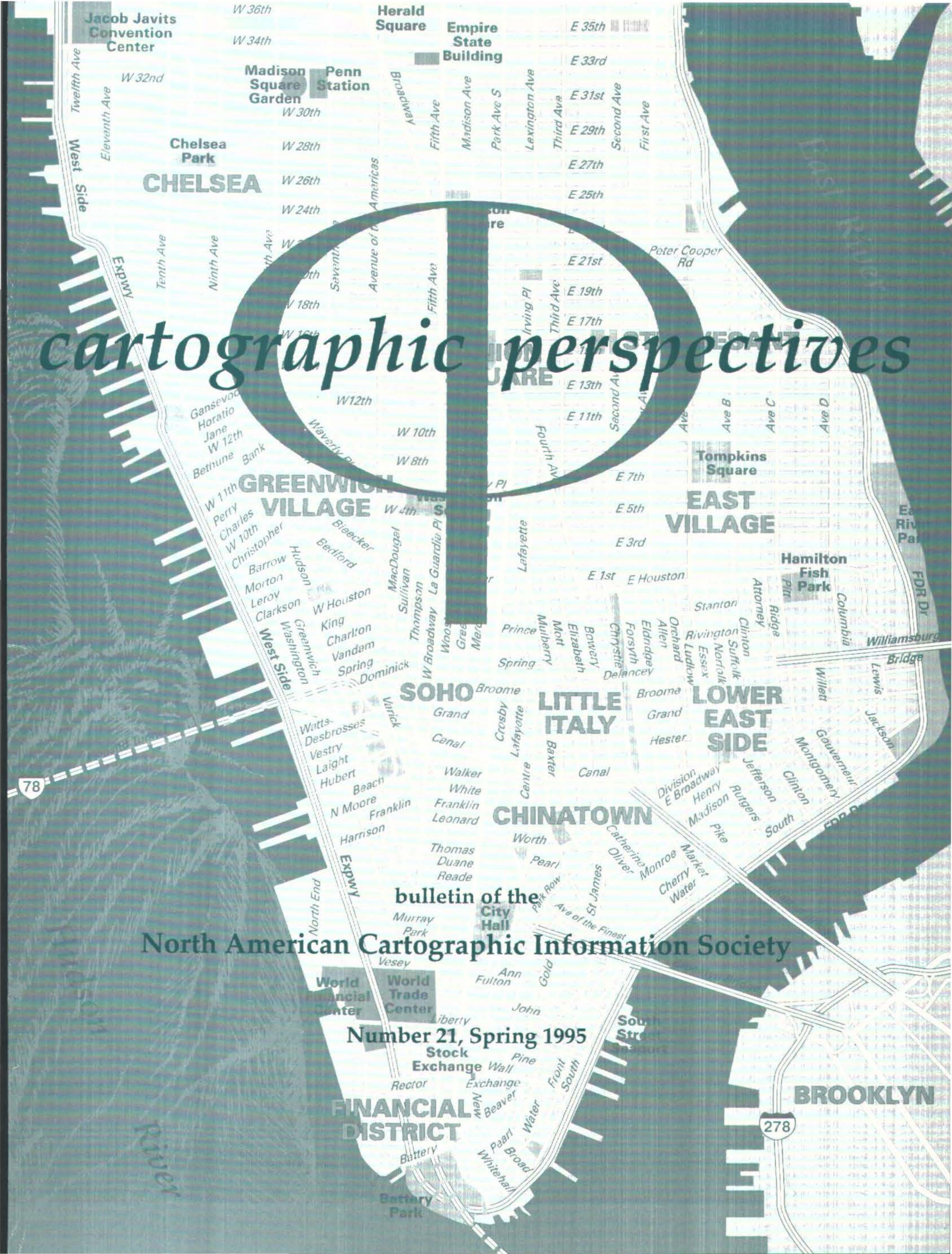
cartographic perspectives

bulletin of the

North American Cartographic Information Society

Number 21, Spring 1995



journal of the North American Cartographic Information Society

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messages

MESSAGE FROM THE EDITOR

As every issue of ***Cartographic Perspectives*** gets ready to go to press, I often find myself thinking "Will members of NACIS find this information useful? Does what we publish make a difference to the cartographic community? Does anyone read ***CP***?" The uncertain answers to these questions are heightened during the week that the issue is actually being printed (when it is out of may hands–out my control). It is only after the issue has been mailed that I have time to reflect on what we, as an organization, contribute to cartography through publishing ***CP***.

I was pleased with what I saw when I did my final read on the galley proofs for this issue. There is an interesting article by Margaret Lanca and John Kirby on verbal and spatial tasks in contour map learning, an insightful article by Peter Gould on source errors in maps, and a series of papers presented at the 1993 Map Libraries in Transition Conference. Although the Map Libraries Transition took place one and a half years ago, the articles from

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ISSN 1048-9085
Cartographic Perspectives
is published triannually

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this conference raise issues that are still so timely that I felt it was important to share them with you. They characterize the dilemmas of dealing with cartographic information in these exciting and sometimes frustrating times of changing technologies.

I am glad that our journal has become a forum, not only for reporting on empirical research, but also for disseminating ideas about the future of our discipline. I would like to see us continue in that role and I encourage all of you to consider submitting articles to our journal.

I would also like to take this opportunity to inform the NACIS membership that I have given notice to our Officers and Board of Directors that I will end my tenure as Editor of ***CP*** in the Spring of 1996. I do this with some regret, however, I also look forward to the day when I can anxiously wait to get my copy of ***CP*** in the mail rather than anxiously wait for a midnight call from the printer. Within the next few months there will be a solicitation for applications and nominations for Editor of the journal. I encourage everyone interested to consider the opportunity.

Sona Karentz Andrews
Editor, ***CP***

about the cover

Eureka Cartography's map of Lower Manhattan was created by Neal Dinoff from Eureka's digital database of American cities using FreeHand 5.0. Street data and points of interest were extracted from the database and rendered in shades of gray, similar in style to tourist information maps which Eureka has produced for a number of clients. The felt-tip pen drawing of the Statue of Liberty was added by scanning a reduced photocopy of the original drawing as a 300dpi line-art TIFF file. The TIFF was then imported into FreeHand, sized, made transparent by clicking the transparent box in FreeHand's inspector and turned 40% gray. A clipping path was used to place the scan inside a clone of the water fill, which was styled as line:none / fill:none.

The Benefits of Verbal and Spatial Tasks in Contour Map Learning

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It has been proposed that the ability to read a map stems from both verbal-analytic and spatial-holistic processes. It has, in turn, been argued that these processes are affected by both spatial ability and gender. This essay presents the results of a study exploring these relationships. Subjects studied a contour map in one of four conditions: a verbal learning group, a spatial learning group, a combined spatial and verbal learning group, and a study-only control group. Contrary to previous reference map learning studies, this study found that the verbal task had no effect upon memory for two-dimensional map information. As predicted, the spatial task did increase memory for three-dimensional map information. In terms of spatial learning instructions, males performed significantly better than females for three-dimensional map information, and females' two-dimensional map memory was better in the non-spatial task groups than in the spatial task groups. There was no effect of spatial ability for map memory. These results suggest limits for the benefit of a verbal learning task in contour map learning.

INTRODUCTION

The cognitive processes involved in map reading and learning are complex and, to date, poorly understood. Previous research has suggested that spatial ability is associated with map reading/learning skills (Kirby and Schofield 1991; Schofield and Kirby 1994; Simutis and Barsam 1983). However, measured spatial ability is a function of subjects' strategies, and in turn have been argued to be associated with gender (Cochran and Wheatley 1989; Allen 1974). A number of studies and theories have pointed to the importance of both verbal and spatial processes in understanding and remembering reference maps (e.g., Kulhavy, Lee, and Caterino 1985). Our purpose in this paper is to examine the effects of verbal and spatial processes, spatial ability, and gender upon performance in contour map reading.

THE ROLE OF SPATIAL AND VERBAL PROCESSING

In attempting to discover the strategies that improve map learning, investigators have researched the effects of verbal and spatial processing of map information. It has been shown that the combination of studying a reference map and a related prose passage describing map features leads to enhanced memory for both the map (Shimron 1978; Schwartz and Phillippe 1991) and the prose passage (Abel and Kulhavy 1989; Gilmartin and Patton 1984; Kulhavy, Stock, Peterson, Pridemore, and Klein 1992). These findings support the dual coding theory proposed by Paivio (1986). The dual coding hypothesis states that spatial information, such as map features, and related discourse are stored in separate knowledge codes that complement the encoding and retrieval of one another. Thus, the combination of related spatial and verbal information increases recall probability of either the spatial stimulus or verbal text due to jointly encoded imaginal and verbal representations.

Although the dual coding hypothesis has been supported for reference maps, dual coding may not be beneficial for all types of maps, especially contour maps. Given that most contour map reading tasks involve inferring the shape of the terrain, a verbal task may not be an appropriate adjunct to contour map learning. Three-dimensional map features may not be easily verbalized, especially without the use of an extensive and highly technical vocabulary and explicit metric information. Lanca (1992) found that multiple spatial-holistic and verbal-analytical strategies were successfully used to solve a contour map cross-section test (generating a cross-section profile of the map terrain from one point of the contour map to another). However, males, who solved the cross-section test by forming three-dimensional mental representations of the contour maps, achieved higher recognition scores for the contour maps than females, who most likely employed a combination of spatial and verbal processes. These results suggest that an additional spatial, not verbal, task may be most beneficial to learning three-dimensional contour map information and that sex differences and spatial ability may be involved in contour map reading.

SPATIAL ABILITY AND MAP LEARNING

It seems plausible that spatial ability is important to contour map learning. Two distinct forms of spatial ability may be involved (e.g., McGee 1979). Spatial relations ability, by which subjects must comprehend the arrangement of elements in a spatial configuration for mental rotation, may be required to retain images of contour map sections and to rotate those images to relate them to other images or objects. In spatial visualization ability, subjects must mentally manipulate spatial stimuli through complex multistep transformations of presented figures; this may be required to transform the two-dimensional map into a three-dimensional image.

Empirical findings suggest that the importance of spatial relations and spatial visualization ability to map reading depends on the map task involved. For example, Schofield and Kirby (1994) found that spatial visualization ability (as measured by the Surface Development test [see Methods section for a description] from the Ekstrom, French, Harman, and Dermen battery [1976]) and verbal ability were good predictors of subjects' ability to locate a position on a contour map, having been shown that position on a three-dimensional model. Card Rotations (see Methods section), a spatial relations measure from the same battery, was not associated with performance on the same test. Lloyd and Steinke (1984) found that spatial relations ability was positively associated with recognition performance for rotated reference maps from previously studied standards. Sholl and Egeth (1982) found neither Cube Comparisons (a spatial relations measure from the Ekstrom, et al. battery) nor the Form Board test (spatial visualization, from the same battery) to be positively related to contour map performance of altitude estimation and terrain analysis. Instead, they found several measures of verbal-analytic ability to be related to performance on the map test. It appears then that both spatial relations and spatial visualization ability can make contributions to contour map learning. The predictors of this association may be the degree of similarity between the spatial ability test and map task and the number of different strategies that can be successfully employed to solve a map task. Verbal ability may also be important to some map tasks.

It appears then that both spatial relations and spatial visualization ability can make contributions to contour map learning.

Spatial ability is in turn related to gender. Many studies have shown males to perform better on some measures of spatial ability than females (for reviews see Linn and Peterson 1985; Maccoby and Jacklin 1974), although the observed differences have been small and exhibited large overlaps (Caplan, MacPherson, and Tobin 1985). Linn and Peterson's (1985) review demonstrated larger sex differences in spatial relations tasks than in spatial visualization tasks. Linn and Peterson also reported greater male advantage for complex three-dimensional mental rotation tasks than for two-dimensional tasks. They suggested that females are more likely than males to use a verbal-analytic strategy in spatial tasks (Allen 1974). While this works well in spatial visualization tasks and moderately well in two-dimensional mental rotation, it functions poorly in three-dimensional mental rotation. A verbal-analytic strategy involves encoding the stimulus as a set of discrete parts, which may be labeled verbally, whereas a holistic or spatial strategy requires that the stimulus be encoded as a single entity. This distinction between verbal-analytic and spatial-holistic strategies (or processes) has been made in a number of studies (e.g., Cooper 1976; Kirby and Lawson 1983; Paivio 1986), including map studies. For example, Galea and Kimura (1993) found that females tend to rely upon landmarks in learning a map, whereas males tend to use metric and directional cues. Presumably, the landmarks are more easily verbalized, and the metric and directional cues support spatial-holistic encoding.

A verbal-analytic strategy involves encoding the stimulus as a set of discrete parts, which may be labeled verbally, whereas a holistic or spatial strategy requires that the stimulus be encoded as a single entity.

Linn and Peterson's conclusions regarding the association between sex differences and spatial ability may also generalize to map tasks. For maps conveying only two-dimensional information, a wide variety of strategies may be successfully employed so that sex differences may not always emerge. Lloyd and Steinke (1984) found that males and females performed equally well in mentally rotating maps to match previously studied maps oriented with north-at-top. Gilmartin and Patton (1984) found a small but significant male advantage in the ability to remember geographic information from studied thematic maps, but this advantage disappeared in a subsequent experiment testing road map reading skills. This may not be the case for maps conveying three-dimensional information, however, where successful map reading strategies may be limited to spatial-holistic processing. Chang and Antes (1987) and Lanca (1992) found that males performed better than females in a topographic map reading task.

PURPOSE AND HYPOTHESES

The purpose of the present study was to investigate the effects of dual spatial-holistic and verbal-analytic processing upon contour map learning. Specifically, the investigation was intended to explore whether spatial and verbal learning tasks can increase memory for two-dimensional and three-dimensional contour map information. Subjects were asked to study a contour map and complete one of three auxiliary tasks (a spatial, verbal, or combined spatial and verbal task). One-fourth of the subjects were assigned to a control condition in which no additional task was required. Following map study, subjects were tested for their memory of two-dimensional and three-dimensional map information.

It was expected that map learning normally elicits spatial-holistic processing in naive subjects, but that this processing is not very sophisticated in nature. Whereas the dual coding hypothesis predicts that verbal-analytic processing will help map learning, this may not be the case in the present study for three-dimensional map information. Two hypotheses were put forth. First, given that contour maps contain the same two-dimensional information (i.e., place locations, and spatial relations) as reference maps, and that map/prose studies have revealed that dual coding improves reference map memory, it was hypothesized that the verbal task would enhance memory for two-dimensional map information. It was assumed that subjects would disregard the irrelevant contour lines when learning two-dimensional map aspects. The verbal task was not expected to increase memory for three-dimensional map information (such as terrain profiles, relative heights and intervisibility) because learning this type of information may require forming a three-dimensional mental representation of the contour map which is difficult given only verbal explanations. Second, it was hypothesized that the spatial task should improve memory for three-dimensional information because it required subjects to mentally visualize the map terrain. Contingent upon the previous two hypotheses being supported, it was believed that the combined spatial and verbal task would produce superior results for both two-dimensional and three-dimensional information.

Previous studies led us to expect that gender and spatial ability would also affect the results. Males should be more adept at spatial-holistic processing, which may emerge as either better memory for three-dimensional spatial information, or better performance when assigned to a spatial task than females. Spatial ability should be positively related to contour map memory; because of the variety of spatial tasks involved, a broadly-based measure of spatial ability was employed, defined by measures of both spatial relations and spatial visualization.

METHOD

Subjects. Subjects for this study were 80 undergraduate Queen's University student volunteers aged 18 to 25. In attempting to equate prior experience with contour map reading, all subjects were given a introductory tutorial about contour maps (further explanation to follow). To further minimize the potential biases due to formal map training, no geography majors or regular contour map users were tested. Subjects completed two tests of spatial ability. The results of which were used to assign them to one of four experimental groups by stratified random assignment (scores on each test were standardized, the two standard scores were averaged, and subjects were rank ordered on the new variable; the top four students were randomly assigned to groups, then the next four, and so on). The purpose of this procedure was to minimize differences in spatial ability between experimental conditions. Subjects were asked to return for a second session, in which the experimental task was administered; 74 subjects (37 females and 37 males) did so. Three subjects were subsequently eliminated from the analyses because their test scores were two standard deviations below the mean.

The two spatial ability tests were Card Rotations and Surface Development . . . Card Rotations . . . requires mental rotation . . .Surface Development is matching the edges . . .

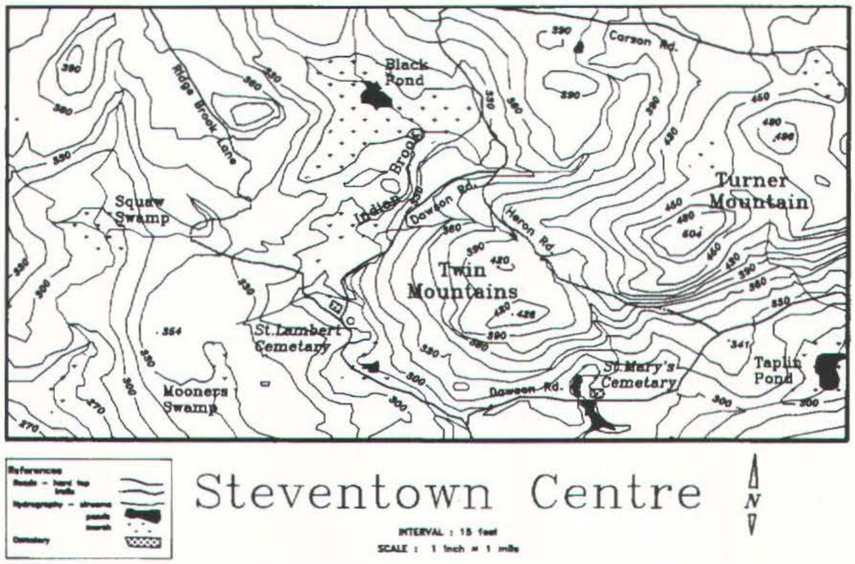
Pre-test Materials. The two spatial ability tests were Card Rotations and Surface Development (both taken from the Kit of Factor-Referenced Cognitive Tests [Ekstrom, et al. 1976]). Card Rotations is a spatial relations test that requires mental rotation of stimulus figures to compare them to a standard figure and decide if a stimulus is a rotation or a mirror image of the standard. Subjects were given three minutes to complete 80 items. Surface Development is a spatial visualization test in which subjects are required to mentally fold stimuli into three-dimensional objects by matching the edges of the unfolded object to those of a given three-dimensional drawing. Subjects were allowed six minutes to complete 30 items. Scores on each of these tests, which were significantly correlated ($r = .49$), were standardized and averaged to form a composite spatial ability measure.

Experimental Conditions and Procedure. Subjects were tested individually or in groups of two to ten. All groups were homogeneous with respect to experimental condition. Subjects were first presented with a brief introduction to contour map reading. Five examples of contour maps (adapted from Simutis and Barsam 1983) were provided in a booklet, each consisting of a simple contour map, a pictorial profile representation of the terrain, and a verbal description of the terrain. The purpose of presenting both pictorial profiles and verbal descriptions was to minimize biasing subjects to use one method of learning over the other. Subjects were allowed to study the booklet for as long as they wished before returning it to the experimenter.

In all conditions, subjects were asked to study a 8 1/2 x 11 inch contour map of a fictitious area labeled Steventown Centre (see Figure 1). The map was presented in color; the only differences between the map used and the version shown in Figure 1 were that rivers and ponds were colored blue, roads red, and marshes green. The map had a contour interval of 15 feet, and 1 inch on the map represented 1 mile. All subjects were informed that the purpose of the task was to learn the map as well as possible and that they would later be tested for their memory of the map. Subjects in the control group were asked only to study the map; no guidance was provided about how to do so. Subjects in the other three groups were asked to study the map and to perform a second task at the same time, using the second task as an aid to learning the map. Subjects in each group were given a total of 10 minutes to study the map and, if appropriate, complete the second task. All subjects then performed a 3 minute filler task (completing a questionnaire). This was followed by the post-test. No time restrictions were imposed upon the completion of the post-test.

Subjects in the spatial group answered five questions while studying the map (see Question box on this page). Each question required subjects to sketch a cross-sectional profile view of the terrain (similar to the ones seen in the introductory maps), as it would be seen from a particular point on the map, facing in a given direction. The points and directions were selected in order to cover most of

Figure 1. A Black-and-White version of the contour map (reduced to 46% of its original size).



Questions

1. *Imagine that you are at the point where Ridge Brook lane becomes a trail. You are observing the landscape to the southeast. Sketch a profile of the terrain that you see.*

2. *Imagine yourself at Squaw Swamp looking north along the river. Draw a profile of the terrain that you see.*

3. *You are at the northernmost tip of Black Pond and you are facing south-east admiring the landscape. Sketch a profile of the terrain.*

4. *Imagine you are at Taplin Pond looking north. Sketch a profile of the terrain that you see.*

5. *Imagine yourself at the highest point of Turner Mountain. Draw a profile of the terrain as you look north-east, then another looking south-west.*

The Prose Passage

Every Labour Day weekend the Cory and the William families reunite for a fishing trip at Black Pond, in the popular Steventown Centre area. Steventown Centre is a very popular retreat area famous for its two main hiking trails: Heron Road trail that cuts through Twin Mountains, and the Ridge Brook Lane trail that is reportedly very scenic.

On the Friday before Labour Day weekend the Corys arrive in Steventown Centre from the north-west along Ridge Brook Lane. They park their car at the point where Ridge Brook Lane becomes a trail, and follow the trail south to St. Lambert's Cemetery. The Cory children, Pete and Susie enjoy this part of the hike to Black Pond the most because the terrain is relatively flat and their mother and father always make a detour to show them Squaw Swamp. Squaw Swamp is especially beautiful because of the three large streams which join in the marshy area and also because the entire swamp is populated by many ducks.

Once the Cory family arrive at St. Lambert Cemetary, they follow Indian Brook until they reach Black Pond. This is the less popular portion of the trip due to the marshy lands which make walking difficult. However, all is forgotten upon arriving at Black Pond. Being the first family to arrive, it is customary that the Corys prepare dinner for the Williams who usually arrive late in the evening.

The Williams family, who are very athletic, always leave on Thursday so that they could spend an extra day windsurfing on Taplin Pond. They arrive in Steventown Centre from the east along Dawson Road eager to begin windsurfing. The high winds from the north from Turner Mountains make Taplin Pond a windsurfing haven. The following day, the Williams get ready for the hike through Twin Mountains towards Black Pond. Beforehand, however, they always drive down Dawson Road to St. Mary's Cemetary whereby they pay respects to Grandma Betty William, leaving flowers by her grave. They drive back up the road to the junction of Heron Road and Dawson Road where they leave their car in an abandoned parking lot. Given the high altitudes of Twin Mountains the hike along the Heron Road trail takes most of the day. Shortly after passing the northern junction of Dawson Road and Heron Road, the Williams always stop for a swim in Indian Brook to cool down and rest for awhile. The children tease their parents about being out of shape, and joke about hiking to the top of Turner Mountain the following year.

