope, the various bands of Cheyennes eventually came into conflict with immigrant Native Americans who had, in the nineteenth century, been placed in reservations along the eastern boundary of their range; armed with modern rifles these reservation Native Americans further depleted the supply of buffalo and other game animals; white traders, trappers, and wagon train parties had already taken a significant toll. For half a century many people had passed through the plains along the trails to the west and southwest. The California gold rush, which began in 1849, and the rush to the Colorado fields which soon followed, were catalysts, and military forts and scattered trading posts became the first harbingers of permanent white settlement. This was a period of deteriorating relationships between whites and Native Americans. Although a treaty had been signed in 1851, hostile feelings on both sides multiplied, and from 1853 to 1856 there were "a series of unfortunate incidents that spelled the end of peace and the beginning of long years of open warfare between the United States and the Cheyenne nation" (Chalfant 1989, 41).

Cheyennes and Horse Soldiers is a story about the Cheyennes, a military expedition which pursued them, and the battle which resulted. The author, William Y. Chalfant, a lawyer from Hutchinson, Kansas, approaching the cartographic group in the Department of Geography at the University of Kansas, stated his goals for the maps which would illustrate his text:

My desire is to simply assist readers with appropriate maps so that they can understand the route . . . , know a little bit about the terrain encountered, the places involved, etc.
The Expedition and its Maps

Ordered in late 1856, the campaign against the Cheyennes by the First Cavalry of the United States Army, was to be undertaken, "as soon as it is practicable, against those Indians, that they may be reduced to submission, and be compelled to release the captives held by them, restore the property taken, and deliver up the criminals by whom these offenses were committed" (Davis 1856). Under the command of Colonel E. V. Sumner, the Army met the Cheyennes in battle on July 29, 1857 on the north bank of the South Fork of the Solomon River (in Kansas Territory). This battle, the only saber charge against Native Americans by a large military force on the plains in the American west, was the first of a series of battles between the Army and the Cheyennes. Of those that would follow, the one at Sand Creek in 1864, is probably the most notorious (U. S. Congress 1865).

Chalfant initiated the project in his first letter:

My present concern is for purposes of illustrating the line of march, etc., to illustrate a book... I do think that it is both helpful and informative to any reader to be able to follow with some accuracy the route of an expedition, the location of important landmarks, the site of various occurrences and the like. In order to give that kind of detail it would appear to me that there will have to be a sequence of maps, probably following the march of each division of

Figure 1. The map of the expedition produced for Cheyennes and Horse Soldiers (Chalfant, 1989, 64-65).
Military expeditions...were generally well described...Unfortunately, the march journal from the Cheyenne Expedition has never been found.

the expedition, and thereafter the march of the combined expedition to the battle site, and beyond (Chalfant 28 September 1984).

Given this intention on the part of the author, it should not be surprising that of the twelve maps which were eventually prepared for the work, five show in detail the route of the expedition to the battle site, two describe the battle and subsequent pursuit of the Cheyenne warriors by the cavalry, and two others show the paths of the Cheyennes after the battle and the forays of the Army units in pursuit of them. The tenth map (a double-page spread; see figure 1) shows the route of the entire expedition to the battle site, in both an historical context (trails, forts, and territorial boundaries) and a contemporary one (major cities and interstate highways).

The Resources for Developing the Expedition Map

Military expeditions such as this were generally well described and first-hand accounts are generally available.

The Army of the day did require that there be maintained a march journal, something like the log of a ship’s captain, giving a daily account of the march, of the topography seen, weather, anything observed of interest, the happenings, etc. Generally these included as an integral part a map of the day’s march, showing the topographic features in relation to the route. Unfortunately, the march journal from the Cheyenne Expedition has never been found... Aside from the official report of Col. Sumner, a master of brevity, the National Archives has been able to come up with nothing (Chalfant 14 January 1985).

Chalfant was, nevertheless, able to locate a diary by Lieutenant Eli Long, who had served in Sedgwick’s column, as well as a number of letters and reports by others who participated in the expedition. These were more significant than the available maps.

While there have been no maps produced specifically with respect to the Cheyenne Expedition, there are a couple of maps which were produced within a span of about ten years that did purport to show the route. One of these came fairly close, but both are highly inaccurate [see figure 2] . Since I know from the writings I have found almost the exact trail followed, I have been able to chart the expedition with fair accuracy on U. S. Geological Survey Maps. I have a few blank spots which, while I know fairly well the route taken, need a little deductive reasoning or, even better, other information which would clarify what I have (Chalfant 14 January 1985).

Thus it appeared at the outset that maps showing the route of the expedi-
The problems would be only to be certain that places along the route would be mapped correctly and that all of the features significant to the story would be included on the maps.

The problems would be only to be certain that places along the route would be mapped correctly and that all of the features significant to the story would be included on the maps. Two examples illustrate the problems encountered in this struggle for geographic accuracy: the Caches (a site near Dodge City, Kansas, see figure 3) and the Trappers Trail (in Colorado, see figure 4). While the available resources yielded a consensus on the general location of both features, some questions remain with respect to various details. Most confusing are the wide variations in the location of the trail in contemporary and modern resources; Chalfant encouraged a single path running along the east banks of Fountain and Cherry Creeks.

Plotting the Expedition Route and the 1857 Base Map

The plotting of the route and the surrounding geography was shared by the author, William Chalfant, and Nancy Walker Fightmaster. (Ms. Fightmaster was an undergraduate major in geography, specializing in cartography, at the time the project began. She is now employed as the cartographer for the Douglas County, Kansas, Department of Public Works.) Both checked available resources in an effort to be certain that every location would be correctly mapped. Problems arose with small settlements in northeast Kansas (crossroad communities which have not survived or which have had their names changed) as well as with some of the outposts and rivers further west (where, exactly, were Fort Mann, the Caches, and Fort Floyd, and which stream belongs to what nineteenth century name). For all of these features it was possible to arrive at reliable map locations. Two examples illustrate the problems encountered in this struggle for geographic accuracy: the Caches (a site near Dodge City, Kansas, see figure 3) and the Trappers Trail (in Colorado, see figure 4). While the available resources yielded a consensus on the general location of both features, some questions remain with respect to various details. Most confusing are the wide variations in the location of the trail in contemporary and modern resources; Chalfant encouraged a single path running along the east banks of Fountain and Cherry Creeks.

... quite frequently [Long, the author of the diary which was central to the mapping of the expedition route], gave measurements which seemed to be extremely accurate, but on other occasions they either did not make sense or were wildly inaccurate. It is most helpful when he refers to physical or geographic markers which can be used to verify a location. ... As I attempted to check locations, I used points where I was satisfied that we had an accurate location ... and would run the measurements backwards. ... For [mapping] purposes they can therefore assume that the location marked on my map is the correct location ... (Chalfant 10 April 1855).

When Chalfant had plotted the expedition route, using the reports available and the perspective on the route which he had acquired in the field, he had
Figure 4. The route northward from Pueblo (extending the Taos Trail to Denver, Fort St. Vrain and Fort Laramie), much less significant than the east-west trails across the plains, ran parallel to the eastern face of the Rocky Mountains, along Fountain and Cherry Creeks and the South Platte River. Along this "Trapper's Trail" were a number of outposts, such as Fort Vasquez and St. Vrain, as well as later settlements which became major urban centers (Denver and Colorado Springs). This map of the trail was plotted by Warren, on the basis of his explorations from 1855-57.  

Figure 3. Two maps to show the location of the Caches. Above, a map by Josiah Gregg, 1844. Below, a sketch map prepared (about 1935) by a Dodge City, Kansas, resident.
en countered a number of problems; from the Long diary, he had introduced a number of errors. When she began the compilation of the expedition map, Fightmaster read both the draft of the text and the supporting documents, measured and remeasured, and plotted the entire route. Using older maps (not the current topographic sheets) from the Kansas and T. R. Smith Collections of the University of Kansas Library in concert with the expedition descriptions, she was able to locate accurately a number of campsites; Chalfant had, in his original compilation, built in a cumulative error along several segments of the route. Further, the path of the combined march, southeastward from Camp Buchanan, was realigned, for the older maps could be matched more correctly with the diary descriptions.

To this Fightmaster added other trails—older maps were adjudicated with Chalfant’s research and the available diaries. While the Santa Fe and Oregon Trails had been accurately mapped during the nineteenth century (see, for example, Franza 1978), other lesser important trails were never very reliably recorded. To overcome this problem Fightmaster undertook an extensive program of research on the nineteenth century trails in Kansas and southern Nebraska.

This was followed by a chapter-by-chapter, page-by-page check of the text. Chalfant wanted every feature mentioned in the written account shown on the expedition maps. Chalfant had noted at one point while reviewing preliminary copies of several of the maps that

Most of the people who read the book, of course, will not be familiar with the streams. While we do not want to make the map illegible due to the presence of too many streams, there are some which have not been shown which I think would be significant in illustrating the march (Chalfant 14 January 1985).

With the exception of a few creeks, omitted to enhance legibility, everything was eventually included.

Expedition Maps: Generalization and Design

The next set of problems associated with developing the map of the expedition route were those of generalization and design. The detail was available: Chalfant had mapped the route on 1:250,000-scale U. S. Geological Survey topographic quadrangles. The process of reduction was very important, for on the double page map showing the entire expedition, the map was to be reduced to about 1:5,260,000 (about one-twentieth in linear scale, the final map area would be only about one-four-hundredth of the original size). The goal was to plot the most accurate line of march possible. While this would be done at a scale of 1:1,000,000, which is significantly larger and more detailed than necessary for the published map in the book, the historical importance of the event (and the lack of an accurate account) encouraged the more detailed treatment.

This compilation process was handled in stages. At the outset, the topographic maps had been used by Chalfant to plot the route; on these he had marked the location of each day’s camp along with the other features which were discussed in the diaries and reports. This “map” contained almost thirty large sheets and covered an area about eight-by-thirteen feet. This information was replotted by Fightmaster on U. S. Geological Survey state base maps (which show only hydrography, political boundaries and settlements) at a scale of 1:1,000,000 (the map was thus reduced to one-sixteenth of its original size, but it was still significantly larger and more detailed than could be accommodated in the book). Using these base maps, worksheet were then prepared at a scale of about 1:2,650,000; the artwork which was created to produce the maps used in the book was prepared from the worksheets and then photographically reduced to scales of 1:3,400,000 or 1:5,400,000. In this process, there was an extraordinary reduction not only in the size of the map but also in the number and the level of complexity of the features shown (see figure 5).
Figure 5. The expedition maps for Cheyennes and Horse Soldiers were developed in a four-step process.
The route of the expedition was plotted by Chalfant on topographic sheets at a scale of 1:250,000
(here, on a portion of the Pueblo quadrangle, showing the route as originally plotted). The route (and
other features) were checked and replotted at a scale of 1:1,000,000.
Worksheets, to be used in drafting the artwork for the printed maps, were prepared (scale 1:2,650,000).
The final printed maps are at a scale of 1:3,400,000.
Map Development: Design

Once the compilation and generalization had been accomplished, there was the development of the design, the creation of the graphic structure which would communicate the expedition effectively. (This design process was actually begun even before the compilation and generalization activities; it continued throughout the entire program). In developing the design plan for *Cheyennes and Horse Soldiers* there were a series of considerations relative to the visual characteristics of the maps which had to be resolved.

For example there was the issue as to whether to create maps which mimicked the graphic design of the period—the mid-nineteenth century (figure 6). For the most part, maps of military expeditions of the period were produced on large sheets and presented, at large scale, with details at an almost engineering level of precision.

The size of the book page, however, does not allow this large scale luxury. Further, the complexity of some of the maps could not be handled appropriately using the symbolization, type styles, design structure and format of the period. At one point, Chalfant had pointed out that

*Usually such village sites (as the great Cheyenne village) are shown by a little tepee symbol, which could be used for the Sun Dance village as well. However, if that is not feasible, a black dot would suffice. (Chalfant 4 June 1986)*

This, and other symbols used on the maps of the period, rely heavily on the use of line work, and it would have been impossible to provide as clearly all of the details which were eventually shown on the expedition maps. Further, the types of symbols used and, particularly, the pictorial landform representation are difficult to produce and, as the examples shown here make clear, the style is not as legible as other alternatives.

Map Development: The Landscape

In addition to the overall design of the maps and the symbols to be used, representation of the landscape was a significant issue.

The use of hachures to show the characteristics of the landscape was a nineteenth century convention. While hachures capture the visual characteris-
Figure 7. Compare the nineteenth-century use of hachures to show relief on a portion of the “Oregon, Washington, California, Utah and New Mexico” map (Colton, 1859) with the modern physiographic drawing by Erwin Raisz (from The National Atlas, 1970).  

The principal liability of hachures . . . is that this system fails to provide the visual continuity across the surface.

tics of the slope of the landscape, they (and the physiographic diagrams which have been widely used in the last century, see figure 7) tend to exaggerate the bluffs, ridge lines, hills and ravines. Further, they are “noisy;” these networks of lines conflict graphically with other features shown on maps. Probably the biggest liability of this form is the degree of exaggeration involved. The reader can be easily misled, “seeing” a prominent ridge or bluff when (as is the case for the area traversed by the Cheyenne expedition) there is not much variation in the topography at all. Often hachures are used only on detailed (large scale) maps, such as a battle site, with a flat stream valley shown lying between the bluffs or valley walls. The principal liability of hachures, as generally practiced, is that this system fails to provide the visual continuity across the surface and the indications of variation that are provided by hill shading (or shaded relief mapping). While shading fails to provide a measurable indication of the amount of elevation difference, it does, nevertheless, when properly executed, provide a good visual indication of the ruggedness of the terrain.

In the design of these maps, the cartographers recognized that there is not much relief in this area—while there are some hills and ridge lines, as well as bluffs along some of the rivers, there are at the scale of these maps few major topographic features. Thus, for the small scale maps of the expedition, a uniform, “flat” gray surface was used. When there was a significant topographic feature (Scott’s Bluff, Castle Rock, Plum Buttes, Pawnee Rock), the feature was
represented by a small circle and named. The significant topographic variations were felt to be effectively represented by stream channels. Only by excessive exaggeration would it be possible to indicate to the reader the subtle variations which exist in the terrain; the area traversed by the expedition is a flat to very gently rolling plain with only a few trees (and these were confined to the river valleys, see figure 8). A drive across Kansas on Interstate 70 will illustrate the situation quite effectively!

