

cartographic perspectives

bulletin of the
North American Cartographic Information Society

Number 4, Winter 1989-90

A report in the weekly newsmagazine *Time* (November 27, 1989) appraises Geller's and Huchra's preliminary findings as "startling." As correspondent Michael Lemonick writes, "Far from being a uniformly distributed collection of galaxies . . . the cosmos seems to be organized into immense bubbles, each of them about 150 million light-years across. The walls of the bubbles are galaxies, and the interiors appear to be virtually empty."

One problem confounding interpretation of the new map is that the size of the largest detectable structures is limited by the extent of the survey. One remarkable feature — a sheet of galaxies at least 200 million light years wide, 500 million long and perhaps 15 million thick — has been dubbed the "Great Wall." Geller and Huchra tentatively hypothesize that the bubbles or voids are fundamental structures, and that the Great Wall "could well be made up by the connection of several surfaces that surround (or nearly surround) adjacent voids." They go on to stress, however, that "Until all of the surveys can be carefully compared, it will be difficult to judge whether the apparent inhomogeneity is caused by variations in the sampling of the galaxy distribution or by a genuine range in structure." Even so, Jeremiah Ostriker, chairperson of Princeton's astrophysics department, observes in *Time* that "There is no theory using conventional physics that can explain these structures without causing other inconsistencies."

The new map is a three-dimensional representation of the universe in "redshift space." Two angular coordinates of the positions in the sky of more than 30,000 galaxies were catalogued by Fritz Zwicky and associates in the 1960s by visual analysis of some 1000 photographic plates recorded at the Palomar Observatory. The

third dimension represents the distance of galaxies from Earth, which is most accurately approximated by the velocities at which galaxies in our expanding universe are receding from the earth. The "apparent recession velocity" or redshift of a galaxy is associated with a shift toward longer (red) wavelengths in certain elements of the galaxy's light. Geller and Huchra credit recent advances in detector technology for making redshift-space mapping feasible.

The CfA survey will be of great importance to astrophysicists working to model the genesis of the universe. Geller and Huchra offer no estimate of how much of the universe the CfA survey will ultimately map, but even the very limited results reported in *Science* provide an invaluable observed distribution against which model outputs can be evaluated. As Ostriker points out, "These surveys test in the most acute way our conceptions of how structure developed in the universe, and for that reason they are possibly the most important studies in extragalactic physics now. This is an exciting time to be in the field."

GRAPHICS AT USA TODAY

With some 6.3 million daily readers, *USA Today* has the largest circulation of any newspaper in the U.S. Its success is in part attributable to its emphasis on information graphics, including maps, graphs and diagrams. The newspaper's colorful weather page has become an icon of contemporary print journalism and is imitated widely.

USA Today's graphics are remarkable not only for their frequency of occurrence and trendy designs, but especially for their timeliness. In September, *USA Today* tracked the approach of Hurricane Hugo toward the southeast coast of the U.S. with a daily series of informative maps

and diagrams (Figure 1). In the three days following the magnitude 7 earthquake that struck the San Francisco Bay area on Tuesday, October 17, 13 different descriptive maps and diagrams



Figure 1. © 1989 USA Today, all rights reserved. 40 percent of original size.

appeared with stories on the disaster (Figure 2). In the latest edition of the paper's 'Graphics Handbook,' reporter Chris Fruittich recounts the frantic efforts of the graphics department in the disaster's wake, concluding that "(i)n the end, deadlines were met, readers served and new weekday sales records shattered."

CP recently contacted *USA Today's* graphics department in order to learn about its production procedures. At *USA Today's* Washington DC editorial offices, information graphics are designed and produced by a team of 14 graphic artists equipped with Macintosh II workstations. Designer Jeff Dionise told *CP* that artists begin their day with a 'budget' assigned by graphics editor Richard Curtis. Typically, graphics must be researched, designed and rendered in one day, in time for that evening's satellite transmission 'window.' Textual continued on page 38

featured article

Ten process-printed color charts based on the perceptually ordered Munsell system were previously developed. Sixteen cartographers with experience in color map design were mailed copies of the chart and were subsequently interviewed by telephone. The objectives of the interviews were to gather background information on the cartographers' general use of color charts and to examine the perceived usefulness of the Munsell-based charts as aids for map color selection. Approximately half of the interviewees were not satisfied with the color charts they were currently using. Over half of the cartographers had difficulties with differences between printed map and chart colors. As a summary of the interviews, eleven recommendations are made for the design of yellow-magenta-cyan charts of the conventional lithographers' format. Twelve of the cartographers judged the Munsell-based charts as potentially useful aids for map color selection, especially for the design of thematic color progressions. Likewise, the cartographers' solutions to difficulties with the layouts of their conventional charts indicated that a different chart organization, possibly perceptual, would be useful to cartographic designers. Overall, the interviews revealed a surprising diversity of opinions about and requirements of color charts that are used in map design.

Cartographers use color charts (collections of example colors) to aid the color selection and specification process during map design. Within map color schemes, the perceptual dimensions of color (hue, value, and chroma) are used to communicate logical relationships between map features or categories. Therefore, perceptually organized color charts should be useful to cartographic designers for map color selection.

The Munsell (1976) color order system provides a perceptual organization of color that is of potential use to cartographic designers. The development of four-color process printed charts based on the Munsell system is described in a separate article (Brewer 1989). Each Munsell chart presents colors of a constant hue with a systematic vertical change in value and horizontal change in chroma (Figure 1). After developing the ten charts, I interviewed sixteen cartographers with experience in color map design. The objectives of these interviews were to gather background information on the cartographers' general use of color charts and to examine the perceived usefulness of the Munsell-based process charts as aids for map color selection.

A wide variety of color selection aids designed specifically for color printing are available to cartographers. The majority of printed color charts are structured to provide a comprehensive catalog of combinations of overprinted screenings of yellow, magenta, cyan, and black (YMCK) process inks (for example, Allan 1989, Pantone 1984, Kueppers 1982). YMCK charts are commercially available, produced by printers for communication with customers, and produced in-house for specific projects or for frequently-used press-paper-ink combinations. Pantone books (1988-89) that specify ink mixtures (rather than colors produced by screen combinations) are important for the selection of inks other than YMCK that are often used in map production.

Other color charts that demonstrate color order systems have been developed with the goal of objective description of perceived color rather than description of the results of color printing. Such charts are therefore

Color Chart Use in Map Design

Cynthia A. Brewer

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not accompanied by printing specifications (for example, YMCK percentages). Example color order systems include: Ostwald (not commercially available), Munsell (from Macbeth, Munsell 1976), Natural Color System (NCS from Swedish Standards Institute 1979), Uniform Color Scales (OSA-UCS from Optical Society of America, Optical Society Committee on Uniform Color Scales 1977), and CIELAB (represented in charts from Colorcurve Systems 1987). These systems are described in Hunt (1987) and Agoston (1987).

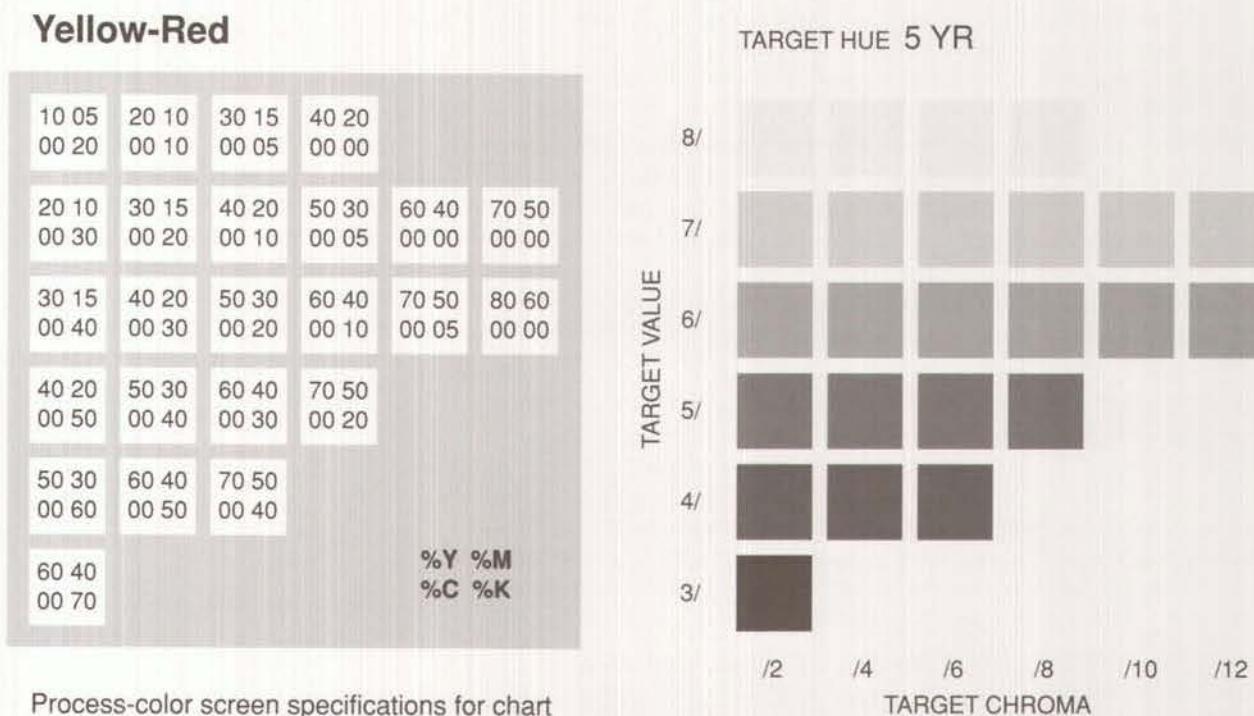


Figure 1: Format of the Munsell-based process printed color charts. The complete set of ten charts appears in color in Brewer (1989).

In response to the apparent need for perceptually ordered color selection aids, the ITC designed and produced a printed color chart for cartographers based on the Ostwald system (Brown 1982) and I have produced the set of Munsell-based color charts (Brewer 1989). Although my Munsell-based printed charts motivated the interviews on which this paper is based, questions were directed to chart use in general as well as to impressions of the Munsell charts in particular.

INTERVIEW PROCEDURE

The sixteen interviewees were selected because they were known to have experience with color map design. I sought experienced cartographic designers, rather than "naive subjects," to gain information on charts in the context of current mapmaking practices. To avoid biasing the responses toward a particular type of organization or type of experience, roughly equal numbers of people from academia, government agencies, and private firms were interviewed (six, five, and five respectively). The cartographers interviewed are referenced (Appendix), with permission, to give credit for the valuable information they have contributed. Permissions were also granted for use of the interview quotes that appear in this article.

Question 1: Number of Color Maps Designed in Two Years

I did not require precise responses to this first question, and the responses are therefore difficult to compare because number of maps and involvement took a variety of forms. Questions arose on how to count atlas maps, series of maps with the same color scheme, revisions, color pen-plotter maps, two-color maps, student projects, and projects given minimal attention. If questioned, I asked participants to include all maps and count the number of individual maps in atlases and series. Estimates of the number of color maps designed in the last 2 years ranged from 5 to 2500, and color maps made up 5 to 100 percent of the design work of the cartographers in those 2 years. I was, therefore, satisfied that each person's responses to the remainder of the questions were based on personal experience selecting map colors.

Question 2: Methods of Printed-Color Specification

The purpose of the second question was to confirm that YMCK process printing was a useful form in which to offer the perceptually organized Munsell-based printed charts. Percentages of the four process inks were used by twelve of the sixteen cartographers for printing maps. Eight used both percentages of process inks and Pantone Matching System (PMS) inks for printing map colors (for simplicity I will use 'PMS' to designate ink colors other than yellow, magenta, and cyan, although these process inks are also included in the Pantone system). Four used only PMS inks and no process printing. Ted Koch noted the difficulty of planning to overprint two PMS colors: "What are you going to get when you combine them? That's really difficult to predict." Two cartographers who used both PMS and process inks usually used process color when the maps were being printed with color photographs, necessitating that the process inks be available on the press. Of the twelve who used process inks, three mentioned occasional substitution of a warmer red for the magenta ink.

Question 3: Color Charts Available, Their Use, and Use Problems

Responses to this multi-part question revealed that all of the cartographers had access to and used color charts. Of the sixteen participants, fifteen had charts that were acquired pre-printed and three rarely used charts other than those developed within their organization. Three others mentioned custom charts they had produced as color proofs or had printed for specific projects. Most of the charts described were conventional process-printed charts (books or sheets) that were commercially available, supplied by printers, or printed in-house. These showed combinations of screened YMC inks and sometimes included screens of black. Black was usually printed in a constant percentage over individual charts, but the black for one set was on a transparent overlay and another set had three percentages of black printed over quarters of each color sample. One cartographer had a choice of special inks printed with conventional YMC combinations and two had charts printed with warm red replacing magenta. Another chart showed the process combinations on a variety of paper types.

Additionally, Pantone books and strip charts for PMS inks were commonly used and other charts named were the Ostwald-based ITC chart, Color Index charts, Defense Mapping Agency's color book, U.S. Geological Survey charts, restricted palettes for specific jobs, a computer firm's plotted chart, color wheels with process colors on transparent overlays, and two-color charts with screens of black over screens of one PMS ink.

In initial responses to the question on how the cartographers used charts, six of the cartographers said they used color charts to find the

SUMMARY OF RESPONSES

specifications for colors they had already decided upon. Nine combined looking for schemes on the charts with looking for pre-selected colors. This approach was often described as having a general idea of the color scheme (working out general relationships or knowing the category of hue desired) and then using the charts to select the final set of colors to be printed. During his interview, Greg Chu said, "I look at charts to give me ideas and see the colors as I'm designing."

Additional specific information on the use of charts surfaced in further comments. Six cartographers cut colors, or parts of colors, from the charts to allow them to align colors in progressions, and two had multiple copies of inexpensive sheet charts to cut up. Two others spoke of folding and overlapping charts to place colors side-by-side or of comparing colors by looking through holes punched in an overlying chart. Three described the use of charts in the iterative process of minimizing the number of percentages of each ink used on a map while maintaining a desirable scheme. This process of refinement reduces the complexity and cost of production and requires much rechecking of colors on charts. Two cartographers discussed the production of a chart showing combinations of a restricted set of percentages. The use of a few common percentages was strongly recommended by Loy (198?) who limited screen percentages to 10, 30, 70, and 100 on his color chart printed for design of the *Atlas of Oregon*. This approach assists simplification of production and brings colors with shared percentages in closer proximity for ease of comparison (they may be pages apart or widely separated on complete charts). An alternative approach described by one interviewee was to design a palette of ten or twelve colors for a project from which to select colors for individual maps.

The question of problems with the use of color charts elicited discussion of many interesting difficulties. The most common problem, reported by nine cartographers, was that chart colors did not match printed map colors. This problem was ascribed to differences between printers, differences in chart and map paper, and changes in color caused by chart aging. Three explained that chart colors also appear different on maps because the areas covered by the colors differ. Four said that simultaneous contrast with surrounding colors on the chart or map caused differences in color appearance, and two of these cartographers used masks to isolate colors on the chart pages to reduce visual distraction and remove induction from surrounding colors. Descriptions of difficulties were qualified with acknowledgement that charts were not a substitute for experience. Chris Arvetis commented that you "need years and years . . . to know what it is you are going to get." As charts are used, cartographers learn to anticipate and compensate for deviation from the chart colors and they choose sets of colors with sufficient contrast that differences are maintained with variation in printing.

Physical layout and the choice of colors on charts were also the subject of comments. Three recommended larger color samples (1x1.5 and 2x2 inch chips were both suggested). Three wanted moveable chips to lay side-by-side in color progressions. Three said their charts showed too many colors, and one solved the problem by taping out alternating rows and columns to simplify the charts. One preferred a color wheel of process-printed transparencies to avoid the cumbersome task of flipping through chart pages, but another was not satisfied with color wheels because the density of the film layers grayed colors. Two preferred all YMC combinations together on one sheet, but the omission of black screens was seen as a shortcoming of this chart design. Another felt that the subtle but useful differences possible with combinations of low percentages were not well represented in color charts.

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In summary, seven of the participants were satisfied and five said they were not satisfied with the color charts they used. Four said they were satisfied, but qualified the statement: there are problems of simultaneous contrast and non-moveable swatches, they could be improved, they are not substitutes for experience, and they all leave something to be desired.

Questions 4 and 5: Munsell System Familiarity

Fifteen of sixteen interviewees were familiar with the Munsell system but nine had never used it. Four cartographers said they used the system indirectly by working with a mental construct of the Munsell dimensions of color when designing map schemes. One had experience with a computerized slide-production system that used hue, value, and chroma for color designation. Two used the system in teaching about color, and one had used Munsell soil color charts.

Question 6: Potential Uses of Munsell-Based Printed Charts

The final question of the interviews focused on the Munsell-based printed charts developed in the first stage of the research (Brewer 1989). Twelve of the sixteen cartographers saw potential uses for these charts. Two felt the charts would not be useful for color selection (one used only limited color palettes and the other said there was no difficulty with current charts). The remaining two gave intermediate answers: one was undecided and the other saw very limited potential use (PMS inks were used primarily). These figures must be interpreted with caution because interviewees were well aware that I had developed the charts and there may have been a tendency to provide encouragement with positive remarks. The elaborations on the responses, however, were informative.

The Munsell-based charts were described as useful tools both for color selection and teaching. Seven of the cartographers stated that the Munsell-based charts would be useful for selecting choropleth or thematic map progressions. Three suggested that the most useful progressions were found on diagonals, along which color difference steps are greater and both value and chroma change. Two mentioned the charts' value as teaching aids for explaining the dimensions of color, and Onno Brouwer made the general observation that "there really is such a thing as a color illiterate when it comes to choosing colors, and any scheme that can help a person in color choice would be great." One interviewee had already begun using the charts to explain the range of colors that would appear in duotone reliefs; this unexpected instructional use was possible because each chart shows a range of value and chroma for an individual hue.