By the day's end, the Williams reunite with the Corys at Black Pond. The weekend is filled with much fishing, relaxation, and reminiscing of past experiences.

the map. Sketches were drawn on blank sheets of paper, which were collected before the post-test. It was intended that these cross-sectional sketching questions would require subjects to visualize the terrain in three dimensions. Theoretically, each profile sketch involved translating two-dimensional contour map information to a three-dimensional representation, then mentally rotating the representation from an aerial perspective to a profile perspective. Although subjects were not given feedback on the correctness of their drawings, and the sketches were not assessed for accuracy, the experimenters verified that subjects had drawn profile sketches. It was believed that the exercise itself would enhance terrain shape knowledge, regardless of absolute pictorial accuracy.

Subjects in the verbal group were presented with a prose passage to read while studying the map (see Prose Passage box on this page). The prose passage was designed to reflect a geographically valid verbal description of two families' hiking trip in the area represented by the map. The 500 word narrative described the families' travels through the different areas of the map, making reference to the locations and place names on the map and elaborating upon the nature of the terrain (e.g., river, mountain, marsh). The text was designed to draw attention to important two-dimensional and three-dimensional map elements and provide sequential, narrative associations between elements. Among the locations referred to in the text were those used in the spatial condition as points from which to visualize. Subjects began by studying the map briefly and then reading the passage, referring to the map to locate names of places. Subjects were reminded that they were supposed to study the map in addition to reading the text.

Subjects in the combined group performed a composite of the spatial and verbal tasks while studying the map. They read the same narrative text as the verbal task group and were asked to answer the same five visualization questions as the spatial task group. The questions were embedded meaningfully in the text; for example, when a character in the text reached a given location, subjects were asked to draw the profile that the character would see when facing a given direction.

POST-TEST

The post-test assessed knowledge of two-dimensional and three-dimensional information about the map. In the post-test, a version of the map in which all names, rivers, marshes, ponds, heights and contour lines had been removed was presented. Only roads remained, and the capital letters A to Y. The letters were positioned to correspond to features or locations on the original map. The two-dimensional questions concerned the names and locations of map elements within the two-dimensional plane; these questions included "Which letter indicates the location of Taplin Pond?" and "Which two letters represent the peaks of Turner Mountain ?" The three-dimensional questions addressed the shape of the terrain; questions included "Which letter indicates the highest peak of Twin Mountains?" and "Would one be able to see P from point F?" For four three-dimensional questions, subjects were asked to select a cross-sectional profile which corresponded to that between two given letters on the map (not the same questions as those used in the spatial exercise). The post-test consisted of ten two-dimensional questions and ten three-dimensional questions. Each answer was scored according to a two point scale; one point was awarded if answers were partially correct (e.g., if one of two locations was correct), and two points were awarded if the answer was completely correct.

Although the two-dimensional and three-dimensional questions were randomized and combined into one test, for the purposes of analyses, the questions were separated to form two tests–named the 2-D test and 3-D test. These tests were not significantly related to each other ($r = .18$, n.s.).

RESULTS

Table 1 (page 10) presents the means and standard deviations of the 2-D test and 3-D test for females and males in each group. Contrary to expectation, the addition of a verbal task (combined and verbal groups) did not seem to improve memory for the two-dimensional map information. However, both male and female performance on the 3-D test seemed to be helped by the spatial task. Female performance on the 2-D test seemed to suffer when the spatial task and especially the combined task were conducted.

Contrary to expectation, the addition of a verbal task (combined and verbal groups) did not seem to improve memory for the two-dimensional map information.

A four-way between-subjects multivariate analysis of variance (MANOVA) was conducted in which the independent variables were spatial task (participated or not), verbal task (participated or not), subject gender (male or female), and spatial ability (high or low) (see Tabachnick and Fidell 1989 for one description of this analysis). The dependent variables were the 2-D test and the 3-D test. With the use of Wilk's Lambda criterion, the combined dependent variables yielded a significant effect of spatial task ($F [2, 54] = 4.26$, $p< .05$); the interaction between spatial task and subject gender ($F [2, 54] = 5.01$, $p<.05$); and the interaction of spatial task, verbal task, subject gender, and spatial ability ($F [2, 54] = 3.62$, $p<.05$). To investigate the impact of each effect, a four-way between-subjects analysis of variance (ANOVA) was computed for each dependent variable. Post-hoc comparisons were computed, when appropriate, with Spjøtvoll and Seline's modification of the HSD test. This procedure is recommended when there is a small to moderate imbalance of sample sizes.

Condition	*Sex*	*N*	*2-D Test*		*3-D Test*	
			M	*SD*	*M*	*SD*
Control	Male	9	11.22	2.54	11.11	3.14
	Female	8	12.13	4.94	11.38	2.26
Verbal	Male	9	11.89	3.37	11.33	3.20
	Female	7	12.71	.95	12.14	2.04
Spatial	Male	9	11.11	3.82	13.68	2.87
	Female	10	10.70	3.30	12.50	2.68
Combined	Male	9	13.22	3.83	14.89	1.97
	Female	10	9.90	2.60	11.10	2.23

Table 1: Means and Standard Deviations for Scores on Two-dimensional (2-D) and Three-dimensional (3-D) Spatial Tests for Males and Females within Experimental Conditions.

The additional verbal task, for the verbal and combined groups, did not improve map memory for either 2-D (F [1, 55] = .193, MSe = 1.96, n.s.), or 3-D, (F [1, 55] = .136, MSe = .975, n.s., information; thus, the dual coding hypothesis was not supported. The hypothesis that the spatial task would improve memory for three-dimensional information was supported (F [1, 55] = 5.20, MSe = 7.16, p<.05). Subjects completing the spatial task (those in the spatial and combined groups) (M = 12.97) performed significantly better on the 3-D test than subjects not completing the spatial task (subjects in the control and verbal group) (M = 11.46).

The hypothesis that males would perform better than females on the 3-D test given spatial training was also supported, [F (1, 55) = 7.18, MSe = 7.16, p<.05]. Figure 2 shows that, of the subjects who completed the spatial task, males (M = 14.28) performed significantly better than females (M = 11.8) on the 3-D test. Females (M = 11.73) performed better than males (M = 11.22) in the no spatial task group, but this difference was not significant. The spatial task (M = 14.28) also significantly increased male performance in the 3-D test as compared to the non-spatial task (M = 11.22).

Figure 3 shows that females performed significantly better on the 2-D test in the non-spatial task groups (M = 12.4) than in the spatial task groups (M = 10.33) (F [1, 55] = 4.47, MSe = 10.15, p<.05).

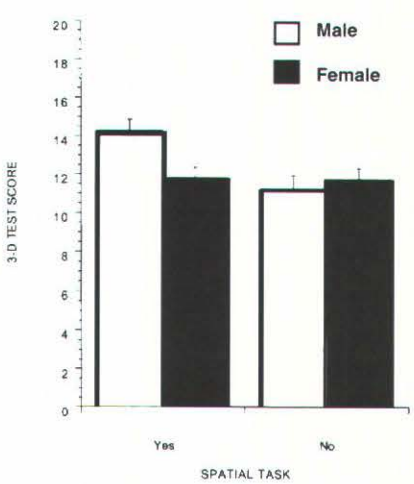


Figure 2. Interaction of spatial task and subject gender on the 3-D test. Bars indicate the standard error of the mean.

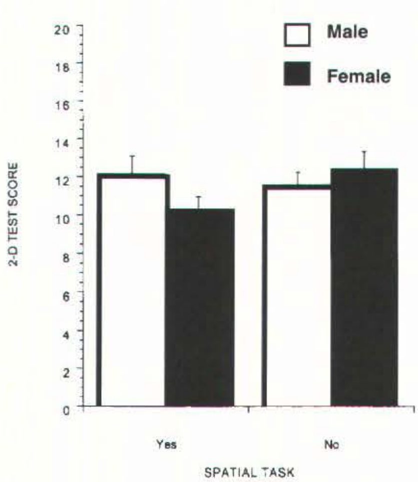


Figure 3. Interaction of spatial task and subject gender on the 2-D test. Bars indicate the standard error of the mean.

Males (M = 12.17) performed better than females (M = 10.3) on the 2-D test, although this difference was not significant. These results indicate that males benefited from the spatial task for subsequent memory of three-dimensional spatial information but not two-dimensional information. The spatial task was detrimental for female performance in the 2-D test and was no help for the 3-D test. There was no main effect for male superiority for either the 2-D or the 3-D test.

There was a significant interaction between spatial task, verbal task, subject gender, and spatial ability for the 2-D test ($F [5, 55] = 2.30$, $MSe = 23.033$, $p<.05$). However, given the small cell sizes ($N = 2 - 6$), these results are largely uninterpretable.

VERBAL AND SPATIAL PROCESSING

We advanced two hypotheses regarding the effects of the verbal and spatial tasks: a) the verbal task should significantly improve learning two-dimensional map information but not three-dimensional map information, and b) the spatial task should significantly improve learning three-dimensional map information. Contrary to the first hypothesis, the verbal task did not increase memory for two-dimensional information. It may be that the two-dimensional information in the prose passage did not adequately complement the two-dimensional map information, which, according to the dual coding hypothesis, prevents subjects from forming associative links between the information in the verbal and spatial codes. Alternatively, memory for the two-dimensional information may have been affected by the presence of the contour lines. Research has shown that the interpretative framework of a map (that is, those aspects such as boundaries, coordinate systems, and grids that allow a viewer to place individual features into a spatial context) can be a critical feature in determining what and how much a person remembers from a map (Kulhavy, Schwartz, and Shaha 1982). In the present case, the contour lines may have been given encoding priority, resulting in the two-dimensional features being overlooked or even distorted in memory.[1]

There is some disagreement in the literature regarding the cognitive process of map information acquisition. One view is that, when studying a road map, the routes and paths are learned first; landmarks and locations are learned subsequently and in relation to the encoded paths (Hart and Moore 1973; Garling, Lindberg, and Nilsson 1981). An extension of this theory might predict that contour information would also take precedence over two-dimensional landmark and location information. The alternative proposal is that primary nodes or reference points such as place locations are encoded first; paths are learned afterwards, forming links among known landmarks (Siegal and White 1975; Golledge 1978). In this case, contour lines describing terrain shape would be learned subsequent to location information. Recently, MacEachren (1992) attempted to distinguish between these two views by manipulating the order of map information subjects viewed while studying a map. Results supported the former view; subjects who learned route information and then landmarks performed better for map knowledge than subjects who received the reverse order of information. Thus, in the present study, if the encoding priority was placed on the three-dimensional elevation information and

There is some disagreement in the literature regarding the cognitive process of map information acquisition

[1] Subjects' encoding of place locations may have also been perceptually distorted by the contour lines. Nelson and Chaiklin (1980), among others, found that people tend to misremember dots closer to enclosing boundaries in simple figures. Bryant and Subbiah (1994) found that people can adopt encoding strategies that bias perception of points towards physical and imagined landmarks.

route information before landmark and location information, the verbal task may not have aided learning of 2-D knowledge because subjects may not have had sufficient time to learn terrain shape as it was not extensively explicated in the prose passage.

As expected, the verbal task did not improve memory for three-dimensional information. This is not surprising given that the prose passage, while mentioning three-dimensional map features, focused on sequential, narrative associations between two-dimensional map elements. The prose passage was meant to reflect a geographically valid verbal description of a contour map, which may not have been appropriate for contour map learning. Perhaps, a more elaborate verbal description of the three-dimensional map features with explicit metric information may be needed to enhance 3-D map information.

The second hypothesis was confirmed. The spatial task significantly improved performance on the 3-D test and not on the 2-D test, suggesting that a complementary spatial exercise is beneficial for learning three-dimensional contour map information.

There was no significant support for the advantage of dual processing (represented by the combined group). It is possible that the combined task was too difficult or too long to adequately complete within the allotted time, resulting in competition for resources at encoding rather than memory facilitation.

THE ROLE OF SPATIAL ABILITY

No interpretable evidence was found that spatial ability was associated with map learning. This is somewhat surprising, especially given the usual characterization of map learning as a spatial task and given the broadly-based measure of spatial ability used in this study. To ensure that the composite measure of spatial ability was not responsible for the lack of effects, we also performed analyses with Card Rotations and Surface Development as separate independent variables. These analyses (not reported here) also failed to show any significant spatial ability main effects or interactions.

It is possible that the absence of spatial ability effects in this study, and the contradictory findings regarding spatial ability and map learning in the literature, are due to variability of subjects' strategies in spatial tasks (e.g., Kyllonen, Lohman, and Snow 1984). Contour map learning may allow several successful approaches, calling upon different mental abilities and producing an unreliable relationship between particular spatial ability measures and performance. This is consistent with the relative success of the female subjects in the present study when they were not forced to perform the spatial task; in other words, the latter may have interfered with their successful strategy.

MALE - FEMALE DIFFERENCES

No general tendency for males to perform better than females was observed; inspection of the means (Table 1, page 10) shows that females attained slightly higher scores in the control and verbal conditions. The lack of an expected overall sex difference on a spatial task is worth noting by itself. As Caplan, et al. (1985) have argued, such effects may be published less often than they are found.

The sex effects attaining significance were the interactions with spatial task. Results indicated that the additional spatial processing, while improving male performance on the 3-D test, had no effect upon female performance and had a detrimental effect for females on the 2-D test. This result may be due to a tendency for females to have less holistic spatial ability, or it may be due to females' preference for verbal (as opposed to spatial-holistic) processing. Ability and preference may also be a function of experience, suggesting that females may require much more extensive training in spatial-holistic processing.

SUMMARY AND CONCLUSION

The purpose of this study was to examine the effects of verbal and spatial processing, spatial ability, and gender upon contour map learning. Contrary to hypotheses derived from dual coding theory, verbal and combined verbal and spatial tasks had little effect upon map memory. Instead, an additional spatial task seems best suited to improve memory for three-dimensional information. Spatial ability was not interpretably related to map memory, but gender was an important factor when subjects were asked to perform an additional spatial task. These results demonstrate limits for the benefit of a verbal learning task and suggest that further spatial training may be most beneficial for contour map learning. Future research should attempt to find out what, if any, verbal descriptions of contour maps can benefit dual processing of contour maps.

REFERENCES

Abel, R. R. and R. W. Kulhavy. 1989. Maps and prose in memory. *Contemporary Educational Psychology*. 14: 33-48.

Allen, M. J. 1974. Sex differences in spatial problem-solving styles. *Perceptual and Motor Skills*. 39: 843-849.

Bryant, D. J. and I. Subbiah. 1994. Subjective landmarks in perception and memory for spatial location. *Canadian Journal of Experimental Psychology*. 48: 119-139.

Caplan, P. J., G. M. MacPherson, and P. Tobin. 1985. Do sex-related differences in spatial abilities exist? *American Psychologist*. 40: 786-799.

Chang, K. and J. R. Antes. 1987. Sex and cultural differences in map reading. *The American Cartographer*. 14: 29-42.

Cochran, K. F. and G. H. Wheatley. 1989. Ability and sex differences in cognitive strategies on spatial tasks. *Journal of General Psychology*. 116: 43-55.

Cooper, L. A. 1976. Individual differences in visual comparison processes. *Perception and Psychophysics*. 19: 433-444.

Ekstrom, R. B., J. W. French, H. H. Harman, and D. Dermen. 1976. *Kit of Factor-Referenced Cognitive Tests*. Princeton, NJ: Educational Testing Service.

Galea, L. and D. Kimura. 1993. Sex differences in route learning. *Personality and Individual Differences*. 14: 53-65.

Garling, T., E. Lindberg, and T. Nilsson. 1981. Memory for the spatial layout of the everyday physical environment: Factors affecting rate of acquisition. *Journal of Environmental Psychology*. 68:177-86.

Gilmartin, P. P. and J. C. Patton. 1984. Comparing the sexes on spatial abilities: Map-use skills. *Annals of the Association of American Geographers*. 74: 605-619.

Golledge, R. G. 1978. Learning about urban environments. In Timing Space and Spacing Time, edited by T. Carlstein, D. Parkes, and N. Thrift, vol. 1, 76-98. London: Edward Arnold.

Hart, R. A. and G. T. Moore. 1973. The development of spatial cognition: A review. In *Image and Environment*, edited by R. M. Downs and D. Stea, 246-88. Chicago: Aldine Publishing.

Kirby, J. R. and M. J. Lawson. 1983. Effects of strategy training upon Progressive Matrices performance. *Contemporary Educational Psychology*. 8: 421-434.

Kirby, J. R. and N. J. Schofield. 1991. Spatial cognition: The case of map comprehension. In *The Teaching of Cognitive Skills*, edited by G. Evans. Hawthorn. Australia: Australian Council for Educational Research.

Kulhavy, R. W., J. B. Lee, and L. C. Caterino. 1985. Conjoint retention of maps and related discourse. *Contemporary Educational Psychology*. 10: 28-37.

Kulhavy, R. W., N. H. Schwartz, and S. H. Shaha. 1982. Interpretative framework and memory for map features. *American Cartographer*. 9:141-147.

Kulhavy, R. W., W. A. Stock, S. E. Peterson, D. R. Pridemore, and J. D. Klein. 1992. Conditions under which maps improve memory for related text: A test of conjoint retention. *Contemporary Educational Psychology*. 17: 56-70.

Kyllonen, D. L., D. F. Lohman, and R. E. Snow. 1984. Effects of aptitude, strategy training, and task facets on spatial task performance. *Journal of Educational Psychology*. 76: 130-145.

Lanca, M. 1992. Sex differences and the role of three-dimensional representation in contour map reading. Master's thesis, University of Western Ontario, London, Ontario, Canada.

Linn, M. C. and A. C. Peterson. 1985. Emergence and characterization of sex differences in spatial ability: A meta-analysis. *Child Development*. 56: 1479-1498.

Lloyd, R. and T. Steinke. 1984. Recognition of disoriented maps: The cognitive process. *The Cartographic Journal*. 71: 55-59.

Maccoby, E. E. and C. N. Jacklin. 1974. The psychology of sex differences. Stanford, CA: Stanford University Press.

MacEachren, A. M. 1992. Application of environmental learning theory to spatial knowledge acquisition from maps. *Annals of the Association of American Geographers*. 12: 41-55.

McGee, M. G. 1979. Human spatial abilities: Psychometric studies and environmental, genetic, hormonal, and neurological influences. *Psychological Bulletin*. 86: 889-918.

Nelson, T. O. and S. Chaiklin. 1980. Immediate memory for spatial location. *Journal of Experimental Psychology: Human Learning and Memory*. 6: 529-545.

Paivio, A. 1986. *Mental representations: A dual coding approach*. New York: Oxford University Press.

Schofield, N. J. and J. R. Kirby. 1994. Position location of topographical maps: Effects of abilities, preferences and instruction. *Cognition and Instruction*. 12: 35-60.

Schwartz, N. H. and A. E. Phillippe. 1991. Individual differences in the retention of maps. *Contemporary Educational Psychology*. 16:171-182.

Shimron, J. 1978. Learning positional information from maps. *The American Cartographer*. 5:9-19.

Sholl, M.J. and H. Egeth. 1982. Cognitive correlates of map-reading ability. *Intelligence*. 6: 215-230.

Siegal, A. W. and S. H. White. 1975. The development of spatial representations of large-scale environments. In *Advances in child development and behavior*, edited by H. W. Reese, 10-55. New York: Academic Press.

Simutis, Z. M. and H. F. Barsam. 1983. Terrain visualization and map reading. In *Spatial orientation: Theory, research, and affiliation*, edited by H. L. Pick and L. P. Acredolo. New York: Plenum.

Tabachnick, B. G. and L. S. Fidell. 1989. *Using Multivariate Statistics*. 2nd ed. NY: Harper and Row Publishers.

AUTHORS' NOTES

This research was supported by a grant from the Faculty of Education, Queen's University, to the second author. Correspondence regarding this article should be addressed to Margaret Lanca, Department of Psychology, 125 Nightingale Hall, Northeastern University, Boston, MA, 02115. The authors would like to thank Dr. Peter Platenius for his insightful comments throughout this project and Dr. David Bryant for the helpful suggestions on an earlier draft of this paper. ❑

Papers From *The Map Library in Transition*

Conference Opening Remarks*

Christopher Baruth

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On a blustery November morning in Chicago in 1988, thirty map librarians and archivists from across the U.S. and Canada, representing eleven different professional organizations, the National Archives of both the United States and Canada, and the Library of Congress assembled in the East Room of the Newberry Library to participate in what came to be called the Congress of Cartographic Information Specialists Associations (CCISA). The aim of the meeting was to explore ways to achieve greater cooperation and better communication within the profession. Before adjourning, the Congress had passed several resolutions. One related to the need for greater intra-professional communication, and another, in recognition of the benefits accruing from the assembly of such a diverse group, proposed holding large international gatherings of cartographic information specialists every few years. The spirit, if not the letter, of the first resolution was subsequently, and very satisfactorily, achieved by the international Internet discussion group, Maps-L, begun by Johnnie Sutherland and Jim Minton. Maps- L, with more than 600 subscribers, provides a forum that not only cuts across the many divisions within our profession but also does so instantaneously. The second resolution has proved more difficult to realize. An attempt to hold a general meeting in Chicago two years ago, in 1991, had to be abandoned, due, in large measure, to lean economic times which made traveling more difficult.

Looking back, it seems difficult to understand that the original Congress found little reason to concern itself with what is now recognized as the digital revolution in cartography.

What did take place, however, was a series of planning meetings that, in a sense, set the stage for this 1993 conference. Looking back, it seems difficult to understand that the original Congress found little reason to concern itself with what is now recognized as the digital revolution in cartography. Our world has changed much since that Wednesday in November, only five years ago, when all the headlines heralded the election of George Bush. The planning meetings in 1991 established the "digital challenge" as the common thread running through the profession, and to meet that challenge, it would clearly be necessary for us to pool our collective resources. Today's meeting is made possible through fortunate circumstances–the CCISA wanted to hold a conference and so did Ralph Ehrenberg and Gary Fitzpatrick. What will occur today and tomorrow is the result of a series of conference calls made during the past year and a half, which included Ralph, Gary, and the CCISA Representatives.

* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

Librarianship, and especially, map librarianship is, I believe, being challenged today as never before. As serial and book prices soar ever higher and budgets are cut or grow by small amounts, libraries are faced with hard decisions, and often, that which is not well understood finds itself the victim in reorganizations or cost cutting measures. We are finding that one such misunderstood area is, increasingly, the map collection, with its specialist practitioners and substantial space requirements. It is within this context that map libraries are being forced to deal with the realities of digital cartography. This situation is hardly unique to map collections, but I believe the implications for the map collection are of greater magnitude than for the library generally, as digital document files are easily read, while digital cartographic files require high powered computers, high resolution monitors, expensive software and printers, and, of course, trained personnel. We must not forget that, since there are many digital formats, a number of software packages are needed, which, of course, increases costs and training requirements.