For all of these reasons, but principally because the physiography was not a major factor in the Cheyenne expedition, no effort was made to indicate the form of the land surface except on the two battle maps. The importance of the streams and rivers, however, could not be underemphasized, both for the Cheyenne and cavalry campsites as well as for the routes of travel across the plains. The first is most obvious on the Cheyenne band map, while the travel situation is apparent in every expedition map. Both the Sumner and the Sedgwick columns followed river valleys for long distances. Only on the battle maps was shaded relief employed, for here it was important to note the microgeographic characteristics of the battle site. Mountainous areas were shown on the tribal map, for reasons which will be discussed in detail below. The Front Range of the Rocky Mountains lie within the area covered on several of the expedition maps. Since these mountains were significant to the line of march only in a "scenic" way, and this was covered by Chalfant in his text, no effort was made to include them on the maps.

There, spread out before them, was a sight so magnificent it took their breaths and held them spellbound for a few moments . . . Immediately to their south were the Spanish Peaks, ravines in their sides filled with snow, giving them a striped appearance. West of the Spanish Peaks were snow-capped peaks of the Culebra Range, running south to north, or a little west of north . . . Beyond the Wet Mountains . . . were great peaks of the Sangre de Cristo Range, capped with snow, which glistened in the morning sun like a solid mass of diamonds. Angling off to their right into the distance was the Arkansas [River] . . . and farther to the right the southern flank of the great Front Range . . . Awed by the great wall of rock, the cavalry column continued its march along the ridge . . . then descended into the valley of Fountain Creek. . . . they made camp on the banks of the creek, having traveled twenty hard, but spectacular, miles. (Chalfant 1989, 98)

Cartographic Design: Differentiation and the Visual Hierarchy

Throughout the venture we recognized the need to sort information visually, developing logical structures which would assist readers in the use . . . of the maps.

[There was] the need to sort information visually, developing logical structures which would assist readers in the use . . . of the maps.

Figure 8. Panoramic sketch looking southward across the valley of the South Fork of the Solomon River.
The design of the expedition maps, because of their complexity, developed conceptually with the notion that these maps had four levels of information. These different levels need to be visually distinctive from one another, with the most important information appearing to the reader as more visually significant, contrasting strongly with the other levels of information shown on the map.

At the top of the graphic hierarchy was the path taken by the expeditionary force, with the location of each campsite. This information and significant features encountered along the way (settlements, forts, and physiographic landmarks) were shown in black. At the second level in the hierarchy were the “other” trails—the Santa Fe, Oregon, and military trails which crossed the plains in 1857. These were mapped in dark gray.

Since there were political boundaries at the time of the expedition, and since in the book I make reference to them, I think it would be helpful to have these boundaries shown on the main map. (Chalfant 4 June 1985)

Territorial boundaries, the least visually significant of the four levels, were shown in light gray; while these lines had the least contrast with the gray background, they would still be obvious visually, for they were simple and continuous across the surface.

Rivers and streams, along with their names, were shown in white. The importance of these to the expeditionary force was surpassed only by their significance to the Cheyennes. These four levels (black, white and two shades of gray) were shown on a light/middle gray background (a thirty percent tint screen was used). By handling this complex array of information in this way it was possible to overlap stream and trail lines, and the most important information stands out (in black) above the various shades of gray (or white) used for the other features. (Technically, these different shades are achieved by using a combinations of tint screens and masks; these types of procedures are common in graphic arts production as well as in cartography; see Keates 1989, as well as Robinson et al. 1984, and Dent 1990).

The graphic structure having been organized, the effort then was devoted to the placing of the names on the maps. An early version of one of the expedition maps brought comments from the editor:

It's unfortunate that some of the boldface labels must overprint some of the screened labels and lines. (Chalfant, noting comments by the University of Oklahoma Press, 2 June 1986)

As the production of the maps (and the manuscript) reached the final stages, the editor pointed out that

Generally the maps look very good. There are, indeed, some problems of legibility that I hope you will resolve. Changing the weight of the screen will eliminate most of these, but I am hoping that you will also consider moving the labels for settlements and rivers where they overlap. (Morrison 4 October 1988)

Although some areas of the maps were very congested, it was possible to include almost everything and not have the names overlap.

Clean, legible type faces were another
More important features were shown in larger and bolder type, while places and locations which were relatively unimportant were indicated in sizes that... often seemed to approach the threshold of legibility!

I think...the appropriate way to identify the three columns, the Sumner march, the Sedgwick march, and the path of the combined units to the battle site is...by using some different marker or designation to distinguish between the route taken by each of the two columns, and then the route to the site of the battle. (Chalfant 4 June 85)

By mapping the routes of each column on separate maps and then by identifying the two separate marches in large bold type on the main map, there was no need to employ different types of line symbols (see figures 1 and 9).

Seven of the maps followed this scheme (the five showing the routes followed by the expedition to the battle, that showing the paths taken by the Cheyennes in retreat, and the map showing the cavalry in pursuit). The map of the expedition as a whole is somewhat different (see figure 1). Here, in an effort to relate the story to contemporary geography, the hydrography was "muted" (blended, with a very low level of contrast, into the gray background) by portraying the rivers and streams in light gray, not white; although reservoirs are major features on many of the major streams throughout this area, we felt it inappropriate to include them on this combined map. State borders, major cities and interstate highways were shown in white and lighter shades of grays. (Obviously, because of the size difference, few of the details shown on the five larger-scale maps appear on this one).

Originally the map showing the entire expedition was developed in two forms. One was to serve as a frontispiece and the expedition would be mapped against the territorial boundaries and settlement pattern of 1857. The book would conclude with the same expeditionary path...
mapped on a base map with present-day boundaries, highways and major cities. When this approach was rejected (by the publisher) the map was completed combining the two sets of base data—and planned as a summary, for inclusion in the final chapter. (It was printed near the beginning of the book, in chapter four).

### Battle Maps

The expedition maps could be developed by carefully plotting the data about the expedition which were readily available. As we saw above, careful data processing and effective cartographic generalization made it possible to create an accurate map of the route followed by the Army in pursuit of the Cheyennes. Mapping the battle provided a different set of problems. Here interpretation and hypothesis became important.

There are two significant factors to recognize with respect to the battle and pursuit maps. First, these maps are interpretations. No one can be quite certain exactly where something occurred. In reviewing some of the early maps which had been prepared, Chalfant assayed the situation:

> Obviously nobody will ever know with certainty but these seem to be reasonable enough guesses that would serve to illustrate the manner in which the Cheyennes left the field and the cavalry followed. (Chalfant 19 November 85)

Nevertheless, it is very clear, as the text describes and the maps suggest, that certain events took place in a certain order in a fairly well defined part of the environment. Unlike the maps showing the march of the expeditionary force to the battle site, which are at much smaller scale, masking a great deal of detail both about the landscape and the activities of the Army itself, the battle maps can only suggest the actions of hundreds of combatants in a location where the features of the environment were critical to the undertaking.

Chalfant, in discussing these maps, emphasized the role of terrain:

> No one actually knows the lines followed except in a general sort of way. My own designation was based upon the probable routes following the easiest terrain through the breaks in the topography. . . . Since this [battle map] is somewhat larger, it seems to me that it might be helpful to include some showing of the topographic features, so that the reader could look at it and locate Stony Point which the cavalry had to clear before they could see the Cheyenne at the far end of the valley . . . (Chalfant 13 February 86)

The text itself encourages a complementary graphic display:

> Forced into a narrow gap between the face of the rocky hill (Stony Point) [that sliced across the valley floor, forcing the river to make its turn to the south] and the sandy riverbed, the advancing companies formed a single column in order to pass into the valley beyond . . . [183] . . . around the rocky projection . . . the valley widened out to between one-half and three-quarters of a mile in width on the north bank of the river for a distance of two or more miles to the east, after which the river turned sharply north. [186]

> [After the battle] Some [Cheyennes] went north, through the many ravines and arroyos leading into the hills; some went east, down the valley of the Solomon. But by far the greatest number splashed across the river and beyond into the line of hills on the south. (Chalfant 1989, 183, 186, 193)

It was decided to map the battle and the pursuit which followed on shaded relief base maps. Stony Point and the ravine-broken bluffs on both sides of the south fork of the Solomon River—as well as the broad flat river bottom itself—figure significantly in the battle. Lacking a digital data base, two shaded relief maps were created by hand (using a soft pencil on tracing paper). The first covered about ten-square miles of the battle site (and was prepared directly from the 1:24,000 topographic quadrangle; see figure 10). The second, covering the pursuit of the Cheyenne warriors toward their village was carried out using portions of twelve topographic quadrangles. While the topography of the battle site itself was significant (and reasonably “portrayable”), the more than 500 square miles involved in the
smaller scale map consists generally of gently rolling plains, and the subtle variations in the geography were very difficult to capture graphically.

An early effort, using inclined planes, was felt to be too "noisy" (while these types of maps can produce a vivid understanding of the landscape, the results of the experiments here were not encouraging. For details, consult Robinson et al. 1984; see, also, Jenks and Brown, 1966).

“A Clash of Cultures”: The Tribal Map

The initial classroom venture and the efforts which followed immediately had focused on two maps, those of the expedition as a whole and the battle map. Responding to the challenge raised by Bill Chalfant in 1984, the first efforts at mapping were carried out as a class exercise by four teams of three students in the Cartographic Design course at the University of Kansas during the spring semester 1985. Each group designed and produced a map showing the route of the expedition along with a map portraying the battle. Working together in a Practicum the following summer, a group of five continued, moving toward a composite design solution and a plan for the entire set of maps to be used in the book. This group included Jefferson Rogers, Karen Tucker and Michael Kemppainen, as well as Dennis Albers and Nancy Fightmaster. Mr. Kemppainen did extensive work in the year after the Practicum to map the locations of tribal groups. Fightmaster continued her efforts throughout the project, most formidable in checking the text and plotting routes and locations; in effect, the historical accuracy of the maps became her responsibility. Albers focused on map production, particularly in the photographic stages, where as many as seven pieces of artwork would be combined with a series of screens and masks and composited into a single finished map. The team was joined at the end by John McCleary, who prepared a number of the inked drawings.

The tribal map would become the most interesting in design concept and, in many respects, no less a research problem than the expedition maps.

Figure 10. Portion of the “Penokee” quadrangle (1979, 1:24,000, reduced to approximately 1:48,000). Shaded relief drawing developed from the quadrangle (and used for the battle maps). Planimetrically correct terrain drawing of the battle site (developed using procedures in Robinson et al. 1984, this approach was rejected because, like hachures, it is “visually noisy” and the land surface representation would interfere with the principal information being shown on a map).
The government established a Permanent Indian Frontier along the ninety-fifth meridian... The vast area lying beyond the ninety-fifth meridian, extending west to the Spanish and British possessions, was then known as the Indian Territory. Lands provided to immigrant Indians consisted of tribal reservations carved from this territory and, for the most part, located along the eastern borders of what later became Nebraska, Kansas, and Oklahoma. The extent and boundaries of the reservations were arbitrarily determined, without much regard for the size of the population to be supported. . . . West of the new line of reservations lay largely unexplored lands inhabited by the powerful and warlike nomadic tribes of the Great Plains. . . .

North of the Arkansas, in territory bounded on the west by the foothills of the Rocky Mountains, on the east by the line drawn roughly at ninety-eight degrees longitude (about where the Santa Fe Trail crossed the Little Arkansas River), and on the north by the Platte, roamed the southern bands of the Cheyenne and Arapahoe tribes. . . . Each of the many bands of Cheyennes had its own favorite territory within the larger range.

The Permanent Indian Frontier, designed to assure both immigrant and native Indians their own separate homelands forever, lasted only from 1817 to the late 1840s. . . . In its place came the organization of nearly all lands west of the Missouri River into states and territories . . . Public lands were thus opened for white ownership and settlement, requiring termination of Indian claims. . . . Lands guaranteed to Indians in perpetuity—for so long as grass grew, streams flowed, and winds blew—were once more demanded by whites. . . . White settlers began to flood into Kansas and Nebraska in 1854, sending new pressures west into the domain of the Plains tribes. (Chalfant 1989, 4, 6, 7)

It is this clash of cultures on the plains, Native American and white, that is the focus of the last two maps in Cheyennes and Horse Soldiers. Although these are discussed last in this article, they are in fact the first two maps which appear in the volume. Tribal lands are shown within a context of the mountains on the west and white settlement (indicated by the boundaries of organized counties) on the east. For the Cheyennes, these are the inflexible limits, for the boundaries with the Sioux, the Kiowa, and other tribes were shared and could be 'adjusted.' Unstated here are the Mexican influences on the south and the gradually increasing number of trails, forts and trading posts which had been established across the plains by the whites. It was impossible on a map of this size to include more than a small part of the important contextual information.

Chalfant’s request was clear:

It would probably be of some assistance if a reader knew the territory claimed by the various Indian tribes. What I had in mind for that was a map which would show a much larger area, starting from about the Black Hills on the north to the Rio Grande on the south and the Rockies on the west to the Missouri River on the east. It would then need something to denote the territory of the various tribes occupying the lands, whose boundaries often overlapped. Most of the maps I have seen in this respect have been unsatisfactory, since they do not show their actual claim to boundaries, but just put a name in an area, frequently inaccurately. (Chalfant 4 June 1985)

This is illustrated nicely by a contemporary map, that of “Kansas, Nebraska and Colorado, showing also the southern portion of Dacotah” (1864; see figure 11). Modern authors use the same approach, but with a less elegant style.

Based on Chalfant’s perspective on the situation of the tribal groups across the plains, the first map was created in the summer of 1986 (see figure 12). Like the expedition maps, the design structure emerged easily. The area inhabited and traversed by the Cheyennes and Arapahoes would be in white on a gray background. Principal rivers and mountainous areas would also be in
There were three responses to this initial effort. First, Chalfant offered a number of suggestions, these organized primarily from his understanding of the Cheyennes and their interactions with other tribes. Michael Kemppainen, on the other hand, saw the map as incomplete, for only nine tribes (and a number of their bands) and less than a dozen reservations had been shown in this initial effort. (An undergraduate, specializing in cartography, at the time the project began, Mr. Kemppainen is now a cartographer with the U. S. Geological Survey). The third, a collective, response of the team was, first, one of satisfaction with the fundamental design solution and, second, a concern about the scope of the research necessary to produce a more accurate map. The latter concern never became an issue, for Kemppainen assaulted the task and extracted from the University of Kansas libraries dozens of volumes and maps which explicated the situation. He consulted other archives as well (including private collections at the Haskell Indian Junior College), and produced a new map which elaborated the information in a different design framework (see figure 13). His continuing research then yielded a large detailed map of the tribal areas and a comprehensive picture of the nearly two dozen reservations which existed in 1857 (see figure 14). This detailed pencil sketch became the basis for the map which was finally produced; the data were merged with ideas derived from the later versions of the text which, as we saw above, set a clear context for this map.