Problems with use of the Munsell-based charts were also discussed. The charts were not of use to two cartographers because many of the colors were too dark for use on most of the maps they produced. In addition, one uses no more than two inks in colors to avoid registry problems and reduce the number of screen angles used for a color; most of the Munsell-chart colors are composed of three screened inks. The number of screens needed to print progressions of color from the charts was viewed by two as a problem when production costs were a constraint. Black screens are present on all of the Munsell-based charts, but two interviewees did not use screens of black in their map colors because black was reserved for type (late revision of type after compositing was common or black screens interfered with type crispness in gravure printing). On the other hand, one said that the greatest benefit of the charts was the presence of black and six mentioned that they frequently used screens of black to darken or enrich colors.

Interviewees also commented on the format of the chart booklet. Two

The Munsell-based charts were described as useful tools both for color selection and teaching.

felt that a good range was shown in a small number of color choices. In contrast, one recommended the inclusion of all screen combinations and another felt that too few choices were shown to allow fine-tuning of a color scheme to simplify production. One said that the white space around each chart color had the advantage of reducing contrast effects from surrounding colors. Another suggested that the color squares each be angled to emphasize the sequences along diagonals. Two felt that the hue, value, and chroma designations were unnecessary and two recommended that the process-color percentages be printed or overlaid directly on the colors because checking the separate listing was awkward.

COMMENTS AND CONCLUSIONS

Cartographers use color charts in many different ways. The wide variety of maps produced, resources available, and personal preferences created a range of chart-use problems and desired chart qualities that would be impossible to satisfy in the design of a single chart. Based on the interviews, the following recommendations are made for the design of conventional process charts for cartographers:

- 1) provide large color samples
- 2) include space between color samples to limit simultaneous contrast
- 3) use percentages that are available in production work
- 4) print percentage specifications directly on or adjacent to each sample
- 5) provide a greater selection of low percentages than high percentages
- 6) overprint screens of black on a subset of charts
- 7) substitute a warmer red for magenta on a subset of charts
- 8) price charts affordably (allows purchase of extra copies to cut apart)
- 9) punch holes in samples to ease color comparison
- 10) show colors on different paper types
- 11) print with the press and inks with which the maps are printed

A conflicting preference exists between the desire to have all percentage combinations represented and the desire to limit the charts to combinations of a subset of percentages. Charts produced for cartographers by Allan Cartography and Pikes Peak Lithographing (Allan 1989) fulfill all of the above requirements with the exception of points 9 (holes for overlay) and 11 (if Pikes Peak does not print the map). Their charts have the conventional format and are printed with a 0, 5, 10, 20, 40, 70, 100 subset of screen percentages.

Approximately half of those interviewed were not satisfied with their charts and, given the problems discussed, I expect that almost all would welcome alternative chart organizations and automated color selection tools. Most chart-use problems discussed in the interviews focused on printing and physical format rather than specific organization of the chart colors. Cartographers did, however, mention moving colors around, folding, overlapping, cutting out colors, punching holes, creating limited palettes, and masking colors. Patricia Caldwell Lindgren described the awkward process of color selection: "When you are working with three or four variables or more . . . you have to either flip through a lot of pages or turn a lot of things or something. It's all just a cumbersome process. If you could sit at some sort of terminal and spec it out, . . . that would be helpful." These practical problems with chart use indicate that different color selection tools, possibly perceptually organized, should be useful to cartographic designers.

Overall, twelve cartographic designers judged the Munsell-based process-printed charts as potentially useful aids for map color selection, especially for the design of thematic color progressions. However, the

Munsell-based charts also had new problems inhibiting their use and shared some of the problems of other charts. As on existing charts, colors often will not match those of future printings and color samples are small and not moveable. The perceptual organization of the Munsell-based charts does not lend itself to looking for a color given a specific screen percentage combination and this was viewed as a disadvantage. Conventional charts, however, already provide a well organized catalog of screen combinations useful for refining percentage selection, and the Munsell-based charts are not intended to replace these charts. The Munsell-based charts are also not intended to obviate the need for color selection experience, though their use as teaching tools may aid in the acquisition of experience.

The nature of map production constraints is changing as automated production becomes more readily available to cartographic designers (Mattson 1989). Screens in one-percent increments are commonly available in digital map design, although limited precision at the press remains an important constraint. Labor for production of composite negatives need not be determined by the number of screens that map schemes require when composites are produced digitally. These developments free the cartographic designer to refine both logical relationships within and the attractiveness of their map color schemes. The flexibility of automated screening will allow perceptually ordered color-selection aids to be useful to a wide range of cartographic designers. Automation of printed-map production will not, however, immediately eliminate the need for printed color charts because of the persisting complexity of equating the appearance of emitted color on a CRT and reflected color from a printed map.

The interviews revealed a surprising diversity of opinions about and practical requirements of color charts. This diversity provides a rich source for future research on both printed color charts and CRT-displayed aids for map-color selection. The perceived usefulness of the Munsell-based charts was dependent on the type of design challenge cartographers faced. Are different color chart organizations better suited to different design problems? The importance of experience in chart use and color selection was acknowledged, but how does chart organization inhibit or facilitate learning about effective color selection and gaining that critical experience? How will cartographers use charts in the automated production environment and what new tools will be most effective for map color selection? Color selection may be better aided by tools such as comprehensive sets of appropriate color schemes or limited palettes and programs that accurately convert hue, value, and chroma combinations into process color specifications. Alternative chart organizations may assist cartographic designers in exploring effective and innovative color combinations. As Barbara Petchenik offered during her interview, "The real question is how do you think of a basic color scheme?"

I would like to thank Judy Olson for her guidance throughout this research.

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scheme?"

ACKNOWLEDGEMENT

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APPENDIX

Names of the interview participants and their professional associations at the time of the interviews in 1985:

ACADEMIC

Onno Brouwer, Associate Director, Cartography Laboratory, Department of Geography, University of Wisconsin—Madison
 Henry Castner, Professor, Department of Geography, Queen's University
 Gregory Chu, Director, Cartography Laboratory, Department of Geography, University of Minnesota
 Richard Groop, Associate Professor, Department of Geography, Michigan State University
 A. Jon Kimerling, Associate Professor, Department of Geography, Oregon State University
 Joseph Wiedel, Associate Professor, Department of Geography, University of Maryland

GOVERNMENT

Frederick Broome, Chief, Mapping Operations Branch, Geography Division, U.S. Bureau of the Census
 Ted Koch, Mapping Technologist, Mapping Services Bureau, New York State Department of Transportation
 Carolyn Weiss, Senior Research and Development Officer, Geocartographics Subdivision, Statistics Canada
 James Wray, Research Geographer (retired), National Mapping Division, U.S. Geological Survey, and Consultant,
 TRADCOMP Charts
 A graphic designer at a government agency (name withheld by request)

PRIVATE

Chris Arvetis, Vice President and Creative Director, Rand McNally
 Herb Heidt, President, Mapworks
 Patricia Caldwell Lindgren, President, Caldwell and Associates
 Barbara Petchenik, Senior Sales Representative, Cartographic Services, R.R. Donnelley & Sons Company
 Alfred Zebarth, Assistant Supervisor, Cartographic Division, National Geographic Society

La Utilización de Cartas de Colores en el Diseño Cartográfico

Extracto

Diez cartas de colores de proceso de impresión, basado en el sistema de orden perceptual Munsell, fueron desarrollado. Se despacharon copias de estas cartas a diez y seis cartógrafos con práctica en el diseño de mapas coloreados, y subsiguientemente fueron entrevistados por teléfono. El objetivo de las entrevistas fue para obtener una historia del uso percibido de la carta base Munsell para asistir en la selección de colores. Sobre un tercio de los entrevistados no estaban satisfechos con la carta de color que usaban corrientemente. El otro grupo, tuvo dificultad con la diferenciación de los colores entre los mapas impresos y los colores de la carta. Sumariamente, once cartógrafos recomendaron el diseño de una carta para los colores amarillo, azul, y rojo en un formato convencional litográfico. Doce cartógrafos votaron por la carta base Munsell como un auxiliar útil en la selección de colores, especialmente en el diseño temático de la progresión de colores. Igualmente, estos cartógrafos indicaron que las dificultades que tuvieron con el modelo convencional pudiera ser corregido por una reorganización de la carta, posiblemente perceptual, que sería más útil para los diseños cartográficos. Sobre todo, las entrevistas revelaron una diversidad de opiniones sobre los requerimientos para el uso de las cartas de colores en el diseño cartográfico.

cartographic techniques

SOFTWARE REVIEW

Software reviews will normally be solicited by the editors, but unsolicited reviews are invited for consideration. If you are using a piece of software useful in working with map information, and are interested in contributing a review, please communicate this interest to the editors.

**SYSTAT version 4.1, SYSTAT, Inc.,
1800 Sherman Ave., Evanston, IL
60201, (312) 864-5670, \$595.00.**

*reviewed by Mark Leitzell,
Donnelley Cartography
and Alan M. MacEachren,
Penn State University*

SYSTAT is one of a small number of serious statistical analysis packages to be developed specifically for use on microcomputers. It is a comprehensive package that should answer most cartographer/geographer's needs. Most parametric statistics found in well known mainframe packages are included, as are a wide range of non-parametric capabilities. The package is divided into seventeen modules, two for data input and processing, one to develop macros, and fourteen sets of analytical procedures. The latter cover: cluster analysis, correlations, factor analysis, simple graphics, multidimensional scaling, multivariate analysis (including regression, ANOVA, etc.), nonlinear estimation, nonparametric statistics, series, statistics (i.e., means, standard deviations, t-tests, Tukey HSD, etc.), and tabulations. All of the analytic modules seem to operate as expected.

Like most mainframe statistics packages, upon which it appears to be modeled, SYSTAT is a command driven package with no menus or mouse support. In the editing module, it does at least support the arrow, PgUp, PgDn, Del, Ins, Home, and End keys, but no function keys. Although the command structure is easy to

grasp, it is reminiscent of the early 70s computing environment. Variable names, for example are case sensitive and failure to remember this results in the obscure message "no non-missing values to tabulate." We were also initially rather intimidated by the 822 page manual and lack of interactive tutorials. The manual does contain examples of data and command sequences for virtually all possible operations and is reasonably well indexed. Following the examples exactly, however, will occasionally produce a different result than that shown, or no result at all! Once you get to know the package, there is an abbreviated 89 page command reference manual that includes both SYSTAT and SYGRAPH (the accompanying statistical graphics package) commands.

Installation is a fairly painless process (if you know how to edit your CONFIG.SYS and AUTOEXEC.BAT files), but our version generated an error message when installation was complete when there was actually no error. Although it is possible to install the package on floppy disks, you would need fifteen! A critical issue that becomes only partly apparent at first is disk space. The package includes nine 360Kb disks in packed form. If you add SYGRAPH, approximately 5Mb of space is swallowed up by the software alone. This is actually not bad if you consider that the microcomputer version of SAS requires about 21Mb for its statistics and graphics modules.

When the package is put to work on any substantial data set, disk space becomes even more of a problem. We found, for example, that a 5391 byte ASCII data file turned into a 42117 byte SYSTAT file — almost an eight-fold increase! By default, files are stored in double precision, and file size can be cut in half if your data do not require it. There is, however,

no software toggle that can be set to effect this change on even a semipermanent basis. Every time you create a file you must add "single precision" to the save command.

If you want to process just one part of a data set or need to group data by one of the variables stored in the file, a variety of procedures are available to do so. A problem is that any of these operations requires that you produce another SYSTAT file containing the subset of data or the data sorted by group. To make matters worse, it is impossible to replace a file with an edited version of that file. You can only save to a different file than the one you are working on. You can not, for example, sort by a grouping variable and replace the original file with the sorted version. Files seem to multiply like rabbits!

If you make the mistake of running a procedure that creates a new file on the same disk drive that SYSTAT is on and there is not enough room for the resulting file to be created, SYSTAT generated a hidden file containing results as far as it got, thus reducing disk space even further.

Another space problem is the standard one in the DOS world — the 640Kb memory limit. More than once we received the message "The problem is too large for this version of SYSTAT." This message is more optimistic than the reality that generated it. No version of SYSTAT for the IBM can access extended or expanded memory and the minimum memory requirement to run the program is 640Kb. We hit the limit with data sets containing 21 variables of 4200 cases each. Analysis of about 25 variables at a time by county for the U.S. should be possible, as should the package's upper limit of 256 variables for counties in any individual state.

Data input is quite easy if you do not have too much of it. The

editing module is spreadsheet-like and has some handy transformation procedures included. Input of data from an external ASCII file is equally easy — if data are in nice neat columns with no missing values. On the output end, you can print results (but not to an Apple LaserWriter), direct print files to disk, and export SYSTAT data files as ASCII files for use in other packages.

Once information is in SYSTAT form, a powerful DATA module is available to manipulate it. There is even a built in BASIC module that can be used to design custom data transformations. A sophisticated macro editor is also included that allows you to build multistep procedures. The macro files are in ASCII, therefore they can be generated externally in a program editor. The macro facility can be used with most of the statistical modules so that running the same procedure on several different files does not require continued entry of commands. Another positive feature of the DATA module is its capability to merge multiple files, both vertically (appending rows) and horizontally (appending columns).

The authors of the manual assume a considerable level of statistical sophistication. Procedures and parameters generated in the output are not explained. Some of the terminology is rather obscure, at least for a pair of geographers. To the author's credit, advice about misuse of statistical procedures is sprinkled throughout the manual, and should inhibit users from making some common mistakes. The authors also have a sense of humor; a pleasant change from most computer manuals!

Support for the package is fairly good. Calls to technical support staff were seldom handled immediately, but they do return their calls and would generally stick with a question until it was

answered, even when that took two or three return calls on their part.

Overall, in spite of some flaws, we give SYSTAT a high rating. It is a powerful package and the learning curve is relatively gentle for the power you get. Most of the problems are in the user interface, or related to space limitations that are a problem for most IBM-based systems. If you want an integrated statistical/graphic analysis package with an intuitive user interface that allows real time interaction between statistics and graphics, SYSTAT/SYGRAPH is not for you. If, on the other hand, you are willing to deal with a command driven package, need a comprehensive set of statistical analysis procedures, and can put up with switching from one package to another between graphics and statistics, we recommend the SYSTAT/SYGRAPH tandem.

Editors' note: a comprehensive review of SYGRAPH will be included in CP Number 5, Spring 1990.

DESKTOP MAPPING SOFTWARE VENDORS MERGE

The December, 1989 issue of *The GIS Forum* reports that "Less than two months after renaming his company, Strategic Mapping, Inc. [purveyors of Atlas*Graphics™, the best known desktop mapping software for MS-DOS platforms], Steve Poizner has announced its merger with Select Micro Systems, Inc., the developer of MapMaker™, the leading Macintosh based desktop mapping system... The combined firm will operate under the SMI banner from its current location in San Jose."

The merger is something less than a surprise, given that "SMI has been a MapMaker dealer since 1987 and Select Micro Systems' exclusive source of data and boundary files." *The GIS Forum*

lauds Poizner for acknowledging that "the Macintosh has become the clear choice for desktop publishing," and concludes that the merger "suggests that desktop mapping has finally gained corporate acceptance and should lead to the introduction of even better and more innovative products."

For a review of MapMaker 3.0, see CP Number 1, March 1989.

SERVICE BUREAU DIRECTORY

The trade publication *Electronic Publishing and Printing* has announced publication of its *Second Annual Service Bureau Directory*, a list of more than 650 outlets offering PostScript output services including color separations, typesetting, and presentation graphic output. In addition to addresses and phone numbers, the operating systems, output devices, software, and special services available at each service bureau are listed. The directory is organized alphabetically within five rough geographical regions (east, central, west, south, Canadian). The directory is available for \$7.50 from Ms. Jean Miller, Electronic Publishing and Printing, Dept. SBD, 29 Wacker Dr., Chicago, IL 60606.

FREE COMPUTER MAGAZINES

The *Directory of Free Computer Magazines* is a listing of more than 200 computer, communications, marketing, and related business titles on an MS-DOS formatted diskette. Each listing describes the magazine and lists an address and phone number for free subscription orders. The introductory price is \$89 plus a \$4 shipping and handling fee. Quarterly upgrades are available for \$33. Contact: SeaBird Associates, 4 Militia Dr., Lexington, MA 02173; (617) 862-9515. *Electronic Publishing and Printing*, 12/89

cart lab bulletin board

THE PLACEMENT OF POINTS IN FREEHAND PATHS

David DiBiase and Kevin Kolb,
Deasy GeoGraphics Laboratory,
Penn State University

Illustrator 88 (Adobe Systems, Inc.) and FreeHand (Aldus Corp.) are powerful PostScript drawing packages that are widely used by graphic designers, including cartographers. Illustrator was introduced in 1987 for the Macintosh and has recently been ported to MS-DOS platforms. New versions for UNIX platforms (NeXT and Sun) have also been announced. FreeHand, a copy-cat program, is currently available for the Mac only. The packages are similar in functions and 'look and feel,' but important differences exist. This note will deal with what may be FreeHand's most important shortcoming and will suggest how users may minimize difficulties.

About 90 percent of the projects coming through the Deasy GeoGraphics Lab are dispatched with FreeHand 2.02. Our typical products are black and white information graphics printed by imagesetter for journal publications and color 35mm slides for professional and classroom presentations. We find FreeHand preferable to Illustrator because of its superior typographic functions, its avoidance of Illustrator's awkward separate drawing and preview modes, and its explicit layer control functions. FreeHand looks very bad in comparison, however, when it is asked to 'close' complex 'paths.' Some background information on PostScript seems in order here.