. . . digital cartographic files require high powered computers, high resolution monitors, expensive software and printers, and, of course, trained personnel.

As cartographic information specialists, I believe that this conference will give us a unique opportunity to explore the meaning and ramifications of digital cartography in the map library, and perhaps, even reach an accord on some of the more fundamental problems that we face. For example, depository libraries in the U.S. have received the TIGER/Line files on CD- ROM. Like any other document, these must be made accessible to the public, but what exactly does that mean–simply copying the files to the user's diskette or providing, in effect, a cartographic laboratory which would be able to produce a map to the user's specifications? If we opt in the direction of the later, substantial new resources will need to be provided, and the library will have to determine were they will come from. And when, in due course, the CD-ROM is replaced by file transfer over the Internet, and the library no longer "holds" the resource in the traditional sense, will the library be rendered superfluous? What can we do now to prevent that from happening sometime down the road. Or, in a market driven economy, would we be interfering where we neither could nor should?

The contributors to this session have been chosen for their leadership within or insightful contributions to this rapidly developing field, and they have been asked to be provocative. What they will have to say can in no way be considered definitive but should serve to foster the thought and discussion which will be required as we begin to address this problem over the next few years. Never in our profession have we faced such a transformation and we, in fact, have little to go on as there is little precedence to guide us, and I have yet to find a suitable analogy to serve as a model for what lies ahead. It is hoped that the dialogue which will be begun here today can be continued as a series of such gatherings which will prepare us to meet the challenges of the coming millennium. ❑

The Future Of Digital Data In Map Collections: One Perspective*

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We can only anticipate what the future holds in terms of integrating digital spatial data into map libraries, and I am from a small one which does not yet accommodate it to any great extent. However, I have been actively investigating the requirements for integrating digital data into my collection. Extensive investigation is necessary since I have to be certain that the data and equipment choices that I make can be justified. As a result, I feel I have been able to anticipate, to some degree, where map libraries may be headed in terms of acquiring digital information and providing related services.

These services can be grouped into four, somewhat overlapping categories: traditional services, electronic atlases, custom map making, and GIS analysis.

TRADITIONAL SERVICES

Acquiring, maintaining, and providing access to geographic information, both locational and attribute, is traditionally the fundamental role of map libraries. The fact that this data is now available in digital form does not alter this role. Just as people consult and borrow paper maps, they can now view digital maps and extract what they need for their own purposes. This does not mean, however, that the move to digital data is straightforward.

SOURCES OF DIGITAL DATA

External sources of data include products from commercial firms or government agencies, such as electronic atlases, the *Digital Chart of the World (DCW)*, *National Topographic System* maps, *Ontario Base Maps* (*OBM* - topographic maps at 1:10,000 scale), and the *Electronic Atlas of Canada*. The Internet is also a valuable external source for map files in various formats, remote sensing data, and gazetteer and bibliographic data.

Internal sources of data at Brock University include approximately fifty computer outline maps created on the Macintosh by the map library for in-house indexes. These maps are produced in multiple layers which makes them useful to researchers who wish to select information to construct their own maps. They are used extensively by students, faculty, and staff in geography and other departments, as well as by local newspapers. We are currently investigating the process to make these maps available on the Internet as gif images, with access by anonymous ftp.

IMPLICATIONS

Acquiring digital data may sound fairly straightforward, but there are significant issues that have to be addressed. These include deciding what data to collect, determining the means of access, and developing the skills required by map library personnel.

Collection policies are standard for paper maps, though not necessarily in written form, but very few exist for digital data collections. Many

* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

things need to be considered before acquiring digital data. The sheer quantity of data available makes selection difficult, as does the fact that it comes in many forms. For example, since every 18 days we can, in theory obtain new Landsat satellite coverage, does this mean that we collect it? Of course, it does not. But, then, what do we select? Also, can we justify collecting remote sensing data if all we can do with it is provide a display of the reflectance values on the screen? Can we justify purchasing electronic atlases if they don't provide anything more than what is already available in a paper product?

The second issue is determining the means of access we provide, which can be done at various levels. The first is to have the products simply circulate on loan as we do for paper maps. This is possible for data that is stored on floppy disk (such as topographic and outline maps or some electronic atlases). However, there are products that can only be used with certain software, such as the *DCW*. The second level is to provide computer facilities on the premises so that users can download data to their own files. A third possibility is to provide access to the map library's computer files through a local area network so that external users, regardless of their location, can download information to their hard drive. A fourth option is to use the network for access to remote databases off-campus. An example of this would be accessing the OBM database from a provincial agency's host computer, or satellite imagery from a federal agency. This method places more emphasis on "access on demand," perhaps for a fee, rather than on acquiring a quantity of data for the purposes of ownership.

The third issue is skills. Working with digital data requires skills that are very different than those required for paper maps. When I first requested data from government databases on floppy disk, I was asked questions such as: "what format would you like it in?" and "what system are you using?" Needless to say, I was not sure on both counts. Acquiring ready-to-use digital data is not a simple task.

Working with digital data requires skills that are very different than those required for paper maps. . . Acquiring ready-to-use digital data is not a simple task.

One of the new requirements is knowledge of data formats and their compatibility with various computer systems and software. We should at least be able to recognize, for example, that users of the MapInfo program require data in dxf format and that the ARCInfo export format will not work. If we fail to communicate with users in these terms, they will quickly lose confidence in the map library. So, how do we develop this knowledge? Standards for digital data transfer and techniques for converting one format to another are no doubt being created, but I have had no choice other than to proceed by trial and error. It is a very complex and confusing area, and at this point, I am seriously considering a course in computers!

The ability to download data files from one database and import them into a mapping program for further analysis is another skill we should develop. But, this too has its complications (we all know how easy it is to download a file from *DCW*!). Downloading sometimes requires special software and also a conversion of some sort. One problem we are investigating at the moment is transferring FreeHand files from the Macintosh computer to CorelDraw for use on the PC. Once we have mastered this skill, are we then responsible for instructing the users in how to do it themselves?

Another requirement is knowing how to use the Internet to search remote hosts and download files in a format compatible with our systems. Again, this is not a simple task. However, students are now being instructed in how to use the Internet in their courses and are quickly learning its potential as a source of information. This will affect our role dramatically.

ELECTRONIC ATLASES

A second service of the map library is to provide access to electronic atlases. This is closely related to the first category mainly because providing this type of data could be done using traditional methods. The simplest case would be that the products circulate on a sign-out basis. This may be possible with some atlases like *PC Maps N' Facts*, but products like the *Electronic Atlas of Canada* and the *DCW* are meant to be used on systems where users can search and query the database, design their own maps, and extract data. This certainly requires a more sophisticated level of access.

Electronic atlases certainly serve a useful function in the map library, but we do have to be selective. Atlases which provide the ability to search and query a database and produce specific maps seem more useful than the "view only" type which offer nothing more than that obtained from an existing paper product.

CUSTOM MAPPING

A third facility that could be considered is to provide access to databases, thus allowing users to produce their own maps using a program such as MapInfo. This involves merging base maps with aggregated statistical data that already resides on the map library's computer. For example, a fourth year geography student at Brock University is currently producing a database of the Niagara Region census tracts based on 1991 Statistics Canada data. This involves creating a base map and tabulating attribute data to provide user-defined choropleth mapping. Although a very useful function of the map library, it is an ambitious one–mainly because it requires a fair bit of expertise with the program to obtain a good quality map, as well as time to prepare the attribute database. This process could be accelerated if existing data files were used, such as the digital boundary and census files. This level of service raises the issue of who is responsible for producing the maps–the user or the staff.

GIS ANALYSIS

Providing comprehensive GIS capabilities in a map library seems to be a topic of much debate among map librarians. According to the proper definition of GIS, this technique involves functions that go well beyond that of creating maps. I am referring to the use of GIS for geographical data analysis–for example, the process of overlaying several attribute data sets as a means of problem solving. I would also question whether it is our responsibility to provide image processing facilities within our libraries, mainly because this involves an enormous amount of remote sensing and GIS expertise. A level of map library service that supports a GIS system, such as ARCInfo, which serves a very small percentage of our clientele at such a great expense, is difficult to justify. If users are so advanced with the use of digital spatial data that they require full GIS analysis to work with it, they likely have access to it already. We would simply be providing another workstation. The map library that provides this facility would serve a dual purpose–as library and laboratory. Is this our responsibility? I do recognize that we should provide the data that is required by this level of analysis, which means that we must remain aware of the systems that are being used and the types of data and formats that are required.

CONCLUSION

I have presented four functions that could be considered for integrating digital data into a map library. At the moment, I have to admit that the services offered in ours do not extend much beyond the traditional functions, although, as a result of my investigations, I am now confident that I can make the proper decisions to improve our facilities.

Our main challenge right now is to create a reputation for the map library and ourselves as key sources of digital spatial data within our institutions. Emphasis must be placed on developing the knowledge and skills that are necessary to provide proper access to these products. The GIS literacy program is indeed an encouraging step towards this goal.

One other issue of concern is continued access to government information. Due to the trend of government agencies producing their map information in digital form, our role as providers of this information has to be redefined to ensure adequate public access. Committees like the Association of Canadian Map Libraries and Archives Map Users Advisory Committee and the American counterpart, Cartographic Users Advisory Council, must move to the forefront and address this issue immediately. ❑

Disenfranchisement: Paranoia or Possibilities*

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Here we are on a quietly beautiful winterbound mountainside, facing the excitement of discovering intricacies of a whole new world. I stand in awe of all the possibilities of things we face, the difficulties and the opportunities. What we confront is not unique to map people; all librarians are challenged by it. I wonder what will be the librarian's role in all of this? Will there even be a role?

I see lack of access as the greatest problem we face. I am concerned that, in the rush to lower costs and to provide electronic access to resources, both our patrons and we ourselves will have to struggle through an envelope of non-access. I worry that, as print goes "out of fashion" in favor of electronic access from remote, public domain databases (such as "anonymous ftp sites"), an unacceptably large group of librarians, and therefore patrons, will become disenfranchised because they cannot get access to this ostensibly "public" information.

This lack of access will be generated by at least one of three things: first, an unwillingness of the library staff to provide service; second, an inability of the library to meet the costs attendant with hardware and software required to gain connection; third, and the greatest I think, the inability of the library to provide connection because no service is available in their area. This third one is the one I will explore more fully a little later.

INFORMATION DISENFRANCHISED

We see the creation of the information disenfranchised even now. How many here do NOT have access to the Internet in their library? How many do NOT have access at their work desk or workstation? How many do NOT have access available for patrons? In any meeting, the number of raised hands increases with each question.

My supervisor is only 45 or 46 years old. She remembers when she was growing up that her aunt and uncle did not have electricity. In about

* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

1962, the National Electrification Act brought electricity to rural areas of the U.S., primarily western farms. How long had there been electricity to other areas of the nation? In fact, her aunt and uncle never did get electricity as long as they lived in that home, which was several more years. This shows well the sluggishness with which the intent demonstrated by passage and funding of such an act is brought to full reality.

In Albuquerque, New Mexico in 1991, I attended the midyear meeting of the American Society for Information Science (ASIS). The final meeting was an open session/sounding board. One very frustrated librarian stood up and said that she had heard so much about the Internet, its resources, its potentials, its challenges. Yet every attempt she had made to find out how to connect to it was met with stone-walling. Who could she talk to, where should she go, what arrangements were needed for her to get access for her staff and patrons? The answer startled me. "It depends on where you are. Come up afterward and we can see if it is even available in your area." The presenters went on to explain that no definitive answer was possible because at that time there were still areas of the country for which no connection was available and no plans existed to provide any. Is that still the case? Very probably.

What are these people to do in the light of the Clinton/Gore Electronic Highway? Some suggest that "they" will be sure access occurs, yet it remains a mystery to whom "they" refers. Will there be a need for a great National Internetworkification Act of 2025? When "they" didn't provide electricity it a timely manner, why will "they" provide access to the Information Superhighway? This is my greatest concern.

The other great issues–education in and development of electronic information resources–are problems which feed the difficulties creating disenfranchisement.

The other great issues–education in and development of electronic information resources–are problems which feed the difficulties creating disenfranchisement. When I finished with my Master's degree in Library and Information Science six months ago, I felt like I was three years behind everybody else. During my studies, we dealt with phone-connected Dialog and direct-link access to the bibliographic database maintained by OCLC, Inc. The Internet was briefly mentioned as a possible resource for discussion lists.

My fellow students learned less about WordPerfect than I already knew; less about DOS than I already knew. Gopher was a rodent and Archie and Veronica were comic book characters. Phone calls to my faculty advisors were long-distance, so I did manage to convert them to using e-mail, but none of the students had accounts allowing access. How many library schools still aren't connected? If you read advertisements for entry level positions, many list Internet experience as one of the preferences. It won't be long, I suspect, before that moves to a requirement. Yet, where is the American Library Association in making sure that this education need is required and met in accredited programs?

What about education specifically designed to train and promote map librarianship? I got a message from Poh Chan of Simon Fraser University Library in Burnaby, B.C. regarding GIS training. I received permission to post it to Maps-L, a discussion list available on the Internet and I repeat it here: "We do not have such technology [GIS] in my map library now. If I were to go on study leave to upgrade myself and acquire this training, can you advise the type of courses one should take. Are there courses that teach this new map librarianship, and where? Or does one go specifically for GIS courses? Or is it more useful to go on practicum at a map library that has this new technology? Which are these libraries? Or should one go for a combination of a GIS course and practicum?"

I can't answer those questions. I am completely ignorant about GIS.

Last week, I decided to try to use the GIS server (which utilizes Arc-Info) that we have in our Government Documents collection. Please keep in mind that these are the impressions of a total GIS novice. I sat down, selected the single icon, and stared at a blank screen. Not a clue about what to do next. HELP–didn't.

One of the librarians came over and showed me some tools and a couple of the views, including one that took data down to a per-block region. Cool. Now what? By that point, I had spent half an hour and had to leave for another appointment.

At the Fall 1993 meeting of the Western Association of Map Libraries, I discussed with another librarian a GIS product I had seen demonstrated that day. I told him that, after about half an hour of instruction on that particular system, I could begin doing things on my own. "I don't have half an hour to sit down with each patron, though." He voiced a great challenge facing all of us. Our own education is of concern. But who will teach our patrons if we don't have the time? Another area of disenfranchisement threatens?

ACCESS

We face important questions. These new technologies are expensive. The education for them is expensive. How can a librarian, with the limits we face in budgets and salaries, get either the equipment or the education? There certainly exists a definite user need which WILL be met. But if librarians do not provide the access, others will–and for a fee. Will access ultimately be based on ability to pay? We know how ability to pay creates disenfranchisement.

I attended the George Washington University Windows of Opportunity Symposium for Female Students in Computing held in Washington, DC in May 1993. Two hundred undergraduate and graduate women students in Computer Engineering, Computer Science, and Information Science programs were selected to receive National Science Foundation funding to attend. Our profession needs to set a goal that at least 25% of the attendees of future sessions of such symposia come from Schools of Library and Information Science. We need to demonstrate, particularly to the National Science Foundation, that we are an important research group.

We need to attract research grants and be seen as a factor of importance and consideration in the realm of information science research and development. We must participate in preventing disenfranchisement. We need to get involved as creators of information science research, not just be recipients of it. There are some who do developmental research, but they are too few. As library schools close, how do we guarantee the continuation of research and the commitment to research which will benefit patrons and ease the task of librarians? How do we avoid punishing librarians who want to conduct extensive research?

As library schools close, how do we guarantee the continuation of research and the commitment to research which will benefit patrons and ease the task of librarians?

How do we help one another achieve research goals? How do we share information? In a word, Internet. Get on, get hooked. If you aren't on already, fight to get on.

As I suggested initially, our present situation is reminiscent of being on a mountainside, deep powder snow more hanging in the air than falling. And presented before us is that eerie, quiet beauty which precedes a deadly avalanche. We are only beginning to hear its roar. We cannot tell where it is–directly above us or slightly to one side. We only know we cannot stay where we are. We have to move. We innately understand one poignant fact: Stagnation is disenfranchisement. Stagnation is death. ❑

Building The Virtual Map Library; Some Considerations*

Patrick McGlamery

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This past winter and spring I have brought up a local area network on campus. The MAGIC LAN, the Map and Geographic Information Center's network, is a ten-user Novell 3.1.1 LAN supplying information across campus. MAGIC is supplying spatial information to a variety of user communities.

Usually, this means that I have to go to academic departments and determine how, given their particular computer configuration, they can best get at the data stored on HOMER–the Library's on-line public access catalog. A frequently asked question, or statement posing as a question, is, "It almost looks as if we won't have to go to the Map Library anymore."

There was a bit of tongue-in-cheek or gentle ribbing in this, but also some anxiety and, I think, a harbinger of the future. Although we are a long way off from the user not visiting the map library, we should begin to think about the virtual map library or digital geo-spatial library now, at the time when we are developing foundations. This paper explores the notion of the virtual map library as space, or in the current thought, the map library in cyberspace.

DIGITAL SPATIAL INFORMATION

Before I define cyberspace, I would like to compare digital geo-spatial information and maps with other types of analog spatial information and point out some differences and similarities.

The map is a carrier of spatial information in a graphic analog format. It is cartographic symbology, highly refined and very enriched; it has been a primary carrier of densely encoded spatial information for centuries (Other examples of analogical carriers of spatial information include air photos, well logs, guide books, telephone books, and censuses.).

Digital information as a carrier of spatial information is extremely mutable. Typically, we do not think of telephone books as carriers of spatial information but, of course, they are if the names are sorted by the address rather than by name. The telephone book as digital information is minimally three variables: NAME, ADDRESS, NUMBER. However, it can be expanded. The NAME is SURNAME, FIRST NAME, INITIAL. The ADDRESS is STREET NUMBER, STREET NAME, PLACE. The NUMBER is AREA CODE, LOCAL CALLING AREA, 4-DIGIT NUMBER. In a database, any of these variables can be used as a primary sort. In the case of the ADDRESS, the database can be mapped to a relational location on a street or in a region. The *Atlas of British Surnames* (Lasker & Mascie-Taylor) is an example of mapping surnames as point-distributed data using telephone books as a primary data source. Some 152 names, samplings for the study, are mapped in the atlas, and thousands more await mapping. The TIGER data, with their wealth of streets and address ranges, awaits the CD-ROM telephone book (and a very large machine) to map all McGlamerys, McClamerys, McClamorys, McLemores and so on

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* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

who issued from that first mumbling John McGlamery settling on the pre-Revolutionary Calf Pasture River, Virginia.

We tend to think of maps when we think of spatial information, but that is a definition based on form rather than function. The primary function of the telephone book is to supply someone's number, whereas the secondary is to give an address. In our library the telephone books are filed at the general reference desk, not in the map library. Libraries tend to be categorized by form, hence: map library, microtext collection, music library (scores, sound recordings, etc.), serial collections. Maps are format specific not subject specific, so maps in libraries are organized into map libraries. In fact, there is much overlap–maps and atlases at the reference desk, microtext in the map library–as the budget allows.

We tend to think of maps when we think of spatial information, but that is a definition based on form rather than function.

Digital spatial information can be used from many places at once. The data are not necessarily localized, and perhaps are not and never will be in a library. Perhaps the data are pulled from several places and blended at the synergistic whim of the researcher. Perhaps the output is a map, or a table, or a report. Perhaps there is no output other than a dynamic data stream as a cartographic display on the monitor screen; the ebb and flow of traffic density in an urban area; the shooting deaths in the nation; a Doppler radar feed of passing weather patterns . . . or all of the above. Is it a map? Pull the plug and it is only a dead screen.

MANAGING, ACQUIRING, STORING, AND PROCESSING

How then do we manage this information? How do we acquire, store, preserve it? And how do we provide reference services to it? In map libraries, we are beginning to grapple with these issues in the shape of geo-spatial information's voracious appetites. In the past three years, we have seen the minimal hardware requirements to service federally supplied spatial data go from 4 to 16 megabytes of RAM, from 100 to 300 Megabyte harddrives. We are anticipating 3,400 CD-ROMs of Digital Orthophoto Quads. Storing these disks will seem simple compared to providing reference and retrieval services to them.

In his book, *Redesigning Library Services: a Manifesto*, Michael Buckland provides a good description of electronic documents and the issues of the future of library services. His manifesto effectively examines the similarities and dissimilarities between the paper and electronic formats. The challenges to the future of library services, he notes, however, have to do with the locality, or the "where" of the library. In order for digital data to work at its highest and most efficient level, it must exist on a network. At the risk of taking advantage of a captive audience, I would like to read Buckland's challenges "into the record."

1. Since library materials in electronic form lend themselves to remote access and shared use, the assembling of local collections becomes less important. Coordinated collection development and cooperative shared access to collections become more important.

2. With materials on paper, having copies stored locally is a necessary (though not a sufficient) condition for convenient access. With electronic materials, local storage may be desirable but it is no longer necessary. Therefore, a catalog defined as a guide to what is locally stored becomes progressively less complete as a guide to what is conveniently accessible. The answer is to shift from catalogs to union catalogs or linked catalogs and to holdings data linked to bibliographies, thus reversing our usual perspective on catalogs as bibliographic descriptions attached to holdings records.

3. In the meanwhile, those to be served are changing their information handling habits. Paper and pen are being supplemented by desktop workstations capable of using a multiplicity of remote sources. This leads to an entirely different perspective: from library-centered world view to one that is user-centered.

4. These technological changes also invite reconsideration of the professional orthodoxy of consolidating academic library services. The view that a multiplicity of branch and departmental libraries is inefficient might well change. Under different conditions the decentralization of library service might well be regarded as an effective strategy by administrators as well as users.

5. The trend is to digitize everything for storage and manipulation: sound, image, moving images, text, and numeric data. Documents of all kinds are becoming more homogeneous in their physical medium. Limiting libraries to printed documents, or, indeed, written documents, makes less and less sense. If that demarcation dissolves, there is a blurring of boundaries. The function of the library, the computer center, and the telecommunications office are converging, overlapping, or, at least, more closely related. New patterns are evolving in the relationships between libraries, publishers, and the information industry. The roles of archives, libraries, museums, and other information stores seem likely to become less clearly differentiated.

The function of the library, the computer center, and the telecommunications office are converging, overlapping, or, at least, more closely related.

6. There is much greater opportunity to bring service to wherever potential users of library service happen to be. (Buckland 1992)

Taking up the challenges Buckland outlined assumes that the information resides on a network and that the user-centered digital library is a series of workstations linked to information stores. It is the information superhighway going to a space yet to be described, a space briefly sketched as cyberspace in the popular literature.