If the expedition map was a challenge (with the search for the details of the route and its cultural context), the development of the tribal map and the "Clash of Cultures" context presented an array of challenges. These fall into two broad categories, those of data and those of design. While the design concept which emerged was fairly simple and visually logical, it was tested by the difficulties associated with the data.

The data which were to form the tribal map were those for 1857. Tribal ranges, reservations, white settlement and phys-
Figure 12. The first version of the tribal map (eastern portion only). 

Figure 13. The revised version of the tribal map, developed by Michael Kemppainen.
Figure 14. "Tribal Territories on the Great Plains" (Chalfant, 1989, 5), with a portion of the compilation drawing prepared by Michael Kemppainen (original compilation in color; the numbers indicate reservations).
... the boundaries of territories and organized counties seemed to be an appropriate way to show the extent of white settlement on the plains.

In a nomadic situation it is difficult to be certain just exactly where a tribe was located at any point in time.

Theography had to be those current at the time of the expedition. The features of the landscape were the major rivers and the areas of high hills and mountains. These unchanging limits on the plains set the boundaries for the tribal groups, while the valleys of the rivers generally housed the trails which crossed the plains. These trails, originally traversed by the different tribes, guided exploration by white men and then channeled their settlement. The mountains and hills, often routinely represented by elevation or, alternatively, portrayed pictorially were adapted from the work of E. H. Hammond. (Hammond's land surface form map of the United States, which appears in The National Atlas (1970), focuses on land surface form, a derivative of slope, local relief and profile type).

White settlement could be represented in many ways. There were censuses in 1850 and 1860 and some form of population map could have been developed. Settlement is accompanied by other manifestations and the boundaries of territories and organized counties seemed to be an appropriate way to show the extent of white settlement on the plains. This also made it possible to understand the position of the established reservations and the spatial significance of this component.

Reservations are, like many other features, portrayed on maps of the period inconsistently. While on any given map some reservations will be shown correctly, others will not be shown at all and some will be mapped in error (wrong place, wrong size). It would appear from the research that was carried out, particularly by Kemppainen, that no one single source exists which chronicles the establishment (and ultimate demise) of the reservation system. It is often clear when a particular reservation was established, but in some cases the actual extent—particularly, for the work here, in 1857—is not clear. Treaty cessions did not become common until the 1880s and 1890s. Thus once it was obvious when a reservation had been established, it was assumed that it existed in 1857. The primary resources here are numerous and widespread. They include The Creek People (Green 1973, especially for reservations in Oklahoma) and, for example, The Kaw People (Unrau 1975, for the areas in Kansas). Many other sources were checked to obtain dates and boundaries for both the tribal ranges and the reservations.

The number of resources which emerged in the various searches was surprising. However, these varied widely in quality and reliability. Chalfant's research about the reservations yielded mixed results.

The next map enclosed, which likewise overlaps and is an attempt to show the territory both at the boundaries of Oklahoma and further west... It does a pretty good job of showing the location of the Cherokees, the Creeks, the Choctaws and Chickasaws. It also shows the small reservations of the Quapaws, Senecas and Shawnees in the extreme upper right-hand corner of Oklahoma. This map is good for the above only, as you will note they have not shown the Cherokee reservation in the southeast corner of Kansas, and the Osage reservation, while shown as not yet surveyed, is mislocated. None of the other Kansas reservations then existing are even shown. (Chalfant 23 June 1986)

While working with the data for the reservations, it became obvious to Kemppainen that the ranges of the tribes needed further investigation. In a nomadic situation it is difficult to be certain just exactly where a tribe was located at any point in time. But the extent of the area inhabited by the Cheyennes was clear to Bill Chalfant. As the project progressed, more tribes were included on the map. No effort was made to map, even generally, the separate bands of the tribes (e.g., the Sioux and Apache) and the areas inhabited by the several bands of the Cheyenne were saved for the more detailed map.

It became clear, for example, that the Chippewa were located both on a reservation (in Oklahoma) and in communities throughout Minnesota and Iowa (unlike
the tribes on the plains, they were not nomadic). Eventually they were relocated onto reservations in Wisconsin and the upper peninsula of Michigan. Locating the Chippewa, then the Crow, and modifying the boundaries of the areas inhabited by other tribes created an array of design problems.

In some cases the situation became very clear. For example, while at the outset it was believed that the Ponca were confined to a Nebraska reservation, in 1857 they roamed freely across northeastern Nebraska. They were relocated to an Oklahoma reservation twenty years later (Cash and Wolff 1975).

To develop a map of this type, merging into one frame the diverse groups of Native Americans, the established reservations and the organized counties, required considerable bibliographic research.

Chalfant monitored the process of development, adding boundary segments, modifying others—drawing from his many resources information which Kempainen had not discovered. His comments were quite extensive:

The map of the tribal territory is very interesting and well done. There are a few errors, and a few additions... I am therefore enclosing a copy on which... I have inserted the names of the various Ute bands... moved down... inserted it... inserted... roughly outlined it... have drawn it in... approximately as I have inserted them...

Continuing,

With respect to the reservations of the immigrant tribes on the east, you may feel that it would be impractical to insert the names of the tribes, and I have no problem with that. If there were any that should be included, however, I would suggest that for the Osage, which gives a nice big background anyway, and perhaps something showing the Kanza reservation, which the expedition passed through, and lastly perhaps the Cherokee, just to show that it is not the same as the Osage. (Chalfant 1 June 1986)

Graphically this map was developed using patterns of different styles and textures. Technically a visual balance was achieved among the patterns used to represent each tribe by screening some patterns and printing others in solid black. Patterns for adjacent and overlapping groups were chosen so that the areas of overlap could be reasonably discriminated by the reader; the most complex of these areas of overlap lies in present-day Texas and New Mexico, where the Apache, Comanche, and Kiowa-Plains Apache shared a section of the High Plains.

This problem was addressed by Chalfant during the creation of the map.

Because of the overlapping of the Kiowa range with the northern part of the Comanche range, this one will cause us a little trouble... Because the Kiowa range overlays that of most of the Comanche bands, at least those on the north, it seems to me we may have to have some kind of inset box, perhaps in the upper right hand corner, which would explain the symbols used to delineate the territory of the two tribes...

It appears to me that you have also inserted some kind of symbol to represent the territory of the Utes and of the Sioux, and therefore the same sort of explanation should be given for that. (Chalfant 1 June 1986)

Recognizing that some aspects of geographical distributions are complex and that they cannot be portrayed simply, no matter how ingenious the cartographer might be, he or she must assume that the reader will, at whatever level of interest exists, study the map to gain an understanding of what is shown. Here the attempt was made to show each tribal group with a unique pattern, a pattern which would, in areas where it overlapped with another, be distinguishable. The reader would thus receive several messages from the map: Here is the area inhabited by this tribe. Here the area overlaps with that of another tribe (or, in some cases, with several tribes). This area is graphically complex; therefore the geography here must be complex.

On a very small map like this, restricted to a single page, it was not

Patterns for adjacent and overlapping groups were chosen so that the areas of overlap could be reasonably discriminated by the reader.

The reader would thus receive several messages from the map: Here is the area inhabited by this tribe. Here the area overlaps with that of another tribe... This area is graphically complex; therefore the geography here must be complex.

The map of the tribal territory is very interesting and well done. There are a few errors, and a few additions... I am therefore enclosing a copy on which... I have inserted the names of the various Ute bands... moved down... inserted it... inserted... roughly outlined it... have drawn it in... approximately as I have inserted them...

Continuing,

With respect to the reservations of the immigrant tribes on the east, you may feel that it would be impractical to insert the names of the tribes, and I have no problem with that. If there were any that should be included, however, I would suggest that for the Osage, which gives a nice big background anyway, and perhaps something showing the Kanza reservation, which the expedition passed through, and lastly perhaps the Cherokee, just to show that it is not the same as the Osage. (Chalfant 1 June 1986)

Graphically this map was developed using patterns of different styles and textures. Technically a visual balance was achieved among the patterns used to represent each tribe by screening some patterns and printing others in solid black. Patterns for adjacent and overlapping groups were chosen so that the areas of overlap could be reasonably discriminated by the reader; the most complex of these areas of overlap lies in present-day Texas and New Mexico, where the Apache, Comanche, and Kiowa-Plains Apache shared a section of the High Plains.

This problem was addressed by Chalfant during the creation of the map.

Because of the overlapping of the Kiowa range with the northern part of the Comanche range, this one will cause us a little trouble... Because the Kiowa range overlays that of most of the Comanche bands, at least those on the north, it seems to me we may have to have some kind of inset box, perhaps in the upper right hand corner, which would explain the symbols used to delineate the territory of the two tribes...

It appears to me that you have also inserted some kind of symbol to represent the territory of the Utes and of the Sioux, and therefore the same sort of explanation should be given for that. (Chalfant 1 June 1986)

Recognizing that some aspects of geographical distributions are complex and that they cannot be portrayed simply, no matter how ingenious the cartographer might be, he or she must assume that the reader will, at whatever level of interest exists, study the map to gain an understanding of what is shown. Here the attempt was made to show each tribal group with a unique pattern, a pattern which would, in areas where it overlapped with another, be distinguishable. The reader would thus receive several messages from the map: Here is the area inhabited by this tribe. Here the area overlaps with that of another tribe (or, in some cases, with several tribes). This area is graphically complex; therefore the geography here must be complex.

On a very small map like this, restricted to a single page, it was not
It is possible to show the series of forts extending between Minnesota and Louisiana which protected whites from Native Americans and Native Americans from whites. Similarly parallels and meridians were not shown, for the ninety-fifth meridian, the eastern boundary of Indian Territory, is obvious from the patterns on the map. Finally the trails (punctuated with scattered forts and trading posts) were relegated to other maps in the text. Nevertheless, the message of the map is clear. This is the domain of the Cheyennes (and the Arapahoes), lodged amidst the other tribes who inhabited the plains and bounded firmly on the west by the mountains and on the east by the growing number of immigrant Native American reservations and white settlement. Here defined visually, figure 14, is "A Clash of Cultures."

The Band Map

The map showing areas inhabited by the ten bands of the Cheyennes was a simpler research problem. Chalfant had in his assiduous research obtained a clear idea of the territory generally inhabited by each band as well as a clear understanding of the actual encampments during the winter of 1856-57. He wanted "a map which would show the territory of the particular Cheyenne bands" (Chalfant 23 May 1986). His concept was clear:

I suggest that you make a blowup of the territory of the Cheyennes and Arapahoes only. You have it very well outlined in the tribal map. If it were made larger, and included a little bit of topographic detail (rivers, political boundaries, etc.), I could insert the normal area in which the ten major bands of Cheyenne normally roamed. The major tributaries of the Republican, the Solomon, the Saline and the Smoky Hill would have to be shown, along with Walnut Creek, Ash Creek and the Pawnee Fork, as well as Sand Creek, since those were streams that are significant in terms of the territory of the various bands. It would probably also be helpful to show the location of the "Big Timbers" of the Arkansas.

That was a line of cottonwood groves running along the north bank of the Arkansas for about 20 miles or so from perhaps 5 miles above present day Lamar to about 15 below it. . . . (Chalfant 1 June 86)

These boundaries and encampments were mapped against a base map showing the rivers and streams of the Cheyenne territory. The importance of the stream network cannot be over-emphasized. It is the context which best fits the Cheyenne. The hydrography was derived from the 1:1,000,000 base map of the U.S. Geological Survey. The hundreds of stream segments shown on this map were inked and photographically reduced to less than one-sixth the original size. The subtle contrast between the light gray of the stream network and the 45 circles representing the clusters of lodges emphasizes visually the small degree of impact of these encampments in the vastness of the plains.

We know that each lodge accommodated seven or eight people, that ten to twelve lodges were generally found at a campsite. The impacts of these campsites on the landscape were small and only if one (or its remains) were found by a pursuing military party and its position recorded in a log or diary would its location be known. Larger encampments, including the Sundance village and the four occupied by the Cheyennes en route to the battle of Solomon’s Fork—as well as verbal accounts, stories, songs and legends obtained from the members of the tribe—provide a reasonable account of the tribe and its activities and movements. Like any nomadic group the Cheyennes present for the pursuing scholar a continuing series of challenges.

There were three stages involved in developing this map. First Chalfant, with a large scale base map, set down the general ideas—the boundaries of the areas generally inhabited by each band and the number of lodges in each band were sketched on the map. This was then modified, so that the number of lodges assigned to each band was commensurate with the total number of

The importance of the stream network cannot be overemphasized. It is the context which best fits the Cheyenne.
... recognizing that [the design structure] was not commensurate with the graphic structure of the tribal map, the film was reprocessed to create the final version.

lodges for the tribe as a whole, and the locations of the encampments for the winter of 1856-1857 were plotted. The map was then prepared for publication and, using a proof, Chalfant asked that a number of the lodges be moved to more accurately reflect the sites of the winter encampments. The map was completed using one design structure (q. v.) and, recognizing that this was not commensurate with the graphic structure of the tribal map, the film was reprocessed to create the final version (see figure 15).

Conclusions
The struggle between Native American and white for possession of the North American continent continues to captivate the public. . . . the story is a significant and dramatic theme in the history of the United States. [It occurs

at] a time before roads and towns, before buildings, trees, and cultivated fields, before any physical evidence of European culture on the Great Plains. [It is set in] a great ocean of grass, broken here and there by some surprising range of hills or buttes or by the sparse and scattered stands of cottonwoods rising above the banks of the shallow streams that meandered through the emptiness. . . .

The Cheyenne Expedition was . . . a single episode. . . . The irony and significance of what happened that day can be truly understood only if the reader is familiar with the Cheyenne Indians and their way of life, and with the nature of cavalry operations across the plains in the mid-1850s. (Utley 1989, xx)

This map presents the areas generally inhabited by the bands of the Cheyenne in the midnineteenth century. Northern Bands
- Omahas
- Suhtai
- Ridge People
- Haskomethamu
- Dog Soldier
- Hotamitamu
- Burnt Aorta
- Yelstusminhaha
- Protruding Jaw
- Ohhtowna
- Scabby
- Owmanah
- Hair Rope
- Hevatamu
- Eat with Sioux
- Wutaphu
- Poor People
- Mohawks

Each circle, O, indicates a cluster of 10-12 lodges, the campsite of the different bands during the winter of 1856-57. Note that the Northern Bands camped in the area normally used by the Ridge People; Southern Suhtai and Dog Soldier bands.