The problem of complex closed paths

A 'path' is an object in the PostScript language that consists of a

collection of points or curves. Paths may be 'stroked' (points connected with a line of definable weight, pattern and color) and 'filled' (interior areas washed with definable patterns or color), among other things. Only 'closed' paths (identical first and last points) may be filled. Several factors impose upper limits on the complexity of a closed path: the PostScript language itself, the operation of particular PostScript drawing programs, and the raster image processors (RIPs) that transform PostScript files into bitmap images that laser printers can print. The current implementation of PostScript allows a maximum of 1500 points in a path. The FreeHand program will not allow paths of greater than 1000 points. Our experience has shown, however, that FreeHand files often bomb with a PostScript 'limitcheck' error when we try to print closed paths of as few as 500 points. Illustrator 88 (we run version 1.8.3) solves this problem by automatically subdividing an excessively complex closed path into linked subpaths of manageable size.



Figure 1: The FreeHand toolbox with the freehand tool selected.

The problem that motivated this study confronted us the first time we used FreeHand. We were staging a 'John Henry test' in which one project was to be rendered by two cartographers: one using established photomechanical techniques (John Henry) and another using FreeHand on the Macintosh (the steam shovel).

That time, John Henry won. The FreeHand document was rendered long before the scribing and type stickup were complete, but we couldn't print it! We made several phone calls to Aldus' technical support department, and mailed them a copy of our file. We were informed that there are no plans to incorporate a path subdividing feature like Illustrator's into future versions of FreeHand. We considered switching to Illustrator, but decided that FreeHand's strengths outweigh (marginally) this weakness. Once this decision was

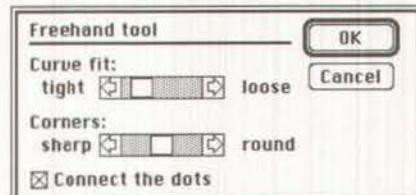


Figure 2: Freehand tool options dialog box. Curve fit option is set at position 2, corners option at position 3.

made, we initiated a small study designed to reveal what factors determine the number of points in a path. What we have learned has helped us avoid unnecessarily complex closed paths in routine production.

A few words on how paths are generated in FreeHand: Nine drawing tools are provided in Freehand's 'toolbox' (Figure 1). The four 'basic shape' tools allow the user to generate square- and round-cornered rectangles, ellipses and lines with a minimum number of points. The more powerful class of drawing tools is the five 'freeform tools.' Four of these — the combination, curve, corner and connector tools — require the user to perform a mouse click to place each point in a path. The 'freehand' tool allows the user to click the mouse button and drag the screen cursor, tracing a path in a continuous hand movement analogous to drafting or scribing (note that in the following 'Free-



Figure 3: Scanned drawing template used in the study (32 percent of original size)

Magnification Level	800%	3783	1995	1376	1135
400%	2493	904	771	649	626
200%	1578	587	550	523	490
100%	930	324	300	281	283
tight	1	2	3	4	5 loose

Figure 4: Number of points placed in test drawing as a function of magnification level (view size) and curve fit setting.

'Hand' refers to the entire drawing program, while 'freehand' refers to a particular kind of path). Points are placed along freehand paths by the program, not by the user. The number of points placed along freehand paths varies as a function of 1) the magnification level (view size) at which the path is created, and 2) tolerance levels set in the freehand tool options dialog box (Figure 2).

FreeHand provides seven view size options. A drawing may be viewed and edited at actual size (100 percent), or at 200, 400 or 800 percent magnifications, as well as reductions to 50, 25 and 12.5 percent. Since users are unlikely to edit drawings from a reduced view, we only evaluated the program's performance at 100, 200, 400 and 800 percent view sizes.

The freehand tool options dialog box appears when the user double-clicks on the freehand tool icon in the toolbox. Two parameters can be adjusted. The 'curve fit' parameter controls the sensitivity of the program to the user's movement of the mouse; a 'tighter' setting in the curve fit scroll bar sets a tighter tolerance value and causes the program to place more

points along a freehand path. The 'corners' scroll bar controls the program's angle detection sensitivity; the 'sharper' this option is set, the sharper an angle must be before a point is placed at its vertex. Although the scroll bars are continuously variable, we evaluated their influence on point placement by limiting their variability to five positions: far left (position 1), middle left (position 2), center (position 3), and so on.

Effect of view size and the curve fit parameter

The FreeHand manual suggests that the curve fit parameter affects the number of points placed along a freehand path, but we learned only by experience that view size is a second independent variable. To derive an approximation of the functional relationship between these variables, one operator drew a cartographic shape twenty times (four view sizes times five curve fit settings; corners option held constant at position 3) and observed the number of points placed in each case (provided in FreeHand's 'element info' dialog box). We used the same shape that crashed FreeHand in the John Henry test: the highly articulated Island of Newfoundland. The shape was compiled at 1:2,980,000 scale onto drafting film with a .012" technical pen and scanned at 600 dpi resolution using an HP ScanJet desktop scanner. The scanned drawing template is presented as Figure 3 (unfortunately, space limitations require that all examples be reproduced at 32 percent of original size).

The number of points placed in each drawing as a function of view size and curve fit setting is given in Figure 4, and the function is graphed in Figure 5. These results demonstrate that the combination of the highest magnification level (800 percent) and tight curve fit settings results in a very large increase in the number of points

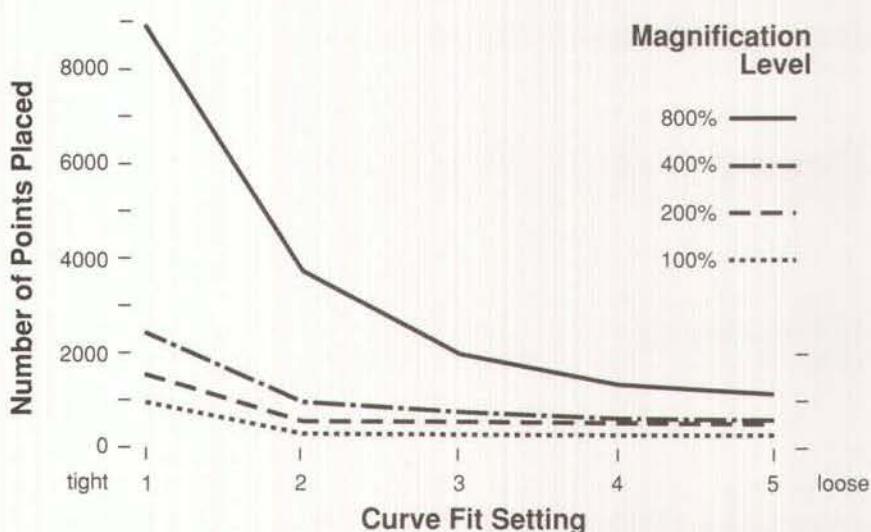


Figure 5: Observed effects of magnification level (view size) and curve fit setting on number of points placed in freehand paths.

placed in freehand paths relative to lower settings.

Figure 6 presents four sample drawings (at 32 percent of original size): 6a shows the shape that resulted when the scanned template was traced at 100 percent view and loose curve fit (position 5). FreeHand placed only 283 points in this path. The visual impact of the semi-controlled generalization that has taken place is unfortunately minimized in this reduced example. Figure 6b shows the other extreme: at 800 percent magnification and curve fit at the tightest setting, 8915 points were placed. If a user wished to close this path, it would have to be manually subdivided into about eighteen subpaths — an ugly chore. Many of the points placed in such a path contribute little to the fidelity of the drawing to the template. Figure 6c, drawn at 400 percent magnification and curve fit setting 1 (tight), compares favorably to 6b, though it is comprised of only 2493 points — 28 percent as many as 6b. Only 904 points (10 percent of the number placed in 6b) were placed in the path displayed as Figure 6d, which was drawn at magnification level 400 percent and curve fit setting 2 (moderately tight). Actual size segments of paths rendered at 800 percent magnification, curve fit 1 (Figure 7a), 400 percent magnification, curve fit 1, (Figure 7b) and 400 percent magnification, curve fit 2 (Figure 7c) are presented for comparison.

The appropriateness of the effect on line character resulting from these adjustments must be assessed on a case-by-case basis. However, we can advise that by avoiding drawing at 800 percent magnification, FreeHand users are likely to experience less difficulty in closing complex paths and noticeably fewer PostScript limitcheck errors when trying to print them.

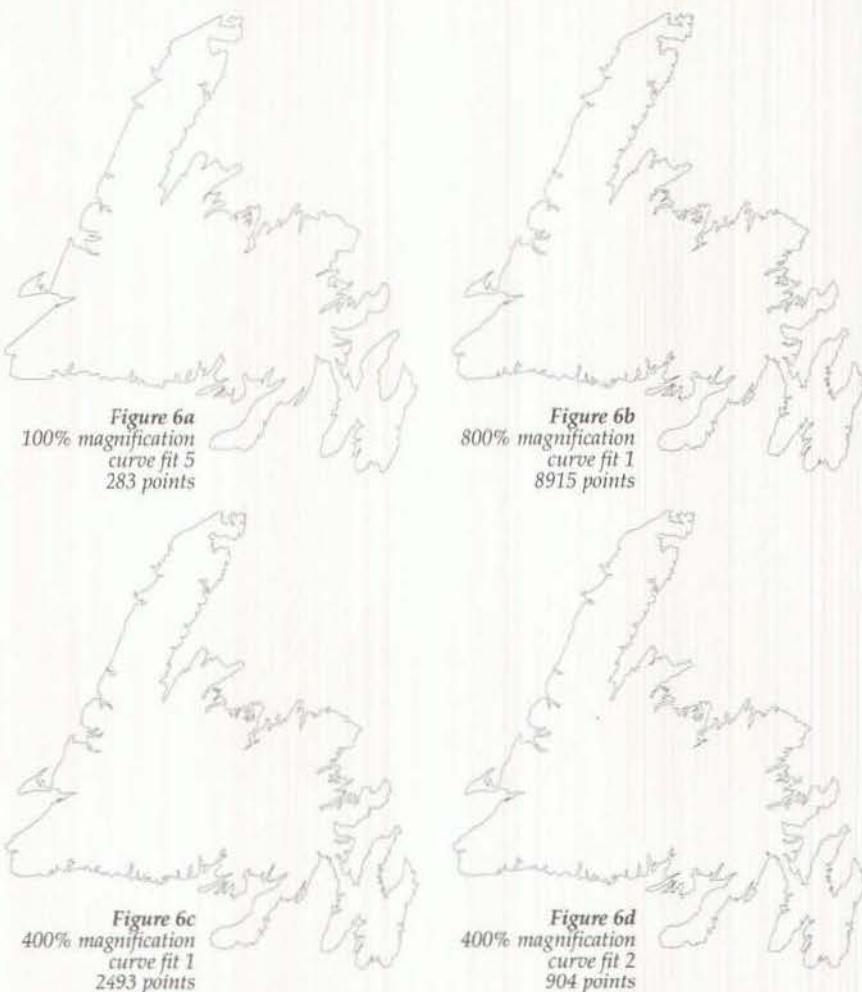


Figure 6: Effects on line character of variations in magnification level and curve fit setting (32 percent of actual size).

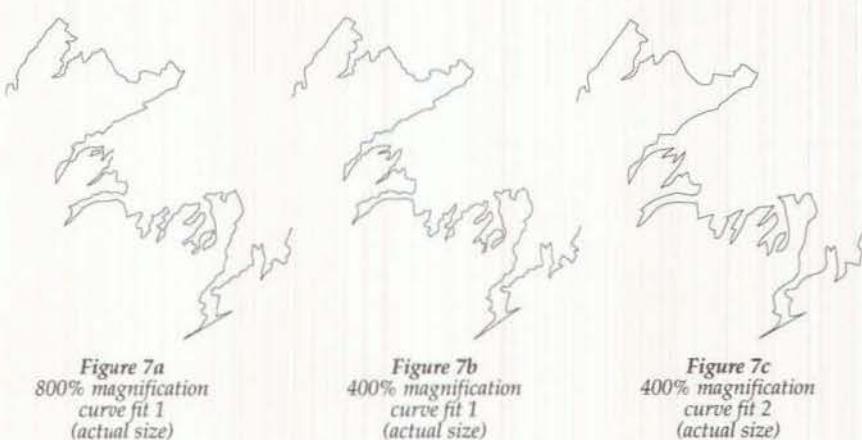


Figure 7: Effects on line character of variations in magnification level and curve fit setting.

Effect of the 'corners' parameter

We also considered the effect of the corners parameter on the quantity of points placed by the program, though we did so in a

more limited way. At 400 percent magnification and tight curve fit (setting 1), we observed a 30 percent increase in the number of points placed when the corners

scroll bar was set at position 5 ('round' — 2770 points) as compared to position 1 ('sharp' — 2125 points). Compared to the nearly 400 percent difference in the number of points placed as a function of curve fit settings at this magnification level, the effect of the corner option is relatively slight.

Summary

FreeHand is a powerful Macintosh-based PostScript drawing package of proven utility in the design and production of maps and other information graphics. Its worst shortcoming is its inability to process closed paths of greater than approximately 500 points. The placement of points along paths created with the freehand tool is determined by the software, not directly by the user. The number of points placed in a freehand path varies as a function of the magnification level at which the drawing is made, the 'curve fit' tolerance set in the freehand tool options dialog box, and (to a lesser extent) the 'corners' option setting. The drawing technique of individual operators probably has an effect also, but this factor was not evaluated. In general, we recommend that users avoid creating freehand paths at the highest level of magnification (800%). This procedure will not eliminate PostScript limitcheck errors resulting from overly complex paths, but it will minimize the number of manual path subdivisions required. Aldus Corp. — the developers of FreeHand — ought to incorporate the automatic path subdivision feature that Illustrator 88 users take for granted into future revisions of their software. This shortcoming makes it hard for us to justify our continuing preference for FreeHand.

PRIVATE SECTOR PROFILE: FERGUSON CARTOTECH

Ann K. Deakin, Ferguson Cartographic Technologies, Inc.

Ferguson CartoTech (Ferguson Cartographic Technologies, Inc.) is a Texas-based, privately held corporation that provides digital conversion, custom cartography, and map drafting services to the private and public sectors.

Ferguson CartoTech was founded in 1907 as the Southwell Map Company. It became Ferguson Map Company, Inc. in 1947 when M.L. Ferguson purchased the business. In 1976, Warren Ferguson joined the family business and determined that the company's focus should shift toward automated mapping technology and services. Subsequently, an Information Services division dedicated to AM/FM and GIS was established in Houston to supplement the San Antonio-based Cartographics and Infographics divisions. In 1986, Ferguson Cartographic Technologies, Inc. was established when the divisions were merged. Ferguson CartoTech's headquarters are now located in northeast San Antonio, Texas and employs 130 professional and technical personnel skilled in geography, cartography, graphic design, computer science, and engineering.

Ferguson CartoTech is committed to providing high quality cartographic products and, as a result, has achieved a reputation as one of North America's leading providers of cartographic services and AM/FM and GIS conversion services. Ferguson CartoTech is currently providing conversion services to Texas-New Mexico Power Company, Salt River Project Thunderstone Division (Geography and Facilities), Jersey Central Power and Light, South Central Connecticut Regional Water Authority, City Electric System of Key West, Monroe County Prop-

erty Appraiser, Southern New England Telephone, Pacific Bell, Bexar Appraisal District, and Rand McNally. Ferguson CartoTech also provides mapping services to Northside and North East School Districts, Houston School Districts, Metropolitan Transit Authority of Harris County, VIA Metropolitan Transit, City of San Antonio, GTE, Southwestern Bell, and a variety of other regional organizations.

GLOBAL COMMONS DATABASE

Environmental impact statements (EIS) are used to document the effects of governmental actions on areas under U.S. jurisdiction. However, there is no agreement on how impacts from such actions should be documented in areas of the world beyond territorial boundaries. These unclaimed territories (generally in the oceans) are termed the "global commons." In 1978, Presidential Executive Order 12114 made the U.S. responsible for actions taken in the global commons; ensuing regulations (DoD 6050.7 and AR 200-2) made this official Department of Defense and Army policies.

The Army conducts activities within the global commons. It has asked the U.S. Army Construction Engineering Research Lab (USACERL) to develop a way to evaluate the environmental effects associated with such acts.

Data necessary for analysis of proposed Army actions have been identified, and are being acquired and input to USACERL's 'GRASS' Geographic Information System. GRASS programs will be used to model the execution of proposed alternatives, allowing their effects to be compared. Relevant global data include vegetations, soils, bioproductivity, sensitive species, oceanography, topography, climatology, demographics, economics, cultural concerns, fisheries, and other data.

In the process of evaluating environmental constraints on activities undertaken in the global commons, USACERL has accumulated an extensive digital global dataset, with potential users for many applications. For further information contact: Robert C. Lozar, USACERL, (217) 373-6739, ext. 739.

(*Grassclippings 3:3, Fall 1989*)

DMA/ESRI GLOBAL DATABASE

The Defense Mapping Agency (DMA) announced that it has awarded ESRI with a \$10 million contract to develop a 'digital chart of the world.' The project will begin immediately and is scheduled to be completed by December 1991.

The project will involve putting a 'complete' digital map of the world (utilizing the Operational Navigational Charts developed by the DMA as a source material) onto CD ROM. The final product will allow users to access the data using personal computers.

The project is composed of two stages: a prototype stage and a production stage. During the prototype stage, ESRI will research and develop data structure tools, building on the knowledge and experience ESRI has put into its ARC/INFO GIS software. The second stage of the project will be the full-scale production of the world database. ESRI will scan and process the entire ONC series (270 charts) maintained by the DMA.

For more information contact: Karen Hunter, Environmental Systems Research Institute, (714) 793-2853 ext. 582.

LOUISIANA COASTAL GIS NETWORK

The Louisiana State University (LSU) has received a \$200,000 award from the U.S. Geological Survey to develop a computer

network that will allow various universities and agencies to share information on Louisiana's coastal land loss.

The Louisiana Geological Survey and both LSU's Department of Geography and Anthropology and Computer-Aided Design and Geographical Information System (CADGIS) Research Laboratory are cooperating on the project. LSU officials expect the one-year award to be continued for four more years, for a total award of more than \$1 million.