Cyberspace is a place of pure information, populated with software daemons and built of fiber optics, twisted pairs, mainframes, UNIX workstations; an infinite and diverse variety of evolving hardware platforms and operating systems. Our role as librarians must be to consider this possibility as we plan to create, in this virtual geography, a virtual map library. I think we will achieve this by adhering to and interpreting the verities of librarianship that is, acquiring information, describing information and interpreting information.

MAGIC

The decision to build a fileserver on the University of Connecticut's campus LAN was based on the challenges of Buckland's manifesto, a push from the Association of Research Libraries' GIS Project, and my belief in the ability of library science to solve information problems. MAGIC's hardware and software are basic, costing less than $10,000. The concept, however, strongly tests our solutions . . . and resolution.

MAGIC is a user-centered virtual library, designed to be used at the user's workstation. With 1.2 gigabytes of harddrive, MAGIC has a fair amount of space, but (true in any library) only if used judiciously.

Acquiring the data has been substantially more difficult than unpacking the TIGER disks from Government Printing Office (GPO) shipments. MAGIC provides various coverages of TIGER derived data from roads to 1980 census tracts, but only for Connecticut. Each coverage is processed into MapInfo for Windows, MapInfo for DOS, and PC ArcInfo and ArcInfo export formats. The data is stored in ZIPPED format at the end of a series of subdirectories structured as a Library of Congress call number. For example the coverage of hydrographic data for Windham County, CT is: K:\G\3783\W5\C3\1993\U5\MAP_WIN\HYDRO.ZIP. Zipping the data requires that the user download (circulate) the data, creating, one hopes, a sense of space. The idea is that the library stores information, and the user comes to the library to get data. In fact, it cuts down on the I/O (input/output) on the MAGIC server, a significant factor with a five megabyte hydrographic data file.

Describing information in a catalog has always been a major component of library science. The user expects to use the catalog for standard library materials. Rarely does the user expect to use the catalog for non-standard material . . . such as maps . . . data. Once the user realizes the importance of an on-line catalog, it becomes a major part of his or her library research. The on-line catalog becomes a vital tool of the researcher's workstation, allowing remote access to the library's resources. At the University of Connecticut's Homer Babbidge Library, the spatial data files are being cataloged in the Library's HOMER catalog. The call number on the record refers the user to MAGIC Fileserver, G\3783\T6\P2\1993\U5, reinforcing the notion of the library. This virtual map library is open 24 hours a day, however, and available wherever a machine is connected to the campus LAN. In fact, the information is available via FTP to the world community. Describing the data in the MARC format in a conventional on-line catalog might not be the best (or most elegant) solution, but it affords me the opportunity to test and play with the concepts we will need to explore as the technology grows.

The on-line catalog becomes a vital tool of the researcher's workstation, allowing remote access to the library's resources.

Providing access to spatial data means much more than simply putting the data on the net. We will continue to work with all level of users, from the expert to the novice. From us, the spatial information expert needs data and data documentation and little else. The novice might need, in varying degrees, hardware, software, and education. The library should probably think not only of supplying simply data, but also the ability to manipulate data. I would like to think I am priming the pump by providing software to users until they can acquire their own.

Providing access to spatial data means much more than simply putting the data on the net. . . the spatial information expert needs data and data documentation and little else.

The MAGIC LAN as a fileserver is based on user access categories. There are currently four logins: MAP_WIN, MAP_DOS, MAP_USER, and REF_USER and ANONYMOUS FTP via the Internet. MAP_DOS allows low-level manipulation of spatial information on a 286 DOS machine. Not demanding of RAM or processing speed, it provides entry into the field for the general word processing user who has a first or second generation machine and is making the transition to a higher level of computational analysis. MAGIC supports five simultaneous seats of MAP_DOS. Manuals circulate from the map library. MAP_WIN, providing a higher level of spatial analysis, works best on a standard Windows 3.1 type machine. MAGIC supports two simultaneous seats of MAP_WIN. MAP_USER utilizes ArcView 1.0 in a very controlled Windows desktop. Also available are *Autoroute USA* and *Europe* and *DeLorme's Map Expert.* MAGIC allows ten simultaneous users of these products. Finally, read-only access to the data is available through REF_USER on the LAN and ANONYMOUS FTP on the Internet. Users simply need to take the data off the shelf and plug it into their own workstations, Unix or otherwise. To these expert users, the library is a storage place for large files which are better available on demand over the LAN than occupying valuable disk space.

SUMMARY

In summary, we must begin to think of the attributes of the virtual map library in cyberspace. It must be constructed to serve the information needs of the digital spatial information user based on the function of the information rather than the form. These needs are similar in type to the needs of the map user; the library continues to collect information, describe it, and provide access to it. The University of Connecticut's Map and Geographic Information Center, MAGIC, is using these three functional solutions to meet the challenges outlined by Buckland in his book, *Redesigning Library Services: A Manifesto.*

REFERENCE

Buckland, Michael. 1992. *Redesigning Library Services: A Manifesto*. Chicago: American Library Association.

AUTHOR'S POSTSCRIPT

Some further observations in light of developments since the *Map Library in Transition* conference: It has been eighteen months since *Mosaic* transformed the Internet and the World Wide Web by opening up a Pandora's Box of information resources. Last year NASA, NSF, and ARPA began the Digital Library Initiative. The cost of computers has reached a point where a basic machine has the computational power which a workstation had when this paper was presented. It is difficult today to buy a computer that is not capable of computer mapping or even analysis. Operating systems are on the verge of true muli-tasking. Desktop mapping and analysis software now come bundled with spreadsheets (for example, Lotus 1-2-3 bundled with AtlasGIS, Notes and Microsoft bundling MapInfo with Office). ❑

Transition in the World of Map Libarianship

Gary W. North

Gary W. North is the President of North Arrow, Ltd., 12364 Lima Lane, Reston, VA 22091-2523. At the time the paper was presented he was with the United States Geological Survey.

It is a pleasure to address you this morning. Over the past 15 years, I have gained a deep respect for the map librarian profession and for the cartographic materials and spatial data information that you provide. The topic of transition is near and dear to my heart, and as a historian, I was interested to see what happened on this day, in years gone by, that we could relate to today.

In 1873, in New York City, delegates from Columbia, Princeton, Rutgers, and Yale met to formulate the rules for American football. We, of course, meet today to discuss transition rules for spatial data collection management.

In 1907, the first plans for an International Court of Justice were announced. The Court was to be set up in The Hague, Netherlands. Today, The Hague is the home of the International Federation of Library Associations (IFLA), and I currently represent us as Chairman of the Geography and Map Section. My first IFLA meeting was in Montreal, Canada, and I am pleased to see several of our Canadian colleagues here today.

* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

In 1922, Marconi and General Electric, the world's leading "wireless" manufacturers, formed a company to be responsible for broadcasting radio programs throughout Great Britain. Today, we have cellular phones and electronic maps zipping across fiber optics cables as part of the information highway.

Today, we have cellular phones and electronic maps zipping across fiber optics cables as part of the information highway.

In 1931, Thomas Alva Edison died at the age of 84. He had invented the phonograph, microphone, and kinetoscope. He also had designed a complete electrical distribution system for lighting and power. I suggest that we can draw a direct parallel to the current plans and designs for electronic cartographic products and information systems.

In 1970, Prime Minister Trudeau of Canada clamped down on separatists who wished to break away from the Canadian Government. I guess we should check on our Canadian friends to see if they crossed the border properly. Actually, it is only fitting that we address today's topic together. A couple of years ago, I had the pleasure of addressing the 25th anniversary meeting of the Association of Canadian Map Libraries and Archives and know that our concerns, problems, and interests are the same.

And finally, lest we forget how quickly things can change, on this day in 1989 the 7.1 Loma Priata "World Series" earthquake hit San Francisco. We, of course, all know that it brought down a section of Interstate 880, but it also raised havoc with cartographic materials collections. For them, it was a quick transition for sure.

HISTORY

As a historian and cartographer, I must begin a discussion of transition by looking back at where we have been and how we have already changed.

As I mentioned earlier, one of my most rewarding and interesting associations with this profession has been through the IFLA. In 1982, at my first conference, I read a paper prepared by Larry Carver on remote sensing and handling remotely sensed materials. Larry was unable to attend the conference, and I was the newly elected United States representative to the section. Think about how many space images or aerial photographs you now have in your collections. It has only been 11 years. With Landsat in orbit at that time, the paper also mentioned digital data, but most listeners still assumed that maps would always be on paper and not on those big 9-track tapes.

In Munich, in 1983, I presented a paper at IFLA titled, "Earth Science Products for Tomorrow's Libraries." I discussed microfiche, microfilm, and videodisc cartographic products. I was also able to illustrate how our 1:100,000-scale digital data were being transferred to something called CD-ROM and that the price for national coverage would go from an estimated $20,000,000 to $448,000 to provide complete sets to the map depository libraries. I am convinced that the introduction of CD-ROMs was a major turning point in our current transition from paper maps to digital spatial data.

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In 1988, we gathered in Sydney, Australia, for the annual IFLA meetings. My topic was "Will Your Library Be the Spatial Data Information Center of the Future?" I spoke about geographic information systems (GIS) and how they could answer complex, multilevel questions from your patrons. The most asked question of me was: "How do I get started?" On the way to Australia, I had stopped in Santa Barbara for a meeting with people from the Research Library Group who were beginning a Library GIS project to link the world's map libraries into a worldwide cartographic information system. Does it sound so farfetched now? How many of you are now running GIS software in your institution and communicating with people around the world?

Continued on page 46

Sources of Error in a Map Series, or Science as a Socially Negotiated Enterprise*

Peter Gould

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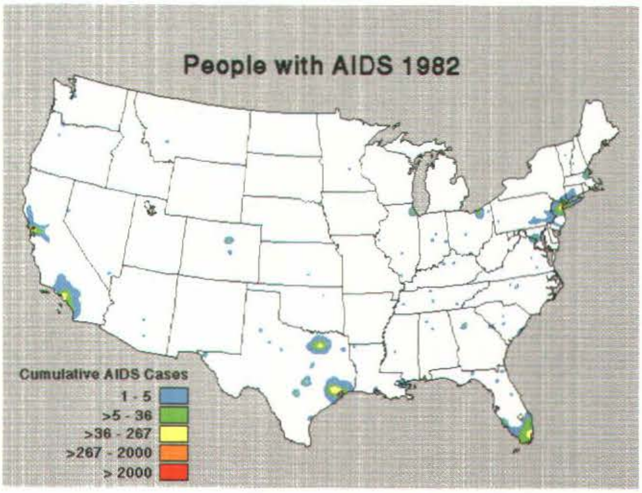
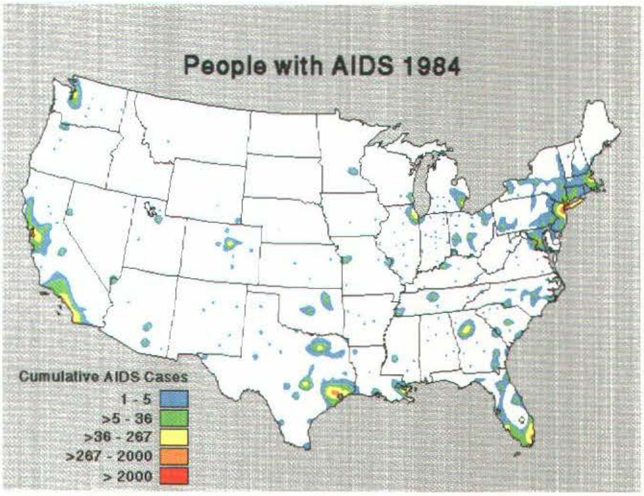
Temporal, definitional, and spatial errors may be present in maps, as well as errors of underreporting and estimation. These are illustrated in a series showing the diffusion of AIDS in the United States, and constitute an example of science as a socially negotiated and hermeneutic enterprise.

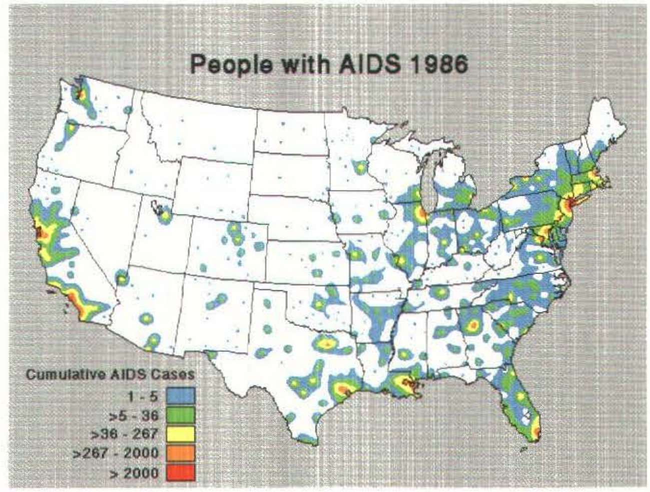
Although terminating in 1990, the five maps illustrating this article still constitute the most detailed graphic expression ever presented of the geographic diffusion of the AIDS epidemic in the continental United States.[1] Based on approximately 2,500 spatially varying units, most of them counties, they have raised questions about the neglect of the spatial perspective by public health authorities during the first decade of the epidemic,[2] and they have shocked an American audience in such public forums as *Time*, *Forbes*, and *Playboy* magazines.[3] They are also available in animated form for educational television directed at young people, who now form the cohort of the population most at risk.[4] It is worth emphasizing immediately that the contour-color interval is geometric, each change up the natural spectrum from blue to red multiplies by 7.5 the previous value, with the red areas simply "over 2000." However, if you made a three-dimensional map in 1995, and used 0.25 millimeters to represent each person dead or dying from AIDS in the five boroughs of New York City, you would have a spike fifteen meters high, and only slightly smaller ones at Los Angeles, San Francisco, Miami, etc.

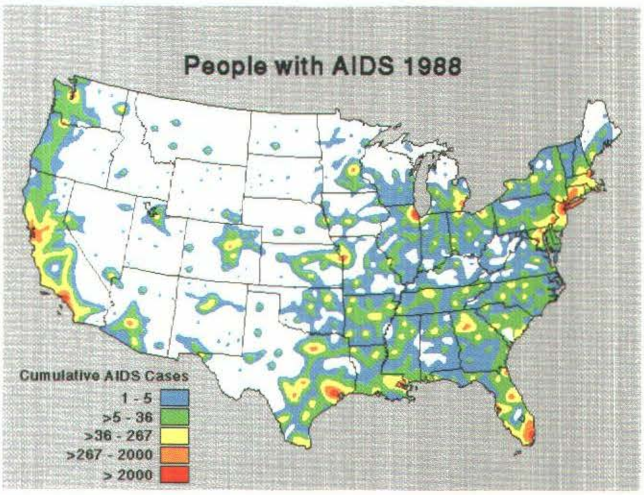


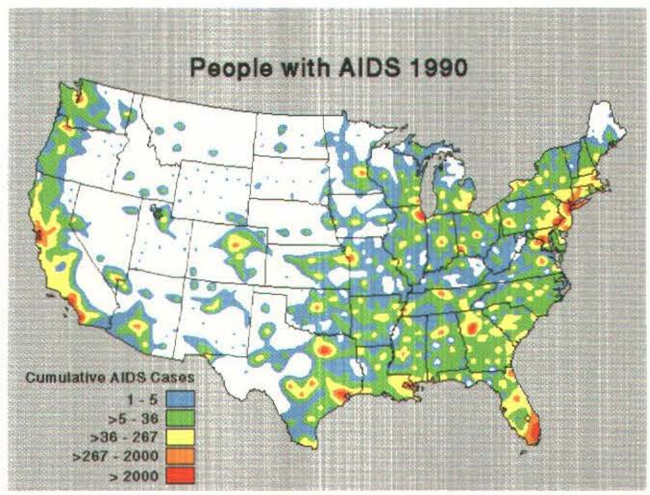
Taken as a whole, the sequence constitutes a powerful rhetorical statement, using the word "rhetorical" in its old and honorable sense as the "art of persuasion."[5] Upon reviewing the "AIDS explosion" in the carto-geographic domain, many people are persuaded for the first time that AIDS is not something "out there," remote and far removed from them, but may well be all around them. To a geographer, the sequence is a classic case of spatial diffusion, with strong evidence of both hierarchical diffusion, controlled by relations of interaction in the urban system or hierarchy,[6] and spatially contagious diffusion from regional epicenters–the "wine stain on the tablecloth" effect.

*Respectfully dedicated to the memory of Brian Harley, University of Wisconsin, Milwaukee. This article is a very slightly revised and updated version of "Sources d'erreur dans une série de cartes, ou: la démarche scientifique, objet de négociations," MappeMonde, 2, 1993, pp. 22-27.









The carto-geographic perspective challenges the totally aspatial view of traditional epidemiological modeling confined exclusively to the time domain.[7] Since the construction of such a series illuminates aspects previously hidden by bureaucratic obtuseness parading in apparently impeccable ethical concern for confidentiality, and since actually seeing the explosive diffusion in the first decade may be politically delicate, especially in an election year in the United States,[8] we may expect attempts to throw doubt on the series, attempts emphasizing that errors are present. It is important to deal with such efforts to denigrate in a direct, firm, scientific and philosophically aware manner.

In any scientific statement, there is error since science is a mortal, rather than a divine, enterprise. However, after examining a large literature, it becomes apparent that little has been added to any theory of error since Karl Friedrich Gauss made maps for the Duke of Hanover during the eighteenth century. Those who boldly pronounced judgment about the amount of error always retreat behind a cloud of assumptions after realizing that one cannot specify any quantity or degree of error without actually knowing the truth. Even such a correspondence theory of truth (and, therefore, of error) has been in disarray since the days of Kant, and no one living in these hermeneutic days could take such an approach seriously. What we can do is make some quite open judgments about the types and sources of error, and then argue that these would not alter any major conclusions about the geographic processes at work and the carto-geographic representations these produce. Whether a reader finds such scientific rhetoric persuasive or not depends on the hermeneutic or interpretative stance he or she is prepared to take. In the end, scientific truth is always socially negotiated, including the construction and interpretation of maps, as Brian Harley was able to teach us before his tragically early death in 1991.[9]

What are the sources and types of error that take this research from the error-free realm of the immortal gods to the foothills of Mount Olympus where ordinary geographers live? There are essentially five, none of which can be cleanly separated except for purposes of exposition. First, there is the problem of underreporting, particularly in the early years of the epidemic. Less was known about the various ways an infected person could convert to symptoms diagnostic of AIDS; tests were less reliable; and some doctors (perhaps up to 50 percent during the early years in Germany) were prepared to sign death certificates for "pneumonia," "cancer," and so on to spare the feelings of shame that some families expressed. Early maps are likely to reflect such errors of omission rather than commission.

Second, there are temporal errors–usually delays in reporting that make it extremely difficult to monitor the course of the epidemic properly, and so use forecasting techniques which rely on recent information to make appropriate parametric adjustments. No matter how sophisticated the methodology and technology used, it is no use monitoring junk.[10] We may even find ourselves in the curious situation that model predictions, far from over-estimating the course of the epidemic, actually turn out in the future to be closer to some unknown truth than the official figures reported by medical bureaucrats. This constitutes a nice philosophical, not to say political, problem in its own right.[11] Even when AIDS is a legally reportable disease, errors of temporal specification may be gross: in June 1991, for example, 75 percent of the AIDS cases reported in Washington, DC were not days, weeks, or even months late but had been diagnosed in previous years.[12]

Errors over time are clearly related to the third type of errors–definitional errors. After the first decade-and-a-half of the pandemic, as more has been learned about the HIV virus and its effects on the human immune system, we are able to recognize, in lowered T4 cell counts and other diagnostic approaches, the earlier signs of conversion to opportunistic diseases. New definitions in 1993 interrupted the previous time series, inflating cumulative totals to the point today (1995) where the 400,000 mark has long been exceeded and the totals are still growing. In the previous year (1992), scientific advances in diagnostic tests were found to be politically unacceptable, and so were socially negotiated away by centralized power structures. For one more year, a nation breathed a sigh of relief that things were not so bad after all. How many more people are infected today we do not know with any reasonable degree of assurance.

The fourth kind of error is spatial error–a form lying in a domain of thinking familiar to the geographer, but an intellectual arena where doctors of medicine and epidemiologists have little if any experience.

The fourth kind of error is spatial error–a form lying in a domain of thinking familiar to the geographer, but an intellectual arena where doctors of medicine and epidemiologists have little if any experience. Unfortunately, such ignorance does not prevent them from making judgments–some of them catastrophic for our deeper understanding of the epidemic and for our ability to intervene with education and health care planning. Spatial error is simply misplacing in space values reported, and it may be thought of as the geographical equivalent of delayed reporting in the temporal domain (i.e., "misplacing" people by a month or a year). Like any other error, it is unavoidable to some degree. Even if we had a dot map of each person,[13] the individual dots would only stand as a spatial mean for a probabilistic smear or "field of movement" created by individual human lives.

Spatial error is particularly likely to arise in connection with the fifth kind of error–errors of estimation. Many of these arise because of the quite proper and understandable ethical concern to protect the identity of people with AIDS. I wish to make it quite clear that I am in total agreement with this ethical ideal, while noting at the same time that it has been carried to quite absurd extremes.[14] Spatial errors of estimation arise when we want to move to finer levels of spatial resolution with data (numbers of people with AIDS) that have been deliberately aggregated spatially, ostensibly to preserve confidentiality. Notice, however, that even the ability to observe scientifically now becomes socially negotiated, with the negotiations directed and informed by the ethos of a society and the power it is willing to allocate to certain groups of professional "experts". In the United States, most states now report regularly by county: some, like Virginia, by zip or postal code; others, such as, Kentucky by aggregations of counties into regions; one (Nebraska) by three, totally irrelevant economic areas; another (South Dakota) by two regions east and west of the Missouri River, although this physical feature is not known to be an effective barrier to the diffusion of HIV; while a few states (Wyoming, Wisconsin) still report only state totals. Generally, there is a tendency to report by smaller and smaller spatial units as the epidemic, measured by rates of infection, intensifies.[15]

Spatial errors of estimation arise when we want to move to finer levels of spatial resolution with data (numbers of people with AIDS) that have been deliberately aggregated spatially, ostensibly to preserve confidentiality.