Figure 15. “Cheyenne Bands Within the Tribe’s Territory” (Chalfant 1989, 48), with a portion of the same map using an alternative design.
William Chalfant set as his goal a set of maps "to illustrate a book." Ordinary, the process of creating maps for a work of this type would have been different from the one which developed over the four-year period. Generally, maps for a book are produced in a much shorter period near the end of the publication process; in most cases, map production seems to be subordinate to text processing.

It seems that maps are created, and books are illustrated, by authors who pay significantly less attention to the conceptualization of the graphic displays than they do to the written text. Too often, the maps are produced for them by people who seem to have little or no understanding of geography—and little intention of consciously integrating the information, complementing the verbal discussion with the graphic.

There is a great deal of effort required to determine and organize what one will "say" on a map. As this project demonstrates so clearly, with historical data there is a considerable amount of research—particularly data gathering and verification. Often this work is invisible, for no one understands how long it took to track down the right location for a point or a line or the correct boundaries for an area.

Then there is the matter of "how you say it." What is of concern here is the manner both in which the data are to be represented on a map and in what context. Although this was not a significant issue here, the type of map projection is a fundamental concern. One must also confront the organization of the base map and the relationship between the data shown on it to the primary (or focal) data portrayed on the map.

There are always options and, from among these, the different pieces of the map, an integrated design must be developed. It is not simply that the data be represented on a map, but rather that they be structured in a visually rational way. In the same way that one structures a sentence, a paragraph, or an essay, one organizes a map—establishing the visual structure that communicates the data most effectively.

Lacking at the outset a clear definition from the author, the students accepted the challenge to experiment. This became, for a few, a solid interest and a commitment to the task: "Illustrate a book." How could the maps reflect the text? How could the text be complemented most effectively?

First, the text is thorough. At the outset, it appeared as a day-to-day diary; it is highly detailed. Thus the maps should be detailed. This challenge was met by a significant amount of research; it was important to check details. The diaries were read and the maps replotted; additional resources were located to verify the location of features and to aid in the plotting of the route of the expedition. The elusive boundaries for the tribal ranges were pursued in dozens of published volumes.

The design plan emerged gradually. At the end, when the production of the maps finally occurred, what had emerged was a style which was a reflection of the group as a whole, a style of graphic design which was not dominated by the esthetic perspective or preferences of any single individual. The maps were clearly a group effort, and no single individual produced an entire map. Most important, the maps met the two principle criteria: They were as accurate as possible and they were readable, both as graphic displays and in their complementarity with the text.

There are a number of other issues associated with this cartographic experience. First, maps are expensive. They consume a great deal of time and resources. Because maps are expensive to produce, there are limits set by the publisher, not only on the number of maps but also on how much money can be spent on them. One estimate of the "market value" of these dozen maps, by a graphic artist/cartographer with considerable experience, is $2700 (and this is only for the actual production, after all of the historical research has been completed). Another felt that "about $400 per map" was a reasonable figure.

Maps are also expensive emotionally.
It is difficult not to become involved when you are producing a map. Perhaps draftsmen handle the tasks unemotionally, with less concern about the content of their products. Cartographers do not. Cartographers, often dealing with authors who do not understand the principles of graphic design, must understand geography, the situation itself and how it relates to the environmental context, as well as the graphic communication process. Only with an appropriate handling of all of these will the map convey the information effectively.

At the beginning, Chalfant wanted maps that would be “both helpful and informative” so that “any reader [will] be able to follow with some accuracy the route . . . [and locate] important landmarks, the sites of various occurrences and the like” (Chalfant 28 September 1984).

There are occasional volumes in which maps have been devised to illustrate a military campaign, and have done it in a careful and constructive manner, helping the reader understand particularly the movements of opposing forces. Most, however, are relatively crude and frequently inaccurate in depicting the area which is the subject of the writing. They pay little attention to topography, do not introduce the reader to the landmarks and geophysical characteristics of the surrounding territory, and do little to help an unfamiliar reader relate to the action. (Chalfant 19 June 1990)

For Cheyennes and Horse Soldiers, there was a conscious, long-term consideration of the graphic possibilities for presenting the information. The result was a series of maps which departed significantly from convention. In addition, the reader was provided more information than possible with alternative design formats in a more legible manner. Such a design approach made it possible to handle the tribal maps in a more efficient way.

...[The] tribal maps ...[give] an idea as to the homeland of each of the tribes which surrounded the Cheyenne country, and in locating the common haunts of each of the Cheyenne bands in terms of time and space. Again, most others have addressed that problem by merely placing names on the map with no indication of tribal territorial claims, the time frame referred to, and frequently placing them in an inappropriate location. (Chalfant 19 June 1990)

To accomplish all of this required more than simply recording data on a map. It required that all involved become students, for the entire venture was one in which everyone had to learn a lot. If it has been successful, those who read Cheyennes and Horse Soldiers will also have a good learning experience.

It is difficult to recall original “intentions” or “desires” . . . I think [that at the outset] I was expecting no more than advice. I knew that maps would be useful, but I lacked a very good grasp of how useful, and I certainly had no idea as to how many of or what character I should have . . . I was probably more the student and the one who learned more than any of the class members . . . you have at the same time helped me and taught me. (Chalfant 19 June 1990)

George F. McCleary, Jr. is Associate Professor of Geography at The University of Kansas. The MS submitted in March 1990.

NOTES
The author wishes to thank Dennis Albers, William Chalfant, Nancy Fightmaster and Michael Kempainen for their comments and suggestions during the development of this article. Donna Koepp not only organized all of this onto the printed page but also posed a number of catalytic questions. The technical assistance of the students who participated in the five-year venture made the maps for Cheyennes and Horse Soldiers possible. It is important to cite Jeff Rogers and Karen Tucker for their early developmental work. Mike Kempainen’s attention to the tribal map and Nancy Fightmaster’s painstaking attention to data and detail not only set the stage for a better set of maps but they also provided an important insight for all of us into the many conundrums associated with this part of the cartographic process. Dennis Albers and John McCleary provided the production expertise. All of us owe our appreciation to Bill Chalfant for the opportunity and the continuing series of challenges.
1. Originally designed as two separate maps, one with contemporary base data, the other with a modern base map, the two were combined for this single figure. Note the strong graphic contrast on this map, with the white state borders and the black lines portraying the expedition route set against the gray background. The contrasts between the background and the hydrography, other trails and interstate highways are not great—some argue that these visual differences are too small, but the goal here was for a strong emphasis on some features and a clear de-emphasis of others.

2. Merrill, Wm. E. (Bvt. Col., Maj. Engrs.). 1868. “Kansas with Parts of Neighboring States and Territories” (St. Louis: 1:1,200,000. Copy from the National Archives, Record Group No. 77, Q140).


6. East is at the left, west on the right. The vantage point is from the road immediately north of the valley, at an elevation of about 2272 feet (this is just west of the “2264” elevation mark shown on the topographic sheet in figure 10). The cavalry entered the valley from the west, behind Stony Point (which blocks the view up the valley); the Cheyennes were in a grove of trees on the left.

7. Characteristic of the expedition maps, five visual levels are readily apparent here. The hydrography is shown in white; the territorial boundary is shown in light gray (lighter than the gray background); the “other trails” (e.g., Council Bluffs Road) are shown in a darker gray, along with the scale for the map; the expedition route and physical and cultural features which are important to the story of the expedition are shown in black. All of this occurs on a “middle gray” background.
LITERATURE CITED


——. Various dates. Personal correspondence.


MILEPOST

Mr. and Mrs. Kenneth Nebenzahl recently donated the archives of Kenneth Nebenzahl, Inc. to the Newberry Library in Chicago. Mr. Nebenzahl is internationally known as an antiquarian book dealer whose specialties include cartography and early Americana. The papers include the manuscripts and proofs of his published works on the maps of the American Revolution, the history of Holy Land cartography, and his *Atlas of Columbus and the Great Discoveries*, to be published this year by Rand McNally. The Nebenzahls, who continue as private rare book and manuscript dealers in Glencoe, closed their Michigan Avenue bookshop in 1989 after more than 30 years of service to collectors around the world. The store's archives are a major source for reconstructing an important chapter of Chicago's booktrade.

Also donated to the Newberry by the Nebenzahls is a collection of some 1,000 titles. Among the items are rare German, Italian, and Dutch 16th-century Americana, French-Canadian pieces, self-education books, devotional and spiritual works, and a large number of titles documenting 19th-century American history. Paul Saenger, George A. Poole III Curator of Rare Books and Collection Development Librarian, describes this collection as, "a perfect Newberry acquisition with great research value."
Preserving Maps in Quantity

The Experience of the New York State Historic Map Preservation Project

By David Y. Allen

The New York State Historic Map Preservation Project is a large-scale cooperative project carried out by seven major research libraries in New York State. The project was carried out in 1988-89, and funded by the New York State Department of Education. This article stresses the importance of combining preservation and bibliographic control activities in such projects. The importance of adopting pragmatic specifications for large-scale map preservation is also emphasized.

Concern about the deteriorating condition of map collections is widespread. But we have only begun to preserve our aging maps. Most map preservation efforts so far have been limited to small numbers of particularly valuable maps, or to often rather minimal in-house preservation treatments.1

Thus, there is a nationwide need for the archival preservation of thousands of maps with potential research value. In the light of this need, the experience of the New York State Historic Map Preservation Project may offer some worthwhile lessons.

The New York State Historic Map Preservation Project appears to be the first multi-institutional map preservation project. It is also one of the largest map preservation projects done by a commercial conservator. In a single year over 2,000 maps were preserved for seven New York State libraries at a cost of nearly $130,000.

The New York project was carried out in 1988-89. The participating libraries were Cornell University, New York Public Library, New York State Library, Rochester University, Syracuse University, SUNY Albany, and SUNY Stony Brook. These libraries are among the eleven major research libraries in the state eligible to take advantage of a cooperative preservation grant program funded by the New York State Department of Education. In this respect, we were fortunate enough, for New York appears to be the only state that provides substantial funding for its preservation programs. Given the nationwide interest in the preservation of library materials, it appears likely, however, that other interested libraries could obtain funding for similar projects from Federal or private sources.

The grant provided for the preservation of a wide range of maps published or produced prior to 1940. All of the maps depict New York State or some part of it. Most of the maps were either transportation or city street maps. The maps came in practically all types and sizes. They included wall maps, roll maps, blueprints, pen-and-ink manuscript maps, and various kinds of printed maps. Only atlases were excluded, as many of them were preserved in a previous grant sponsored by Rochester University.

The project was intended to further the bibliographic control of New York State maps as well as their preservation. All the preserved maps were required to be cataloged on either OCLC or RLIN, and all have been listed in a still unpublished checklist that will be made available to all interested libraries. We emphasized in our project proposal that preservation and bibliographic control have to go hand in hand. It is difficult for a library to set preservation priorities without knowing which of its maps are unique or scarce. And without the maps being cataloged or listed in some way, there is no way to make that determina-

...there is a nationwide need for the archival preservation of thousands of maps with potential research value.

The project was intended to further the bibliographic control of New York State maps as well as their preservation.

29
tion. In the case of Stony Brook, which is probably typical, we have found that less than ten percent of the maps we preserved were cataloged on either OCLC or RLIN.

The aspect of the project most likely to interest those outside of New York State is our experience in drawing up preservation specifications and selecting a contractor. Because we were preserving such a wide variety of maps, we faced a correspondingly wide range of conservation challenges. The standard treatment for most maps was surface cleaning, alkalization using the Wei-T'o soft-spray system, and encapsulation in polyester. But many maps required more extensive treatment, including tape removal, mending, removal of backing or varnish, and mounting on rice paper.

Even the simplest of these treatment options is beyond the in-house capabilities of most libraries. Although it is easy to encapsulate maps using double-coated tape, this type of encapsulation is far less desirable for archival purposes than ultrasonic seam welding, which requires an expensive machine. The apparatus required for Wei-T'o deacidification is also fairly expensive, and the process requires lots of space and good ventilation. Such procedures as tape removal and backing removal require much time and expertise, and are out of the question for all except a very few libraries.

Thus, for archival preservation work our only real option was to send our maps to an outside conservator. We first had to determine exactly how we wanted the maps to be treated. Then we had to find a contractor who could meet our standards, and at the same time do a large volume of work in a short time at a reasonable cost.

In writing our specifications we were fortunate in being able to draw upon a great deal of experience and expertise. All of the participating libraries have active in-house preservation programs, and several of them have nationally known conservators working for them. Most of the libraries also had some experience in having maps preserved by
outside conservators. John Dean, Conservation Librarian at Cornell, wrote the conservation specifications for the project, and he acted as consultant to the participating libraries on conservation questions. The specifications drawn up by John Dean appear to be the only comprehensive specifications that have been written for map preservation, and they may be of considerable interest to other map librarians contemplating preservation projects. A copy of these specifications follows this article.

The project specifications are brief and deliberately leave a good deal to the judgement of the conservator. In the case of maps requiring extensive treatment, considerable room was also left for individual custodians to specify how they wanted the work done. Deacidification may be either aqueous or non-aqueous, depending on whether a map needs to be washed or not. Cloth backings may or may not be removed, depending on whether removal is considered necessary to preserve the map. In general, the specifications prescribe the minimal treatment that is necessary to ensure the twin goals of stabilizing the image and making the map usable. Thus, we avoided cosmetic stain removal. In some cases, maps were divided to facilitate storage. We did not require that corners be rounded on the encapsulations, which were lightweight three mil polyester. We allowed mending to be done using LC heat-set tissue as well as wheat starch and rice paper. In dealing with wall maps, we discouraged removal of backing or varnish, unless these procedures were necessary to preserve the map. These specifications were designed to facilitate our goal of preserving a maximum number of maps at the lowest possible cost.

Our pragmatic approach to map preservation is somewhat of a departure from accepted conservation practice. Our concern was to preserve the information on the maps. Professionally trained conservators, however, are much more inclined to treat maps as works of art. They tend to be concerned about preserving the integrity of the object, and aesthetics is

---

Fig. 2. Rand McNally map of New York City shows severe water damage. In spite of loss of portions of edge and staining, information loss was negligible. Map was deacidified and encapsulated. No attempt was made to remove stains, which will not cause further damage and do not obscure information on map.
much more of an issue for them. In talking with conservators, I have found these attitudes to be, to a greater or lesser extent, pervasive—both among in-house conservators and commercial conservators. They frequently react with horror to the suggestion that a map might be cut in half. Given the choice, they tend to opt for the most labor-intensive and cosmetically attractive treatment option. Some of them are hyper-conservatives on the dangers of deacidification processes or the use of heat-set tissue to mend maps. While one can respect the professional integrity embodied in these attitudes, they can raise the cost of preservation inordinately. In the meantime, thousands of maps go unpreserved. What we were asking for was sort of a compromise between the craft tradition of Morris and Ruskin, and the needs of twentieth-century mass production.