Louisiana accounts for 80 percent of the nation's lost wetlands and is being looked at carefully by coastal planners around the world, said Don Davis, project coordinator with the Louisiana Geological Survey at LSU. "Louisiana's problem will be the nation's problem and the world's problem," said Davis.

The five-year cooperative project, known as the Louisiana Coastal Geographic Information System Network (LCGISN), is part of an ongoing U.S. Geological Survey study of coastal erosion and wetland loss throughout the country. Major projects are also underway in the Great Lakes region, along both the east and west coasts and along the Mississippi-Alabama coast.

Goals for the network include:

- Improving communication among coastal researchers, planners, universities and local, state, and federal agencies;
- Identifying where coastal information is available, simplifying the way the data are organized, incorporating it into the new system and sharing data among system; and
- Eliminating duplication of research efforts.

For further information, contact: Chip Groat or Don Davis at (504) 388-5320, Randolph McBride at (504) 388-8612, or Clancy Soileau at (504) 388-8654.
(*LSU News Service*)

FUTURE NAUTICAL CHARTS TO BE METRIC

The National Ocean Service (NOS) is planning to produce future nautical charts referenced to metric rather than English units. This is due in part to the Omnibus Trade Act of 1988 which establishes the metric system as the preferred system of measurement in U.S. trade and commerce. The act gives federal agencies until 1992 to adopt the metric system in their business dealings.

The offshore and coastal charts now published in fathoms will be converted to meters first, and those in feet and fathoms will be retained until total conversion is complete. No dual publications of feet and meters will be possible. At present no definite timetable for the conversion has been established. During the conversion period, NOS will make an effort to educate users on the advantages and use of the metric system.

S.C. Cartographic Information Center Bulletin (Summary 1989)

fugitive cartographic literature

Interesting articles about cartographic information often appear in unexpected outlets. The goal of this section is to bring those publications to the attention of our readership. We invite synopses of papers appearing in journals other than those devoted to cartography, geography, and map librarianship.

Rossano, Matt J. and Warren, David H. (1989) Misaligned maps lead to predictable errors.
Perception, 18:2, pp. 215-229.
reviewed by Pat Gilmartin, University of South Carolina

The authors of this article conducted three experiments to investigate subjects' abilities to judge direction when using misaligned maps; that is, maps on which the top, or "up," does not correspond with forward, or

straight ahead, in the map user's environment. Previous studies have shown that map readers experience difficulty using misaligned maps for wayfinding, regardless of whether the spatial data are encoded tactually, visually, or motorically. In the research summarized here, two further questions were addressed: is the map orientation effect just a function of the response mode used in previous studies, rather than being inherent to mental representations of spatial relations; and do directional errors reflect the cognitive operations which people use to deal with misaligned maps?

In connection with the latter question, the authors hypothesized that responses to contra-aligned maps (maps rotated 180° to the reader's orientation) would fall into three categories, reflecting the cognitive strategies used to formulate the answers. Correct responses would indicate that the subject had mentally rotated the image through two dimensions to bring it into alignment with his or her environment. Incorrect answers which are 180° off (so-called "alignment errors") would reflect a failure to make any correction at all in the map image. Angular judgments which are relatively accurate but are on the opposite side of the correct response would suggest that the subject had mentally "flipped" the map image through the third dimension, creating a mirror image.

The "maps" used in the study were three-sided rectilinear figures (an unsymmetrical "U"-shape, in essence, with corners and endpoints numbered one through four) which represented a path to be followed. The maps were either "aligned" (the top of the map representing straight ahead for the subject) or "contra-aligned," a 180° rotation of the aligned version. Subjects studied each of nine maps

for 30 seconds. The map then was removed from view, and the subject was told to imagine that he or she was standing at point "n" facing toward or away from point "m" on the map and to indicate the direction of point "j."

Responses were made in one of two modes: locomotor or manual pointing. The locomotor subjects were blindfolded and asked to step in the direction of the designated point, while the pointer subjects rotated a metal arm on a table-top pointer to indicate direction. Zero degrees was always straight ahead of the subjects. Accuracy (the absolute angular difference between a subject's response and the correct angle) and reaction time were recorded as dependent variables. Independent variables were gender, response condition (locomotion or pointer) and alignment of the map (aligned or contra-aligned).

In the first experiment, only the map alignment had a significant effect on performance. Mean angular errors and response times were much higher for the contra-aligned maps than for the aligned maps in both response modes. The distribution of angular errors was not random but tended to cluster around values reflecting inappropriate cognitive strategies used by the subjects, as the authors had hypothesized. However the distribution was different for the locomotor and the pointer conditions: in the locomotor condition, mirror-image type errors predominated, while in the pointer condition, misalignment errors were more common. This difference in the pattern of responses led to Experiment Two.

Experiment Two was designed to investigate further the variation between the locomotor and pointer conditions. In the first test, the locomotor subjects had been blindfolded, while the pointer subjects were not, which might have affected their responses in

some way. Experiment Two was conducted with the same materials and methods as before except that the new subjects were not blindfolded. Results were very similar to those of the first experiment, indicating that differences in the patterns of responses between locomotor and pointer response conditions were not due to subjects' eyes being open or closed but to some other phenomenon.

Experiment Three examined the generality of the cognitive strategies found in the preceding tests on maps aligned at intermediate angles of 45°, 90°, and 135°. The authors hypothesized that mirror-image errors would not occur in intermediate alignment conditions because flipping such a mental image does not bring reference points into alignment as it does with an image rotated to 180°. And the number of mirror image errors on a 180°-rotated figure should decrease because the intermediate rotations would encourage a greater use of a mental rotation strategy. Results were as hypothesized: 1) performance on aligned maps was excellent; 2) alignment errors were the predominant type for both the locomotor and pointer conditions at all degrees of misalignment except 180°; 3) the proportion of mirror-image errors at 180° was less than in the preceding studies. Response times were found to increase as the degree of misalignment increased.

Results of the research show that the map orientation effect does reflect people's mental conception of space and is not just an artifact of experimental procedures. Further, it appears that lawful, though not necessarily appropriate, cognitive processes underlie people's use of misaligned maps.

Sonenberg, Maya (1989)
Cartographies.
 University of Pittsburgh Press.
 174 pp., \$17.95 ISBN 0-8229-3627-5
 reviewed by Jeremy Crampton,
 Penn State University

"The distance imagined to lie between texts of information and texts of pleasure is exactly that: *imaginary*. There is none, the distinction is false, the chasm lies elsewhere."

—Denis Wood 1987

I bought this book, not because it had the "right" kind of title, but because of a quotation from the title story that was used as a come-on in an advertisement in *Harper's*: "it has always been this way with the mapmakers. From their first scratches on the cave wall to show the migration patterns of the herds, they have traced lines and lived inside them." What better definition of cartography and mapmaking could there be? (I recommend its use in all intro cart courses. I further recommend the title story as required reading for all advanced cart courses: there are a hundred and one points of departure.) Sonenberg's definition has everything; the use of maps to help understand the world and profit from it, emphasis on the centrality of maps in people's lives, and the structure of maps themselves as a bunch of lines representing the world. But what really catches my attention is the possibility of a dual interpretation of the last phrase, "living inside the lines." Cartography can be seen as both desirable and undesirable; lines help us to understand the world, yet our lives and imaginations are also constrained by lines, by borders, by limits, *by maps*.

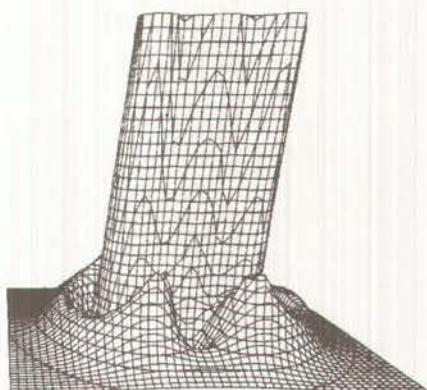
Sometimes outsiders see things that insiders miss. Let's hope that Sonenberg doesn't become a geographer; if she did we'd be left standing. Her raw material, her points of departure into character

development are often geographic, and certainly cartographic. Even the dust jacket is wise: "a love affair is evoked entirely within the metaphors of mapmaking.... Bodies, faces, the emotional distance between lovers, the setting of the table or a mountain to be climbed: all are maps to be pondered and read, just as all maps, so pondered, reveal new stories." Maps as narrative? Now where have I heard that before?

Flynn, George W. (1989). Chemical cartography: finding the keys to the kinetic labyrinth. *Science*, 246 (24 Nov.) pp. 1009-1015.
 reviewed by Alan M. MacEachren,
 Penn State University

Cartography by chemists! We'd better stay on our toes if we want to play a leading role in scientific visualization. In an article dealing with the use of lasers to take spectroscopic pictures of collision between molecular reactants, Flynn draws several analogies to topographic mapping in producing a 3D fishnet "map" of the global potential energy of interaction between H and CO₂.

The paper, as one would expect, deals primarily with the chemical reactions under study, but with its emphasis on the shape of interaction offers an interesting example of a landform description analogy to the role of graphics in non-geographic visualization. The author goes as far as stating that, "The potential itself is akin to a map of the terrain through mountains and valleys where elevation is a measure of energy instead of height." The logic being used is, of course, the same as that followed in early applications of isarithmic mapping to demographic information in the nineteenth century. In describing the 3D representation itself, Flynn draws heavily on the topographic analogy.



The H-CO₂ interaction is highly repulsive (an energy of at least 110 kJ/mole) everywhere (the "foothills" before the tall mountains except along a line perpendicular to the OCO axis at the C atom. Here there is a small plateau with an energy of 54 kJ/mole, and beyond this a well or valley corresponding to stable H-CO₂ where H is attached to the C atom.

From a cartographic perspective, "Chemical Cartography" is just one of many examples of scientific visualization in which cartography plays a role. Cartographers should have much to offer to disciplines in which the use of visualization tools is only now becoming an accepted part of scientific inquiries. Are we ready to meet the challenge?

cartographic artifacts

VIDEO REVIEW

Maps: From Quill to Computer
 New Dimension Media, 85985
 Lorane Highway, Eugene, OR
 97405; (503) 484-7125. Available
 for rent (\$45/day) or purchase in
 1/2" VHS (\$280), 3/4" VHS (\$300)
 or 16mm (\$475) formats.
 reviewed by Cherie A. Semans,
 University of California at Berkeley

The primary emphasis of the 26-minute film *Maps: From Quill to Computer* is on recent technological developments in mapping, including aerial photogrammetry, satellite imagery and computer-generated maps. These modern

mapping operations are presented in easily understood terms and illustrated with both actual footage and action diagrams. Interspersed throughout the explanations of modern cartographic activities are vignettes designed to give a brief look at the history of Western cartography. Examples include a Babylonian map more than 4,000 years old, a Ptolemaic representation of the world, the Hereford Map, the 1492 sketch of Hispaniola by Columbus, parts of the Catalan Atlas (1375), Cook's charts of the North Pacific, and the Cassini maps of France.

The length of the film (4,000 years in less than one-half hour) is my major criticism since so much had to be left out. To the film's credit, many types of maps are introduced: plan views, maritime and aviation charts, as well as relief, computer, and thematic maps (which are particularly well documented). A few of the major historical advances in cartography are touched on — including Ptolemy's role in constructing map projections and Harrison's invention of the chronometer — but many other notable events go unmentioned.

While I agree with the producers' notion that the film should appeal to a wide audience and age range (they suggest 6th grade through college), I do not find that it would always be a "useful adjunct to introductory coursework in geography and cartography at the college and community college level." As a cartography instructor, I believe that it would be more beneficial to a geography class where a brief introduction to mapping is needed rather than in a cartography class where most of the film's topics are, or should be, covered in greater detail.

ATLAS REVIEW

Les Villes "Européennes"

(ISBN 2-11-002200-0; price 120F or \$20.00) and

La France dans L'Espace Européen

(ISBN 2-86912-023-X; no price available)

(Montpellier: Groupement d'Intérêt Public RECLUS, 1989)
reviewed by Peter Gould, Penn State University

Directed or authored by Roger Brunet, and supported by the imagination and resources of Informations RECLUS, two more publications from La Maison de la Géographie have appeared to inform an educated citizenry about their place in the world, and their geographic relationships with other places. Both publications rely almost exclusively on computer based systems for data storage and mapping, ensuring easy comparison and rapid publication. *Le Villes*

"Européennes" was commissioned by DATAR (La Délégation à l'Aménagement du Territoire et à l'Action Régionale), to situate the cities and towns of France within a larger European context. What comes through, again and again, is that simple, 'everyday' mapping, informed by a lively geographic imagination, can catch the public eye and make people reflect upon their geography.

Each plate focuses on the 165 central places over 200,000 people in Western Europe (excluding Norway and Sweden, but including Greece), and provides an informing perspective on their functions. Sounds simple? Yes. Sounds dull (another urban classification)? Not at all. For many people it will be the first time that they have been presented with a *European*, as opposed to a national, view. As cartographers and geographers, we forget too readily how the geographically informed map can hold the attention of a thoughtful public.

For example, *Le Monde*, arguably the most politically sophisticated newspaper in the world, republished the map of international urban functions "with astonishing success." People want to know . . . about cultural characteristics, and research, economic power, communications, publishing, conferences, the arts, air traffic, banks, multinational firms, birth rates . . . and more. Including a 'general classification' of cities synthesizing the obvious interrelationships between their functions. Each plate has an informative page of text, not the least the last one on the Tissus de Villes, a broad brushstroke map that gives an overview of the central 'dorsal fin' of Europe, as well as the Finistères (literally, the ends of the earth!).

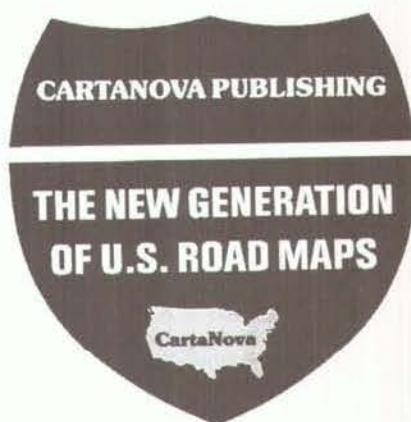
La France dans L'Espace Européen looks towards the 'New Europe' of 1993 (and who today can tell what that might contain?), and so helps the French people to see themselves in this larger social and economic context. The first ten plates display France in Western Europe (the 'access by air' plate is wretched, and could have been much more informative if constructed along the lines of Törnqvist's face-to-face contact map), while the remaining 20 plates focus on France itself using a variety of scales and generalizations. A map of France based on a square lattice of approximately 5,000 cells gives an intriguing picture of fiscal potentiality, and judging from a recent issue of *MappeMonde* we may see more of these highly detailed views. All the plates were created by the team working on *l'Atlas de France* (in preparation).

In brief, atlas-making does not have to be a huge undertaking, producing plates already years out of date when they appear. Computer aided design, and vivid color printing, allow us to produce clear, up-to-date, and intellectually

stimulating maps that can be put into the hands of the public—including the youngest citizens in our schools. From top officials in government to the newest members of society France is forging ahead. Will our comparable 'institutions' please copy?

100% REALISTIC MAPS NOW AVAILABLE

In a recent cleverly-trimmed brochure, CartaNova Publishing (Burgemeisterstr. 32, 1000 Berlin (West) 42, West Germany) has announced publication of eight new regional road maps of the



United States. The most remarkable feature of this new map series is its accuracy, which CartaNova claims to be absolute. To quote the brochure: "CartaNova Maps present the road system absolutely accurately and realistically [sic]. That goes for the entire run of the road, for each intersection, for every junction... CartaNova has put an end to the ordinary and unrealistic art of mapping. CartaNova maintains that today's traveller has the right to highest possible precision and unlimited reliability." All this for only \$2.95 retail. As with luxury automobiles and coffee makers, it seems you have to look to European engineering if you want quality.

LIMITED EDITION

FACSIMILES OFFERED

The Netherlands Chamber of Commerce in the United States and The Mercurius Group-Wormerveer have collaborated to make available a limited edition set of Artisan's Proofs reproduced directly from the original manuscripts charted by such early cartographers of the New World as Gerard Mercator, Antonio Sanchez, Abraham Ortelius and Willem Blaeu.

The collection of 24 individual maps and charts are divided into two portfolios, which are bound by hand in leather and linen covers, for both the East and West Coasts of North America.

Limited to 500 sets and distributed exclusively by the Chamber, this collection contains some reproductions so rare that no others exist, save the original manuscript. The collection is printed on handmade, acid-free paper—'Hollands luxe koperdruk.' All proofs are numbered and the printing plates were destroyed after production was completed. The collection is priced at \$1500 for both portfolios, \$950 for one.

For further information, contact: Peter Jutte, Membership Director, The Netherlands Chamber of Commerce, One Rockefeller Plaza, New York, NY 10020.

LONDON TOPOGRAPHICAL SOCIETY

For more than 100 years the London Topographical Society (LTS) reprints maps, plans and panoramas of London for its members and the general public. The Society has a membership of about 750. The LTS does not organize lectures or outings, nor does it campaign to save historic buildings or sites. It exists mainly to publish maps and panoramas. In addition to reprints, the LTS also publishes *The London Topogra-*

phical Record, a volume of essays on aspects of London's history which comes out every few years—the next is due in 1990. For more information on LTS, contact: Trevor Ford, Membership Secretary, 151 Mount View Road, London N4 4JT.
History Today (9/89)

cartographic events

EVENTS CALENDAR

1990

Spring 1990: **First European Conference on Geographical Information Systems**, Amsterdam, The Netherlands. Contact: Mieke Elekán, Geoplan, Weteringschans 12, 1017 SG Amsterdam, The Netherlands; 31-20-241433/247599.

March 5-8: **GIS for the 90's**, Ottawa, Canada. Contact: Canadian Institute of Surveying and Mapping, PO Box 5378, Station F, Ottawa, Canada, K2C 3J1; (613) 820-2291.

March 13-16: **GIS '90**, Vancouver, B.C. Contact: Hugh Legg; Reid, Collins and Associates, 15th Floor, 401 West Georgia Street, Vancouver, B.C. V6B 5A1; (604) 664-5922.