I want to illustrate the problem of spatial errors of estimation and the way these problems are produced and convoluted by a mélange of other problems by focusing upon three states in the map sequence–namely Texas, Florida and Iowa. Texas is prepared today to report by county, and from 1986 onwards, the map sequence uses the officially reported, updated, and corrected figures. But, before 1985, there was no consistent database, and even today, the state medical authorities only know the cumulative county totals from 1985 onwards. As a result, we have to estimate the 1982 and 1984 values in this part of the country. This actually requires no sophisticated mathematics or computational model: the annual totals for 1985-1990 plot with classical smoothness and regularity, and they can be extrapolated back with a plastic curve to be anchored at 1981, when what we now call AIDS was first recognized (although not the HIV, which was only "discovered" in early 1983). Thus, we can estimate, with what must be only the very slightest error, the cumulative totals for 1982 and 1984.

The question then is: how do we assign these totals spatially? Since we have the map distributions (i.e., the spatial series) for 1985 onwards, we can simply deflate county values, say for 1984, by the ratio of the cumulative totals 1984/1985. This is a simple linear extrapolation backwards, but the difference between the linear and nonlinear approximation will be minute over this time span. Some informed and educated guesswork is involved: a county may appear on the map in the lowest category (blue) with one or two people with AIDS a year before or after it really did, but recall that we have no idea what the reality was in those days and no better way of capturing it. The reader of this text and map must simply judge whether this is plausible, whether it is reasonable, whether it is persuasive. And note: this judgment will be informed by what the reader brings to these written and graphical texts; in other words, it will be related to the hermeneutical stance one is prepared to adopt. I suggest that an experienced geographer will find such spatial estimations acceptable. I further suggest that the ordinary lay person, viewing Texas in the entire sequence, will accept the 1982 and 1984 maps without comment since they reflect what I can only call a "spatial logic" that is to be found everywhere else on the map (California, Washington, New York, New England, etc.). Each map seems to develop quite `logically' out of the previous one, like a photographic plate developing in the darkroom. On the other hand, bureaucratic epidemiologists, trained to think exclusively in the temporal domain, and slowly realizing that they may have been

. . . this judgment will be informed by what the reader brings to these written and graphical texts; in other words, it will be related to the hermeneutical stance one is prepared to adopt.

sitting on scientifically valuable spatial series without knowing what to do with them, may try to exaggerate the minute errors injected by such a procedure. Science becomes, once again, a socially negotiated endeavor.

Florida presents other human, not to say politically charged, problems. Many polite inquiries to the Florida State Health Authorities for cumulative county values produced replies to the effect that they were quite capable of handling the geographical analysis of the epidemic themselves, that only state totals were available to outsiders, and that they needed no help whatsoever–thank you very much! Fortunately, one state health worker, who clearly must remain anonymous, thought this attitude was unreasonable, defensive, and even unethical since, in a state where the epidemic was rapidly becoming catastrophic, it made a major database the private preserve of a few researchers who had no appropriate geographical and methodological ways of using the data. At that time, no geographic modeling had been undertaken, let alone published. We received a xeroxed packet of county values as they had appeared at the end of each year, and we inflated these by a factor based on corrected state totals after the database had been revised by incorporating late reports. In constructing the Florida sequence from these revised figures, we were also fortunate in having perhaps the only geographical analysis of the diffusion of HIV at the time, an analysis which used Florida as one of four case studies.[16] The result is the only published sequence of AIDS diffusion, a sequence with very small, though still unspecifiable, errors.

Iowa presents another problem, one shared by states like Montana and South Dakota. These states are characterized by rural populations of very low density, interspersed by a few urban centers. Only state totals are available for states like these.

Iowa presents another problem, one shared by states like Montana and South Dakota. These states are characterized by rural populations of very low density, interspersed by a few urban centers. Only state totals are available for states like these. Even states, such as Wisconsin, which has a higher population density and a reasonably developed central place structure focusing upon Milwaukee-Chicago, exhibit this problem. In cases like these, the cumulative state totals must be assigned in proportion to the county populations. Such an estimation procedure is based on the perfectly reasonable assumption that AIDS is, in large part, density dependent.[17] Detailed analyses of somewhat similar states, like Ohio and Pennsylvania,[18] confirm this procedure as reasonable in the absence of any other information. In actual fact, other information for Montana, Wyoming, and North and South Dakota was made available to me under the standard and strict ethical conditions governing the scientific reviewing procedure. It is clear that in the early stages of the AIDS epidemic–the so-called "seeding" stages–the appearance of AIDS cases in areas of extremely low rural population densities consisted almost entirely of young homosexual men coming home to die from major urban epicenters on the east and west coasts. I cannot and will not use such information to "correct" the earliest maps, so here spatial error must be knowingly left literally in place.

In the early years, the cumulative numbers for these sparsely settled states are very small, counted in tens or less, and in later years, as the epidemic takes hold, the maps become more and more reliable (i.e., less prone to error). In a year when Montana had ten cases, the national total was already in the tens of thousands. The overall relative error is minute: the local spatial error may be initially quite large but reduces quickly. Notice it is not the totals in a state that are in dispute (except for the other sources of error discussed above) but the exactitude of the spatial allocations. With the exception of Waldo Tobler's "error ellipses" in the very different area of multidimensional scaling and cartography, I do not think we know much about measuring such errors. And, once again, how can you measure error without knowing beforehand what the truth is?

Turning back to the five map sequence, what effects might such errors have on our belief that the sequence is a reasonably accurate representation of the diffusion of the AIDS epidemic at this scale? I emphasize "at this scale" since we recognize degrees of generalization in any cartographic representation.[19] No one would attempt to use these maps for analytical purposes appropriate to much finer levels of resolution. The thickness of a contour line may well exceed the size of some of the townships reporting in a state like Virginia. Some degree of generalization is inevitable in any scientific statement. Indeed, and perhaps almost by definition, a scientific statement in words, graphics or algebras is a generalization where we can see the forest rather than the individual trees. Notice that in regions where the county database is reasonably fine, and the official values reported considered reasonably reliable (over much of the eastern part of the country, for example), the unfolding sequence generates a high degree of trust and therefore belief. The "spatial logic" appears reasonable and truthful mainly because the information content in such "spatial logic" arises precisely out of the plausible spatial autocorrelative properties in such relatively "local" areas. But why should we believe that Iowa, Texas and Florida, and other states where estimations have been made, are any different? Yet, notice further how words like "trust," "belief," "reason," and "truth" have entered the discussion. Whether you trust the map sequence, whether you believe it to be reasonable and close to some unknown truth, depends upon you and what you bring to the hermeneutic task, a task that faces us as human beings as a condition of possibility. Thus, and as thoughtful scientists, it is necessary to negotiate in a communicative discourse.

Some degree of generalization is inevitable in any scientific statement. Indeed, and perhaps almost by definition, a scientific statement in words, graphics or algebras is a generalization where we can see the forest rather than the individual trees.

NOTES

1. They appear in black and white in P. Gould, *The Slow Plague: A Geography of the AIDS pandemic* (Oxford, UK, and Cambridge, Massachusetts: Blackwell, 1993).

2. They were shown at the International AIDS Conference, Amsterdam, July 1992, by Dr. Mindy Fullilove, a doctor of medicine and an AIDS researcher, who pointed out the almost exact correspondence between the geographic development of the epidemic and the assumed sources of original infection specified by several hundred people interviewed in North Carolina. After the cartographic presentation, one epidemiologist in the audience said, "I believe we have a new paradigm here," only 7,000 years after the maps of Babylon were incised on clay tablets.

3. Inexorable march, *Time*, Vol. 40, No. 9, 1992, p. 20; *Forbes*, Vol. 154, No. 6, 1994, p. 250; *Playboy*, Vol. 41, No. 2, 1994, pp. 44-45.

4. I would like to thank Joseph Kabel, Ralph Heidl, and William Holliday for their expert help in making these maps, from the laborious compiling of the original data base, to the final, high-resolution slides, to the animation sequence for educational television.

5. P. Gould, D. DiBiase and J. Kabel, "Le SIDA: la carte animée comme rhétorique cartographique appliquée," *MappeMonde*, 1, 1990, pp. 21-26.

6. Based upon the largest 102 urban centers, containing half the population of the United States, a simple model of hierarchical diffusion predicts AIDS rates in 1986, 1988, and 1990 (r=0.80), with residuals highlighting well-known social and cultural characteristics (P. Gould, "Spreading HIV Across America with an Air Passenger Operator", paper given at *the International Symposium on Computer Mapping in Epidemiology and Environmental Health*, Tampa, Florida, February, 1995).

7. Particularly when such a map sequence becomes the data input for spatial adaptive filtering and parametric tracking, techniques which search out the information in spatiotemporal sequences and use it to forecast the next maps. See, for example, P. Gould, "Epidémiologie et maladie," Chapter 53 in A. Bailly, R. Ferras and D. Pumain (eds.), *Encyclopédie de Géographie* (Paris: Editions Economica, 1992), pp. 949-969; and J. Kabel, *A*

Geographic Perspective on AIDS in the United States: Past, Present and Future (University Park, PA: Ph.D. Dissertation, Department of Geography, 1992).

8. New definitions of AIDS, based upon impeccable medical criteria, and designed to enhance earlier diagnosing and life-prolonging treatments, were meant to come into effect on January 1, 1992, a presidential election year. They were "delayed" until January 1, 1993.

9. J.B. Harley, Deconstructing the map, in T. Barnes and J. Duncan (eds.), *Writing Worlds: Discourse, Text and Metaphor in the Representation of Landscape* (London: Routledge, 1992), pp. 231-247.

10. P. Gould, J. Kabel, W. Gorr and A. Golub, AIDS: predicting the next map, *Interfaces*, 21, 1991, pp. 80-92.

11. We raised this question while modeling, with spatial adaptive filtering, the course of the AIDS epidemic in the 64 health districts of the Bronx (New York). See Gould, *The Slow Plague*, pp. 130-133.

12. AIDS Surveillance Group, *Monthly Report for Washington*, D.C., June, 1991, p. 2.

13. Such maps have been created for Los Angeles, with the full cooperation of the Los Angeles AIDS Surveillance Group, by Dr. William Bowen and his undergraduate students as a socially meaningful cartographic exercise. The dots are placed randomly within the thousands of census districts, some of them no bigger than 4-5 city blocks. Total confidentiality is preserved. See W. Bowen, et al., AIDS in LA, and AIDS in LA 1983-89, *Occasional Publications in Geography*, Nos. 4 and 6, California State University, Northridge, CA, 1989.

14. An excellent empirically-based study on the confidentiality question, using the more open Italian census, particularly the region of Tuscany, has been carried out by S. Openshaw ("An empirical study of confidentiality crisis in the release of micro census data," *CURDS Publications*, 1989, Center for Urban and Development Studies, Newcastle University).

15. T. Dawson, "Towards a spatial ethic: the question of confidentiality and the geographic aggregation of data," *Proceedings of the Association of American Geographer, American Association of Geographers*, Miami, Florida, April 1991, p. 45.

16. This remarkable paper was based on over 2 million medical exams given to young (17-23) people volunteering for military service. Even today, it is the largest data base in the world, generally denigrated by classically-trained statisticians because it is not a pure random sample. The reader must judge when an N, now exceeding 4 million, is worth considering as a source of information, or whether it should be thrown away. See L. Gardner, J. Brundage, D. Burke, J. McNeil, R. Visintine, and R. Miller, "Spatial diffusion of the human immunodeficiency virus infection epidemic in the United States, 1985-87," *Annals of the Association of American Geographers*, 79, 1989, pp. 25-43.

17. Confirmed by analyses using the expansion method of Casetti, in which the parameters of a cubic temporal equation are made quadratic functions of a spatial variable like population density. The fit of such models is quite tolerable, although not as good as spatial adaptive filtering. See J. Kabel, *A Geographic Perspective on AIDS in the United States*; and R. Wallace, "Transmission on geographically-centered social networks: effects of population density and spatial distribution," New York Psychiatric Institute, July, 1992, pp. 1-7.

18. A. Gorlub, W. Gorr, and P. Gould, "Spatial diffusion of the HIV / AIDS epidemic: modeling implications and case study of AIDS incidence in Ohio," *Geographical Analysis*, 1992, pp. 85-100.

19. P. Gould and R. Wallace, "Spatial structures and scientific paradoxes in the AIDS pandemic," *Geografiska Annaler*, 76B, 1994, pp. 105-116.

cartography bulletin board

EUREKA CARTOGRAPHY

by Susan Waldorf, President
Eureka Cartography

Eureka Cartography of Berkeley, California is the largest provider of custom map production services in the Western U.S. Clients include magazine, textbook, guidebook and telephone directory publishers, advertising agencies, government agencies, visitors bureaus, environmental organizations and transit agencies. Recently, Eureka has been active in multimedia, producing hundreds of maps for CD-ROM titles and interactive textbooks. If Fodors, Sierra Club, GTE, U.S. West, Mindscape, Macmillan, and the U.S. Forest Service publications are familiar to you, you've probably seen a Eureka map or atlas. Our clients think of us as their own in house mapping department, from initial concept development through final output.

Founded eleven years ago, the company has grown to a staff of fifteen professionally trained geographers and cartographers with expertise in digital map design and production. The size of the staff enables Eureka to handle both large and small projects with the same attention to customer service. Variety is the norm at Eureka; in addition to traditional cartographic designs, the staff has produced game boards, puzzles, maps on Plexiglas, maps for astrological charting, maps for children, and maps for courtroom presentations.

Eureka has complied detailed base maps for the Bay Area, California, the U.S., most major cities, and all countries worldwide at multiple scales. Typically, clients work with Eureka's senior cartographers to identify the content and the *look* of a map, carefully tuning each design element to support the intended use of the product in print or digital form. Clients preview their maps before final production to ensure proper map coverage, content, style, and layout. Eureka produces raster or vector digital files, high quality plots, final films and proofs, or printed maps, depending upon the client's target medium.

In addition to customer services, Eureka is now a publisher of map products, with seven titles to be printed this year. In a joint venture with Map Link of Santa Barbara and Allan Cartography of Medford, Oregon, Eureka will also publish high quality maps and atlases under a newly created imprint, Benchmark Maps. Digital versions of Eureka maps may now also be previewed and purchased on-line through PNI, a new stock photoservice for print and multimedia editors and producers.

Eureka employs a wide range of GIS, desktop publishing, and graphics software tools including Autocad, Microstation, MapInfo, Freehand, Photoshop, Quark and PageMaker. In addition to databases developed in-house, Eureka utilizes geographic and demographic databases from a number of commercial data providers. The San Francisco Bay Area provides a rich supply of service bureaus, conversion shops, illustrators, photo researchers, travel writers and other specialized services Eureka utilizes as required.

On the next page (pages 38-39) is a color map of Fresno, California created by Eureka Cartography. It is a convention and visitors bureau map, designed to attract commerce to the region. It is a hybrid cartographic design, incorporating accurate road and city information with illustrative elements to give readers a positive image of the area. Cartographic license was taken to represent surrounding attractions without losing the accurate navigational information a visitor requires. The map appears in a regional magazine and other derivative publications. Cartographers Stacy Wright and Kevin Kolb used Freehand 5.0 to create the overview and inset maps. ❑

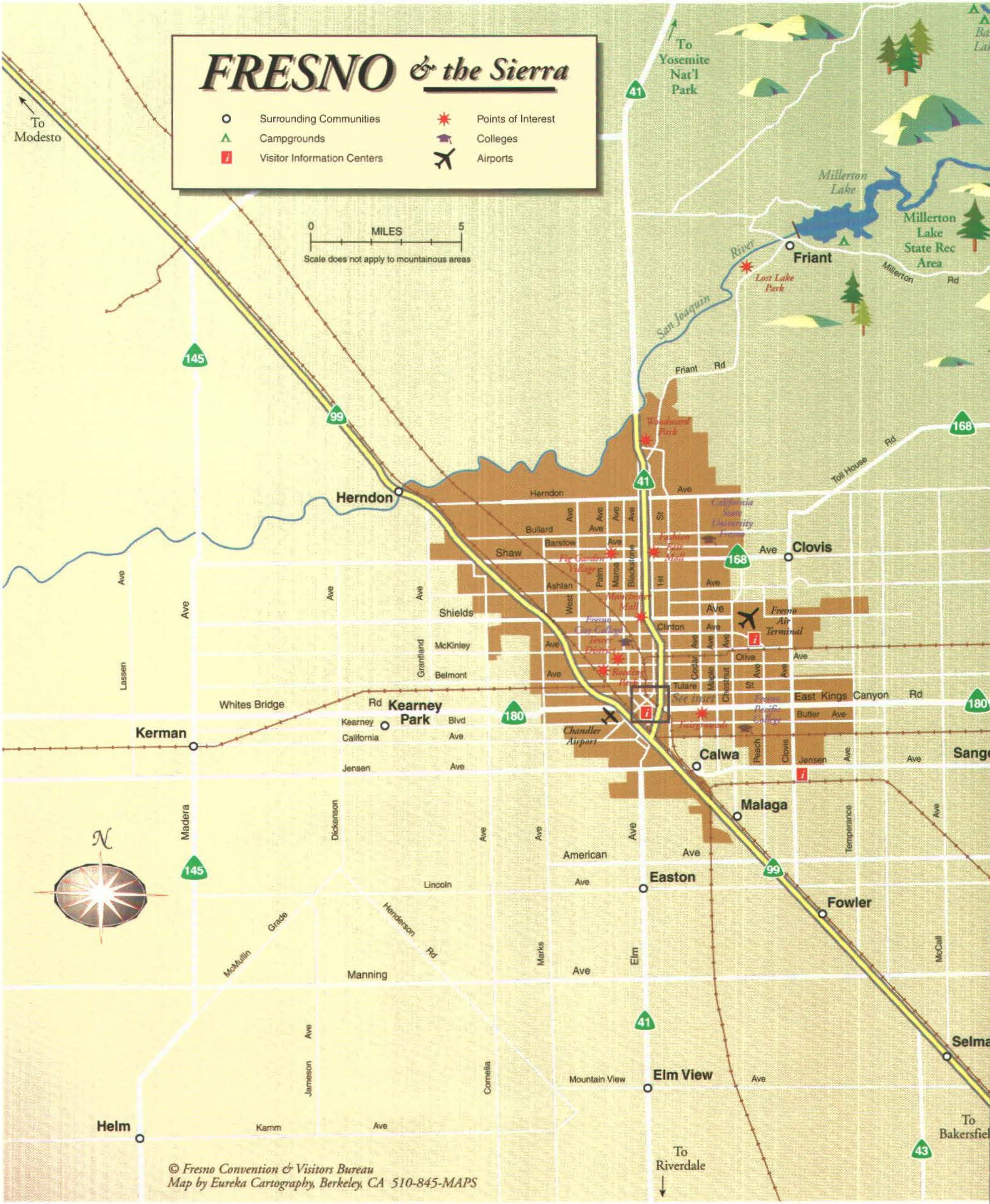
CARTOGRAPHY AT THE 1995 ASSOCIATION OF AMERICAN GEOGRAPHERS MEETING

by Jim Anderson, Director
Florida Resources & Environmental Analysis Center
Florida State University

The recently concluded annual meeting of the Association of American Geographers that was held in Chicago included participation by many NACIS members and provided a variety of sessions on many aspects of cartography, numerous workshops, and a site visit to Rand McNally's company headquarters.

The majority of the cartography related paper sessions were sponsored by the Cartography Specialty Group or co-sponsored in conjunction with the GIS Specialty Group. Four sessions on theoretical cartography were held: *Cartographic Techniques, Computer Applications in Cartography, Cartographic Symbolization*, and *Cartographic Symbolization and Cognition*. A session (similar to one held last year) on National Science Foundation Equipment Grants provided information to departments that are considering setting up a GIS or computer cartography lab. This year's *Student Honors Paper Competition* session had representation from only three universities. I would urge you to encourage your students to submit a paper for this

continued on page 40


FRESNO & the Sierra
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Campgrounds
Visitor Information Centers
Points of Interest
Colleges
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To Modesto
To Yosemite Nat'l Park
Millerton Lake
Millerton Lake State Rec Area
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Lost Lake Park
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Toll House Rd
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Fresno Air Terminal
Shields
McKinley
Belmont
Whites Bridge Rd
Kearney Park
Kearney Blvd
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Jensen Ave
Kerman
East Kings Canyon Rd
Chandler Airport
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Lincoln Ave
Henderson Rd
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Manning Ave
Mountain View Ave
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To Riverdale
To Bakersfield
Lassen Ave
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Fig Garden Village
Manchester Mall
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Tower District
Roeding Park
Fresno Pacific College
Fairgrounds
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41
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43
© Fresno Convention & Visitors Bureau
Map by Eureka Cartography, Berkeley, CA 510-845-MAPS


Mammoth Pool Reservoir
Huntington Lake
Lake Thomas Edison
Sierra Summit
Florence Lake
Shaver Lake
Auberry
Dinkey Creek Rd
Toll House
Toll House Rd
Courtright Reservoir
Wishon Reservoir
SIERRA NATIONAL FOREST
Academy
Trimmer Springs Rd
Pine Flat Reservoir
Pine Flat Rec Area
SEQUOIA NATIONAL FOREST
Watts Valley Rd
Wonder Valley
Elwood Rd
King River
East Kings Canyon Rd
To Kings Canyon Nat'l Park
To Sequoia Nat'l Park
Squaw Valley
Reed Ave
Academy Ave
Manning Ave
Parlier
Reedley
Kingsburg
Downtown Fresno
Voorman St
Divisadero St
Community Hospital
Hobart Park
Fresno Metropolitan Museum
CSPP
Federal Building
La Quinta Inn
Meux Home
Santa Fe Depot (Amtrak)
City Hall
State Building
Memorial Auditorium
Police Department
Warnors Theatre
Courthouse Park
Library
Post Office
Trailways Bus Station
Fresno County Courthouse
Hall of Records
Fresno Hilton
Fresno Convention & Visitors Bureau
Fresno Convention Center
Greyhound Bus Station
Centre Plaza Holiday Inn
Southern Pacific Depot
AT & SF Railroad
Southern Pacific Railroad
To Kings Canyon/Sequoia Nat'l Park
Fulton Mall
Broadway
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continued from page 37
session next year. A cash prize is awarded for all papers that are accepted, as well as an additional award for the winning paper.

A session on *Map Use as a Field of Study* examined various ways that maps are being used in natural hazard situations and environmental studies. This session also included a paper on how visualization and multimedia are changing the concepts of map use. There was also a session that focused on some problems and solutions of digital map production and publication. Participants from the University of Wisconsin-Milwaukee, the University of Tennessee, the University of Oregon, and the H.M. Gousha Company discussed their experiences in producing digital, book-size and large-sheet format map products.

At this year's meeting there was a dramatic increase in the number of sessions and papers that were devoted to multimedia. Three sessions were jointly sponsored by the AAG Multimedia Software Committee, the AAG Commission on College Geography, and the Geographic Information Systems and the Geography Education specialty groups. The sessions, *Innovations in Hypermedia and Multimedia I, II,* and III, dealt with the development of curriculum support materials using multimedia techniques and how these materials are used in the classroom. It was evident from the sessions that several cartography labs have become involved in developing supplemental materials for physical and human geography courses as well as for book publishers.