The need to somehow combine high quality work with high volume production made the selection of a conservator a delicate task. There are a very small number of commercial conservators with any kind of track record in preserving cartographic materials. We decided to select our conservator only after soliciting bids from those we knew to have the necessary expertise. We gathered together a representative group of about ten maps in a single location and asked conservators from three leading firms to submit treatment recommendations and cost estimates on each of the maps. We had given each of the conservators a copy of our draft specifications, and John Dean and I were present to answer questions and discuss specific conservation problems.

The results of this procedure were revealing. We seem to have done a fairly good job of communicating our requirements. The treatments recommended by all three conservators were similar. But, in spite of this, there was a large disparity in the cost estimates. The highest estimates averaged more than twice the lowest, with the intermediate bidder falling about half-way between the two extremes. The successful bidder was Don Etherington of Information Conservation, Inc. Mr. Etherington carried out all of the conservation work for our project, and his work was found satisfactory by all of the participants. To avoid tarnishing Mr. Etherington’s reputation as an exacting craftsman, I should reiterate that in spite of our emphasis on “mass production,” all of the work he did required considerable skill, and a portion of it was extremely difficult, involving such delicate procedures as

Fig. 3. Map of Brooklyn waterfront is typical of many maps included in the project. Highly fragile and acidic, map was split on several folds with some loss of paper. Map was deacidified, mended, and encapsulated. Without treatment map would have been unusable and have eventually turned into brown confetti.
removing highly fragmented and varnish-coated maps from cloth backings and remounting several hundred pieces on Japanese paper. Except in certain marginal cases, we avoided sacrificing quality to obtain quantity. What was important from our point of view was Mr. Etherington’s ability to combine high quality work with large volume at a reasonable cost.

It is interesting to speculate on, but difficult to ascertain, the reasons for the large discrepancies in the cost estimates. In the final analysis, the differences have to be tied in to labor costs, which make up the bulk of the expense in preservation work. Part of the spread in the estimates may be a result of regional differences in labor costs. On the basis of talking with conservators, I also have the impression that some conservators are more willing or able than others to utilize less highly skilled technicians to carry out the more routine aspects of conservation. It is possible that certain labor-intensive procedures, such as washing, would have been carried out more frequently by other conservators. And it is also possible that some conservators have simply become set in their ways—that their commitment to a particular conservation ethos has prevented them from seeking innovative ways to reduce costs while at the same time maintaining quality. Whatever the exact combination of reasons, our experience shows the value of soliciting bids for this kind of work. And it also underlines the importance of knowing in advance what kind of work you want to have done, and of putting your requirements in writing.

All in all, we were pleased with the results of our project. Although we accomplished our goal of preserving over 2,000 maps in one year, the scale of the project imposed some strain on both the participants and the conservator. I would suggest that anyone attempting such a large-scale project in the future consider preserving a somewhat smaller number of maps in the same time period. Most of the participating libraries were sufficiently enthusiastic about the project to apply for a continuation for next year.

Our new grant proposal was successful, and in the coming months we will be spending some $90,000 to preserve the most important maps and atlases of New York State not covered by the previous grant. Our ultimate goal is to preserve and catalog at least one copy of every historically significant New York State map and atlas in our libraries.

And it is also possible that some conservators have simply become set in their ways . . .

David Y. Allen is map librarian at the State University of New York at Stony Brook (Stony Brook, NY 11794-3331). This is a revision of a paper he presented at the MAGERT annual conference, June 1989. The MS submitted January 1990.

NOTES

(1) For an overview of the map preservation situation see Mary Lynette Larsgaard, Map Librarianship: An Introduction, 2nd ed. (Littleton, Colorado: Libraries Unlimited, 1987), 163-97. Larsgaard’s work contains references to most of the relevant literature on the subject.

(2) We were, however, able to build upon the specifications drawn up by the Library of Congress Preservation Office for atlases entitled County Atlas Project: Manual of Procedures and Materials Specifications (1983). This work includes a useful discussion of encapsulation and deacidification options and procedures.

NEW YORK HISTORIC MAP PRESERVATION PROJECT
Conservation Guidelines and Specifications

The maps described in the original program application to New York State represent a variety of conservation challenges. The following guidelines and specifications are designed to establish a common understanding among librarians and conservators about the general nature of the project, stipulations on the forms of treatment, and mutually acceptable levels of expectation. It is not intended to be a manual of treatments covering every eventuality.
Condition

Unlike the county atlas project, the maps are in a medley of sizes, types, formats, and condition. The sizes range from quite small folded road maps to large mounted wall maps. Many have been repaired with a variety of tapes, paper strips, and adhesive types. Some are mounted, usually on woven fabric, and in some cases, the adhesive has caused uneven staining. In many cases, the surfaces are soiled and the paper in poor condition.

The maps have been stored in a number of ways, usually depending upon size. The larger maps may have been rolled (with resultant damage to the roll ends and leaving some crushed creasing), or multi-folded (often leaving tears and fold-breaks). Large wall maps are most often in the worst condition, largely because of handling and storage practices, but also because of shellac or varnish coating which, while it has protected the surface, has caused some discoloration especially when absorbed by soft paper. The surface of many wall maps is badly fragmented because of constant rolling and unrolling and the shellac or varnish has helped to prevent flaking.

Some of the folded maps are dissected and fabric-mounted, the fabric folds varying in width to accommodate bulk. Many of these folded maps are mounted into a case or portfolio by one section glued or pasted solid onto a cover board.

Treatment

Because of the diversity of map forms and conditions, it is not possible to specify every type of treatment and combination of treatments. Moreover, different librarians may have different requirements depending upon their scale of priorities. An appropriate approach for all but the most rare and valuable maps, is essentially pragmatic, aimed at rendering maps more usable, easier to store, and more stable. Purely cosmetic treatment does not seem as appropriate for maps as it is for art-on-paper. Thus, for example, most staining should not be removed unless potentially damaging or seriously obscuring information. Fabric backing and shellac or varnish should generally not be removed as a matter of routine, as unnecessary damage and map loss can occur with even the most careful treatment. All treatments involving wetting maps with water or solvents should be preceded by appropriate solubility testing. The treatments described assume flat storage as this is the most stable, secure, and least damaging method of storage. In the case of oversize or wall maps, it is sometimes preferable to dissect the maps in order to provide stable storage rather than maintain them in a rolled format subject to damage in storage and use. Alternatives to dissection include: folded encapsulation (i.e., usually a single fold map encapsulated to form a folder-like unit); hanging encapsulation (i.e., encapsulated with a strengthening strip and grommets to permit vertical storage).

Flattening

Maps which have been folded or rolled will need to be flattened to reduce the creases and curl. This should be done by dampening the paper by fine water spray, damp blotting paper, or humidification, and drying between blotting paper and felts under a weight.

Maps which are folded and mounted into a case or portfolio, may have the attached map section removed from the cover board along with any other printed matter. The map should be flattened, as described above, treated, and encapsulated with the previously mounted section in place. If the owning library requests it, the cover and printed matter may be returned as removed, the cover fabric and printed matter encapsulated as a separate item, or placed in the same encapsulation as the map. If the latter, the map should be separated from the cover fabric and printed matter by a sheet of Permalife bond paper or its equivalent. The decision on most appropriate format for jackets and covers should be made by each library.

Dry Cleaning

Maps which are soiled should be dry cleaned using appropriate erasers (such as Eberhard Faber kneaded eraser 1222-1225) or draft clean powders (such as Dietzgen Skum-X drawing cleaner). Judgement should be exercised when erasable notations are discovered, and librarians of the owning institutions should be consulted if questions arise. It is most important that soil and eraser particles be thoroughly removed before further treatment.

Tape and Repair Removal

Pressure-sensitive tape and repair papers and tissues should generally be removed. The removal techniques will naturally be dependant upon the type of tape or repair, but the objective is to remove repairs and adhesive residues without color or image loss. Pressure-sensitive tape has been satisfactorily removed dry (by carefully peeling the tape), with warm air (softening the adhesive and peeling), and with various solvents (usually combinations of toluene, hexane, acetone). Paper repairs can often be removed by dampening with water or by “floating.” In some cases however, paper tape does not pose a threat to the map, and does not obscure information, thus it may not be necessary to remove it. In every case, map fragments detached by repair-removal should be carefully tagged and set aside for reattachment. The conservator should use his judgement in the removal of labels, and should confer with the librarian if in doubt. In cases where labels function as identification or
marks of ownership, the librarian should devise an alternative form of marking prior to shipping for treatment.

**Repair**

Repair methods require the use of L.C. heat-set tissue or Japanese paper with wheat or rice starch paste, the choice depending upon the condition of the paper or the forms of other treatment. Generally, because of the use of encapsulation, repair should be limited to the filling of significant losses and to the attachment of fragments and splits.

If mounting is necessary (because of large numbers of losses or fragments), it should be done onto Japanese paper. Mounted maps should still be encapsulated.

**Alkalization/Deacidification**

Unless aqueous treatment is specified, deacidification should be by solvent spray (Wei-T’o soft spray system for example) on the verso of the map or on the recto of the map if mounted on fabric which is not to be removed. In this case, it is important that calcium deposits not be visible. If aqueous treatment is necessary (when, for example, a map must be washed), deacidification should be aqueous. A surface pH of 8.5 (minimum) and 9.5 (maximum) with alkaline reserve of 1.0 to 1.5 percent is the primary objective of this treatment. If deacidification is considered unsuitable for some maps because of the possibility of crucial color changes, an alkaline environment may be created within the encapsulation by the insertion of alkaline papers behind the maps. Blueprints in particular should not be deacidified or otherwise chemically treated, but may be strengthened with Japanese tissue prior to encapsulation if fragility demands.

**Encapsulation**

Encapsulation should be accomplished by the ultrasonic welding of 3 mil polyester film, such as Melinex 516 (by Imperial Chemical Industries available from Transilwrap). It is most important that welds hold consistently and that there be no over-welding. Some libraries may wish to specify a 4 mil polyester film for unusually heavy or large maps. Maps with extremely uneven surfaces and/or unstable media may not be suitable for encapsulation; in these cases, the librarian should confer directly with the conservator.

**Documentation**

Unless extensive and complex treatment is performed, documentation should be limited to a short statement on my chemical treatment, date of treatment, and conservator. This should be printed on a small Permalife bond paper label which should be placed without adhesive attachment at the verso of the map under the polyester film. A typical (and probably generic) label might be:

*Acme Conservation Studios Inc
Deacidified on the verso by use of the Wei T’o Soft Spray System.
November 1988.*

John F. Dean
Revised Jan. 25, 1990

John F. Dean is Conservation Librarian at Cornell University Libraries.
CONSERVATION AND RESTORATION OF MAPS

- Removal of old cloth linings and surface varnish
- Stain reduction
- Washing, deacidifying, drying, and flattening
- Remounting the map on new paper and cloth linings
- Encapsulation or rehanging the map on old rods

Archival Conservation Center
8225 Daly Road, Cincinnati, Ohio 45231
(513) 521-9858
Established 1978

Coming Soon!
David A. Cobb, editor

The expanded and updated second edition of the Guide to U.S. Map Resources provides librarians and researchers with the most current, comprehensive information now available on the map collections in the United States.

The second edition features three new indexes, providing access by collection strengths, names of key staff, and institution and library names. The collection-strengths index, based on the LC G "map classification" headings, allows users to identify collection specialization by subject, area, and by special collection names. The personal name and institution indexes are made more useful by the repetition of key information within index entries. For example, entries in the personal name index include each individual's institution, phone number, electronic mail, and address, in addition to the entry number where complete information can be found in the main listing.

The number of collections identified in the second edition of Guide to U.S. Map Resources has increased to more than 950. The scope of the new edition continues to be defined as libraries in the United States with map collections of at least 500 items. In addition, certain collections of regional importance have been included though they hold fewer than 500 items.

David A. Cobb is the Map and Geography Librarian at the University of Illinois at Urbana-Champaign and a member of the MERIDIAN Publications Staff.

David A. Cobb, editor
$65.00cl. Approx. 496p. ISBN 0-8389-0547-1 August 1990
Providing access to geographic information is a problem in libraries, museums, and other environments. The only apparent solution is for traditional index maps and place name subject headings to be largely replaced by a map-based computerized system.

This paper presents the attributes of such a system. It also reviews the relevant progress of the ImageQuery software developed at the University of California at Berkeley. The paper concludes by discussing the steps needed to continue development of a full featured system.

Introduction

Providing access to geographic information is a problem in libraries. This paper examines the nature of the problem, the need for a solution, the features of a probable solution, accomplishments to date, and future prospects. The paper discusses the problems with traditional geographic cataloging and why a better system is urgently needed. The report focuses on the attributes of a hypothetical computerized system which can satisfy the complex cataloging and accessing needs for geographic information. It then describes the progress which has been made toward attaining those attributes. The article concludes by outlining the steps involved in planning, organizing, and coordinating the future effort to develop a full featured system.

Problems with Traditional Cataloging

Traditional geographic cataloging methods are very limited. Map index sheets rapidly become cluttered and unreadable. Some materials cannot be readily indexed onto maps because of difficulties with locating relevant points and differences in map projections. Furthermore, the current deluge of digital and film imagery makes its indexing by traditional methods extremely tedious and time consuming, if not impossible (Carver 1988).

The principal traditional library approach to geographic cataloging has been by place names. Subject cataloging by place names is inadequate in many ways (Mischo 1982; Mulvihill and Eaglesfield 1987). Unless a publication is about a named place with well defined boundaries, it cannot be accurately indexed with a place name. Even then, the name must have a certain level of recognition before it is suitable as an indexing term. There are identical place names throughout the world and place names frequently change. Variant word spellings, especially in different languages, is a problem. The meaning of a place name may change while the name stays the same. Moreover, a name such as “The South” can mean various places to different people.

Cataloging by authorized Library of Congress place names is complicated and inconsistent (Brinker 1962; ALA 1983). The complex rules and exclusive set of authorized names has the end result of confusing the subject catalog user. All geographic cataloging has continued to be revised on an irregular basis (Perreault 1982; IGU 1964). And traditional placement of geographic headings as secondary to topical subject headings has made access to regional information using card, bound or filmed catalogs awkward at best. Many library users...
simply have no concept that such an arrangement exists.