March 18-23: **ACSM/ASPRS Annual Convention**, Denver, CO. Contact: ACSM; (703) 241-2446.

March 19-22: **National Computer Graphics Association '90**, 11th Annual Conference and Exhibition dedicated to computer graphics applications, Anaheim Convention Center, Anaheim, CA. To register, call 1-800-225-NCGA.

March 21-24: **Western Association of Map Libraries**, Tucson, Arizona. Contact: Jack Mount, Map

Library, University of Arizona, Tucson, AZ, 85721. Bitnet: DOCMAPS@ARIZRVAX

April 19-22: Association of American Geographers 86th Annual Meeting, Toronto, Ontario, Canada. Contact: AAG, 1710 Sixteenth Street NW, Washington, DC 20009-3198.

April 23-26: AM/FM (Automated Mapping/Facilities Management) International Conference XIII, Stouffer Harborplace Hotel, Baltimore, MD. Contact: AM/FM International, 8775 E. Orchard Road, Suite 820, Englewood, CO 80111; (303) 779-8320.

April 30-May 3: Eighth Australian Cartographic Conference, Darwin, Northern Territory, Australia. Contact: Conference Secretariat, Eighth Australian Cartographic Conference, Convention Catalysts, GPO Box 4352, Darwin, Northern Territory, Australia 0801.

June 10-13: Canadian Cartographic Association Annual Meeting, Victoria, B.C. Contact Dr. C. Peter Keller, Dept. of Geography, University of Victoria, P.O. Box 1700, Victoria B.C. V8W 2Y2; (604) 721-7333.

June 21-22: International Symposium on Mapping and Geographic Information Systems, San Francisco, CA. Contact: Laurel Davis O'Brien, 1916 Race Street, Philadelphia, PA 19103; (215) 299-5478.

June 22: ALA Preconference Workshop: "Remote-Sensing Imagery: Identification, Control, and Utilization." Advance registration, postmarked by May 26, 1990 will be required. Contact: Nancy Vick, MAGERT Preconference, Map and Geography Library, University of Illinois, 1408 W. Gregory, Urbana, IL 61801; (217) 333-0827.

June 23-28: American Library Association Annual Conference, Chicago, IL. Contact: Brent Allison, University of Minnesota, S 76 Wilson Library, 309 19th Avenue South, Minneapolis, MN 55455; (612) 624-0306.

July 23-27: 4th International Symposium on Spatial Data Handling, Zurich, Switzerland. Contact: Dr. Duane Marble, Dept. of Geography, 103 Bricker Hall, The Ohio State University, Columbus, OH 43210.

August 12-16: URISA Annual Conference, Edmonton, Alberta, Canada. Contact: URISA, Suite 304, 900 Second Street NE, Washington, DC 20002; (202) 289-1685.

September 23-28: ASPRS/ACSM Fall Meeting, Atlantic City, NJ. Contact: ACSM; (703) 241-2446.

October 1-4: International Map Collectors' Society 8th Annual International Symposium, Washington, DC, under the aegis of the Washington Map Society. Contact: Eric W. Wolf, 6300 Waterway Drive, Falls Church, VA 22044.

October 24-28: NACIS Annual Meeting, Orlando, FL. Contact: James F. Fryman, University of Northern Iowa, Cedar Falls, IA 50614-0406.

1991

September 23-October 1: Mapping the Nations—15th Conference of the International Cartographic Association, Bournemouth, England. Contact: Conference Services Limited, Congress House, 55 New Cavendish St., London W1M 7RE, England.

CALL FOR PAPERS

The Map and Geography Round Table (MAGERT) of the American Library Association (ALA) is seeking contributed papers for

programs to be held during ALA's annual conference in Chicago, Illinois, June 23-28, 1990. Papers will be considered on the following topics: automated geographic/cartographic reference tools and non-cartographic images of early exploration (i.e., photographs, birds-eye views, etc.).

Please contact the Program Chair, Brent Allison, John R. Borchert Map Librarian, University of Minnesota, S 76 Wilson Library, 309 19th Avenue South, Minneapolis, MN 55455; (612) 624-0306.

CALL FOR PAPERS

XV International Cartographic Conference
Bournemouth, England
23 September - 1 October 1991

The U.S. National Committee for ICA invites the submission of abstracts for consideration by the program committee of the IV ICA Conference. Limited travel funds for people giving papers are anticipated to be available. The Preliminary Program includes the following topics for the Conference:

§ Cartographic Expert Systems

§ Education and training for cartography and GIS

§ GIS technology: management issues of national mapping agencies

§ Graphic design in the computer mapping environment

§ History of Cartography

§ Maps for the handicapped

§ Marine Cartography; the impact ECDIS

§ Marketing topographical data and maps

§ National atlases: sources, design and use

- § National mapping organizations in the 1990s
- § Remote sensing for thematic maps
- § Research developments in GIS analytical techniques
- § The development of global digital cartographic databases
- § Using maps and spatial data

Abstracts will first be screened by the U.S. Program Committee. Those selected will be sent on for screening by the Organizing Committee in England. Abstracts sent directly to the British Conference organizers will be forwarded to the U.S. Program Committee for review. The abstract should be 300-500 words long in English or French, and must be typed on an abstract form available from the Chair, U.S. Program Committee. The deadline for all submission is 15 April 1990. Send the original and three copies of the abstract and a short biographical sketch, all single spaced to:

Prof. A. Jon Kimerling
Chair, U.S. Program Committee (ICA)
Geosciences Department
Oregon State University
Corvallis, OR 97331
(503) 737-3141

It is the ICA Executive Committee policy that no one can deliver the paper but the author. Authors will be contacted just before the final program is set and should be ready to make a firm commitment to attend the conference as a U.S. participant or withdraw the paper. The author's employer will also be asked for a firm commitment of release time.

For further information about the conference and a Provisional Program may be obtained from: Conference Services ICA, Congress House, 55 New Cavendish Street, London W1M 7RE, UK

NACIS news

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*banquet address***NUEVAS PERSPECTIVAS
NOUVELLE PERSPECTIVES
NEW PERSPECTIVES**

Ninth Annual Meeting of the
**NORTH AMERICAN
CARTOGRAPHIC INFORMATION SOCIETY**
ANN ARBOR, MICHIGAN
OCTOBER 11-14, 1989

New Perspectives On Cartography

D. R. F. Taylor

President, International
Cartographic Association

Carleton University
Ottawa, Ontario, Canada

It is a truism to argue that cartography is in a period of rapid change and we are all grappling with the need to redefine our discipline. The International Cartographic Association (ICA), in response to this need, established a Working Group on Cartographic Definitions in Morelia in 1987 and in Budapest this group issued an interim report on its efforts proposing two new working definitions for consideration. These are quite different from the existing ICA definition of cartography adopted in 1973 which reads:

The art, science and technology of making maps together with their study as scientific documents and works of art. In this context maps may be regarded as including all types of maps, charts and sections, three dimensional models and globes representing the Earth or any celestial body at any scale. (ICA 1973)

Some have argued that there is no need for change and that the current definition is still quite adequate. That is not a view which is widely shared and most cartographers recognize the need for change.

Dr. Christopher Board, the chairman of the working group, suggests that **Cartography** be defined as:

The organization and communication of geographically related information in either graphic or digital form. It can include all stages from data acquisition to presentation and use. (ICA 1989)

The suggested definition for the **map** is:

A holistic representation and intellectual abstraction of geographical reality, intended to be communicated for a purpose or purposes, transforming relevant geographical data into an end-product which is visual, digital or tactile. (ICA 1989)

Both of these working definitions are deceptively simple descriptions of evolving cartographic processes and products. The map is a powerful and very complex product of great significance and utility, produced by a variety of processes, which are culturally specific and which change over space and time. It is a serious mistake to trivialize the map or to see it, as some do, simply as one means of illustrating the results of Geographic Information Systems.

In recent years the technological paradigm has increasingly dominated

cartographic literature and research but despite the importance of technological change it is, in my view, not the central issue for cartography in the information era. To allow our understanding and definition of our discipline to be determined by a technological imperative would be a mistake.

Brian Harley, in a stimulating recent article entitled 'Deconstructing the map' (Harley 1989), has argued that maps are neither scientific nor objective and that the notion of cartography as a progressive science is "a myth partly created by cartographers in the course of their own professional development." (Harley 1989) Harley's paper draws on the 'postmodern' ideas of Foucault and Derrida and attempts to redefine the nature of maps as presentations of power. He argues that cartography should not be understood from the perspective of the dominant epistemology of scientific positivism but should be rooted in social theory. To Harley, the map is a discourse or text and the metaphysical and rhetorical nature of maps must be explored. He also attaches considerable importance to Foucault's notion of power and the need to look at the social and political dimensions of cartography — how the map works in society as a form of power-knowledge and how it is used in this respect. His plea is for a context dependent form of cartographic history.

Despite the surrounding rhetoric of postmodernism and deconstruction which Harley uses, the message which he gives to historians of cartography is essentially a simple but powerful one. The maps you are studying are at one and the same time not all, yet perhaps more, than they seem. Not all cartographers will agree with Harley's arguments and many may find them overstated and unpalatable but the questions he raises are important ones worthy of careful consideration as cartographers struggle to establish their niche in the emerging information era.

Does cartography's future lie in the increasingly technological and scientific nature of the discipline or should we be paying more attention to the purposes for which our products are to be used and designing these products in more imaginative ways specifically for these users? Maps have been, and continue to be, made for a variety of purposes and can never be truly objective because one of the distinguishing features of maps "is that they focus attention *selectively* on regions of space, features, objects and themes." (Visvalingam 1989) Even as new cartographic products and processes emerge this is unlikely to change. The map is an *abstraction* of reality: it is not reality itself. Nor is communication a purely objective process: it is a *rhetorical* process. At issue is just how explicit the rhetoric is.

In my view too many modern cartographers are primarily technological specialists with a limited understanding of the problems to which cartography can be usefully applied and with a very limited, sterile and unimaginative view of the discipline.

Carl O. Sauer said of maps many years ago, "Maps break down our inhibitions, stimulate our glands, stir our imagination, loosen our tongues. The map speaks across the barriers of language." It would be difficult to find many cartographic products today which would result in the same reaction from users.

We are in an era of exciting and dramatic change to which cartography and cartographers can make a major contribution. If we fail to respond adequately then our relevance as a profession and discipline may suffer. The "emergence" of cartography as a discipline described in the 1970s (Wolter 1975) may be replaced by an equally rapid "submergence" of the discipline in the 1990s.

The central argument is a simple one. Cartography is an applied, mainly visual, discipline with a strong communication element. In the final analysis society will judge us not by our definitions, our theories, the

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titles we give ourselves, our organizations or our professional books and journals but by contributions we make to the understanding and solution of some of the pressing problems of our times.

The usual debates about cartography revolve around whether or not it is a formal or a cognitive science, around the adequacy of the communication model as a theoretical basis for the discipline, around the artistic element and its role in cartography and around the changes in the discipline caused by the increasing impact of computer technology, all of which we mirror in our attempts to redefine our discipline. These are important topics but in the process of considering them we must not lose sight of perhaps the most critical issue of all which is the demand for, and the response to, our products from the users. There has probably never been a period in the history of cartography where the pace and impact of technological change has been more rapid but when this process is examined we find that change is being driven primarily by the technology itself while the needs of the user, despite rhetoric to the contrary, are usually of less importance than they should be.

Technology may be driving the concept of art out of cartography for as Robinson (1989) points out "What can be explained to a computer is science and everything else is art." But the losses to cartography on the artistic side will be minor compared to the losses we will face if we fail to respond to changing user demand.

As cartographers look to the future we would do well to carefully consider the major new application challenges facing us and to consider how our discipline should respond to them. Existing application challenges will, of course, continue although hopefully we will avoid a major stimulus of previous cartographic activity — world war. I would like to consider two of these challenges: the challenge posed by the emerging information revolution and the global challenge of socio-economic development and environmental degradation. Cartography has much to offer in the understanding, analysis and solution in both these world problems but our response will require innovation and adaptation on our part. The major focus of cartography in the past has not been centered on such issues but this focus can and must change because on this depends our future. If we start with needs and applications and derive our response from them we are likely to be more successful than if we allow technology to dominate — a situation which can often lead to cartographic products that are merely solutions in search of a problem. This was especially the case, for example, with some of the early experiments with Geographic Information Systems. There is evidence that in the second generation of such systems some of the same mistakes are being made.

The information revolution is the result of rapid change in both computer and communication technology. Cartography's first response grew out of a formalistic view of our discipline. The computer was used in an automated way to produce existing maps in what was hoped was a faster and cheaper way. The test applied was often whether or not the map produced by the computer was indistinguishable from that produced by manual methods. Fortunately this view has now changed as cartographers realize that the real power of the computer lies in the flexibility it gives to create new products only one of which is the map.

In the information era our products must help us to answer not only the question where, but also why, when, and by whom. We must also communicate our message more effectively using new technologies as they emerge. A major objective of cartography is the cognition of reality; as Papp-Vary (1989) points out, it is difficult to separate the form (cartographic representation) from the content (the representation of reality).

In the final analysis society will judge us by contributions we make to the understanding and solution of some of the pressing problems of our times.

Although cartographers have been active in the computer field many of the important developments are taking place outside of the cartographic community. The rapid development of Geographic Information Systems and Land Resource Information Systems is a case in point and these developments have greatly expanded the range of data to be mapped and the range of disciplines exploiting such mapping. This process has been further extended by the impact and availability of remote sensed imagery. Cartographers must be part of these developments. "GIS is, in fact, a new device to obtain deeper knowledge about reality. Cartographers have, and must have, their role not only in the development of new devices, but also in the exploration of new areas of reality and of newly discovered spatial relationships. This requirement strengthens the cognitive function of cartography." (Papp-Vary 1989)

In many information systems the map is, at present, an optional add on and the cartographic representations are usually very poor. This is often because cartographers have not been part of the design and implementation of the system. Visvalingam (1989) suggests that there are three options for cartography in relation to GIS:

- a) a separate discipline providing part of the knowledge base of GIS
- b) a subsidiary activity within GIS
- c) a regressive parent of GIS, which could well inherit, develop and exploit the intellectual wealth and concerns of its parent in an age biased towards the utilitarian, rather than the academic, potential of Information Technology

Although I have problems with the distinction between 'utilitarian' and academic I think the latter choice is preferable to the others.

Communication is central to cartography and in the information revolution new challenges present themselves, as improved communications technologies emerge with increasing speed and complexity. Maps on screens are an interesting example of new types of maps resulting from technological change based on the micro-chip. It can be argued that in the 1990s such maps will be equally, if not more, important than maps printed on paper. Commercial electronic atlases are already on the market and several nations, such as Canada, are developing an electronic atlas as part of their national mapping strategy. Increasingly, maps designed for the screen are being distributed either interactively from central data bases, or on new storage media such as optical disk. It is interesting to note that in some large projects using optical disk storage, such as the impressive Domesday System in the United Kingdom (Openshaw and others 1986) the map is a central component. As video and laser disk players, high density TV screens, and powerful micro-computers become more common in the home, the term 'distributed cartography' will take on new meaning. The cartographic design and production challenges for visual images for this type of situation are obvious but have not received much attention from cartographers (Taylor 1987). More imagination is required and there is evidence that this is occurring (Moellering 1989; Slocum and others 1988), although much more needs to be done.

The second major challenge is in the area of socio-economic development and for the struggle against poverty and environmental degradation. Cartography has always had a role to play in this respect over the centuries but that role has rarely been the dominant one. Some of the most rapid periods of cartographic development have taken place as a result of the demands of war, and cartography has not responded nearly as well to other challenges. Such challenges exist in all nations but are perhaps

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greatest in developing nations. Cartographers have been slow to respond to a 'cartography for development' (Taylor 1989) which requires a major emphasis to be placed on thematic mapping. The thematic map must become a more important, more timely and more relevant product if cartography is to make a more effective contribution to development and environmental challenges. The topographic map has, in the past, been the product in greatest demand during wars; the thematic map should be seen as major cartographic product for another kind of war — the war against poverty, ignorance, disease and the destruction of our environment. There is a need for cartographers to utilize remotely sensed imagery more effectively in the development of new products. In the nations of Africa, Asia and Latin America remotely sensed imagery plays a very significant role in socio-economic development planning and this is a role which is likely to increase, especially in large countries like India and China. As high resolution satellite imagery (such as that produced by SPOT) become increasingly available these may, in fact, be used as the base for thematic mapping, especially at small and medium scales. Denègre argues "... if high resolution satellite images can be the source of numerous topographic data, they can also constitute, like aerial photographs as well, the basis of the cartographic representation itself ..." (Denègre and others 1986)

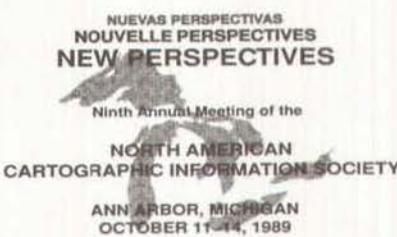
The response both to challenges of the information society and the cartography of development is beginning to converge. The development of cheap microcomputer technologies is substantially increasing the feasibility of the introduction of computer assisted cartography and GIS in many developing countries. These technologies are not particularly capital intensive and may allow the cartographers of the developing world to adopt the most recent techniques to make their products of more direct utility to the development process. Unlike some of the initial computer technologies based on mainframes, the new technologies increase the productivity of labour rather than replace it and are also particularly well suited to a more decentralized form of planning which is gaining increased acceptance in many countries. What is required is an effective merging of new and existing technologies in a way which is appropriate both to the tasks at hand and to the socio-economic context in which the technologies are to be applied. The emerging generation of GIS and LRIS systems may be equally useful in both industrialized and developing countries. Such systems may well be able to use remote sensed imagery in almost real time. The products of such systems can also be varied according to change in demand and presented in a variety of formats ranging from a simple plotter map to a high resolution complex visual illustrating inter-relationships on an optical disk. Sustainable development (World Commission on Environment and Development 1987) which takes the environment into account is now a world wide imperative regardless of whether or not we are talking about developing nations or post-industrialized society. There is also a need for an understanding of the complex inter-relationships between the physical and human environment. Here graphic representation takes on an added educational and informational imperative.