Specific items discussed or presented at the meeting of noteworthy interest were:

The Virtual Department Project
The Virtual Department Project is an ongoing effort to link curricula among geography departments using the Internet and the World Wide Web. The stated goals of the project are to:

- Offer high quality curriculum materials in the form of classroom and laboratory modules that can be used across the Internet by geography students and faculty at any university in the world.
- Develop new types of on-line and interactive research publications that promote collaborative research.
- Work toward global curriculum sharing and integration in geography through the creation of on-line "electronic" textbooks and research materials.
- Share the time and expense of developing hypermedia and multimedia curriculum materials and benefit from materials that might not otherwise be made available commercially.

Phase I of the Virtual Department Project will link geography departments already on-line, inventory existing research and teaching materials, prepare samples of hypermedia materials and research reports, and begin to organize an on-line hypermedia geography journal. Future phases are planned that will sponsor workshops and have sixty credit hours of courses on-line. The following home pages provide information about the project:

- Texas Geography: http://www.utexas.edu/depts/grg/main.html

- Virtual Department: http://www.utexas.edu/depts/grg/virtdept/contents.html

Workshops
This year's meeting saw an increase in the number of workshops held that related to cartography from four to eight:

- *Introduction to Computer Cartographic Programming in C*
- *Proficiency with MicroCAM Mapping Software*
- *An Introduction to Global Positioning Systems*
- *Map Production and Design on the Mac*
- *Map Design and Production with Corel Draw*
- *Using ArcView in the Classroom*
- *Multimedia and the Mac*
- *Surfer for Windows*

Since workshops are a source of revenue for the specialty groups, it would be nice to see this trend continue at next year's meeting.

AAG Committee on Multimedia
For those interested in multimedia, the AAG has established a Committee on Classroom Multimedia Software chaired by Sona Andrews from the University of Wisconsin-Milwaukee. The original charge to the committee was to provide the AAG Council with guidance on where geographers and geography stand with respect to multimedia classroom software and to recommend what the Association should do in this area. The charge has been modified to emphasize the ways that the Association can (and should) play a role in fostering innovative teaching based on multimedia. To provide input to the committee or to receive information about activities of the committee contact Sona Andrews at sona@csd.uwm.edu.

Cartography Specialty Group
Several items of interest were discussed at the Cartography Specialty Group business meeting. The current membership of the group is six hundred and forty-eight. Keith Clarke from Hunter College, New York is the incoming the chairman. Eugene Turner from California State University-Northridge is the newly elected vice chairman. As vice chairman,

Gene will be responsible for organizing sessions for next year's program. Suggested session topics include Cartographic Education, Map Use, Historical Cartography, Electronic Publishing, Map Design, Design of Presentations, Critiquing Map Design, and Analytical Cartography. Workshops will also be offered. I would encourage NACIS members to participate by contacting Gene. The deadline for paper submission is sometime in September.

The specialty group will continue to award master's research grants and to sponsor the Student Paper Competition. If you know of students who are conducting thesis research related to cartography they should be encouraged to contact the specialty group. The idea of establishing a service bureau for next year's meeting to assist paper presenters with their graphics was also discussed. The Central Office of the AAG has also asked the specialty group to develop guidelines for graphics used in presentations. This is an ongoing problem which NACIS members should also be aware of when presentations are created for our own annual meeting. One final item of discussion was the feasibility of creating a home page on the world wide web which could be used to distribute minutes, newsletters, a membership directory, and other items of interest.

In conclusion, cartography was well represented at this year's national meeting of the AAG. The Cartography Specialty Group is one of the largest in the Association and is very active in organizing sessions and promoting cartography. I would urge you to participate when possible and to consider making a presentation at next year's meeting in Charlotte to be held April 9-13, 1996. For information contact the AAG, 1710 16th Street NW, Washington, D.C. 20009-3198 or GAIA@AAG.ORG.❑

reviews

BOOK REVIEW

Thematic Mapping from Satellite Imagery: A Guidebook.
Edited by Jean Denègre. Published on behalf of the International Cartographic Association (ICA) by Elsevier Science, Oxford: Pergammon, 1994. 269 + xxvi pp. English and French text, 24 images in color, 4 in black and white, preface by D.R.F. Taylor, acknowledgments. Size: 29.2 cm X 20.3 cm (11.5" X 8"). Contributors include: Andrzej Ciolkosz, Andrzej B. Kesik, Donald Laurier, Sten Folving, Jean Denègre, Janos Lerner. $105.00 hardcover. (ISBN 0-08-042351-5)

Reviewed by Michael P. Peterson
Department of Geography/Geology
University of Nebraska at Omaha

The stated purpose of this book is to present methods for producing maps from satellite images. It is intended for "inexperienced satellite imagery users desiring practical guidance on methods employed and their expected results." Of the five chapters, four examine two general technical problems: 1) how to interpret the collected data, and 2) how to integrate the information acquired from conventional cartography. The remaining chapter, by far the longest, describes the methods and includes examples for the production of maps from satellite imagery. This chapter includes most of the black and white and all of the color images.

The first chapter describes the characteristics of different remote sensing satellites, especially for cartographic applications. It examines the spectral, spatial, and temporal resolutions of twenty different satellite systems, including those for weather, oceanography, geology, and environmental applications. The chapter takes a historical approach, beginning with a description of meteorological satellites, then discussing the land observation satellite systems of the 1970s and 1980s, and finally providing an overview of other systems from Russia (COSMOS), India (IRS-IA), Japan (MOS-1), Germany (MOMS), and the U.S. Space Shuttle radar imagery.

The second chapter concerns the process of extracting information from satellite imagery. The fourteen page chapter examines both the methods of visual image interpretation and computer-assisted image analysis. The first part of the chapter looks at the elements of the interpretation process, including tone, color, and texture. The second part of the chapter looks at image preprocessing (radiometric and geometric corrections), image enhancement (contrast and spatial enhancement), and image classification (minimum distance to means, parallelepiped, and maximum likelihood). The last part of the chapter examines accuracy in image classification.

The third chapter looks at the methods for combining satellite imagery with maps. Topics include image / map registration, mosaicing, radiometric processing, and GIS techniques. A major part of the chapter concerns the color transformations that are needed to create an image that looks as "natural" as possible for use of a satellite image as a map background.

Chapter four (nine pages) concerns the design and "semiology" of image map representations. A majority of the chapter looks at typology or lettering. Other parts of the chapter cover the relevant cartographic techniques for selection of information, cartographic representation, and design.

The last chapter, Chapter 5, describes a number of different applications for satellite image mapping. At 110 pages, this chapter represents the core of the book. It is divided into twenty sections, each about six pages in length, and presented in both English and French. Each section describes a specific application, including the mapping of land use/land cover, urban areas, soil, agriculture, coastal zone areas, ice and snow fields, vegetation, flood-zone areas, and the representation of three-dimensional landscapes. The international aspect of the book is apparent in this chapter. A total of sixteen different countries are represented. The specific applications make use of a number of different sensor platforms. Of the applications, four involve the use of SPOT imagery, three use LANDSAT Thematic Mapper (TM) imagery, four combine SPOT and TM imagery, three use AVHRR (Advanced Very High Resolution Radiometer) imagery, and one uses imagery from the LANDSAT multispectral scanner (MSS).

After Chapter 5, Chapters 1 through 4 are presented in French. Considerable effort has been taken to translate the text, including the text within the illustrations. However, the first two chapters still contain English text within the individual figures. Chapters 3 and 4 have French text throughout.

In one respect, the book is short. Of the total 269+ pages in the book, only about ninety pages are text in one language. But, the pages are somewhat bigger so that there is still a considerable amount of text. The best aspect of the book is the discussion of the different applications in Chapter 5. In general, the applications make use of existing technology rather than demonstrating new innovations. The discussion of each application (presented in French and English) is brief and is presented in a manner similar to a "poster session" at a conference. The color images vary from high-resolution photographs to ink-jet printed image classifications with a limited number of colors. Almost all of the images are the result of some type of image classification procedure. Although some have been annotated with text, few contain a reference map or other ancillary data to help locate the image. One wishes the images could have been printed at a larger size since much of the detail in the images is lost.

The information in Chapter 1 through 3 represents a summary of the major remote sensing topics as one would find in any of the current textbooks on the subject. Chapter 4 attempts to integrate some cartographic theory to satellite image mapping. The information here is derived from books on cartography, including Bertin's book on the "Semiology of Graphics." In total, these chapters provide some necessary background to the discussion of the applications in Chapter 5. However, few of the image maps in Chapter 5 make use of the cartographic techniques that are discussed in Chapter 4.

The most significant contribution of the book is that it provides some general guidelines for how information from maps and images can be combined and how images can be annotated with information from maps. The initial chapters provide necessary information concerning the general transformations and other aspects involved in the computer processing of the satellite imagery. It presents some interesting approaches for the application of remote sensing techniques for examining a variety of environmental problems.

Thematic Mapping from Satellite Imagery: A Guidebook is an organized and accessible discussion of current methods and applications in remote sensing. The editor has succeeded in creating a well-organized, dual-language book that summarizes the major remote sensing techniques, shows what is currently possible with the technology, and describes a set of applications from a number of different countries. The two languages have been incorporated in an effective manner. Separating the languages in the first four chapters and combining them in Chapter 5 was a good approach. The figures are legible and the numerous color images have been professionally printed. The applications from different countries indicate the degree to which the technology is being applied around the world. The book does not quite achieve its stated objective of being a pedagogical device, however, because the major topics have been treated in a cursory manner. Overall, the book seems to be intended for people who have considerable prior experience in remote sensing. ❑

BOOK REVIEW

American Places Dictionary: A Guide to 45,000 Populated Places, Natural Features, and other Places in the United States.

Frank R. Abate (ed.) Detroit : Omnigraphics, Inc., 1994. 4 v. Cloth, price $350.00/set ($100.00/vol). (ISBN 1-55888-147-4)

Reviewed by Christopher Baruth
AGS Collection
University of Wisconsin-Milwaukee

The American Places Dictionary is a hefty four volume work which contains select information on 45,000 populated places in the United States. The work is arranged geographically: each volume contains the states in a region of the country (Northeast; South; Midwest; West) which are, in turn, arranged by county. For each state there is an introductory section containing summary census data and other basic information relating to the local government, history, and boundaries of the state. Here one can also find a list of state *things* (eg: animals, beverages, birds, dogs, fish, etc., etc.), the state seal, a map of the counties, and a statewide alphabetical index. Each state is arranged alphabetically by county, and each county, alphabetically by place. Entries contain the class (city, township, etc.), geographical coordinates, zip code, population (1980 and 1990), population density, area (land and water), and elevation. Many entries include the date of settlement, founding, or incorporation, and the origin of the place's name. The county entries also include the name of the county seat and the telephone area code. A complete alphabetical index covering all 45,000 places is located in volume 4, as are several appendices which list American Indian Reservations, U.S. military installations, and major geographic features. The work is thoroughly explained in the introductory pages and its sources of information are revealed in its bibliographies.

This compilation is the result of a considerable amount of thought and labor and brings together a large quantity of information in an arrangement that will be both loved and hated depending on the users current task. Unless one knows the county in which the sought after place is located, it is necessary to consult the index first. This, I suspect will pertain in most instances of usage. Once in the county, one can, however, gain a view of the area which is not possible in an alphabetically arranged work. One way around this arrangement problem would be to issue the work on a CD-ROM, offering a variety of search and retrieval strategies. In summary, this publication has value as a reference work and is recommended for any research library. ❑

BOOK REVIEW

Basic Cartography for Students and Technicians, Vol I, 2nd ed. Edited by R.W. Anson and F.J. Ormeling. London: Elsevier Applied Science Publishers for the International Cartographic Association, 1993. 212 + xiii pp., maps, diagrams, graphs, photographs. Cloth (ISBN 0-08-042343-4) paper (ISBN 0-08042344-2).

Reviewed by Jeremy Crampton
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While there is an urgent need for a series of introductory books on the basics of modern cartography, preferably with copious quality illustrations of map design and production, this book does not meet that need. Although it is not an uninteresting or irrelevant book, it reminded this reader of the curate's egg which was only "good in parts." Which parts are good and which bad is likely to vary according to the individual, but the overall flavor of this book is one of missed opportunity.

First published in 1984, this is the second edition of Volume I. It has been subjected to a "complete revision, re-edit and update" (Preface). Its five chapters cover "The History of Cartography" (by C. Koeman); "Mathematical Cartography" (by D.H. Maling); the "Theory of Cartographic Expression and Design" (by B. Rouleau); "Map Drawing and Lettering Techniques" (by K. Kanazawa); and "Cartographic Pre-Press, Press and Post-Press Production" (by C. Palm and S. van der Steen). The second Volume extends these topics with coverage of generalization and thematic map design, while the third Volume ("in preparation") will cover map design, GIS, and desktop cartography.

This division of labor raises the question of the relevance of the material in Volume I, which is largely focused on non-digital, not to say old-fashioned, map production. Of course, there is no reason not to write a book that details the proper operation of a pantograph or how to sharpen a pen nib (as this book does), but I think most people would question whether this was quite "mainstream cartography" as claimed by R. E. Dahlberg in the introduction. Indeed, Dahlberg seems to recognize the retro approach of this book when he states that Volumes I and II "provide an authoritative and comprehensive view of the subject as seen during the early stages of the transition from a conventional analogue, or graphics-based, discipline to a database technology"(page 1). In fact, one might say that this volume offers a "view of the subject as seen during" the very early stages as it mentions digital techniques only in passing. It may be that the revised Volumes II and III (not seen by this reviewer) will provide a more modern flavor. Or, it could be said that the international scope of the series encourages a least common denominator approach to avoid excluding those without the very latest technology. This is understandable, but it does not necessarily produce an even or useful book.

Chapter one, "The History of Cartography" is a madcap dash by C. Koeman over six millennia of cartographic history in less than 13 pages (over 450 years per page!). Nevertheless, it manages to provide some generally lively remarks coupled with the book's highest quality illustrations (although the illustrations often seem to have a somewhat tentative relationship to the text). In among the usual suspects (Eskimo maps, Marshall Island stick charts, the Babylon clay tablet, Greek–Roman–Arab–Dutch cartography), there is a higher than average concentration on China and Japan (2.5 pages), which is to be welcomed, but one wonders what a short exposition like this could be used for apart from whetting people's appetites (and, unfortunately, no further references are provided).

Derek Maling's more wordy chapter (44 pages) on "mathematical" cartography covers his usual material on projections and measurement. Unlike the rest of the book which targets an introductory audience, Maling's chapter is probably the most detailed. His chapter is useful reference material for the student who needs to investigate the sheet numbering system employed by the *International Map of the World* or whether parallels are R *sin* χ or R *cos* ϕ (both of which this reviewer has in fact needed). GIS users will benefit from the short remarks on coordinate transformation, although the information on how to make grids is more relevant to surveyors than cartographers in this age of derived maps. The discussion of projections is perhaps more mathematical than that found in other textbooks (readers are invited to react to this with joy or dismay as they prefer) but is otherwise unremarkable.

A chapter on the theory of cartographic expression and design by B. Rouleau follows. This is a chapter heavily influenced by the map communication model and its busy evangelists, the visual variables of J. Bertin. Here, we learn that the purpose of maps is to "represent the correct spatial location of data on [the] plane surface" (page 66). A similar comment from Maling that map quality "refer[s] to the positional accuracy of points of detail" indicates the empiricist approach of the book. How different this perspective is to the discussion of maps' power and influence found in Denis Wood's *The Power of Maps* or Mark Monmonier's *Drawing the Line*. Is this because there is no introductory text for the general reader on theory in cartography or because that theory has largely turned out to be irrelevant to the practice of cartography? Those of us who reject the second position must surely do more to show how the kind of assumptions about cartography made here actually do play determining roles in cartographic "practice."

The most interesting aspect of K. Kanazawa's chapter on map drawing and lettering is his discussion of relief depiction (hachures, contours, and hill–shading). These pages (p. 130 ff) contain some quite beautiful illustrations that demonstrate the power of a skilled airbrush. It would be a pity if this skill were lost, although the capabilities of good raster–based image editing programs (e.g., PHOTOSHOP or COLLAGE) may encourage graphic artists / cartographers to depict relief landscapes in a new medium. However, the rest of the chapter on scribers, pen nibs, and stick-up lettering is more happily defunct.

For those who need a frequent fix of the minutiae of pre- and post-press production, (and who doesn't?), C. Palm and S. van der Steen run the gamut from process camera photography through offset plate corrections to laminating the finished product. Despite my generally critical comments about the concentration on non–digital production in the book, this chapter is still relevant despite its photo-mechanical approach. The notions of "negative" and "positive," registration, separations (layers), and masks are all employed directly or indirectly in desktop publishing / mapping. At the same time, they have an independent beauty and thrill, as anyone who has designed and produced any kind of document can attest, because they are the basis of publishing. This returns us to chapter one and the historical development of the printing press.

Without the following two volumes it is hard to put this volume in context. Although many of the techniques described here are dated—if not obsolete—this is not the volume's major failing; people will buy it or leave it as they need. More worrying is the vision of cartography as a collection of techniques that is presented. Many contemporary cartographers reject this description, seeking instead to understand mapping as a way of seeing that involves ideology as much as it does symbolization. This understanding will not be apparent to the "students and technicians" who read this book. Because there is nothing here which cannot be found in standard cartography texts, I recommend skipping this volume and moving straight to Volumes II and III. ❑

ATLAS REVIEW

Disease and Medical Care in the United States: A Medical Atlas of the Twentieth Century

Gary W. Shannon and Gerald F. Pyle. New York: Macmillan Publishing Company, 1993. 150 + vii pp., 120 maps, 9 graphs, 5 diagrams, 1 table. $ 95.00. (ISBN 0-02-897371-2)

Reviewed by Connie Weil
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University of Minnesota

This three-part atlas examines both medical care and health in the U.S. since the turn of the century. It is intended for the general public and students, and this is indeed the audience for which it is most appropriate.

Part I, which comprises twenty pages, summarizes the history of death registration in the U.S. and changes since 1900 in the size of the national population, its age composition, and per capita income. National standards for registration of deaths were implemented in 1900, but only ten states and the District of Columbia initially met them; all states have satisfied them since 1933. Between 1900 and 1990, the U.S. population more than tripled. Over the same period, life expectancy at birth increased from 47 to 75 years, and remaining life expectancy at age 65 increased from 12 to 17 years. Maps in this first section of the atlas depict the population density, racial composition, and per capita income for each state at four points since the turn of the century. The maps of racial composition are difficult to interpret, since census definitions shifted during the period under consideration and no doubt will change again as we become better attuned to the complexity of biological reality.

Part II, which comprises two-thirds of the volume, surveys "geographic patterns of infirmity and mortality." It begins with a consideration of tuberculosis, the leading cause of death in the U.S. in 1900. Today, tuberculosis remains globally an important public health issue, but it is numerically insignificant as a cause of mortality in the U.S. However, the rise in tuberculosis rates among low-income, minority populations is reason for concern, especially because of the appearance of drug-resistant strains. "Urban Tuberculosis Cases, 1985" depicts this phenomenon by using graduated circles and color to portray 1985 tuberculosis rates for "racial" groups in U.S. cities.

The sophisticated and effective presentation of information about influenza and AIDS in this atlas reflects the authors' specialization in research on these diseases. The influenza epidemic of 1918-19 killed over a half-million people in the U.S. This is five times the number of U.S. troops who died from battle-related deaths in World War I and a quarter more than the number who died in World War II. The maps depict the diffusion of influenza globally in two waves in 1918 and nationally for four different times since 1900. In "AIDS Quotients for the Period, 1981-1983," "AIDS Quotients for 1984," "AIDS Quotients for 1985," and "AIDS Quotients for 1986," one of the most informative map series in the atlas, the "AIDS Quotient" is used to portray the prevalence of the disease in each state in relation to that of the country as a whole for four different times.

The bulk of the atlas relies on series of four maps to depict changes over time in a particular variable. Most of the diseases included in the atlas are examined as causes of mortality. All of today's leading causes of death—coronary heart disease, cancer, cerebrovascular disease, and accidents (specifically, motor vehicle fatalities)—are covered. The atlas also includes interesting material on infant mortality and Alzheimer's disease.

The third and final part of the atlas consists of just over twenty pages. It addresses the distribution of physicians, dentists, hospitals, and public mental hospitals. The authors point out that, at the turn of the century, "hospitals were shunned by everyone but the very poor." One of the most dramatic changes in recent decades has been the deinstitutionalization of the mentally ill. In 1955, more than half a million patients were in long-term, state-supported facilities for the mentally ill. The number today is about 100,000.

While *Disease and Medical Care in the United States* offers a fairly solid introduction to the history of diseases and health care in the U.S., it is not as attentive to the needs of its intended audience as it could have been. For example, most of the users of the atlas are likely to be relatively inexperienced in map interpretation, and yet the authors provide neither their rationale for presenting maps in a certain way nor guidance for the reader in how to approach them. In addition, the colors used on most of the maps are not very attractive. Furthermore, there are numerous errors and points which are unclear, especially on the graphs. One might conclude that, since no individual is credited with producing the maps and graphs, and since both Shannon and Pyle are primarily medical geographers, this project would have benefited by the inclusion of a third author who was more skilled in cartography.

Despite the shortcomings of the atlas, it will be of great interest to students of medical geography and others interested in changing patterns of health and health care. It pulls together a great deal of information that is otherwise not readily available. Straightforward description in the text does generally ameliorate problems presented by the graphics. Shannon and Pyle's atlas can be fruitfully employed to provide the historical background for the forthcoming *U.S. Mortality Atlas* being produced by the National Center for Health Statistics. Using over eight hundred Health Service Areas (composed of multiple counties) rather than the fifty states as the spatial units, the latter work will be more useful for analyzing contemporary patterns of mortality. It will also be more satisfactory cartographically. ❑

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Transition in the World of Map Librarianship

FUTURE

What does the future have in store for us? What new things will we have to deal with as we make the transition into the future? Obviously, we will be dealing with digital data in one form or another. For new United States earth resource satellite images, we will have to wait because Landsat 6 recently became "Hydrosat" and is imaging the bottom of the ocean. But with SPOT and future Landsats or commercial satellite systems, we will have high-resolution digital images in our collections and running in our GIS.

We will soon have raster-scanned images of our maps on CD-ROMs. A company in Aurora, Colorado, can already provide you a scanned image of any one of our 1:24,000-scale topographic maps for $99.

. . . the data will only be available in digital form. We do not intend to print hard-copy versions of these black-and-white electronic products.