The advent of computerized catalogs has overcome some of the accessing difficulty. Used properly, random access can eliminate the disadvantages of secondary positioning of geographical headings. However, with the increased sophistication comes new problems: difficulties with too much information and too many possibly appropriate place names. For example, selecting citations concerned with any area of South America from a large database is a vexing job. While South America is an obvious search term, it is also necessary to specify each country and larger and smaller regions within South America in English as well as other languages.

Several organizations are developing geographic thesauri which provide guidance to authorized geographic terms and spellings (Tahirkheli 1988). More advanced systems include a time scale which sets the temporal relevance of certain place names, especially important for political place names. While addressing the problem of what terms a patron or cataloger should use, these catalogs are still restricted to words, which when it comes to geography, are frequently subject to different interpretations.

Why a Better System is Needed

Underlying the need for better geographical information management is its burgeoning volume (Carver 1988). Having even a few digital geographical files without a suitable index is difficult enough to manage, but the new earth resources satellites will inundate existing facilities unless provisions are made for sorting and indexing the huge volumes of information the satellites will transmit. Even the volume of traditional media is growing rapidly. As new editions of maps, thousands of new flight lines of aerial photographs, and gigabytes of environmental data are accumulated, it becomes increasingly difficult for the librarian to organize and for the user to find these materials.

A second driving force for better geographic information management is the increasing need for integrated geographic information (Sargent and Matti 1988). Environmental impact studies require historical and ecological analyses of regions. Development plans need consideration of natural and cultural factors. Environmental battles revolve around site-specific attributes. And modern scientific research frequently requires a more integrated approach, looking at the distributions of various environmental components, such as a soil type or an insect species.

A corollary to this demand is the existence of a wide range of geographic materials which need to be integrated into the retrieval system despite different formats and methods of storage. These media include such diverse materials as space imagery; digital terrain and attribute tapes; streamflow, climatic, bore hole, transect, study plot, water depth, and pollution data; maps; aerial photographs; maps in books and journals; landscape art and photography; regional studies; and botanical, archaeological, geological, and paleontological specimen collection sites.

A third influence is a recognition that when manipulated by a computer, geographic information can be remarkably informative. Instantaneous graphics and maps, statistical analyses, coordinated maps and images, and image processing can be worked together to quickly provide a substantial understanding of a place.

The fourth factor is the increasing need to manage and monitor human activities around the globe. Human activities have extensive and pervasive influences and distant events are often meaningful to persons far removed. Consider an oil spill or nuclear accident far away. Modern media brings the information into our living room and we are concerned. This interest means that we need to readily access information on these distant places.

A fifth factor is that this is an opportunity to further democratize information. Such a system puts information into the hands of people to whom it has traditionally been unavailable. An example is making rare maps available for viewing over a computer system. Most people could not gain access to such
maps without making a special expedition to the appropriate archive and even then access may be denied. Over a computer system such access could be convenient to almost anyone.

Of final importance is the increasing demand to acquire access to collections without having to travel from collection to collection. Computer networks provide fantastic possibilities for access to geographic information of all types regardless of what media it is in or where it is stored. This, of course, is an adjunct to the problem of having to manage a larger volume of information and public concern over distant places and events.

**Beyond Libraries**

The value of referencing geographic information in map-based computerized systems extends far beyond libraries and their patrons. In an effort to provide an understanding of their collections, museums would find it advantageous to selectively show their holdings on various maps and in relation to environmental attributes. Plant, animal, fossil, artifact, rock, and soil distributions could be displayed in a host of logical and intelligible ways. Landscape art has its place on maps. Resource management and planning agencies would benefit from implementing such a system: access to their collections of maps, aerial photographs, land records, resource distribution information, and digital and paper documents would be enhanced. Emergency response agencies could provide improved service with help from such a system. Finally, complementary coordinated software for image processing can provide new opportunities for document conservation and for museum patrons to make use of the holdings (Besser 1987a, 1987b).

**Computers for Geographic Information**

Computers provide an opportunity to provide advanced tools for cataloging and accessing geographic information. A computer can display high resolution reference maps, which, in turn, can serve as a base map for showing the geographic region applicable to each library holding. These regions are indicated with a footprint which replaces the place name. A computer can display a wide range of base reference maps, provide overlays of all shapes and sizes for the footprints, show the applicable textual citation, and, if relevant, link each citation to an image. The citations can be text searched using full database Boolean functions and concurrently be linked to map-based geographical search functions. For those citations which are for images, such as photographs, it is possible to provide small low resolution digital images that can be used for browsing among several images (of photographs) at once. High resolution digital images can also be available for image processing (Besser 1987a, 1987b).

Such a system is distinctly different from Geographic Information Systems (GIS). The primary difference is that we are concerned with providing access to geographic information available in all types of media. Our concern is essentially a catalog. As such, the catalog is a superset of the GIS’s purpose, which is to display and manipulate digital geographic information for a specific site. The fact that a catalog system may allow one to select and access the data, and then manipulate it, using graphics, mapping, image processing or GIS software, is simply an aspect of its modularity. The manipulations are subordinate to the catalog’s basic access function.

A hypothetical computerized catalog system for geographic information could work by using multiple concurrently functioning display windows to show text, maps, footprints, and images for each citation. Such a system might work as follows for a library patron. First the searcher chooses an area in the world about which information is desired. This could be done through place names or by selecting a region on a displayed map. Either way, one would end up with a map displayed for the exact region of interest. This map could be in full color and may even be of the quality of a topographic map. Once a region is picked, a textual query screen is made...
available and a search based on words can be made. This search may specify the type of documents desired, such as maps or landscape photographs or environmental data. It also can include any of the normal search parameters such as date, author, title or topical subject heading.

The search results are shown as a list, generally in spreadsheet format. One could arrange the list to see the desired fields, such as date and title, on the display. Concurrently, footprints for each citation could be shown on the reference map displayed in another window, see Figure 1 for an example. If some of the citations are to image documents, such as photographs, then another window may be opened to show small snapshots of the images. A fourth window may also be available for showing the complete bibliographic citation for any selected document. Clicking with a mouse on any item in any window will automatically show the related parts in the adjacent windows. For example, when one chooses an interesting-looking image, the textual spreadsheet and full citations are highlighted, and the footprint is shown on the reference base map, see Figure 2. One could also call up a high resolution image and do image processing on it, see Figure 3.

Selected items may then be referred to a save list for future use. That use may include printing out a list of citations, printing out a map with a display of footprints, calling up a high resolution version of an image for further study or image processing, or sending the high resolution images to a digital storage device to use with a video...
Fig. 2. Screen display showing the linkage between a spreadsheet citation, full citation, footprint, and an image.

In many cases, it provides access to the documents themselves and facilitates manipulation of this information.

Projector or as a land surface depiction in a GIS.

The basic capabilities for such systems have existed for many years. However, actual development and implementation of such systems has been slow. Simplistic systems are fairly common, but the integrated system which provides the professional attributes of speed, large database capacity, high resolution, adaptability to different media and collections, color, flexibility, networkability, and the ability to operate on different computers is only in prototype form.

Attributes of a High Quality System

The ideal geographic computer system provides for administering and cataloging the holdings of libraries, museums, agencies, organizations, and individuals. It provides patron access to the citations for the holdings of geographical and other materials by using sophisticated integrated database, map, GIS, and image software. In many cases, it provides access to the documents themselves and facilitates manipulation of this information. The system gives output in a wide range of media and formats to accommodate patron need.

A professional system requires detailed consideration of many potential features. To this end, the following discussion outlines the attributes which provide the basis for designing a more advanced system which covers the full spectrum of potential uses. While no system can have all features from the outset, all systems should be developed with the idea of eventual modular growth into these different functions. Only in this way can obsolescence be avoided.
Fig. 3. Screen display of a high resolution image with image processing tools for zooming, color manipulation, and brightness adjustment.

A system must be adaptable. Libraries, museums, herbaria, special collections, resource management agencies, conservation organizations, corporations, large landholders and individuals: all these potential user groups have their own special needs for information. Their cataloging capabilities and needs vary widely: the depth and detail of cataloging at a major academic library will differ widely from that at a national park museum. Modern libraries require some provision for the display of Library of Congress records in MARC format. Similarly, different media require cataloging in radically different ways. For example, a core from a bore hole has different attributes than a map; the few things they have in common are the essential themes of places in time and space. Beyond basic shared fields, it must be within the realm of the local cataloger to determine how complex and detailed records are to be.

A system needs to be operational on different computer platforms. Expectations that everyone will buy the same hardware are not realistic. Major investments have been made and must be accommodated if possible. Currently the X-windows protocol serves as an interface to a variety of different machines. If current software is written to X-windows protocol, these machines will be able to run the program. There will be other protocol options in the future.

The software needs modular construction. When it consists of largely standalone units, new functional dimensions can be added without rewriting the entire catalog program. New computer programs from commercial and public
Networking capability is another key.

As modern libraries become increasingly online, so the demand to share catalogs and resources increases. It is no longer feasible to compile central stores of information and expect users to come to one location for access to the catalog. Users demand networked access from their local libraries or even their offices or homes. The librarians or curators need to manage their own collections, and update and store their records locally. Therefore the network needs to provide for access to remote CD-ROMs, optical disks, and hard disks. Transmission of images requires an extremely high rate of data transfer. For the near future, a combination of locally held basic information (such as reference base maps) and networked materials (such as small images, text, or occasional high resolution images), is probably the most feasible.

The computer hardware must be robust. A high speed processor is needed and the software needs to take full advantage of that. Additional specialized processors may be needed for adjunct programs such as image processing. Adequate RAM is needed for handling large images and multiple windows.

To perform the complex display tasks, multiple concurrently-functioning windows are necessary. Images, footprints, and textual information displayed in different windows need to be linked and function together automatically.

The screen needs to be large in order to accommodate multiple windows and substantial map and image displays. A color display is highly desirable especially for maps and images but is useful for text as well (Cribbs 1987). While an 8-bit display (allowing 256 colors) is often adequate, a 32-bit display (allowing all colors and an independent overlay) is preferable. In addition, the screen needs to be big enough to display multiple windows and still have adequate resolution. For example, even with 80 picture elements (pixels) per inch, a topographic map needs to be enlarged to at least 150 percent to prevent lines and characters from being lost; this uses a lot of screen space.

Computer users are becoming increasingly sophisticated in their demands for quality user interfaces. Software which is awkward to use, confusing, inconsistent, tedious, slow, circuitous, or otherwise dysfunctional is getting to be unacceptable. User-friendly software includes a well-integrated use of a mouse, clear and consistent menus, easy to read fonts, logical arrangement, online help, and intuitive command sequences.

A part of making the system user-friendly is providing tools for use on the screen. When maps are displayed, a map scale, north arrow, and measuring device should be available on the screen. A mouse driven "map wheel" for measuring along curved lines and a planimeter for measuring areas are desirable.

Another appropriate feature is an online authority list for each database field with automatic copy-paste into the search command. Complementary to this would be a subject heading thesaurus which guides the user to proper authorized search terms. The software should gently coerce the user into proper search syntax. It is also useful to have an ability to automatically prioritize search results (such as in chronological order).

A cataloger needs the additional functions of being able to easily add and edit the database contents. To be usable in the library, museum, or agency setting, any system must provide convenient tools for the cataloger. While text
databases and scanned images can frequently be compiled on other machines and subsequently imported, all cataloging should be possible directly on the computer. One critical feature is to be able to define a new citation’s geographic footprint on the screen and with a simple mouse click, link the image, citation, and footprint (and its automatically created digital coordinate files) together. The system must be easy to update and amend and not require the excessive use of peripheral equipment or external finding aids. Imported data formats must be readily translatable to match the system’s requirements. This should be as automated as possible. Of course foreign character diacritics should be fully implemented.

Catalogers need one very special type of ancillary database: a comprehensive place name listing with appropriate footprint coordinates. Much geographical information will become available with preexisting place name information. Whenever it is suitable, it should be utilized. The cataloger needs a database of place names which will allow their display for cataloging purposes. For example, a citation may refer to Kurashiki, Honshu, Japan. If a lookup of Kurashiki in the comprehensive place name database shows only one Kurashiki displayed on Honshu, then one can assign a link from the citation to the predetermined accurate set of coordinates without redefining them. Coordinates may have to be developed in other ways as well. Translations will be required from other standard place designations such as the Universal Transverse Mercator coordinates or from a location based on the Township and Range system (Minkler and Minkler 1988).

Perhaps the most critical tool for the cataloger and user is image processing which allows images to be warped or rubber sheeted to fit other images of known projection and scale. It allows space images, aerial photographs, sketch maps, and other non-planimetric materials to be readjusted to match known scales and projections. They too can then be used as reference images for footprint displays.

Image processing is also needed to allow the cataloger to correct the originally-scanned images, be they reference images or pictures of slides. Cropping, color balance, and brightness are common problems with scanned images. Once they are adjusted they can be saved as permanent images, either for reference images or as citation images.

Image processing offers many tools for the library or museum patron in addition to those above. Similar areas on an aerial photograph can be defined as polygons and then exported as maps to a GIS system. One can also zoom in to take a careful look at an enlarged subregion. Adjusting the colors or brightness of the image can bring out hidden features. Doing annotations on the image can be useful.

The primary advantage of putting all place name and location information in coordinate form is that there is absolutely no ambiguity about the place. Furthermore, its relationship to all other coinciding, overlapping, adjacent, nearby, and distant places is intrinsically developed as one develops the catalog. The citations also can be shown in their geographical relationship to each place name, allowing retrospective assignment of place names to citations. Geographic indexing with coordinates has many potential advantages including virtual elimination of geographically incorrect search results, graphic depiction of the areas, concurrent display of base maps and footprint area, automatic arrangements of citations in user-defined priorities, automatic analysis of areal overlaps, and direct interfacing with GIS.

Geographic information must be maintained in a form which provides independence from any particular base map. Footprint coordinate information must be done in planimetric measure. Since most projection manipulation programs convert the data into longitude and latitude prior to projection warping, it is useful to store the information in this form. Doing so in decimal degrees rather than degrees-minutes-seconds is useful for most people, but the alternative is easily programmable. It is important to be able to view citation footprints individually or
Footprints can be displayed as points, lines, or polygons.

Inputting images requires scanning.

Output from the system should include more than just video images.

Footprints can be displayed as points, lines, or polygons as points, in El Dorado County, California. Unrealistic roaming digital output from the eye turns should include more than just video images: high resolution maps and images, reference images with or without overlaid footprints, guidesheets of multiple browse images, large printed wall displays of maps and images, bibliographies, needs to be able to switch rapidly between different reference images at differing scales. One may wish to show place name or photopoint footprints on top of an aerial photograph at one moment and then on a regional toposgraphic or road map in the next. Some reference images, especially those derived from a GIS, should also be available in a digital line or vector format. Of course having an ability to change the map projections of the base maps, as well as those of the footprints, is essential.