Cartography as a visual applied science can play a central role in modern society. The challenge to cartographers is to demonstrate by our products both the nature and importance of our discipline. This is a challenge to which I am sure we can respond. I believe that the greatest challenge facing us does not lie in the development of new technologies so much as in our ability to create a new conception of our discipline. This is a human, not a technological problem.

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paper abstracts



List compiled by Ellen White,
Michigan State University,
who also designed the nifty logo.

THURSDAY, OCTOBER 12
SESSION A:
CARTOGRAPHIC DESIGN

Color Chart Use in Map Design
Cynthia A. Brewer, Department of Geography, Michigan State University, East Lansing, Michigan

(see this issue's featured article, p. 3)

A Functional Model of Color in Cartographic Design
Charles P. Rader, Department of Geography, Michigan State University, East Lansing, Michigan

Color performs a number of important functions in the graphic and conceptual organization of a map. A map can be thought of as having a conceptual structure, a cartographic statement or message, and a related graphic structure, the coding of the symbols. The cartographer's job is to organize both of these structures in such a way that the intended message of the map is made apparent. Color provides a powerful means for organizing the map's message. A model is developed which examines the major functions of color (symbolization, legibility, and visual emphasis) in creating the required visual differences and syntactic relationships between the map

symbols. This involves relating communication goals to the ways in which color can be systematically modulated to change the map's message. The model provides an explanation of and a systematic approach to the use of color in cartographic design by focusing on the relationship between the formation of the map's conceptual structure and the formation of the map's graphic structure using color. While cartographic color syntax is, at present, somewhat elementary and highly variable depending on the nature of the map, the approach to color map design provided by the model indicates that the choice of specific colors may not be the overriding concern in determining the effectiveness of the colors employed, but rather that the relationships between the colors may be the most important concern in color selection. Ultimately, the utility of the model should fall in four main areas: the creation of new maps, the evaluation of existing maps, the instruction of students, and the design of expert systems.

The Look of Maps: Maintaining a Balance between Form and Function

Jeremy Crampton and Debra Daggs, Department of Geography, Pennsylvania State University, University Park, Pennsylvania

In *The Look of Maps*, Robinson proposed that "form follows function," an observation most cartographers would agree with. However, function has two meanings. The cartographic communication model highlighted a cognitive component which addresses how we operate on the map. This diverts attention from a more fundamental and complementary component, that is, what a map is for, or why we would use a map in preference to another form of representation.

Form also has two dimensions. Selecting the type of map establishes a framework within which subsequent design decisions will be made. Whether non-professional cartographers adhere to this conception and whether their range of map types is constrained is important because their maps appear frequently in the media. The increasing availability of computer cartographic software also places map design in the hands of people who do not necessarily have a cartographic or geographic background.

The result of this is that important map design questions are ignored. When the questions of what a map is for and what type of map is appropriate are not addressed, the "look of maps" will revert to defaults. This can result in what Petchenik has called map-like objects (MLO's) which are ill-conceived graphics.

We analyze these interlinked questions with reference to our beginning statement that map design is dictated by its function. We argue that an area where this is especially relevant is in education, where children are taught "map skills." We argue that it is just as important that the child be able to judge just when it is necessary to employ a cartographic representation (and not, say, a written description). By emphasizing the two aspects of function and of form, cartographers will best be able to resist the question of their obsolescence.

SESSION B: ATLASES

The Design and Production of the Political Atlas of Illinois

Richard P. Vaupel, Department of Geography, Northern Illinois University

The creation of the Political Atlas of Illinois was a cooperative effort to integrate two different data streams into a useful information source for state legislators and the general public. The database for the atlas required that 80,000 census units be aggregated into 118 house district levels to permit linkage of political to demographic data. The result was an integrated information product containing 112 colored maps together with tables and graphs.

A three-way partnership was formed to create the atlas. The Social Science Research Institute established the need for the atlas and provided the necessary political expertise. The NIU Press served as publisher and provided book design and marketing expertise. The conceptual geographic structure, together with the design and production skills, were provided by the Laboratory for Cartography and Spatial Analysis.

The creation of the atlas was compressed within a ten-month period, four of which were expended in reaching a consensus on the atlas dummy. Considerable time in base map construction was saved by using portions of existing census maps. Choosing colors proved to be difficult and several prototypes had to be made before consensus could be reached. All typesetting was done by NIU Press and as the components for each page came together, it was routed numerous times among the three units for editing. As mass production of final composite negatives began in month seven, three sifts worked for several weeks. The Cartographic Lab invested approximately 1,730 hours of labor and nearly 1,500 pieces of mylar, scribe coat, peel coat, and film. 2,150 copies of the 104 page atlas were printed and have sold well. The atlas was warmly received by state legislators who showered

our President's office with accolades. The atlas has received favorable reviews, including an award for best design of its class in the Chicago Book Clinic competition in 1989.

Atlas of Ukrainians in Canada

Geoffrey Matthews, Department of Geography, University of Toronto, Toronto, Ontario, Canada

Published to help commemorate the centennial of Ukrainian settlement in Canada, the atlas of Ukrainians in Canada is unique in North America. For the first time through the use of maps and graphs we can discover the history of an ethnic group who migrated to Canada and created a new landscape through their settlement patterns and architecture, and through the formation of Ukrainian cultural, social, religious, and political organizations. Simple in design, modest in size and presentation, this atlas about people is a significant contribution to the cartographic catalogue.

Boundary Symbols in World Atlases to 1800: Towards a Standard Vision of the Political World

James R. Akerman, Herman Dunlap Smith Center for the History of Cartography, The Newberry Library, Chicago, Illinois

Although the boundary line is one of the oldest and most easily grasped cartographic symbols, it is absent from the majority of early printed maps. The specific use of boundary lines to represent the limits of political sovereignty or jurisdiction in early modern Europe developed slowly, as the concept of territorial sovereignty itself took hold as the guiding principle of political relationships among European states. Study of 50 atlases published between 1500 and 1800 and now housed in Chicago's Newberry Library reveals three stages in this development. In the first stage (to about 1640), engraved boundaries became increasingly common, but were limited to larger and medium-scale maps. Lines were infrequently used to designate the fluctuating frontiers of larger states, such as France and the German (Holy Roman) Empire, and hardly used at all on maps of continents and world maps. In the second stage (circa 1640-1740), engraved boundary lines became standard features of atlas maps at all scales, and the first graded symbols were introduced to help distinguish between the limits of sovereign territories and the limits of their internal provinces. Finally, after about 1740, the hierarchical systems for the delineation of political

territory were applied consistently throughout individual atlases. Moreover, the geopolitical meaning of engraved lines was effectively reinforced by the more rigorous application of other symbolic elements, such as color and marginal detail reduction.

SESSION C: ETHICS IN CARTOGRAPHY ROUNDTABLE DISCUSSION

Ethics in Cartography Roundtable Discussion

Patrick McHaffie, Department of Geography, University of Kentucky, Lexington, Kentucky

Representatives from academic, private and government cartographic agencies will provide a summary of their perspective of professional ethics in their sector of the cartography profession. Roundtable participants include: Ronald M. Bolton, Chief, Aeronautical Charting Division, NOAA; David DiBiase, Associate Director, Deasy GeoGraphics Laboratory, Penn State University; and Matthew Edney, University of Wisconsin-Madison.

SESSION D: MAP LIBRARY MANAGEMENT

Managing Map Collections: An Introduction Overview

John Sutherland, University of Georgia Libraries, Athens, Georgia

This paper is an overview of the state of management in map libraries in the United States. Management issues related to size, age/history, budget, space, the place within the administrative hierarchy (departmental, branch, etc.) and other characteristics will be examined.

Managing Cartographic Collections: The Development of a Selection and Retention Model

James O. Minton, United States Geological Survey, National Center, Reston, Virginia

The collection management function in large academic map collections consists of many elements: budgeting, community surveys, policy development, selection, cooperative programs, weeding, storage, preservation-conservation, security and more. This paper will address the evolution of a collection development policy and present models for the selection and retention of cartographic and related materials. As emphasis in academic libraries has moved from building

collections to managing information resources, map librarians are finding that they are not isolated from this process and are expected to write mission statements, conduct community surveys and assign levels of collection strength and manage cartographic collections in a manner similar to librarians responsible for managing book collections. There have been debates as to how much emphasis to place on any of the varied steps in the collection development process and librarians must balance their time and energies accordingly.

A model based on the Research Libraries Group (RLG) Conspectus using Library of Congress subject classes and the assignment of specific field values of 0-5 representing collecting intensities which can expand to consider 20 subject categories and scale as elements in selection decisions is presented. A geo-political profile sheet for each selected LC class (geographic area) is generated to document collection intensities for future consultation. Additional maps and tables are presented as aids in the selection process.

FRIDAY, OCTOBER 13

SESSION A: MICROCOMPUTER-BASED CARTOGRAPHIC PRODUCTION

Microcomputer Cartographic Production: Theoretical Problems and Prospects
John B. Krygier, Brian Goudreau, and Onno Brouwer, Department of Geography, University of Wisconsin, Madison, Wisconsin

This paper will cover several theoretical and general questions which the implementation of microcomputer cartographic production has raised in the UW Cartographic Lab. Included among these are modifications in the "layer" concept inherent in the traditional map production process; the shift to "real-time" map design and interaction with the map; the questions of accuracy and efficiency in microcomputer versus traditional production, and the impact on cartography of PostScript, a graphics computer programming language. In all these cases traditional and ingrained cartographic concepts must be reevaluated and reapplied to a new production environment crowded with new tools, capabilities, and possibilities.

Microcomputer Cartographic Production: Practical Problems and Prospects
John B. Krygier, Brian Goudreau, and Onno Brouwer, Department of Geography, University of Wisconsin, Madison, Wisconsin

Initially, a series of important practical problems must be dealt with when considering the implementation of microcomputer cartographic production. General hardware configuration questions deal with the type of computer, its memory, and monitors that are suitable for digital cartographic production (i.e., IBM or MAC, necessary RAM and hard disk capacities, color or monochrome monitors, 4-bit, 8-bit, or 24-bit color). Viable software, that is, software that can be modified to be of use for cartographers, must be chosen and learned (i.e., cartographic software, paint/draw software, PostScript software). Devices with which to input data, base maps and compilation worksheets must be decided upon (i.e., digitizers, pre-existing files, or scanners; input resolution). Output of a quality similar to traditionally produced maps is necessary if the microcomputer is to be a viable cartographic production tool (i.e., laser printers or film output, PostScript or bitmapped). Each of these areas will be reviewed and specific problems and prospects, with reference to microcomputer cartographic production, will be discussed.

Marketing Cart Lab Services in a Research-Oriented University
David DiBiase, Deasy GeoGraphics Laboratory, Pennsylvania State University, University Park, Pennsylvania

Facilities for the production of maps and other scientific graphics are a common fixture in North American universities. Such facilities - commonly known as "cart labs" - represent the principal academic niche for practicing cartographers. Recent research reveals that the typical North American cart lab is managed by a professional cartographer with a staff (if any) of two or three part-time student employees. Geography departments are the principal clients of cart labs (nearly 60 percent of all clients). About 80 percent of Cart Lab products are produced by manual photomechanical methods. In light of the ongoing proliferation of computer graphics hardware and software, it seems likely that the traditional niche of cart labs may be changing, especially in research-oriented universities. This paper will introduce the notion of a "scientific graphics studio" as an evolutionary advance on the traditional cart lab model. Strategies will be suggested whereby cart lab managers may upgrade

their facilities and market their design skills to a wider client base within research universities. Benefits likely to accrue from such efforts include increased quality of all types of scientific graphics, and a more fertile niche for university cartographers.

SESSION B: GEOGRAPHIC INFORMATION SYSTEMS

GIS in Michigan - Today and the Future
Michael Scieszka, Michigan Department of Natural Resources, Lansing, Michigan

This session will focus on the Michigan Resource Inventory Program and its GIS called MIRIS. MIRIS was started in 1980 and contains the most extensive digital base in the nation. Base maps, with land cover/use, soils, thematic overlays are being delivered to state, local and private decision makers across the state. The presentation will discuss how the data base was developed, who uses it and for what purposes.

Issues to be Considered in the Development and Management of GIS/LIS
Claudette M. Dillion and Ronald M. Bolton, Aeronautical Charting Division, National Oceanic and Atmospheric Administration, Rockville, Maryland

The sources of GIS/LIS implementation problems are many but tend to fall into similar categories for most systems: 1) too much emphasis on technical issues and available technology; 2) failure to identify system requirements; 3) inadequate study of organizational impact and system/organizational staffing changes caused by GIS/LIS operations; 4) organizational inflexibility and lack of preparation for the changes that occur with the installation of a GIS/LIS; 5) failure to assess long-term costs of operating a GIS/LIS and underestimation of data base creation and maintenance costs; 6) lack of management control due to oversight in defining policy-making, advisory, and execution roles.

A quick review of these problem areas reveals that organizational problems outweigh technical ones. However, this is not surprising; the organizational aspects of most systems development and system operations have more to do with a system's success than the quality of technology. Unfortunately, many GIS/LIS systems are developed on an ad hoc basis with technical personnel leading the efforts, and proper executive and policy-making level direction lacking. The traditional systems analysis techniques are circumnavigated under the guise of expediting or facilitating the implementation of many GIS/LIS

systems. The following questions are not being satisfactorily addressed prior to hardware/software procurement. 1) What are the actual system requirements? 2) Can the proposed system do the task at hand more cost effectively? 3) Will it meet the schedules outlined in the requirements documentation? 4) Will it produce the required outputs faster than the existing system? 5) Does the proposed system have the ability to expand and change as requirements change? 6) What are the hardware, software, systems maintenance, data base creation, and data base maintenance costs? 7) Is the technology mature and tested? 8) What risks are involved in the development and implementation of the system, and how would they impact the organization?

In summary, GIS/LIS development often occurs on an ad hoc basis without proper systems requirements, cost analysis, and executive control exerted. The probability of a successful outcome is far greater if more traditional methods are applied to the development of GIS/LIS systems. How a system will meet, or has met, its requirements is a major consideration in the successful operation and development of a GIS/LIS.

SESSION C: CARTOGRAPHIC VISUALIZATION OF TIME-SPACE RELATIONSHIPS

Time-Space Mapping: Early Evolution of Skyscrapers in Lower Manhattan

Deryck W. Holdsworth and Matthew S. Tharp, Department of Geography, Pennsylvania State University, University Park, Pennsylvania

Since the inventions of the elevator and the self-supporting steel frame in the late 1800's first permitted the building of skyscrapers, the role of those structures in the development of New York City has been undeniably significant. One plate in the proposed *Historical Atlas of Greater New York* is devoted to graphically portraying this growth through the use of a series of three-dimensional maps of Lower Manhattan, the cradle of building development in the city. Inherent in the creation of such images are questions of appropriate map coverage and degree of generalization, optimal viewing angle and orientation, and a suitable map projection. Limitations complicating these decisions include availability of 3-D computer mapping packages, lack of precise data concerning building heights and uses, and space restrictions of the atlas itself. This paper addresses several of these problems and presents some preliminary solutions.

Disoriented Prism Maps:

A Recognition Experiment

Keith Rice, University of Wisconsin, Stevens Point, Wisconsin and Dan Seidensticker, George Mason University, Fairfax, Virginia

Predicated by past psychology and cartography image rotation studies, it was postulated that the amount of time needed to recognize a prism map is directly related to the degree by which it was rotated from the north. Sixteen prism maps of Wisconsin were digitally encoded for display on a high-resolution computer monitor. There were two sets of maps, both having eight north-at-the-top 45 degree incremental rotations. One set were "correct" representations of the state, the others were "mirror" images, which were needed to verify the accuracy of responses. A prism map program was then used to plot three different geographic data sets for each of the sixteen base maps, which created a total set of 48 test stimuli. The three data sets represented both askew northern and southern concentrations, and a uniform distribution. Test maps were presented to forty-six subjects who had to determine if the map was a correct or mirror image. Cognitive rotation of the map image was inherently implied by subject task reaction time. Maximum reaction time was achieved with a 180 degree rotation from the north, with a systematic time decrease back to 360 or 0 degrees. But, the highest rotation time for both mirror images of the northern and southern distribution was at 135 degrees. Plotted mean reaction times were asymmetrical for the non-uniform maps. ANOVA results illustrated a significant difference between the uniform and southern distribution mean reaction times. Rotation time variation was attributed to the influence of particular prism surfaces obscuring prominent map outline features or landmarks. Present cartographic procedures for prism maps may therefore be inadequate. Animated or dynamic map displays may represent one viable solution to achieving an optimal viewer perspective for visualizing three-dimensional maps.

Animated Maps of Aggregate Data:

Conceptual and Practical Problems

Alan M. MacEachren and David DiBiase, Department of Geography, Pennsylvania State University, University Park, Pennsylvania

Mapping of data collected by political enumeration unit always presents the cartographer with a choice among several symbolization methods. This choice should

be made to reflect the underlying phenomenon that the data represent. This criterion, however, is often not observed. When the data represent changes over time, and the planned representation is to be a dynamic one, the decision on appropriate form of representation may be even more critical. Our cartographic laboratory has been faced with such a problem in the representation of quarterly data on AIDS incidence per county.

Our presentation addresses the conceptual issues behind mapping of epidemiological data that is aggregated to county. We draw on Jenks' concept of a data model as the basis for a discussion of how various symbolization choices match to the spatial pattern of AIDS distribution. We then consider the implication of the data model choice, and the available data, for dynamic maps of AIDS. Practical problems encountered in generating a dynamic map using relatively inexpensive microcomputer software are addressed. A set of dynamic maps generated thus far are then compared. Emphasis is placed on both the mental image communicated by different choices for the underlying data model as well as on differences in difficulty of implementing the model using different hardware and software configurations.