The largest new program that we are involved with is the digital orthophoto quadrangle (DOQ) program being run out of our Western Mapping Center in Menlo Park, California. We intend to produce 1:12,000-scale DOQs on a county-by-county basis for the whole country. The project is being accomplished in conjunction with the Department of Agriculture and several States. Minnesota and the upper Mississippi flood areas will probably be the first areas covered. One very important aspect of this program is that the data will only be available in digital form. We do not intend to print hard-copy versions of these black-and-white electronic products. Not only is this a challenge for you, but the Government Printing Office (GPO) must figure out how to fund the production of thousands of discs if they are to be depository items.

Within the U.S. Geological Survey, we are establishing a series of cooperative research projects with private industry. New legislation allows us to enter into these agreements to pool our respective talents and solve problems. We currently are negotiating one of these agreements with the Environmental Systems Research Institute, Inc. (ESRI). We hope to draw on ESRI's talent in GIS software development to assist us in land use and land cover programs and in developing applications programs that use digital line graph data from the USGS. There are hopes that this mechanism can be used to work with other private companies so that neither of us needs to digitize the same information and so that we can exchange it.

As the National Mapping Division goes through its transition, we have come to realize that we aren't the only people that can make maps. With today's hardware and software, any of you can probably make a map that is cheaper, more up-to-date, and just as accurate as ours. Recently, I was asked to judge a student map contest for the American Congress on Surveying and Mapping. In one Canadian geography program, each member of the class was asked to make a map of the same Caribbean island. Five of the resulting maps had been entered in the contest. What was fascinating about the results was the differences between the maps. Even though they covered the same area, the colors were different and some emphasized the highways while others highlighted the parks and natural areas. North arrows were in different places, and legends and keys were treated in very different ways. My guess is that we will see more and more of this, and while it will make it more difficult to catalog these products, the key to finding them again will be that same cataloging information.

Perhaps the area where transitions are occurring faster than in any other is in cartographic communications.

Perhaps the area where transitions are occurring faster than in any other is in cartographic communications. Today, the Internet road on the super highway of information is being built from one campus or town to the other. Many of you are on the Maps-L list server, and questions and answers are being passed worldwide. At the USGS, we have started to use the World Wide Web Mosaic system as a means to provide information. In addition to providing information, we are also providing data free of charge. While the National Mapping Division is selling digital elevation models of the country, our own Water Resources Division decided to put them on the Internet where anyone can sign on and download them. Not very many years ago we were under pressure to recover not only all our reproduction and distribution costs for these products, but the production costs as well. Things have changed quickly. Because Government data can not be copyrighted or patented, anyone can put the data from any agency on the Internet.

Other things that we see in the future are on-line indexes, the ability to produce status graphics, and many metadata systems. These are what engineers and scientists call cataloging systems. After all the years of systems engineers designing information systems, they have finally discovered that the libraries knew how to describe and catalog data all along.

Other things that we see in the future are on-line indexes, the ability to produce status graphics, and many metadata systems.

We also project that you will see maps and other spatial data products produced under cooperative programs. The U.S. Forest Service and the USGS, for example, are starting to produce a joint edition topographic and forest service map. There are 10,000 quadrangles covering the National Forests, and it is silly for both agencies to produce a same-scale map of the area. We have compromised on symbology and content and will now produce a similar map. If the Forest Service makes one quad, we won't remake the same one but will work on the one beside it instead. This will save money, speed up the revision process, and provide people with what they want. We hope this same approach can be taken with State agencies and even private companies. Talks are underway with firms like Bell South and Minnesota Power and Light.

I have already mentioned free data on the Internet, and with last week's announcement of the possible merger of Bell Atlantic and a cable company, I believe it won't be long before all our homes are wired into the information highway and we will not only be able to communicate with each other, but also to move data around and create products for ourselves to meet specific needs.

QUESTIONS

All of this raises many questions about how we, in the spatial data business, will work in the future. The following are a few questions that I think may stimulate additional discussion at this conference.

- What do you do when we no longer produce a final product but simply maintain national digital data sets?–For those of you used to dealing with maps, you may find that all the data we have are on tape or some optical storage media. How will your patrons see the maps if you don't have plotters, computers, and GIS software to handle the data?

- What happens if the reinventing government activities make major changes in the GPO depository program?–Major shifts to electronic media are one thing, but what if the agencies don't consider electronic data to be publications.

- What do we have when there are so many one-of-a-kind products that it is senseless to catalog them?

- What happens to any collection when you can access it from home?–Will your reading room be necessary, and do you charge for the outside access?

- Who sets national standards, and how do you know who produced what?–Will the developing metadata systems look like, and be able to interface with, map cataloging systems?

- Have you started acquiring computers, software, and GIS packages?–Why haven't you?

- As an archivist, have you realized that you can't have it all and have you begun to figure out how to network or connect with the major sources or producers of spatial data products?–What happens when you become a producer and create a product with your GIS in your library?–Will you catalog everything?

CONCLUSION

We are continually told that we live in a changing world, and that is true. If people who died just 50 years ago were to return, they would be amazed and bewildered. The changes in our electronic information world have just begun. As an example, I just heard this information-age version of a famous old nursery rhyme. It went like this:

Mary had a little lamb,
Its fleece, electrostatic.

And everywhere that Mary went
the lights became erratic.

It followed her to school one day,
electrons all a-jiggle.

It made the children's hair rise up
and finger tips a-tingle.

The teacher tried to turn it out
her body was not grounded,
the sparks were seen for miles away,
and she's not yet rebounded.

You must not abandon the treasures that you, as map librarians and archivists, care for. Even in digital form, the maps you handle today will be the old relics for those who follow.

In the midst of so much that is new and in transition, there is a persistence of the old, the very old, in the world we inhabit. These old things are still, perhaps, more important than the new. We ride today in jet planes, but I can still remember the feel of the cold air on my face as I rode in my grandfather's sleigh, behind a team of horses, on a clear winter night. That memory has lasted longer than any plane flight for me.

You must not abandon the treasures that you, as map librarians and archivists, care for. Even in digital form, the maps you handle today will be the old relics for those who follow. Step forward and don't let the engineers and scientists define your role and your systems. Cartographic information is our province, and we should decide what we need to do to enhance and modernize the profession. ❑

Planning For GIS In Libraries: Decisions, Choices and Opportunities*

Linda R. Zellmer

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Internet. National Research and Education Network. Information Superhighway. Information Age. National Spatial Data Infrastructure. Geographic Information System. Almost every library and librarian is trying to deal with changes and questions about the future. Map librarians and libraries are no different. Mentioning the words Geographic Information System or its abbreviated form, GIS, in a group of map librarians these days will elicit one of three reactions. One response is to eagerly accept and acquire the equipment and software needed to operate a GIS in a library. Another is to totally ignore this new technology; this response often comes from people who believe that if the data used with a GIS were worth anything, the government would print it (a somewhat short-sighted reaction, because electronic access to this data facilitates its use and analysis). The third possible response is the one most of us adopt: we are aware of the new technology and will introduce it some day, but we have some questions that need to be answered before we proceed. The questions concern the technology, systems, functions, and hardware that are needed in a map collection, and the map librarian's role regarding electronic map resources. These questions should be answered while planning for the electronic map library.

I started thinking about the map library of the future when I was asked to plan a new facility. I began by reading articles on electronic libraries and taking GIS classes. Then, a patron from a local consulting firm called to request a slope map for a specific area of Wyoming. Although the United States Geological Survey (USGS) did produce a few slope maps, the only ones I had seen were labeled as experimental products, and none had been published for the area of interest. After this reference exchange ended, I realized that with what I had learned in my GIS classes, and considerable time on the Sun workstation, *I* could produce a slope map. This prompted the first of many questions related to GIS in Libraries:

What is the role of the map librarian with respect to this new technology?

- *What is the role of the map librarian with respect to this new technology?*
- *Should the librarian generate specialized maps on request or allow patrons to generate their own?*
- *What impact does this have on the training we receive in library school?*

On discussing the second of these questions with my GIS professor, he asked whether I wanted to be a librarian or cartographer. After a bit more contemplation, I posted these questions to the listserve Maps-L to generate some discussion. Since then, I have been trying to develop a vision of the map library of the future and to make some necessary decisions about the choices that are available.

* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

TECHNOLOGICAL CONCERNS

The first decision that must be made about GIS in libraries is whether to acquire this new technology. Given the variety of digital spatial data available on CD-ROM and the Internet, it appears that this choice has already been made. Libraries will have to accommodate new technology in order to survive. Those that choose not to acquire GIS technology will probably just circulate data on CD-ROM and may offer Internet access, but personnel at these libraries will not be expected to assist patrons using the data. Libraries that adopt this model of service to electronic information will soon find that they are warehouses rather than information providers.

SYSTEM CONCERNS

Librarians faced with choosing a geographic information system need to answer a number of questions before selecting a system. The primary question deals with defining the functions needed for the library. ESRI's *Understanding GIS* (1990) states that a GIS is "An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information." Given this definition, libraries interested in acquiring this technology need to choose whether to acquire a full or partial geographic information system for patron use. With a full system, patrons would be able to create, access, retrieve, process, analyze, and store cartographic data. Patrons using a partial geographic information system would be able to select, view, and combine data, as well as rotate, scale, and transform images. Patrons using either full or partial systems would also be able to print maps if they wish. The decision to acquire a full or partial GIS for a library should be made based on the library's goals. If the goal of the library is to provide the information and technology needed to use and analyze all forms of spatial information, then a full GIS workstation will have to be acquired. Libraries that wish to allow patrons to access digital data from various sources to create maps may prefer a partial system. In either case, some specialized functions might also be useful. Many collections that maintain copies of all current 7.5-minute U.S. topographic maps might be able to eliminate less-used maps if this topographic data were available via the Internet. At present, creating topographic maps from digital elevation models can be done only on UNIX-based systems.

If the goal of the library is to provide the information and technology needed to use and analyze all forms of spatial information, then a full GIS workstation will have to be acquired.

A full geographic information system includes a workstation running either UNIX or DOS, one or more digitizers, a scanner, one or more laser printers with graphics capabilities (both black and white and color), a plotter, and the equipment needed to both access and store data sets. On this system, users would be able to create new coverages, select, display and overlay coverages, perform analyses, and create and print maps. Before opting for a full system, the potential users and their needs should be analyzed. The library should provide the level of service needed by its primary patrons. However, providing for the needs of other library users, such as patrons from local consulting firms and information brokers, should be based on the library's goals and priorities to provide service to these patrons. If the system will be located in a university library, and similar equipment is accessible in a laboratory for student and faculty use elsewhere on campus, a full GIS may not be needed in the library.

Libraries that make a full GIS available to all patrons will have to set some policies concerning its use. These policies should address the length of time a patron can use the equipment in a single day, fees for use by non-primary patrons, and services (such as digitizing data and generating maps on demand) that will be offered by the library and its personnel. The library might also wish to adopt some rules on whether copies of new coverages or files created using library scanners should be retained by the library for its collection.

Libraries and map collections that do not have space or budgets to supply all walk-in patrons with the equipment to digitize and analyze data will probably adopt more limited goals, such as providing access to digital spatial data and the technology needed to use it. This data may be on a compact disk issued by the Government Printing Office (GPO), in a dataset created by a state government agency, or in a database that is accessed via the Internet. Patrons in these collections will be able to select, view, and combine data and print maps but will not be able to create new coverages. The ability to do complicated analyses might be blocked or eliminated entirely.

HARDWARE CONCERNS

In addition to deciding about software, choices will have to be made concerning the hardware to be acquired. The major choice on equipment is whether a DOS or UNIX system will be purchased. The type of system selected should be based on local needs. Three-dimensional capabilities used to analyze topography, slope, and aspect are only available on UNIX workstations. Data storage is also a concern. A map library may opt to acquire its own server to store data or access data on a server maintained by others. If the collection acquires a separate server, the equipment, and the data on it, will have to be maintained by the library. Files on a server may have to be backed up on occasion. If the library does not have an in-house systems person, other options, such as contract personnel, will have to be available. The decision about a main storage device should consider all possible factors. In addition to a main storage unit, peripheral storage devices will be needed because even simple coverages are sometimes too large for a floppy disk. The library might need equipment to enable patrons to save files on tape cartridges or optical disks. Providing equipment to store data on these media is another expense.

The final hardware decision is whether the library will maintain plotting and printing equipment capable of outputting high-quality maps or use printers and plotters in another facility, such as a campus computing or reproduction center. This decision should be made based on the number of patrons that will be using the library facility and its equipment. University libraries may wish to use plotters available elsewhere on campus, at least at first, because demand may not be high enough to justify the purchase of a high quality plotter for the library. The ability to share access to plotters, rather than purchase them, assures the library that its patrons will always have access to the most current equipment. Smaller printers with graphical capabilities will also have to be available. Laser printers can be used for many applications, including printing of small maps, so a laser printer should be available in the collection. However, color printers, like plotters, can be acquired or shared, depending on local demand. The library's cost of printing or plotting a map should be recoverable, no matter how maps are printed.

SOFTWARE CONCERNS

Once a decision has been made about the hardware needed by the library's primary patrons, selection of software can begin. The steps involved in choosing software include:

1. Determine the functions and other criteria needed on a library-based geographic information system.

2. Identify the geographic information systems capable of performing the functions and meeting other criteria determined in step 1.

3. Test the potential systems identified.

4. Select the software with the best performance.

Although each librarian will have to develop her or his own selection criteria, some general specifications can be identified. Ideally, a library-based geographic information system should be user-friendly, capable of accommodating new data sets, connected to the Internet/NREN (so that data from other sites can be accessed and acquired), and have a reasonable cost. The definition of the words "user-friendly" varies greatly. User-friendliness needs to be judged by patrons and library personnel not computer programmers. Since new datasets received from GPO or other sources need to be installed, the system should be able to accommodate new data sets easily. The library should also be able to add disclaimers for data received through GPO, state governments, or government-run file servers. In urban areas, information brokers might attempt to download files from digital databases in a library and offer them for sale. Since data received through the Depository Library Program is not copyrighted, patrons who download datasets or produce specialized maps from that data with the intent to sell them should receive a warning from the system that the data and maps cannot be sold. However, both the patrons and library personnel should be allowed to charge a reasonable rate for the time required to download data or create maps.

Ideally, a library-based geographic information system should be user-friendly, capable of accommodating new data sets. . . User-friendliness needs to be judged by patrons and library personnel not computer programmers.

The major functions needed to perform specific tasks are easily identified, but additional functions might be added to the "wish list." For example, a map collection could use a GIS to help patrons locate maps by creating a graphical index to the collection. Use of a GIS to provide such an index would streamline the reference process in the map collection. The index could be developed from the 034/255 fields of MARC records or by creating entire data files on the map collection. Patrons would simply outline the area of interest, specify the range of scales and subjects for the maps desired, and retrieve a list of maps held by the library for that area. Alternatively, a GIS might also be interfaced with an on-line catalog to provide a similar map reference system.

THE MAP LIBRARIAN AND LIBRARY SERVICES

Whether we like it or not, digital spatial data and geographic information systems are redefining the role of the map librarian and the services we provide. We are fast approaching the age of the electronic map. The electronic map librarian will be required to identify, locate, obtain, and create access to coverages, and may be asked to create maps on demand, install new datasets, and provide reference service or clearly written guides on use of the hardware and software available in the library. If a library has a full system, the map librarian will have to be an expert in that system. These expectations will probably be added to our present job descriptions. Cartographic information specialists will have to carefully monitor their workloads, because responsibility for electronic map technology will be an additional duty; normal activities will not decrease because of electronic map formats.

CONCLUSION

Before a library invests in the GIS technology required for the ever-increasing number of spatial databases available, several questions need to be answered. To choose a system, basic knowledge of the capabilities of geographic information systems is needed. The functions needed in the library should be determined based on the goals of the library and the collection. Once defined, other criteria need to be considered, including the ability to adapt the system to local needs and requirements, user-friendliness, and cost. Map librarians and libraries will have to analyze their needs to choose the system that best meets the local requirements. Additional work needs to be done to evaluate the capabilities of specific geographic information systems and their suitability for library settings. Alternatively, librarians should work with GIS vendors to help them develop systems that will meet the requirements of libraries or create interfaces that could be used in libraries on existing geographic information systems.

REFERENCE

Environmental Systems Research Institute, Inc., 1990. *Understanding GIS: The ARC/INFO Method*. Redlands, CA: ESRI. ❑

What You'll Need To Know To Use GIS in 2001*

Ronald F. Abler

Ronald Abler is Executive Director of the Association of American Geographers, 1710 Sixteenth Street NW, Washington, DC 20009 rabler@aag.org

A student who enters a college or university in 1998 will, in the normal course of events, graduate, and, one hopes, seek gainful employment in 2001. Many students who major in geography will specialize in geographic information systems (GIS) and related skills because of their interest in life after college. GIS is currently a fifteen billion dollar industry that barely noticed the recent recession and that gives every promise of continued rapid growth over the next decade.

Training to use geographic information systems varies greatly at the moment. Although most college and university geography programs offer GIS instruction, it is also provided in departments of agronomy, computer science, electrical engineering, forestry, geology, landscape architecture, planning, and surveying engineering, among others. Some progress toward standardization of GIS curricula has begun under the leadership of the National Center for Geographic Information and Analysis (NCGIA), but variations in GIS curricula will and should continue to exist. Geographic information systems are supple tools, and different applications will continue to demand different curricula.

I will, therefore, suggest what geography students should be taught beginning in 1998. There will doubtless be considerable commonality between what I will suggest and what a forester or a planner might propose. Less overlap would be evident between the curriculum a computer scientist would prefer and my specifications. Because 1998 and 2001 are a long way off in industry and technological terms, I will focus primarily on general classes of attributes rather than on specific skills.

* Paper presented at a conference on *The Map Library in Transition*, sponsored by the Congress of Cartographic Information Specialists Association and the Geography and Map Division of the Library of Congress, October 1993, Library of Congress, Washington, DC.

CURRENT CURRICULA

A recent, comprehensive survey of GIS instruction (Morgan and Fleury 1993) reveals that the typical GIS curriculum consists of but one GIS course that is offered at both the undergraduate and graduate levels. The course is generally offered only once a year and it does not have prerequisites. The modal course trains students to use GIS software, usually one of the commercially available packages designed for microcomputers. Student projects involve entering data via manual digitizing and translation from other data formats, and manipulating the data in various ways. Few colleges currently offer the three courses recommended in the NCGIA curriculum (Goodchild and Kemp 1990). A typical sequence of topics in the single course is: Introduction, Data Acquisition, Spatial Data Bases, Vector Views of GIS, Coordinate Systems and Geocoding, Raster Data Structures, and Applications.

This curriculum and syllabus betoken a young specialty. As recently as five years ago, there was no journal devoted to GIS, nor was there a textbook. As the specialty continues to develop, we can expect a proliferation of courses and approaches, and eventually the development of a cumulative and sequential curriculum, in which introductory courses will be prerequisite to intermediate and advanced courses. We should also expect a gradual abandonment of instruction based on proprietary software packages in favor of technical training in the commonalities among individual software systems. We can also reasonably expect a migration of curricular focus up the hierarchy of tasks. Inordinate amounts of time and energy are now devoted to data capture and input, in GIS applications as well as in GIS instruction. In eight years time, one hopes to see more focus on manipulation of spatial data, analysis, display, and decision-making than is currently evident in GIS teaching and applications.

This curriculum and syllabus betoken a young specialty. As recently as five years ago, there was no journal devoted to GIS, nor was there a textbook.

DESIDERATA

Let us assume those hopes will be realized, that in major outline, the evolution of geographic information systems will parallel that of the computers on which the technology is based. Let us assume, therefore, that by 2001 GIS users who wish to do so will be able to focus almost exclusively on the descriptive, analytical, and managerial tasks geographic information systems facilitate, rather than on the internal operations of GIS software. On that basis, I will spell out my desiderata for the baccalaureate graduate of 2001 who I would like to apply for a job using GIS if I had such a position to fill.

Above all, I'd want more education and less training. Too much effort is now devoted to training students to use GIS software; too little attention is given to its pitfalls and to the purposes to which it can legitimately and usefully be put. That desideratum implies several specifics.

Too much effort is now devoted to training students to use GIS software; too little attention is given to its pitfalls and to the purposes to which it can legitimately and usefully be put.

One is greater sensitivity to the shortcomings and misuses of GIS. GIS is a powerful tool for many purposes, but it is not panacea for all the world's ills, and it can be the basis for frightful errors. A half billion dollar GIS did not prevent a United States warship from shooting down a civilian airline over the Persian Gulf some years ago, and disasters of similar magnitude await those who rely uncritically upon analysis based on careless or inappropriate uses of GIS.

Another specific is more education in the principles of sound map design and less making of maps simply because we now have software and hardware that can generate them cheaply and quickly. One good map is worth dozens of mediocre maps and hundreds of poor maps. One really bad map is much worse than no maps at all.

What I'm suggesting is that however widespread it becomes, GIS is no substitute for the substance of the specialties that employ it. On the contrary, because it is a powerful tool, GIS must be used with increasing caution. The geography students of the next millennium will need more and better education in the fundamentals of geography, not less.

That geography will be somewhat different from today's discipline. It will stress synthesis as much as analysis, and GIS will be quite helpful in that respect. Much attention has focused heretofore on the analytical capacities of geographic information systems. I am equally or more excited about their capacities for integrating diverse kinds of information in ways that are difficult or impossible with paper maps. Therefore I hope that current requirements that students take a course in analytic techniques will soon be matched by a required course in synthetic techniques.

Geographers now focus primarily on mapping existing phenomena. As geographic information software evolves and becomes more adroit at incorporating change and time, emphasis will shift toward simulation of future states of places and regions. Geographers will, accordingly, need to hone their forecasting skills. I don't know if geographers will ever forecast changes is land use the way meteorologists now forecast the weather, but I think the trend will be in that direction.

Geographic research is still largely a solitary enterprise. Cooperative effort between two scholars is infrequent, and among more than two rare. Geography and GIS research is–with few exceptions–a refugee from the industrial revolution that has occurred in research in the medical and natural sciences. Large research projects that achieve economies of scale based on division of labor are the wave of the future, and colleges preparing students to work in the next millennium will shortchange their charges if they do not teach them how to work as members of research and management teams.

Geographic research is still largely a solitary enterprise. Cooperative effort between two scholars is infrequent, and among more than two rare.

New concepts and skills will be required that are not common elements of current GIS instruction. If I were tsar of the national GIS curriculum I would mandate at least one course in ethics. One course will not enable anyone to resolve the ethical dilemmas GIS practitioners and theoreticians will face in the future, but it would sensitize them to the issues with which they will grapple, and it would help them avoid some of the most egregious snares they will encounter.

I would also mandate formal instruction in decision science or some similar specialty that examines how and why people decide among alternatives. I would insist that a component of such instruction be attempts to understand how people perceive risks and how they make decisions among alternatives carrying known and unknown risks. Many applications of GIS will involve risk assessment and decision making under conditions of considerable uncertainty.