Reference images and maps should be scrollable, allowing panning or roaming throughout their extent. Maps of the same scale should be mosaicked in advance, providing an apparently seamless map to the viewer. The primary reference image at any given moment should concurrently be shown on a small regional map — a location map; this helps keep the user oriented.

Inputting images requires scanning. In order to make a sound choice of scanning technology a thorough understanding of one’s needs for color, resolution, and formats is required. This technology, like several others in innovative systems development, is changing extremely rapidly.

When a library patron is selecting images, she cannot rely only on textual information; it is essential to see the image. A browse feature to concurrently show several small snapshots of images from the collection is thus valuable. Users can make a preliminary selection based on textual and geographical indexing and then see the appropriate images. Versatile software allows the browse images to be individually kept or discarded. It also allows them to be dragged around on the screen and arranged into a slide show order. Ultimately, the final slide show could be exported in a digital form to be used with a video projector.

Output from the system should include more than just video images: high resolution maps and images, reference images with or without overlaid footprints, guidesheets of multiple browse images, large printed wall displays of maps and images, bibliographies,
shelf or collection lists, screen displays, footprint information, and search and display histories are just a sampling of expected exports. Export can be onto a network or to digital tape, floppy disk, hard disk, optical disk, film, paper, photographic paper, or mylar. Appropriate peripherals need be available for handling these materials.

**Current Developments**

Several systems have been designed or built to various levels of performance which provide the basis for reaching the above conclusions regarding desirable system attributes. Among these are the *ImageQuery* software developed by a team including the author into an operational prototype at the University of California at Berkeley; the *DeLorme Mapping System* being developed as a commercial product by DeLorme Mapping of Freeport, Maine; OASIS also developed as a commercial product by Image Understanding Systems in Alameda, California; the *Geo-Referenced Information Network* (GRIN) designed by the Research Libraries Group (RLG) of Mountain View, California (RLG 1989); *Geoindex*, a vector-based system for georeferencing geologic maps used by the U.S. Geological Survey (Fulton 1982); the *Image Selection System* of the National Aeronautics and Space Administration (Myers 1985), and numerous GISs and many HyperCard catalog-like applications.

Simple computerized geographic cataloging systems provide no real world coordinate system for their data; they use the computer's inherent coordinate system. Data is entered based upon the image on the screen which is an x-y system not tied to longitude and latitude. Typically a simple outline base map is displayed on the screen and icons or outlines representing the footprints of holdings are drawn on the display. Normally these are linked to a database. Creations done under HyperCard often have these attributes. Although eminently suitable for a small project or a local area with a narrow topical interest, such systems lack the transferability essential to modern data sharing concepts.

Advanced systems address many of the general systems requirements specified in the previous section. The most library and museum oriented of these is the *ImageQuery* software.

**Berkeley's ImageQuery**

At the University of California at Berkeley, we have been fortunate to have an alliance capable of developing a successful prototype. The project was originally coordinated and supported by the former Assistant Vice Chancellor for Information Systems and Technology, Raymond K. Neff. Subsequently the project brought together campus computer programmers from the Advanced Technology Planning Group, and librarians and academics from the Geography Department Library, the Architecture Slide Library, and the University Art Museum. A common need for creating a visual catalog for images and for geographic cataloging made us a natural group.

This project began with the intent of making the system on a professional standard; it had to begin to address the issues raised above. The Berkeley system addresses many of the criteria successfully. To provide an understanding of the current status of system development it is useful to review the achievements of the Berkeley team. Clearly a solid foundation for further development has been built:

- Development based on a user requirements study
- Adapted to more than one type of collection, different media, and different formats
- Operates on different computer platforms including Sun 3, 4 and SPARCstations; DECstations and VAXstations running Ultrix; Macintosh with A/UX; and IBM RTs and PS 2s under AIX, all through an effective implementation of X-windows
- Modular program with SQL attached Ingres relational database software and image processing
- Operates over TCP/IP network
- Utilizes robust computer hardware with varying levels of RAM

This project began with the intent of making the system on a professional standard...
Such a full featured system is technically and practically feasible.

- Fully implemented use of multiple windows
- Concurrent display of a footprint on a reference map with a browse image, text citation, and a high resolution image
- Developed under UNIX operating system
- Supports 8-bit color and monobit displays
- User friendly with well-integrated use of mouse and menu buttons, logical arrangement, easy-to-read fonts, and intuitive command sequences
- On-line authority list with automatic copy-paste for searches
- Coerced search syntax
- Successful importation of text and image data from multiple sources
- Image processing for color balance, brightness, and limited editing
- Rectangular and point (with direction) footprints
- Different footprints for various media types
- Record fields include information on the original base map used for determining the footprint location
- On screen display of longitude and latitude for any geographic point
- Various scales and types of reference maps
- Storage of geographic footprints independently from maps
- High resolution, color reference maps
- Limited map scrolling
- Conversion of image files between various formats and resolutions including: 24-bit, 8-bit, 1-bit, EGA, Targa, Sun Raster, Eikonix, Postscript, TIFF, and GIF
- Preservation of image integrity despite conversion of images from 24-bit to 8-bit representations
- Image browse allowing many snapshots to be viewed at once
- Postscript printer output
- Extensive cooperation between users and programmers

Over the last three years, versions of the prototype have been demonstrated over 200 times to a wide range of groups including academics, administrators, librarians, vendors, and agencies. The prototype shows that such a full featured system is technically and practically feasible. Widespread interest and a very positive response has been received. Nonetheless a prototype is not capable of withstanding the great demands of a production environment; much remains to be done.

**Planning for Future Systems**

The key to developing an advanced system capable of use in an operational or production mode is having a comprehensive conceptual framework and a practical plan explicitly described in a user requirements study. This analysis should address the salient features and functionality of one’s existing accessing and cataloging system and should ascertain the possible benefits from a new system. The study provides the basis for deriving development priorities and options. User requirements vary with each specific site. The following list spells out the scope of contents for a user requirements study. It is essential to examine:

- the purpose of the project
- the types of media and formats in the collection
- the structure of the data associated with the holdings
- the technological and practical aspects of data entry including scheduling, personnel, and costs
- storage requirements and technological options including hardware and file compression
- the nature of access needs including query structures and information retrieval formats
- parameters for screen displays
- factors in the management of the collection records including cataloger needs
- careful evaluation of potential system features ranked as required, optional, and not required
- prioritizing of required and optional system features
- consideration of output media and formats and related technologies
- needs to manipulate digital files
- the critical path for development including achievement benchmarks
The greatest challenge is obtaining funding

The Future

Development of a dream geographic catalog will be enhanced by numerous concurrent technological developments. Digital portable cameras that store raster images rather than using film are improving (Canon 1988). Couple such a camera with a global positioning system and automatic time and date stamping, and the geographic record for a new photograph is automatically derived when the picture is taken. Other impressive developments include very fast and reliable computer networks, high volume low cost digital storage, cheaper and better central processing units for computers, improved X-windows protocol, cheaper workstations, more extensive and better networking infrastructure, cheaper improved scanners, commercial availability of prescanned high resolution topographic maps, and an ever increasing amount of geographic information in digital form. As these advance, so does the feasibility of the ideal geographic catalog.

Daniel O. Holmes is the Librarian, Department of Geography, University of California at Berkeley 94720. The MS submitted March, 1990.

LITERATURE CITED


BOOK REVIEWS

Historical Atlas of Texas
By A. Ray Stephens and William M. Holmes; Phyllis M. McCaffree, consultant.

This new and needed work is one in a series of historical atlases that the University of Oklahoma Press has been methodically churning out since the mid-1960's. So far there are eight states (Arizona, California, Kansas, Missouri, New Mexico, Oklahoma, Washington), two Indian reservations (Navajo and Zuni), and a region (American West). They are all quarto size. This one measures 12 by 9 inches with all maps black on cream-colored paper.

The 64 maps are arranged in three untitled sections: physical, historical, and contemporary. The first six are physical; the next 42, numbers seven through 48, are purely historical and can be subdivided chronologically into Spanish, Mexican, Texas Republic, and American periods. The last 16, numbers 49 through 64 are of contemporary cultural and political phenomena. There is a page of text opposite each map. A separate "References" section at the end of the atlas has a thorough bibliography for each map and text. There is an index.

The cartography is fairly crisp, although some of the larger and smaller scale maps are less so. A standard county outline base map at 1 inch to 100 miles (2.2 cm to 100 km), or 1:6,336,000, is used for 48 of the 64 plates. Of the remainder, six are smaller scale and the other ten are larger scale regions and detail maps. For some reason the larger and smaller scale maps are not given metric equivalents.

Physically the production is solid. Five signatures are sewn into a firm binding, the hinges hold well, and the paper is long life. The cloth cover is well-finished and the colors are an un-Texanish light mauve with shiny blue letters. The dust cover illustration is attractive and appropriate: the echt-historical Alamo.

Stephens and Holmes hope that the atlas will assist students and scholars from the "professional scholar" to secondary schools (and even to elementary "topical studies"). This is an unusually broad spectrum of users, and the authors generally succeed, although I have some caveats.

The text, though written in an unexciting narrative, is clear and comprehensible. The level of writing is in middle or high school, though the information given can be detailed. The lack of formal pagination causes some confusion. Do the index numbers refer to the map or text? Because the maps are basically subservient illustrations for the text, the references seem to be textual.

Even though the base maps are adequate, the maps of expeditions (8-11, 14, 16-17, 20) might be better served with a physiographic rather than a country outline map. A detail of Texas
from Erwin Raisz’s unsurpassed Landforms of the United States map (Raisz 1957) or A.K. Lobeck’s State of Texas from Physiographic Diagram of the United States (Lobeck 1945) would make an excellent backdrop. This would give a better idea of the terrain that the explorers, soldiers, and settlers traversed. In two cases, Stephens and Holmes do show the importance of the landscape. The Cap Rock Escarpment and two of its canyons are featured in map 31, which delineates the justly ill-fated Texan Santa Fe Expedition, and in map 42, the “Last Days of the Free Indian in Texas.”

A few other small critiques: map 23 of “The Fredonian Republic” seems a little bare without settlements noted. On maps 35 and 41, forts have what appear to be founding dates, but not ending dates. On map 49, it would be useful to know the dates the reservoirs were constructed. The reference map for counties, map 64, has an alphabetical list of all the Texas’ 254 counties, but there is no corresponding cross-reference by number if one does not know the county name. Using county names in the base maps could have helped here. In “References,” map 8, the citation to Carlos Castaneda’s Our Catholic Heritage in Texas, notes the Arno reprint, but later citations (maps 9-12) lack it.

The authors and/or the Press should be congratulated for the use of Spanish diacritics in the text. It is always irritating to see them not used or misused. The only typo in regard to the latter seems to be the circumflex over Gonzales in the map 30 text.

The only other major work of similar type is A Historical Atlas of Texas (Pool 1975). Strangely, it is not cited. Nor is the fifth edition of the Atlas of Texas (Arbingast 1976) which has a batch of historical maps. Also not cited is Imperial Texas (Meining 1969), a classic essay on the cultural geography of the state.

One of the most fascinating maps, number 39, is on the secession vote and points up the contrast between Stephens and Holmes’ atlas and Pool’s work. The authors narrate many of the facts, but fail to mention, as Pool does, that the vote was marked by “... intimidation, intolerance, and violence ...” (Pool 1975, 108). Stephens and Holmes’ comment that slaveholding counties ran up wide margins is generally true; however, some counties with large numbers of slaves voted against secession. Pool’s map includes the slave population county by county, which aids in discovering this ambiguity. The authors do include a table of votes by county. Both maps ably counter the misrepresentation that the South thought in a monolithic manner on the issue of secession.

Sometimes there is plain difference of opinion between the two atlases. For instance, in regard to the Republic of Texas’ exaggerated western boundary claims, Stephens and Holmes state that “The annexation agreement between Texas and the United States in 1854 accepted those boundaries” (p. 34), while Pool remarks that “The most amazing thing ... is that the Texans were able ... to hold on to their vague claims until the compromise settlement of 1850” (Pool 1975, 61).

The only other Texas atlas with a significant historical content is Arbingast’s Atlas of Texas. Of its 179 pages, 27 are on “Culture and History.” It has fascinating maps on courthouses, dialects, church membership, culture patterns, liquor option, illegal stills, voting patterns, and slavery percentages. None of this information is available in the other two atlases.

The major methodological problem is the inclusion of the last grouping of maps, the 16 contemporary topics. This is a large section to devote to non-historical subjects. There are a number of themes that are not covered that could be treated in future editions. For instance, African-Americans (slavery, lynching, settlement and towns), Hispanics and Europeans (settlement and language), early industries (e.g. timber cutting in East Texas), early to recent population distribution, and religious affiliations, just to name a few.

On the other hand, please do not let my carping dissuade collections from buying this work. State historical atlases are not common publications and several
The work is both handsome and functional. The maps themselves are reproduced at full-scale necessitating several to be printed on more than a single sheet. They are in black and white with the quality of reproduction being excellent. Each map has on the face of the fold a complete description. This includes a map history including cartographer, compiler, engraver, publisher, imprint, works in which it was published, a description of any additional notations on the map and the date of acquisition. Also there is a complete description of the physical condition including the type of paper used, dimensions, a statement of condition and notes on watermarks. Finally there is a description of the image itself which indicates the reproduction method, quality of impression, any particular design features, the scale, type of projection used and the latitude and longitude of the map. The maps range from Nicolas Sanson’s *Amerique Septentrionale* (1650) to Father Hennepin’s *New World* (1698). Other map makers included are Pierre Duval, Francois Du Creux, Giovanni Battista Nicolosi, Richard Blome, Sanson Heirs, Giovanni Giacomo De Rossi, William Berry, Alexis-Hubert Jaillot, Vincenzo Maria Coronelli and Chretien Le Clercq.

Assembled with the portfolio of maps is a volume of 108 pages by Kevin Kaufman of the History of Cartography project at the University of Wisconsin. The foreword is by George S. Parker, giving an interesting insight to the collector’s mind. Prefaces are by David Woodward of the University of Wiscon-
The main body of the [volume which accompanies the maps] is the individual description and analysis of each map in the collection. . . . there is an analysis putting the map in its historical-geographical context.

The combination of full-scale reproductions . . . good carto-bibliographic research, a well written and researched accompanying text and toponymic index makes this a welcome addition to the literature.