SESSION D: MAPPING SOFTWARE WORKSHOP

Mapping Software Workshop

Richard E. Groop and J. Michael Lipsey, Department of Geography, Michigan State University, East Lansing, Michigan

A hands-on mini lab set up for participants to review various cartography software products on the market. The workshop chairs are available to provide participants technical assistance rather than qualitative opinions on software. Software available for review will include titles such as: PC Globe+, MAPIT, OSU Map-for-the-PC, Concepts Computerized Atlas, Student Atlas USA, Student Atlas World, and others.

SESSION E: MAP PROJECTIONS

Map Projection Applications

Ronald M. Bolton and Claudette M. Dellon, Aeronautical Charting Division, National Oceanic and Atmospheric Administration, Rockville, Maryland

The subject of map projections and their use has been discussed in thousands of books and papers dating from at least the time of the Greek astronomer Claudius Ptolemy (about 150 A.D.). Projections are

known to have been in use some three centuries earlier. This paper describes twelve commonly utilized projections in terms of their history, features, and application.

Each of the projections covered has distinctive features which make it preferable for certain uses, no one projection being best for all conditions. For anyone selecting a projection, we recommend the manual entitled, *Map Projections - a Working Manual* (U.S.G.S. Professional Paper 1395).

The Effects of Map Projections on Map Distance and Emotional Involvement

Robert Lloyd and Patricia Gilmartin,
Department of Geography, University of
South Carolina, Columbia, South Carolina

Previous research has shown that there is a relationship between subjective distance and how emotionally involved people feel with events at places: the closer the places are thought to be, the more people care about events there; and the further away locations seem, the less emotionally affected people are by events there.

Specifically, the intensity of emotional involvement has been found to decrease according to the square root of increasing subjective distance. It is not so clear whether the same relationship holds between objective distance and emotional involvement. All of the existing research on this topic appears to have been conducted by psychologists, but it is a topic which should be of great interest to geographers, since it involves spatial relationships between places and people's perceptions of places. The topic can also be related to map design — in particular, the use of different projections to represent global locations. For example, certain places can be shown to be relatively close together or far apart, depending upon the geometric properties of the projection selected for the map and how it is centered. This paper reports the results of a study which was designed to investigate whether people experience different levels of emotional involvement with places as a function of the distances between the places as shown on the maps. Three different combinations of map projections and centerings were used in the experiment. Emotional involvement with locations as experienced in people's cognitive maps was also investigated.

Microcomputer Tools for Teaching Map Projections

Douglas J. Dudycha, University of Waterloo, Waterloo, Ontario, Canada

Consideration of map projections is a common component of introductory cartography courses although, to judge by textbook presentations, treatment of the topic varies considerably in scope and level of technical detail.

Students often find the topic bewildering due to the variety of projections available and the lack of clearly defined criteria for choosing among them. This problem is exacerbated by the limited time available for discussion of map projections in an introductory course.

Use of microcomputer-based teaching tools offers one means of more effectively presenting this topic. This paper outlines an approach to the discussion of map projections, describes a computer program for generating map projections which forms the basis for a map projection lab exercise and presents a framework for a self instruction module using HyperText.

cated understanding of the cognitive skills of college students. Once this understanding is achieved, it is possible to match the curriculum to the students. This match will affect the choice of classroom examples, sequencing of concepts, model of explanation (graphic, algebraic, geometrical), design of exercises, type of feedback, performance expectations, design of testing procedures, etc.

To support and illustrate this argument, we review the recent psychological literature demonstrating the lack of adult mastery of spatial concepts. These deficiencies have serious implications for students' understanding of cartographic concepts. We consider two aspects of map understanding that depend upon spatial concepts: map projections and coordinate reference systems. In each case, we point out the relevance of the underlying spatial concepts; cite data showing that many college students may have difficulty understanding these concepts; and apply these findings to the teaching of basic cartographic concepts.

Anatomy of the Introductory Cartography Course

James F. Fryman, Department of Geography, University of Northern Iowa, Cedar Falls, Iowa

Introductory cartography courses have undergone considerable change within the past two decades. These changes reflect new technological advancements as well as shifts in emphasis within the profession. This paper will explore the differences and similarities between introductory cartography courses offered in the United States in an attempt to determine characteristics common to all courses. In addition the paper will summarize variations in course content and teaching strategies.

The discussion of course characteristics is based on a survey of instructors responsible for teaching introductory courses. Specific subjects covered in the survey are equipment availability and use, text and readings required, types and quantity of laboratory exercises, extent of computer use and differences in course goals.

SESSION B: GENERAL PAPERS

Regional Patterns on Choropleth Maps

Ruth Anderson Rowles, Department of Geography, University of Kentucky, Lexington, Kentucky

This paper presents the result of research on regional patterns as they are portrayed on choropleth maps. In choropleth

SATURDAY, OCTOBER 14 SESSION A: CARTOGRAPHIC EDUCATION

Cartographic Education at the College Level: A Cognitive Developmental Perspective

Roger M. Downs, Department of Geography, and Lynn S. Liben, Department of Psychology, Pennsylvania State University, University Park, Pennsylvania

Successful teaching at any educational level requires an appreciation of the cognitive developmental level of students. By cognitive developmental level, we mean the structure of cognitive skills that students must deploy in order to understand a concept.

Cognitive skills undergo significant developmental change from early childhood onwards. We argue that it is dangerous to presume that developmental changes are complete for all people, even those in college-level cartography courses. The entire audience may not possess the necessary skills in either equivalent ways or to the same extent. Moreover, students build models of how they think the world works (naive models) and develop expectations based on these models. Teachers must not presume that students share disciplinary-based, expert models and expectations.

We argue that cartography and geography teachers need a more sophisti-

mapping statistical data are collected for unit areas, classified based on similarity, and symbolized on the map with patterns or colors covering areas. Regional patterns are formed on the map when contiguous unit areas are covered by the same symbol. Choropleth maps serve two main functions: 1) they provide information about values at specific places, and 2) they create an impression of overall geographic trends. Choropleth maps can be made to maximize the first function, that is, providing the most accurate information about values at specific places for a given number of classes using Jenks' method of classification. Although it is known that the number of regional patterns usually, but not always, increases with an increase in the number of classes, there is no model to predict the number of regional patterns for a choropleth map. Different simulated data sets are used in order to systematically investigate how the spatial structure of the data changes the number of regional patterns on choropleth maps. The simulated spatial distributions are constructed using four pseudo-random data distributions, which are normal, uniform, skewed, and bimodal, and placed on a base map to produce eight different levels of spatial autocorrelation measure by Moran's I. The base map for the research was composed on 100 hexagons, which can be considered a theoretical surface closely representing the average number of joins on a typical base map of contiguous polygons. The choropleth maps were made with Jenks' optimal method of class interval selection. Finally, a model is presented: the number of regional patterns on a choropleth map is a function of the type of data distribution, its spatial arrangement, and the number of classes on that map.

Color and the Figure-Ground Relationship in the Perception of Bipolar Choropleth Maps

Richard E. Lindenberg and Audrey E. Clarke, Department of Geography, Kent State University, Kent, Ohio

Cartographic researchers have shown that information on a bipolar choropleth map is understood better when it is symbolized with value progressions of two hues. Some hues used in this way in map experiments perform better than others. The conception of a choropleth map as a statistical surface suggests that certain hues may enhance the communication of the bipolar character of the data displayed by these maps. An experiment was conducted to determine if advancing hues should be associated with high data values and receding hues with low data values mapped on bipolar

choropleth maps. This paper reports the results of this experiment.

The Use of Maps in Children's Literature

Nancy B. Ryckman, University Library and Jeffrey C. Patton, Department of Geography, University of North Carolina, Greensboro, North Carolina

This paper reports the findings of a survey conducted to determine the frequency and use of maps in children's literature. This study focused on works of fiction aimed at children just beginning to read through those reading at the sixth-grade level. The survey was conducted using children's literature collections of the Greensboro Public Library and the Learning Resources Center of the University of North Carolina at Greensboro. The survey consisted of three parts.

In the first part of the survey every tenth book on the shelves of the public library's Easy (kindergarten through 2nd grade) reading section was examined to determine if maps were utilized. If so, the number of maps, type, general scale, and other attributes were noted. The second part of the survey was a similar sampling of books from the public library's Intermediate (grades 3 through 6) collection. The last part of the investigation surveyed the Newberry and Caldecott award or honor-winning books. Similar information was gathered for these books as for those in the first two categories. Results from the three categories were then statistically compared and analyzed. The paper also includes a series of slides on the use or non-use of maps in children's literature, as well as suggestions for areas of future investigation.

SESSION C: MAP AND ATLAS PRESERVATION AND COLLECTION MANAGEMENT

Map and Atlas Preservation and Collection Management

Maria Grandinetti, Conservation Lab, University Library, University of Michigan, Ann Arbor, Michigan

This session will address the following basic preservation questions:

— How does the environment affect my collections? How do I monitor the environment and what can I do to improve unsatisfactory environmental conditions?

— What bearing do storage and handling have upon the life of maps and atlases? What can I do to improve the storage conditions of my collections?

— How do I integrate preservation principles into my daily activities?

— How do I provide for the physical repair of damaged items? What kinds of repairs can be handled in-house? What kinds of repairs should be referred to a conservator? What does a conservator do?

The format will encourage discussion of these topics as they relate to the participants' collections.

SESSION D: INTER-AMERICAN MAPPING ROUNDTABLE DISCUSSION

Organized by Bill Stewart, Inc., Ann Arbor, Michigan. Participants included J. Hull McLean, United States Department of State, Washington DC, Joao Francisco de Abreu, University of Brazil, Belo Horizonte, Brazil, as well as Mr. Stewart.

MINUTES OF THE BOARD MEETING, WEDNESDAY, OCTOBER 11, 1989

Ann Arbor, Michigan

Ron Bolton, Greg Chu, Patricia Gilmartin, Nancy Kandoian, Diana Rivera, Johnnie Sutherland, Juan Valdés, and Ellen White present. Guest, Everett Wingert.

OLD BUSINESS

Juan Valdés called the meeting to order at 3:00 pm and asked to begin by discussing conference-related issues.

Diana told about costs for the annual meeting so far, and what had not yet been included in the figures. \$6,840 was a low approximation and \$7,091 a high approximation. She announced that there were 68 pre-registrants, with 10 or 12 registrants at the door up to the present.

She informed us that 14 checks had been lost in the mail. She knows names of people whose checks were lost. The package of checks is being traced in the mail from both ends. It was decided that Greg Chu will try to contact those whose checks were lost here at the conference. Anyone not contacted here will receive a letter explaining the situation.

There was discussion about expenses and honoraria for our guest speakers. We voted to reimburse expenses for travel and lodging to Mr. Fraser Taylor, and to give Ms. Olson an honorarium since she is local and we are not paying her expenses.

Student helpers from Michigan State University will be given free meal tickets.

NACIS IX Program Evaluation

The Annual Meeting at Ann Arbor was attended by 103 persons, 26 of whom responded to the Program Evaluation questionnaire that was distributed with registration materials. 20 of the respondents are associated with educational institutions (13 faculty, 4 students, 3 staff), 7 with government agencies (4 federal, 2 state, 1 local) and 1 with private industry. In the matrix below, each ■ represents one response. It should not be assumed that this sample of responses is representative of the total population of attendees.

		excellent	good	fair	poor	excellent	good	fair	poor
		Paper sessions							
THURSDAY, 10/12		Session A: Cartographic Design	■■■■	■■■		Session B: Atlases	■■■■	■■■■	■
		Session C: Ethics in Cartography Roundtable Discussion	■■■	■■■■	■	Session D: Map Library Management	■■■	■■■■	
FRIDAY, 10/13		Session A: Microcomputer Cartographic Production	■■■■■	■■■■		Session B: Geographic Information Systems	■	■■■■	■■
		Session C: Cartographic Visualization of Time-Space Relationships	■■■■■	■■■	■■■	Session D: Mapping Software Workshop	■■■■	■■■	■■
		Session E: Map Projections	■■■	■■■■■					
SATURDAY, 10/14		Session A: Cartographic Education	■■■	■■■■		Session B: General Papers	■■	■■■■	■■
		Session C: Map & Atlas Preservation and Collection Management	■■■■■			Session D: Inter-American Mapping Roundtable Discussion	■■	■■■	■
		Program format	■■■■	■■■■		Topics	■■■■■	■■■■■	■
		Number of papers	■■■■■	■■■■■	■■■	Length of papers	■■■■■	■■■■■	
		Poster sessions	■■■	■■■■■	■■■	Exhibits	■■■■	■■■■	■■
		Field trips	■■■■■	■■■		Social activities/functions	■■■■■	■■■■■	■■
		Preconference information	■■■	■■■■■	■■■	Hotel service	■■■■■	■■■■■	■
		Meeting rooms	■■■■■	■■■■■		Guest rooms	■■■■■	■■■■■	■■

Greg described problems with the circulation of *Cartographic Perspectives*. A significant minority of the membership is not receiving the bulletin because the membership records have deteriorated. We have no accurate count of members because of clarification needed concerning checks given to the treasurer last year. Greg has had a problem learning the database software the preceding Treasurer used to maintain membership records. The problems should be corrected with the new year. Recently we have had some 20 additional members because of *CP*; readers are literally tearing out the back page to fill out the membership application.

Greg reported that the NACIS checking account balance was \$18,622.58, including \$3,845 so far from conference registration fees. We also have a printing bill to pay and other expenses to reimburse.

Diana announced that transportation expenses for field trips and tour guide services have not yet been added to the conference total. The remote sensing field trip is already booked up. Diana also called to our attention a printing error on the conference registration form; at the door and advance registration fees were indicated as the same, though that was not the intention. Meal guarantees were set at 95, plus or minus 5%. We have learned that some people had problems registering at the hotel. Some were told that the conference was cancelled; some were told that the front desk was too busy to take a reservation; some were told the computer system was down and that a reservation could not be made manually; some were told that the hotel was full; others found that their reservations had been lost. Greg suggested that we get these problems in writing (this was subsequently done on a sheet at the conference registration desk).

Diana reported that 33 rooms were taken at last count; we have been told orally that we do not have to fill the number of rooms indicated in the contract in order to have the promised savings. Johnnie Sutherland suggested that we get any such comments in writing. A bankruptcy court will not honor the hotel's verbal promises but will follow the contract. We should be mindful of this in light of the hotel's recent problems. It was decided that we would, at Ron Bolton's suggestion, go ahead and write up a memo about this, date it, and have a hotel representative sign it.

Nancy Kandoian reviewed her activities as secretary over the past year, and made recommendations that we decide how to handle requests for our mailing list. Also, because of all the correspondence we received related to cartography as a career, she suggested we consider developing some activity that addresses this interest.

Greg told us about one request this past

year for our mailing list. We have a list with 1800 names, 200+ of whom are members. Actually, approximately 390 on the list were members at some time but many have not renewed. Ellen White and Johnnie both commented about the need to update the extended mailing list. Ron commented that while serving as Treasurer, Jim Anderson sold the list for \$25, but we should raise the fee to be in line with other organizations' charges for mailing lists. Probably we should sell the list selectively. The board should vote on how much to charge and which list to sell. This issue was to be taken up by the new board at the Sunday meeting.

Regarding interest in cartography as a career, Patricia Gilmartin noted that the American Cartographic Association has been working on a brochure on that subject for over a year. She suggested that we see what they are doing and not duplicate it. Perhaps they will give us a large quantity if the brochure at cost so that we can also distribute it in response to inquiries to NACIS. We can ask our liaison with the ACA to negotiate this.

Diana announced that there is no speaker for the Saturday luncheon.

Greg mentioned that at the U.S. national exhibit at the International Cartographic Association meetings he put a stack of *Cartographic Perspectives* at the display, and they were well received.

Greg and Alan MacEachren were turned down by the Post Office to mail at bulk rate as a non-profit institution. A Postal Service official judged that NACIS does not qualify as a scientific organization whose main purpose is to disseminate information. We briefly discussed that there may be two separate issues: being non-profit for tax purposes and qualifying for non-profit bulk mail rates. With regard to tax issues and the Internal revenue Service, we should ensure that our income does not surpass \$25,000. We do have a tax ID number and certificate. These issues require further attention.

Ron announced election results. Fifty responses were received. Diana interjected that because of mailing list problems, not everyone received a ballot. Ron suggested that election results were not so close as to warrant a recount. Preliminary results indicate that James Fryman was elected vice president with 45 votes, James Anderson was elected secretary with 26 votes. Johnnie Sutherland, Pat McHaffie, and Nancy Ryckman were elected directors-at-large with 34, 33 and 27 votes respectively. Craig Remington came in a close fourth for director; Ron suggested he be appointed by the board to serve as director also, because we need more directors at meetings to form a quorum. The constitution/by-law change passed 47

to 1, so the past president will now head the Nominations Committee. The proposed dues passed 42 to 7, meaning that dues for individual memberships will now be \$28, student memberships \$8, and institutional memberships \$58.

Ron remarked that all the nominations came through board members. There is not enough participation of the whole group in the nomination process. Nothing came from the solicitation of nominations in *CP*. Now the past president will be taking over as chair of the Nominations Committee. Ron suggested that the membership be asked for nominations now, at the annual business meeting. Candidates will be needed for two directors-at-large, vice president and treasurer. Ron also advised that a third position for director-at-large be opened for nomination as well.

Ron next addressed the topic of sites for future meetings. The package of materials on Milwaukee has been turned over to Sona Andrews and Donna Schenstrom for 1991. They should be given the matrix which Ron developed for evaluating sites and proceed with site selection. Kansas City is looking good for 1992. There are very good hotel prices, and because it is an air hub city, there should be good air fares. He suggested that we adopt Kansas City as the 1992 site, but expressed concern that NACIS may not have a local member to help with site arrangements. He suggested further that we offer a free membership to a local person willing to help with conference arrangements.