I would insist that a component of such instruction be attempts to understand how people perceive risks and how they make decisions . . .

More generally, I would require a broad exposure to another GIS, geographic information science. Too many geographic information system experts are still at the Alexander Graham Bell stage of thinking. Bell never conceived of his contraption as the basis for a network; he thought largely or only of pairwise connections. Similarly, most current specialists think of geographic information systems as stand alone entities, when it is becoming increasingly obvious that GISs are much more powerful when they are interconnected than they can ever be in isolation.

Internet, and the vision of telescience that underlay its establishment, will create a new world in which new wayfinding skills will be needed. Neophyte geographers were once tutored in the use of tools such as compasses, sextants, and transits so they could navigate the worlds they hoped to explore. In the future, they will have to navigate global information networks using tools such as Gopher, WAIS, World-Wide Web, Archie, Veronica, and Jughead (Pool 1993). Without the command of such tools, they will be lost in the vast seas of data they will encounter in the future.

Finally, I would demand explicit and detailed exposure to questions of research design. The definition of data and the relationships between data and theory, of which too many GIS specialists are wholly innocent, would be a good starting point, but my course(s) would embrace simulation as a research technique, and strategies for community research. I'd try to devise GIS versions of the *collaboratories* William Wulf (1993) has proposed, dispersed but virtual facilities devoted to the telecartography and telegeography that will be vital parts of the geography of the future.

ENVOI

How successful GIS specialists will be in restructuring curricula to incorporate the desiderata I have here identified remains to be seen. I know from discussions with numerous GIS specialists and industry leaders that they are sensitive to the needs I have identified. But formalizing such needs, and more to the point, shepherding them through the curriculum committees and the other pettifoggery that infest United States University campuses within the next four years, will be difficult. I do not know if those preparing GIS specialists will be able to meet the goals I have specified this afternoon. I do know that they will shirk their obligations to their students if they do not.

ACKNOWLEDGMENTS

I am grateful for the helpful suggestions of Andrew Frank, Bruce Gittings, Greg Koerper, Matt McGranaghan, Grady Meehan, Scott Purl, David Topping, Bob Linzell, Arco Wasserman, Xiaoming Xu, and Mark Zollinger, who responded to the question implicit in the title of this paper when I posted it on GIS-L.

REFERENCES

Gittings, Bruce M. Richard, G. Healey, and Neil Stuart. 1993. Educating GIS Professionals: A View from the United Kingdom. *Geo Info Systems*. 3 (4): 41-49.

Morgan, John M. III and Barbara B. Fleury. 1993. Academic GIS Education. *Geo Info Systems*. 3(4): 33-37.

Goodchild, Michael J. and Karen K. Kemp. 1990. *NCGIA Core Curriculum for GIS*. Santa Barbara: National Center for Geographic Information and Analysis.

Pool, Robert. 1993. Beyond Databases and E-Mail. *Science*. 13 (August): 841-843.

Wulf, William A. 1993. The Collaboratory Opportunity. *Science*. 13 (August): 854-855. ❑

CALL FOR PARTICIPATION

XV Annual Meeting of the NORTH AMERICAN CARTOGRAPHIC INFORMATION SOCIETY

Wilmington, North Carolina
October 25 - 29, 1995

The NACIS Program Committee invites your participation in this meeting by:

giving a paper
organizing a session
developing a panel discussion
conducting a workshop
preparing a poster or exhibit

Poster, paper sessions, and panel discussions are now being organized on a variety of topics, including cartographic animation, multimedia presentations, and cartographic database access on the Internet. All cartographic-related topics are welcome, specific sessions or workshops are being planned for cartographic animation, multimedia presentations, and cartographic database access on the Internet and the use of Mosaic & the World Wide Web.

Persons interested in participating should develop a proposal or abstract which includes the author's name, professional address, telephone number and a description not to exceed 250 words. Student participation is encouraged. Proposals should be sent to:

Keith W. Rice
Department of Geography & Geology
University of Wisconsin-Stevens Point
Stevens Point, WI 54481
Phone & Audix: (715) 346-2629
FAX: (715) 346-3372
e-mail: krice@uwspmail.uwsp.edu

PROPOSALS and ABSTRACTS MUST BE RECEIVED BY JUNE 30, 1995
Participants will be notified by July 31, 1995 of the acceptance of their abstracts or proposals.

For those of you interested, Wilmington, North Carolina is an ideal location to travel with your family. There are many attractions and recreational activities available - Plan now for a sojourn to the Atlantic Coast next October!

NACIS XV to be held in Wilmington, N.C.

Wilmington, N.C. - The Last Stronghold of the Confederacy, Wilmington, a city of 80,000, is located on the mouth of the Cape Fear River.

The 1995 annual NACIS meeting will be held from October 25 - 29 at the Hilton Hotel in Wilmington, North Carolina. The hotel is located on the waterfront in the heart of the historic district. Restaurants, from the elegant to the quirky to fast food, abound along with numerous night-life spots for music and dancing. Specialty shops, riverside walking paths, and several museums are also within easy walking distance of the hotel. Temperatures are normally quite mild at the end of October and although it may be a little cool for swimming in the Atlantic there are miles of sandy beaches that are open for walking or just relaxing.

Historic Wilmington is located at the mouth of the Cape Fear River in the Southeastern corner of North Carolina. European contact in this area began when Giovanni da Verrazano first made landfall in the New World near the present town of Wilmington in 1524. Verrazano was so taken with the region that he wrote in his journal:

> *Sailing forward, we found certain small rivers and curves of the sea, washing the shore on both sides. And beyond this, we saw the open country rising in height above the sandy shores with many fair fields and plains, full of mighty great woods. . . as pleasant and delectable to behold as is possible to imagine. . . And the land is full of many beasts. . . and likewise of lakes and pools of fresh water. . . with good and wholesome air.*

In the mid 1730s the town of Wilmington was founded and named in honor of Spencer Compton, the Earl of Wilmington. In November of 1765 the stamp master, appointed by the British Crown, was forced to resign. Two weeks later local militia prevented the landing of the British sloop-of-war Diligence, which was carrying stamp paper, marking the first armed resistance to the Stamp Act in the American colonies. In 1781 the British forces occupied the town and forced its total evacuation. After the War for Independence Wilmington quickly became North Carolina's largest city, a title it retained until after the Civil War (known locally as *The War of Northern Aggression*).

Beginning in 1818, steamboats plowed up the Cape Fear River carrying tens of thousands of Highland Scot immigrants to the western wilderness of the Appalachian Mountains. Rice grown on the Cape Fear River became the dominant crop of the region and the rice was used as "seed rice" for the flourishing rice industry of the Carolinas, Georgia, and Florida. In 1835 the Wilmington and Weldon Railroad was constructed; at the time it was the longest rail line in the world. It was during this period that most of the beautiful churches and handsome homes in the historic district were built.

Guarded by Fort Fisher, Wilmington was one of the Confederacy's most important blockade-running seaports and by the end of the war its' only one. Fort Fisher fell to Union forces on January 15, 1865 in the greatest naval bombardment and amphibious operation the world had ever seen or would see until the naval landings in the Pacific during World War II. With the capture of Wilmington the South's fate was sealed.

Today Wilmington is a city that has actively developed strong ties to its' past. Old Wilmington, a 200 block area of the city, was listed in the National Register of Historic Places in 1974. The city's emphasis has been to restore the area to its old-town residential style. Across the river from the conference hotel is the battleship *U.S.S. North Carolina*, a massive memorial to the naval veterans of World War II (visitors are welcome aboard daily for self guided tours). A few miles away one can tour the remains of Fort Fisher, or see the great antebellum plantation, Boone Hall, with its' famed half mile avenue of moss-draped live oaks that have been seen in numerous movies and television shows. The Conference hotel lies on the Cape Fear River between the Cotton Exchange, a collection of thirty or so shops located in a complex of historic buildings dating to the turn of the century, and Chandler's Wharf, which contains a nautical museum, specialty shops, and fine seafood dining. Other attractions include the North Carolina State Aquarium, the gardens at Orton Plantation, Greenfield Gardens where one can rent canoes and paddleboats or go jogging, and of course the sand, surf and sun of the nearby beaches.

Boone Hall - This spectacular half mile long entrance way lined by ancient live oaks draped with Spanish moss has been used repeatedly in movie and television sets.

The modern city is home to the University of North Carolina at Wilmington, the fastest growing of the state's 16 university campuses. UNC-W offers an undergraduate degree in Geography and a Master's degree in Earth Science. The major economic engine of the region is tourism; last year nearly 300,000 visitors a month came to the Wilmington area during the peak summer season. There is a also a healthy manufacturing base, including lumbering, marine boilers, and textiles all supported by the state operated deep water port facilities The newest industry in the region is "movie making." giving the city the title "*Hollywood East*." Television shows, such as *Matlock* and *The Young Indiana Jones Chronicles* are filmed there, as well as numerous feature length movies. Last year alone 18 movies were filmed in the area including *Sleeping With The Enemy*, the *Hudsucker Proxy*, and the ever popular *Teenage Mutant Ninja Turtles*. Only California exceeds North Carolina in revenue generated by the film industry.

Access to Wilmington, by car, has become quite simple with the recent completion of Interstate 40. By air, New Hanover Airport has regularly scheduled flights to Charlotte (USAir's Hub), Raleigh, and Greensboro (Continental Airlines Hub).

All in all, Wilmington, North Carolina should be one of the most "fun" venues ever for a NACIS meeting. All of us on the Local Arrangements Committee look forward to seeing you all in October.

NACIS news

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cartographic perspectives Back Issues

*The first issue of **Cartographic Perspectives** was published in March 1989. Back issues (for all issues) are now available at a cost of $20 per issue ($10 for members). Please specify the issue numbers (1-20) when ordering. Makes checks or purchase orders payable to NACIS. Send your back issue requests to:*

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NACIS BOARD CONFERENCE CALL, February 9, 1995

The following officers and members of the Board participated for the conference call: Henry Castner, Ed Hall, Craig Remington, Patricia Chalk, Barbara Fine, Carolyn Weiss, and C.E.O. Chris Baruth.

NACIS XIV. The meeting began at 1:02 EST with Henry's thanks to Heather Stevens and Betty Kidd for their efforts in presenting a detailed financial accounting of the Ottawa meeting. NACIS received a repayment of C$4245.60 which included C$1529.96 of our original seed money. When the C$2715.64 residual was converted, we were able to deposit a net income of US$1873.79, less bank charges, into our general funds.

TREASURER'S REPORT. Ed Hall reported the total balance of all accounts as $28,823.53. A breakdown: $13,787.94 in money market account; $3,959.00 in Ohio checking; $11,076.50 in Wisconsin checking. Hall suggested investing a part of the money market funds into three cascading CD's with 6,12 and 18 month maturities. The Board approved.

COSTA RICA. Henry reported that as of February 9 he has had no response from Professor Ucles Nunez since mid-December when the latter suggested a meeting in June or July of 1995 rather than March or April. It was the feeling of the Board that the window of opportunity for any meeting this year had closed. Henry will attempt to establish a reliable means of communication with Professor Nunez and will explore the possibility of a meeting in the Spring of 1996.

NACIS XV. Henry and members of the local arrangements committee visited the Wilmington site in September and found it suitable for our needs. Frank Ainsley will offer an introduction to the region at the opening meeting and Dennis Wood will serve as the banquet speaker. Keith Rice will work with Chris and Henry on a timely Call for Papers. Rather than have our summer Board meeting at the forthcoming Annual Meeting site, which would already be high season in Wilmington, The Board decided to meet in Milwaukee on May 20. It was agreed that Liz Hines should be invited and her way paid.

NACIS XVI. Trish Chalk reported on her survey of accommodations in San Antonio. The Board expressed a preference for a downtown meeting site. This preference focused on Trish's contact with the Menger Hotel. Exact dates and rates are under discussion and will be reported at a later time.

MEMBERSHIP QUESTIONNAIRE. Barbara Fine is working on a questionnaire for circulation to the membership. The purpose of this instrument is to better understand members motivations toward attending annual meetings and to gain perspective on interests that would contribute to the intellectual life of the Society. Baruth expressed concern over the slow growth of the Society along with the timeliness of membership renewals. It was the feeling of the Board that the Society has a yet untapped potential for expansion, and efforts must be continuously explored to fulfill these goals.

OTHER BUSINESS. The Call for Papers will be announced on the INTERNET. Further attention will be brought to the Wilmington meeting by canvassing interested parties in the region with word of the event. All business being transacted, the meeting was adjourned at 2:05 EST.

Submitted,
Craig Remington
NACIS Secretary

cartographic events

September 3 - 9
International Cartographic Association Conference.
Barcelona, Spain. Organizing Committee: Jaume Miranda i Canals, Chairman, Institut Cartografic de Catalunya, Balmes, 209-211 – E-08006 Barcelona, Catalunya, Spain. (343) 218 87 58; fax (343) 218 89 59.

September 13-16
International Map Trade Association 15th Annual Conference and Trade Show.
Dublin, Ireland
Contact: Nancy Edwards, IMTA, P.O. Box 1789, Kankakee, IL 60901 (815) 939-4627 Fax (815) 933-8320.

September 18 - 20
Third Thematic Conference Remote Sensing for Marine and Coastal Environments.
Seattle, Washington. Contact: ERIM, P.O. Box 134001, Ann Arbor, MI 48113-4001. (313) 994-1200, ext. 3234; fax (313) 994-5123.

October 25 -29
NACIS XV
Wilmington, NC. See call for papers on page 57. For more information contact: Keith Rice, Dept. of Geography, Univ. of Wisconsin-Stevens Point, Stevens Point, Wisconsin 54481. (715) 346-2629

November 13-17
LIS/GIS '95
Nashville, TN
Contact: LIS/GIS '95, 5410 Grosvenor Lane, Suite 100, Bethesda, MD 20814-2122 (301) 493-0200 fax (301) 493-8245.

EXCHANGE PUBLICATIONS

Cartographic Perspectives gratefully acknowledges the publications listed below, with which we enjoy exchange agreements. We continue to seek agreements with other publications.

ACSM Bulletin. Published six times a year by the American Congress on Surveying and Mapping. Offers feature articles, regular commentaries, letters, and news on legislation, people, products, and publications. Contact: Membership Director, 5410 Grosvenor Lane, Bethesda, MD 20814; (301) 493-0200.

Baseline. Published six times a year by the Map and Geography Round Table, American Library Association. Contact: Editor Nancy J. Butkovich, Physical Sciences Library, 230 Davey Laboratory, Penn State University, University Park, PA 16802; (814) 865-3716; e-mail:njb@psulias.psu.edu

Bulletin of the Society of Cartographers. Published twice a year, the *Bulletin* features articles on techniques and ideas applicable to the Cartographic Drawing Office. Contact: John Dysart, Subscriptions Manager, Room 514, Middlesex Polytechnic, Queensway, Middlesex, EN3 4SF, England.

Cartouche. A quarterly publication offering news and announcements to members of the Canadian Cartographic Association. Contact: Canadian Cartographic Association, c/o Jim Britton, Sir Sandford Fleming College, School of Natural Resources, P.O. Box 8000, Lindsay, Ontario K9V 5E6 Canada; (705) 324-9144; e-mail: britton@trentu.ca; fax: (705) 324-9716.

Cartographica. A quarterly journal endorsed by the Canadian Cartographic Association / Association Canadienne de Cartographie that features articles, reviews, and monographs. Michael Coulson, Editor. ISSN 0317-7173. Contact: University of Toronto Press Journals Department, 5201 Dufferin Street, Downsview, Ontario, M3H 5T8 Canada; (416) 667-7781.

Cartographic Journal. Biannual Journal of the British Cartographic Society. Includes research articles, 'shorter' articles, official records of the Society, book reviews, and a list of recent cartographic literature. Contact: Hon. Secretary, Charles Beattie, 13 Sheldrake Gardens, Hordle, Lymington, Hants, SO4 10FJ, England.

Cartography. Biannual Journal of the Australian Institute of Cartographers. Each issue contains two parts: the Journal proper and the Bulletin. The Journal contains original research papers, papers describing applied cartographic projects, reviews of current cartographic literature, and abstracts from related publications. ISSN 0069-0805. Contact: John Payne, Circulation Manager, GPO Box 1292, Canberra, A.C.T. 2601, Australia.

Cartography Specialty Group Newsletter. Triannual publication of the Cartography Specialty Group of the Association of American Geographers. Features news, announcements, and comics. Contact: Ann Goulette, Editor, Intergraph Corporation, 2051 Mercator Drive, Reston, VA 22091-3414; (703) 264-7141; e-mail: ann@pluto.ne1300.ingr.com.

Cartomania. The quarterly newsletter of the Association of Map Memorabilia Collectors. Offers a unique mix of feature articles, news, puzzles, and announcements of interest to cartophiles. ISSN 0894-2595. Contact: Siegfried Feller, Publisher / Editor, 8 Amherst Road, Pelham, MA 01002; (413) 253-3115.

Geotimes. Monthly publication of the American Geological Institute. Offers news, feature articles, and regular departments including notices of new software, maps and books of interest to the geologic community. Articles frequently address mapping issues. ISSN 0016-8556. Contact: Geotimes, 4220 King Street, Alexandria, VA 22302-1507.

GIS World. Published monthly, this news magazine of Geographic Information Systems technology offers news, features, and coverage of events pertinent to GIS. Contact: John Huges, Managing Editor, GIS World, Inc., 155 East Boardwalk Drive, Suite 250, Fort Collins, CO 80525; (303) 223-4848; fax: (303) 223-5700.

Information Bulletin. Triannual publication of the Western Association of Map Libraries. Contains features, atlas and book reviews, WAML business, and news. Contact: Mary L. Larsgaard, Executive Editor, Map and Imagery Laboratory, UC-Santa Barbara, Santa Barbara, CA. 93106; (805) 893-4049; fax:(805) 893-8799, 4676, 8620; e-mail: mary@wash.uscdic.ucsb.edu.

Mapline. A quarterly newsletter published by the Hermon Dunlap Smith Center for the History of Cartography at the Newberry Library. This newsletter contains notes, announcements, recent publications, calendar, and short essays on topics of interest to the history of cartography. ISSN 0196-0881. Contact: James R. Akerman, Editor, *Mapline*, The Newberry Library, 60 West Walton Street, Chicago, IL 60610.

Perspective. This newsletter of the National Council for Geographic Education (NCGE) is published five times a year in October, December, February, April and June. News items related to NCGE activities and geographic education are featured. Contact: NCGE, Leonard 16A, Indiana University of Pennsylvania, Indiana, PA 15705; bitnet: clmccard@iup.

FEATURED PAPERS

Each issue of *Cartographic Perspectives* includes featured papers, which are refereed articles reporting original work of interest to NACIS's diverse membership. Papers ranging from theoretical to applied topics are welcome. Prospective authors are encouraged to submit manuscripts to the Editor or to the Chairperson of the NACIS Editorial Board. Papers may also be solicited by the Editor from presenters at the annual meeting and from other sources. Ideas for special issues on a single topic are also encouraged. Papers should be prepared exclusively for publication in *CP*, with no major portion previously published elsewhere. All contributions will be reviewed by the Editorial Board, whose members will advise the Editor as to whether a manuscript is appropriate for publication. Final publication decisions rest with the Editor, who reserves the right to make editorial changes to ensure clarity and consistency of style.

REVIEWS

Book reviews, map reviews, and mapping software reviews are welcome. The Editor will solicit reviews for artifacts received from publishers. Prospective reviewers are also invited to contact the Editor directly.

TECHNICAL GUIDELINES FOR SUBMISSION

Literature cited should conform to the Chicago Manual of Style, 13th ed., University of Chicago Press, Chapter 16, style "B." Examples of the correct citation form appear in the feature articles of this issue. Authors of Featured Papers should submit four printed copies of their manuscript for review directly to Dr. Michael Peterson, Chair of the *CP* Editorial Board, Department of Geography, University of Nebraska - Omaha, Omaha, Nebraska 68182. Manuscripts are reviewed by a minimum of two referees. The recommendations of the reviewers and the Chair of the *CP* Editorial Board are sent to the Editor of *CP*. The Editor will contact all authors to notify them if their paper has been accepted for publication and if revisions are necessary prior to publication. The following technical guidelines should be followed for all accepted manuscripts (these guidelines also apply to book, map, and software reviews).

Material should be submitted in digital form on 3.5" diskettes. Please send a paper copy along with the disk. Text documents processed with Macintosh software such as *WriteNow, WordPerfect, MS Word,* and *MacWrite* are preferred, as well as documents generated on IBM PCs and compatibles using *WordPerfect* or *MS Word*. ASCII text files are also acceptable.

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Materials should be sent to:
Dr. Sona Karentz Andrews, Editor- *Cartographic Perspectives,* Department of Geography, 3413 N. Downer Avenue, University of Wisconsin-Milwaukee, Milwaukee, WI 53211; (414) 229-4872, fax (414) 229-3981;
e-mail: sona@csd.uwm.edu.

COLOPHON

This document was desktop-published at the Department of Geography, University of Wisconsin-Milwaukee, using a Apple Macintosh IIci and Centris 650 computers. Word processing was accomplished primarily with *Microsoft Word 5.1* ; page layout with *PageMaker 5.0*. Graphics not rendered with *Aldus FreeHand , Adobe Illustrator, Corel Draw, or ATLAS*GIS* were scanned from paper originals using a desktop scanner. The *PageMaker* document was output at 2400 dpi. The bulletin was printed by offset lithography on Warren Patina 70# text stock. Text type is set in Palatino, a face designed by Herman Zapf.

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The North American Cartographic Information Society (NACIS) was founded in 1980 in response to the need for a multidisciplinary organization to facilitate communication in the map information community. Principal objectives of NACIS are:

§ to promote communication, coordination, and cooperation among the producers, disseminators, curators, and users of cartographic information;

§ to support and coordinate activities with other professional organizations and institutions involved with cartographic information;

§ to improve the use of cartographic materials through education and to promote graphicacy;

§ to promote and coordinate the acquisition, preservation, and automated retrieval of all types of cartographic material;

§ to influence government policy on cartographic information.

NACIS is a professional society open to specialists from private, academic, and government organizations throughout North America. The society provides an opportunity for Map Makers, Map Keepers, Map Users, Map Educators, and Map Distributors to exchange ideas, coordinate activities, and improve map materials and map use. *Cartographic Perspectives*, the organization's Bulletin, provides a mechanism to facilitate timely dissemination of cartographic information to this diverse constituency. It includes solicited feature articles, synopses of articles appearing in obscure or non-cartographic publications, software reviews, news features, reports (conferences, map exhibits, new map series, government policy, new degree programs, etc.), and listings of published maps and atlases, new computer software, and software reviews.

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