The maps reproduced on this work are not meant to be a complete cartographic record of the Great Lakes region in the latter half of the seventeenth century. Aside from that it does come close and if one’s appetite needs further satisfaction the bibliography will lead one to more adventures. It is a fine series of reproductions from one very good but not complete collection. It would be rare indeed if all the maps documenting the subject would be held in one private or public collection. What does bind the collection together and broaden it in its historical-cartographic context is the accompanying text. It offers both a general survey of the cartographic history of the region and a detailed description of the Parker’s collection. Both are extremely useful. The overview is clearly written and imparts ample information in a short space. Also it is well foot-noted. The detailed descriptions of the individual maps are extremely useful as many of the features attributed to the specific maps will be true of other copies in other collections. The toponymic indexes are an added bonus. The amount of time taken to produce them will be greatly appreciated by students of Great Lakes history and geography. The only disappointment is the quality of the maps reproduced in the appendix. The reduced scale of many makes them difficult to use, although their reproduction was meant to be illustrative and not a full-scale effort as the Parker’s collection is.

The combination of full-scale reproductions of the Parker collection, good carto-bibliographic research, a well written and researched accompanying text and toponymic index makes this a welcome addition to the literature on the exploration and discovery of the Great Lakes region. It will benefit the serious collector as well as any student of the subject or region, including library reference collections. At $165 it would seem expensive, but compared to the cost of reproduction and research it is a bargain.

Jon L. Walstrom
Map Curator
Minnesota Historical Society
St. Paul, Minnesota

Index to Advertisers

American Library Association........................................36
Archival Conservation Center, Inc.............................36
Richard B. Arkway, Inc........................................36
Art Source International........................................35
Map Link.........................................................55
Martayan Lan..................................................Back cover
I.T. Monckton..................................................Back cover
George Ritzlin..................................................36
New England Cartographics..................................Back cover
A cooperative project of the three Commonwealth Research Universities, Temple University, editors, David J. Cuff, William J. Young; University of Pennsylvania, editor, Edward K. Muller; The Pennsylvania State University, editors, Wilbur Zelinsky, Ronald F. Abler.
ISBN: 0-87722-618-0. $120.00.

Having lived in Pennsylvania for almost twenty years, I thought I knew quite a bit about the state. What I discovered, after reading through the new Atlas of Pennsylvania, was that although I knew a good deal about Philadelphia and somewhat less about the surrounding metropolitan area, I really was rather deficient in my knowledge of the rest of the state. I suppose that might be expected since I live and work in the largest city at one end of a mostly rural state. It does give one pause, though, so I'm quite appreciative and impressed by this new state atlas. I can say at the onset that, despite state chauvinism, I can highly recommend this atlas to the widest possible audience.

Pennsylvania has never really had a comprehensive state atlas. An atlas of selected socioeconomic patterns was published in 1975 (Miller) and two editions of a thematic atlas of the state have appeared (Rizza, 1975, 1982). This new atlas is the first attempt to portray the extensive diversity of the Keystone State through maps, charts, diagrams, drawings, text, tables and other images.

A decade in preparation, the atlas is a cooperative venture of the three Commonwealth research universities: Temple, Pittsburgh and Penn State. It was produced by the Temple University Press.

The Atlas of Pennsylvania is a "coffee table" size book measuring 13 by 15 inches and weighing in at a hefty six pounds. Its hardcover binding is quite sturdy and should hold up through repeated and extended use. When open, the pages lie flat, making even the two page maps easy to read.

Following an introductory essay, "The Pennsylvania Mosaic," the editors have arranged the atlas into four broad subject areas: land and resources, Pennsylvania's past, human patterns and economic activity. These categories are, in turn, divided into numerous specific areas discussing aspects of the main divisions. As an example, the section on economic activity is broken down into discussions of land use, business and finance, employment, personal income, transportation, etc. Each of these areas is further refined into even more specific categories. Thus, economic activity—energy—coal, oil and gas, electric power and selected renewables.

The four major subject divisions (pp. 1-227) are followed by a twenty-four page section of text, maps and graphics analyzing both Philadelphia and Pittsburgh. Next is a section presenting various reference maps (legislative, judicial and executive districts) and a section on map resources (U.S.G.S. and Pennsylvania government mapping). Following that are eight largescale reference plate maps covering Pennsylvania for use with the 3,200 place-name gazetteer. Next is a listing of recommended readings to supplement the notes throughout the atlas. Following is a three page index.

The final two pages are devoted to state facts and records and a county identification guide. This is a big book, both in size and content.

Each of the four broad subject areas is preceded by an introductory essay and the explanatory text for each subsection is coordinated with the maps on a particular page. So, even though the maps can stand on their own, reference to the text is an easy matter. Both text and maps are contained within a generous border so that none of the material runs into the gutter. The only exception to this are the two-page maps, but since the book lies flat, there is no real loss of material. The great majority of maps are choropleth maps formatted on a standard county boundary base and used to show various ranges (i.e., per capita income). Other approaches used to map quantitative information are dots (i.e., number of dairy farms), scaled circles (i.e.,
persons speaking German at home), columns (i.e., residents in group homes) and cubes (i.e., regionally significant industries). These maps are themselves liberally supplemented with line and bar graphs (i.e., historical natural gas production), pyramids (i.e., age and sex structure) and pie charts (i.e., commercial forest land ownership). Maps are keyed to a notes and sources listing on either the same or the facing page for easy reference.

This is an atlas intended for a broad audience. The amount and variety of information is truly astounding. Where else could you find a map of professional football and baseball "fansheds" (p. 160), the tandem-truck network (p. 187), or "dry" areas (as in liquor) in Pennsylvania (p. 218). Some elementary school children might have trouble interpreting some maps, but certainly readers from high school and college through the governmental agency and researcher level will be quite comfortable with this atlas. Even though many of the sections are written by specialists, the text is very clear and organized.

There are a number of areas for criticism, however. By using gradients of a particular color for a particular choropleth map and key (especially browns and blues), there is sometimes a problem distinguishing color separation, particularly in the key. This problem is overcome with very close scrutiny, but it does detract from easy use in a few cases. Another small problem is the lack of a separate pocket map for county identification that could be placed on the page for easy reference. I certainly don't know all sixty-seven counties in the state and constantly turning to the back of the book is most inconvenient. A final point of criticism (and perhaps the most serious) concerns the index. It seems to me that an atlas of this size deserves an index to match its comprehensiveness. In this case, size seems to be related to a certain inconsistency of criteria for inclusion in the index. Thus, "women in the workforce" has entries under both "women" and "workforce," but maps on "groundwater" requires the reader to make his or her own way to "hydrology." Likewise, "hazardous waste sites" is listed only under "land use, state." These topics deserve their own entry or at the very least a "see" reference. A second inconsistency is the reference to only one of two maps on a subject. Hence, the index refers only to page 225 for a map of scenic rivers in Pennsylvania (scenic rivers only) while neglecting the map on page 71 (scenic rivers along with other state-designated special areas). The serious user would want to know of both maps. A final problem is the omission of maps. The most glaring example of this is the lack of any reference at all in the index to the map of federal Superfund sites (p. 70). The only access point is in the table of contents under "land and resources—environmental overview—threats."

There definitely should be a direct index reference to this map. Overall, though, the index is quite acceptable and will get you where you want to go. There just seems to be an occasional lack of quality control.

Notwithstanding the above criticisms, the Atlas of Pennsylvania is a wonderful piece of work. Its coverage is extremely comprehensive and the maps, graphics and text truly informative. It should be in every map and geography library.

LITERATURE CITED


Rich Boardman
Head, Map Collection
Free Library of Philadelphia
Philadelphia, Pennsylvania
Forthcoming Events

NACIS ANNUAL MEETING 1990

The North American Cartographic Information Society (NACIS) will hold its tenth annual meeting at the Holiday Inn on International Drive in Orlando, Florida, October 24-27, 1990. The Society is a young, interdisciplinary organization whose goal is to promote communication, coordination, and cooperation among the producers, disseminators, curators, and users of cartographic information. The NACIS membership includes professionals from government, academic, and private organizations. The theme of this year’s meeting is “Changing Cartography in the Nineties.” The program will include such topics as cartographic activities in Latin America and Canada, cartographic education, cartographic laboratories, mapping of water resources, cartography and the media, cartographic software, geological mapping, geographic information systems, navigation, atlases, and map library technology. There will be a mixture of contributed papers, keynote speakers, invited papers, panel discussions, poster displays, exhibits, workshops, and field trips. The deadline for submitting abstracts is July 15, 1990. For program and registration information contact Dr. James F. Fryman, Program Chair for NACIS X, Department of Geography, University of Northern Iowa, Cedar Falls, Iowa 50614-0406. Telephone: 319/273-6245 or 319/273-2772.

THE HEBRIDES SURVEYED

Map and chart enthusiasts—not to mention anyone attracted by the lure of the Hebrides—will be delighted to learn of a major exhibition opening in the National Library of Scotland, Edinburgh, on 1 August.

Entitled The Hebrides Surveyed, the exhibition explores the mapping and charting of the Hebridean islands, from the earliest maps based on Ptolemy to modern satellite images. The exhibition is derived from the highly-acclaimed Togail Tir exhibition first shown in the Western Isles in 1989, but takes advantage of the additional facilities and security of the Edinburgh venue of display a more extensive range of rare and intriguing maps and charts. In addition, completely new displays of photographs—from stunning aerial shots to historic pictures—help to capture the atmosphere of the islands, while surveying instruments and map-making tools shed light on the men who first—literally—put the Hebrides on the map. On sale to accompany the exhibition will be a study of the mapping of the Western Isles entitled Togail Tir: Marking Time, edited by Finlay MacLeod.

The Exhibition dates are 1 August to 31 October 1990. For illustrations and further information contact: Dr. Kenneth Gibson, National Library of Scotland, George IV Bridge, Edinburgh, EH1 1EW. Telephone: 031-226 4531.
INFORMATION FOR CONTRIBUTORS

Meridian is published semi-annually by the American Library Association’s Map and Geography Round Table. It contains articles which (1) advance the organization and dissemination of cartographic, geographic, and remote sensing collections and information; and (2) describe and document the major trends and issues in the professional development of cartographic and geographic librarianship in North America.

ALA members and other persons interested in the objectives of the Map and Geography Round Table are invited to submit manuscripts to the Editorial Board for consideration. Full-length manuscripts (generally not exceeding 7,500 words) as well as shorter commentaries, research notes and letters should be addressed to: George F. McCleary, Jr., Department of Geography, University of Kansas, Lawrence, Kansas 66045-2121.

Format. Manuscripts should be submitted either on a 5.25 inch floppy disk with one paper printout, or in three paper copies. Papers should be typewritten or computer-printed, double-spaced on one side only of white 20 x 22 cm. (8.5 x 11 inch) paper with 3 cm. (1 inch) or larger margins on all sides. They should be in the English language. Disks will be returned to the author.

Abstracts. A typewritten, double-spaced abstract of approximately 75 to 100 words summarizing the main points of the paper should accompany each article.

Endnotes. If needed, notes should be used sparingly and should be brief and limited to explaining points in the manuscript. They should not be combined with citations to literature, which are to be in a separate list. Endnotes should be numbered, and should be submitted on a separate sheet, typed double-spaced, and placed at the end of the text under the heading “Notes.”

Literature Cited. All works cited should be listed alphabetically by the first author’s last name in a separate, double-spaced list at the end of the manuscript, following endnotes (if any). Bibliographic information should be in the following order: Author’s last name, first name, second author (first name, last name), date of publication, title of the work, and (in the case of books) the place of publication and publisher, or (in the case of periodicals) the periodical title, volume number, and inclusive paging. For example:


Cite references in the text by giving the author’s last name(s), publication date and any relevant information within parentheses, e.g., (Smith 1988) or (Smith 1988, 299). When an author has more than one publication in a given year add a letter to the date to distinguish them, e.g., (Jones 1988a) (Jones 1988b). All citations should be verified carefully. For further guidance on this and other matters relating to manuscript preparation, refer to The Chicago Manual of Style, 13th ed., University of Chicago Press.

Units of Measure. Authors should ordinarily use the International System (metric); other units may be given in parentheses.

Tables. While each table should be discussed in the manuscript, its meaning should be clear without reference to the text. Each table should be assigned an Arabic number (e.g., Table 1), and be typed double-spaced on a separate sheet at the end of the text. Each should have a clear, concise title and column headings.

Illustrations. Each illustration should be assigned sequential Arabic numbers (e.g., Fig. 1) and should be camera-ready. If an illustration is not easily understood independent of the text, it should be accompanied by a caption, typed double-spaced on a sheet at the end of the manuscript. Photographs should be 8 x 10 inch glossy prints. Illustrations should be professionally prepared. Each photograph or illustration should be capable of legible reduction to 7 x 9 inches. Only black-and-white illustrations can be accepted.

The cost of preparing illustrations is the responsibility of the author. Please protect camera-ready copy when mailing the manuscript. All original, camera-ready art will be returned to the author(s) after publication.

Copyrighted Material. Permission to include copyrighted material in the manuscript should be obtained by the author from the copyright holder. Articles published in Meridian are copyrighted by the American Library Association. Inquiries for reprinting, photocopying, or translating material should be addressed to the Office of Rights and Permissions, American Library Association, 50 E. Huron St., Chicago, IL 60611. All material in Meridian subject to copyright may be photocopied for the noncommercial purpose of scientific or educational advancement granted by Sections 107 and 108 of the Copyright Revision Act of 1976.

Cover Letter. Each manuscript submitted should be accompanied by a letter of transmittal. It should include names, titles, institutional affiliations and telephone numbers of the author(s), and a statement that the material has not been published and is not under consideration for publication elsewhere. Authors should also include copies of any of their papers which are in press or under consideration elsewhere if they include information which would be helpful in evaluating the work submitted to Meridian.

Review of Manuscripts. Manuscripts received are given an initial review by the editor. Those selected for further review are submitted to at least two readers, generally members of the Editorial Board or the panel of consulting editors. Names of authors are removed from the manuscript and thus author name(s) should be on the first page of the manuscript only. Insofar as possible, other items in the manuscript that identify the author are blocked out by the editor prior to submission for formal review. When the review is completed, a process generally taking six to eight weeks, the editor will notify the author. Reviewers consider the style and content of the manuscript, giving weight to organization, writing style, originality, importance to the literature, methodology employed, and the author’s investigative thoroughness.

Publication. If a manuscript is accepted for publication, it will be published generally six to 12 months after acceptance, depending upon the number of accepted manuscripts. It may be edited to conform to the style of the journal, and the editor may recommend changes to the author. The author will have an opportunity to review proofs to insure accuracy. Twenty-five offprints of the article will be supplied without cost to the author.