Ron announced that he will tender his resignation as Executive Officer at the Orlando meeting. He estimated that annual expenses associated with the Executive Officer post are approximately \$1000, principally for phone calls and postage.

NEW BUSINESS

Juan introduced visitor Everett Wingert of the University of Hawaii, who serves as liaison from the Cartography Specialty Group of the Association of American Geographers. The liaison relationship has been accepted and papers signed between NACIS and the CSG. Mr. Wingert spoke about CSG activities that emphasize education: encouraging student research and offering workshops. We look forward to a long association and joint projects to support common goals.

The new board will meet on Sunday, October 15 from 9 am to 12 noon.

Diana acknowledged Craig Remington's organization of 13 cartographic lab poster exhibits, and Chuck Harrington's coordination of 3 professional exhibits.

The meeting was adjourned at 4:40 pm.
—Nancy A. Kandoian, Secretary

**MINUTES OF THE BUSINESS
MEETING, Friday, October 13, 1989
Ann Arbor, Michigan**

Juan Valdés called the meeting to order at approximately 3:15 pm.

Greg Chu presented the Treasurer's report. The balance in our bank account is \$18,622.58, including an initial \$3,485 from conference registration fees. Our membership numbers at least 246, and may be as many as 280. The membership consists of at least 14 corporate members, 30 student members, and 178 regular members. In the last two weeks approximately 20 new members signed up by tearing out the membership application from *Cartographic Perspectives*. Final figures from expenses and income from the annual meeting are not available yet.

Alan MacEachren presented the Publications Committee report. The work of the committee is evident from the success of *CP*. Thanks to committee members Marsha Selmer, Claudette Dellon, Jeffrey Patton, and Donna Schenstrom. Special thanks to *CP* co-editors David DiBiase and Karl Proehl. Committee membership will remain the same for the next year except for Donna Schenstrom, who has asked to step down.

The committee is open to suggestions. They are working towards having topical contributors to be responsible for certain sections of *CP*. November 15 was the final deadline to submit papers to Alan for consideration for publication in *CP*. Three featured papers will come from annual meeting presentations, and one will be solicited by the committee.

Some members did not receive some issues of *CP*. Alan said that a problem with NACIS' mailing list is being worked on. Let Greg Chu know if you have not been receiving *CP*. The mailing list should be completely updated with the new year as dues are paid.

Ronald Bolton, as head of the Tellers Committee, announced the results of the elections. The by-law revision, for the past president to serve as Nominations Committee chair, passed 66 to 3. The dues increase to support *CP* passed 61 to 12. James Fryman was elected vice-president, James Anderson was elected secretary, and Patrick McHaffie, Johnnie Sutherland, Nancy Ryckman, and Craig Remington were elected directors-at-large. Juan announced that for 1991 officers we will need to elect next year a vice-president, a treasurer, and 3 directors-at-large. Juan urged members to offer suggestion and nominations because we have difficulties in finding candidates to run for office.

Sona Andrews reported on the Membership Committee activities. The Committee's

two charges were: 1) each committee member was to recruit ten new members, and 2) the committee was to develop guidelines for membership improvement. Regarding the first charge, it could not be determined how successful that effort was because of a lack of data about who was dropping out and who was signing on. Most new members that the committee members attracted came from individual contacts. In most cases they were students at Penn State and the University of Wisconsin-Milwaukee. The committee came up with ideas, if not actually guidelines for membership improvement. The committee would like all members to have an extra membership form so that each can attract a new member through personal contacts. It would be good to know who is dropping out as well as who is signing on as new members. A better database will allow us to keep track of this.

There was some discussion of how to handle membership lapses. Diana raised the point that even involved members and officers may have neglected to pay their dues and may not realize it. Some possible remedies were suggested: putting expiration dates on mailing labels, and sending follow-up requests for dues (a separate mailing, include an envelope, send on Bitnet, and/or send on different colored paper) to those who do not respond to the first request. It was also suggested that we send *CP* issues to those whose memberships have lapsed in order to entice them to join again. Greg said that as things stand now, there are about 390 people on the mailing list who are receiving *CP*, and not all of them have paid their dues.

Jim Minton made a request that the NACIS membership application in *CP* be put on a separate page so that text of the bulletin is not lost when people tear out the application form.

Sona Andrews brought up the issue of membership acknowledgement. If a *CP* issue is the first acknowledgement that a new member receives, there may be a three month lag before they have contact with their new organization. New members have a right to expect more of a confirmation than receipt of a cancelled dues check.

There was some discussion of the denial of non-profit status in Pennsylvania for NACIS postage. *CP* is currently being mailed at commercial bulk rate. Ed Hall warned that it is illegal for nonprofit institutions to send dues notices in their newsletters or bulletins.

Dan Seldin reported on the January 12-13, 1989 meeting of the Cartographic Users Advisory Council at the Library of Congress, where he represented NACIS. He summarized the mapping and depository news from several federal

agencies presented at that meeting. He reminded NACIS members to contact him if we have any concerns about depository maps. The date of the next CUAC meeting was not certain.

Diana Rivera reported on a map conference that she attended in Costa Rica in September. She presented a paper there on the map library at Michigan State University. Mr. Vega-Herrera of Costa Rica, who attended the NACIS meeting in 1988, sent his greetings. He invited NACIS to hold a future meeting in San Jose. A travel agent is gathering information on the costs of holding a meeting there; Diana will forward the information to the Inter-American Committee. The committee will present the facts to the membership for consideration.

There has been a rotating chair for the Inter-American Committee. Jerry Thornton is serving as chair this year. Jerry welcomed input and new members. Being bi-lingual or tri-lingual is not a requirement for participating.

Diana reported on the Congress of Cartographic Information Specialists Organizations that she attended as a representative of NACIS in Chicago in November 1988. Several other map library organizations were represented. A few other NACIS members were present. The meeting went well. Some resolutions were introduced, voted on, and passed regarding direction for map librarianship and sharing resources. (The text of the resolutions appears in *CP* no. 2, Summer 1989, pp. 25-26). A date is being set for a future meeting of representatives of map library organizations; 1990 was the intended year, but it will probably take place in 1991.

Regarding the Inter-American Committee, Jim Minton asked if there were any special recruitment efforts going on. Juan answered that so far efforts have focused on Central and South America, and colleges with large proportions of Hispanic students. Diana mentioned that 4 new members signed up in Costa Rica, and that they are very interested in building linkages with cartography and survey organizations in this country. Greg mentioned that we also have a member from Hong Kong, and 3 members from the U.K.

The next NACIS annual meeting will take place on October 24-28, 1990, at the Holiday Inn on International Drive south of Orlando, Florida.

The meeting was adjourned at approximately 4:15 pm.

—Nancy A. Kandoian, secretary

**MINUTES OF THE BOARD MEETING,
SUNDAY, OCTOBER 15, 1989**
Ann Arbor, Michigan

Greg Chu, David DiBiase, Fred Fryman, Patricia Gilmartin, Diana Rivera, Johnnie Sutherland, Juan Valdés, and Ellen White present.

Greg reported that the tentative cost of the conference is \$6854. Of that total, hotel cost account for approximately \$4291. As of October 15, approximately \$4500 in conference fees (excluding exhibit fees) have been received.

The board discussed problems with the conference accommodations — particularly reservation problems and the fact that beverages and food had disappeared from NACIS' hospitality room — but it was acknowledged that reviews of the hotel's service were generally favorable among attendees.

Reviews of the conference paper sessions were also largely favorable, board members agreed. Responses to the program evaluation questionnaire should be published in *CP*.

It was agreed that NACIS could do a lot better with regard to exhibits. Johnnie urged that coordinators not oversell the size of NACIS to potential exhibitors. Diana pointed out that it is important to recruit exhibitors as a source of conference revenue, but agreed that we should be upfront about the size of the conference. David pointed out the need to make more sophisticated audio/visual equipment available at future conferences.

The board agreed by a voice vote to reapply for non-profit status.

Diana reported on the Membership Committee's membership database project. Pat stressed the need for NACIS to invest in simpler, more easily transferrable database software. Ellen made a motion that Sona Andrews and Greg Chu be authorized to purchase database software that is supported on both the MS-DOS and Macintosh platforms, such as Microsoft Excel. The motion carried by voice vote.

Juan wondered if the question of offering the membership list for sale ought to be submitted to the membership as a referendum. Greg raised the related question of what should be charged for the list, and whether some organizations should receive lists at no charge. Johnnie proposed that lists be sold at \$.50 per name. Diana suggested that the matter be discussed again at the February board meeting, informed with figures on what comparable organizations charge. Nancy Ryckman agreed in absentia to cull those figures from ACSM, AAG, CCA, and SLA. The tentative rate of \$.50 per head was approved for the interim.

Ron Bolton's impending resignation as Executive Director was discussed. It was pointed out that the Executive Director carries out NACIS' day-to-day business and correspondence, providing the organization with a permanent address and directing mail to officers. David suggested that Ron be asked to draw up a job description, and asked the board to consider authorizing a paid part-time Directorship. Greg argued that NACIS' funds are insufficient to support such a position, and that institutional support of the kind enjoyed from NOAA during Ron's tenure is critical. Diana agreed that Ron should assist in establishing criteria for selection of a new Executive Director. The issue will be raised again in February.

Diana next reported on the status of NACIS' various committees. Alan MacEachren will continue to chair the Publications committee. One additional member of the committee will be needed to replace Donna Schenstrom. The Inter-American Committee will be chaired by Jerry Thornton. The Tellers committee is currently vacant. As past president, Juan Valdés will chair the Nominations committee. Sona Karentz Andrews will chair the Membership committee.

The plan to establish a NACIS archive was discussed next. Greg asked whether paid archival services were really necessary. The matter was not resolved.

There ensued a discussion on NACIS' general financial status. Greg pointed out that the organization is currently operating with approximately a \$14,000 balance, which he described as "a marginal operation."

Juan presented Rhodes Travel's bid for air travel arrangements for the 1990 conference in Orlando, one feature of which is a 5% percent rebate of Rhodes' fees paid to NACIS for each ticket sold. The board agreed that although the offer seems very generous, given the small number of members who are likely to use Rhodes' services, NACIS' actual rebate is likely to be insignificant.

David mentioned Karl Proehl's idea of publishing a complete membership list in *Cartographic Perspectives* as soon as an accurate list becomes available, perhaps in the Spring, 1990 issue. He also proposed that NACIS acknowledge the forthcoming name change of *The American Cartographer* to *Cartography and Geographic Information Systems* by sponsoring a 'Special non-GIS Issue' of *CP*. The motion was defeated on voice vote.

Finally, the board discussed potential meeting sites for 1992. Kansas City seems viable. Diana presented the prospect of an international meeting in San Jose, Costa Rica or Niagara Falls or Windsor, Ontario. It was pointed out that employees of

government agencies would very likely not be funded for travel to an international conference. The point was also made that it seems hypocritical to call the organization "North American" while meeting only in one North American country. Ellen stressed the importance of local members to help plan conference logistics.

Diana proposed that the February board meeting include a meeting of past presidents to discuss future directions of NACIS.

By this time noon had come and gone, and board members were leaving one by one to catch planes or begin long drives. The meeting was adjourned at about 12:30 pm.

—David DiBiase, scribe

GRAPHICS AT USA TODAY
continued from page 2

and numerical sources are compiled by the News, Money, Sports, Life and Special Projects departments. Base maps are manually compiled from printed sources. Oblique perspective bases are manually compiled from planimetric projections via standard perspective grids. Pencil compilations are then scanned and used as

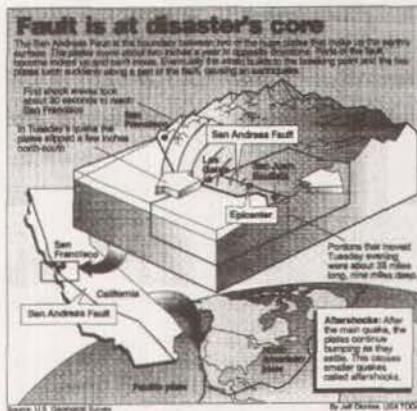


Figure 2. ©1989 USA Today, all rights reserved. Forty percent of original size.

drawing templates in Aldus FreeHand, a PostScript-based drawing program for the Macintosh. Printing negatives are generated from the FreeHand PostScript files using a Scitex prepress system.

Many of the graphics produced at *USA Today* are archived for possible future use. Post Script graphics files are collected from the artist' workstations via a Tops local network and those likely to be modified for future use are saved on a special file server.

Of course, its emphasis on graphics is not all that distinguishes *USA Today* from other major newspapers. In a recent critique of broadcast journalism ("Illusions of News," PBS, November 22, 1989), Bill Moyers presented it as an archetype of "the newspaper of the future, created in the image of television: news that pleases, many short reports, lots of visuals, news on the run." *USA Today* is to be commended for its efforts to improve the quality and timeliness of journalistic graphics. But if good graphics are associated in the public mind with bad journalism, the cause of graphicacy is not likely to be advanced.

EXCHANGE PUBLICATIONS

Cartographic Perspectives gratefully acknowledges the publications listed below, with which we enjoy exchange agreements.

Canadian Cartographic Association Newsletter. A quarterly publication offering news and announcements to members of the CCA. Contact: Canadian Cartographic Association, c/o Department of Geography, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X9; (709) 737-8988; Bitnet: CHWood@MUN

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

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. Contact: John Payne, Circulation Manager, GPO Box 1292, Canberra, A.C.T. 2601, Australia.

Cartomania. This quarterly newsletter of the Association of Map Memorabilia Collectors offers a unique mix of feature articles, news, puzzles, and announcements of interest to cartophiles. Contact: Siegfried Feller, publisher/editor, 8 Amherst Road, Pelham, MA 01002; (413) 253-3115.

GIS World. Published six times annually, this news magazine of Geographic Information Systems technology offers news, features, and coverage of events pertinent to GIS. Contact: Debbie Parker, Subscription Manager, GIS World, Inc., P.O. Box 8090, Fort Collins, CO 80526; (303) 484-1973.

Information design journal. Triannual publication of the Information Design Unit. Features research articles reporting on a wide range of problems concerning the design and use of visual information. Contact: Information design journal, P.O. Box 185, Milton Keynes MK7 6BL, England.

instructions to contributors

FEATURED PAPERS

All featured papers will be *solicited* by the NACIS Publications Committee. The goals of the solicitation procedure will be to select high quality papers that provide a balanced representation of the diverse interests of the membership. The primary mechanism for soliciting featured papers will be a paper competition held in conjunction with the Annual Meeting. All papers prepared for the meeting and submitted in written and/or digital form will be considered. Three of these will be selected to appear in *Cartographic Perspectives* during the next year.

In addition to the competition winners, the Publications Committee (in consultation with the editors) will solicit one or more papers each year from other sources. The goal here is to ensure that all aspects of the membership are served and to attract some thought-provoking ideas from authors who may not be able to attend the Annual Meeting.

Authors of selected papers will be given an opportunity to respond to suggestions of the Publications Committee before submitting a final version. The writing quality must adhere to high professional standards. Due to the interdisciplinary nature of the organization, it is particularly

important that papers are carefully structured with ideas presented succinctly. The editors reserve the right to make editorial changes to ensure clarity and consistency of style.

Papers ranging from the theoretical/philosophical to methodological/applied topics will be considered providing that ideas are presented in a manner that will interest more than a narrow spectrum of members.

To be considered for the paper competition, papers should be prepared exclusively for NACIS, with no major portion previously published elsewhere.

TECHNICAL GUIDELINES

Cartographic Perspectives is designed and produced in a microcomputer environment. Therefore, contributors to CP should be submitted in digital form on 3.5" or 5.25" diskettes. Please send paper copy along with the disk, in case it is damaged in transit.

Text documents processed with Macintosh software such as WriteNow, WordPerfect, MindWrite, Word, and MacWrite are preferred, as well as documents generated on IBM PCs and compatibles using WordPerfect or Word. ASCII text files are also acceptable.

PostScript graphics generated with Adobe Illustrator or Aldus FreeHand for the Macintosh are most preferred, but generic PICT or TIFF format graphics files are usually compatible as well. Certain graphics formats for the PC may also be submitted (for example, HPGL (.PLT), CGM, EPS, and TIF).

For those lacking access to microcomputers, typed submissions will be tolerated. Manually produced graphics should be no larger than 11 by 17 inches, designed for scanning at 300 dpi resolution (avoid fine-grained tint screens). Continuous-tone photographs will also be scanned.

Submissions may be sent to: David DiBiase, Department of Geography, 302 Walker Building, Pennsylvania State University, University Park, PA 16802; (814) 863-4562; Bitnet: DWD1@PSUV

COLOPHON

This document was desktop-published at the Deasy GeoGraphics Laboratory Department of Geography, Penn State University, using an Apple Macintosh IIcx. Word processing was accomplished primarily with WriteNow 2.0; page layout with PageMaker 3.01. Graphics not rendered with Aldus FreeHand 2.02 were scanned from paper originals using an HP 9190 ScanJet desktop scanner. The PageMaker document was output by a Linotronic 300 at PSU Printing Services. 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. The featured color is PMS 3282.

NACIS membership form

(form designed to be photocopied)

**North American Cartographic Information Society
Sociedad de Informacion Cartografica Norte Americana**

Name/Nombre:

Address/Dirección:

Organization/Afiliación profesional:

Your position/Posición:

Cartographic interests/Intereses cartográfico:

Professional memberships/Socio de organización:

Membership Fees for the Calendar Year/**Valor de nomina de socios para el año:**

Individual/Regular: \$28.00 U.S./E.U.

Students/Estudiantes: \$ 8.00 U.S./E.U.

Institutional/Miembros institucionales:

\$58.00 U.S./E.U.

Make all checks payable to/**Hagan sus cheques a:**

NACIS

c/o Dr. Gregory Chu, Treasurer

Department of Geography

University of Minnesota

414 Social Sciences Building

Minneapolis, MN 55455

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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