MATRIX COMPILATIONS

Automated mapping and GIS business sectors are weathering the global recession very well. Market leaders Intergraph and ESRI posted gains in turnover and profitability in 1991, a feat attained by only a few other computer firms (e.g. Hewlett-Packard, Microsoft). Dataquest's end-of-year report stated that GIS/Mapping application sales should remain among the strongest in the computer graphics industry during the next five years.

Map producers are having a more difficult time. Sheet and book map sales are down, particularly in the U.S. Everyone I talk to describes the situation as "tough." World atlas and European wall maps are languishing in inventory. Retailers are waiting for producers and publishers to catch up to current affairs, but the status quo is changing daily. Uniting Germany and freeing the Baltic states have turned out to be minor cartographic events compared to the free-for-all taking place in Eastern Europe. The smart publishers are producing do-it-yourself maps so that buyers can update the maps themselves.

Map producers who used the good times in the 80's to automate and diversify are doing better than those who stuck with traditional cartographic production. Some are adding to revenue by selling data and production software (e.g., Thomas Brothers and GLA Kartor, among others). Others, like DeLorme Map Company, are selling electronic maps. DeLorme's **Street Atlas USA**, a CD-ROM digital map with interaction software, has been getting a lot of attention recently.

Companies operating on the periphery of the map publishing market are also doing well. These are firms producing databases for routing and computer-based navigation, as well as companies developing application packages to operate on digital geographic and demographic databases. Some of these products are for future markets (i.e., for now, there's lots of money being spent without much money coming in) but the future is closing in fast.

For a look at how some consumers will be finding their way in the future, take a trip to Orlando, Florida this summer and rent a car from AVIS. General Motors, the American Automobile Association, and the Federal Highway Administration have teamed up on a project called **Travtek**. Around one hundred rental cars will be equipped with GM's in-vehicle navigation and routing system. AAA has been responsible for testing the databases used in the cars and selecting the drivers from among their members. **Navigation Technologies** and **ETAK** have provided the digital geographic data.

Digital geographic databases are expanding the role that maps--and the information we obtain from maps--play in our everyday lives. At the same time, the number of alternative delivery systems for maps and geographic-based information is also growing. Today, in addition to the printed map, we have desktop and portable computer mapping. In-vehicle navigation and routing will be well-established within a few years because most American, Japanese, and European auto manufacturers have already committed to introducing systems for the 1994 model year. Telephone direction services will also grow, as will public access kiosks dispensing directions and travel information.

The sleeping giant, in my opinion, is the hand-held electronic map. This includes palm top and tablet computers, as well as portable telephones and paging devices. I discuss some of these systems and their potential in PROJECTIONS in this issue. I am also preparing a study on the topic: The North American Market for Mapping Applications on Hand-Held Computers. The report will be ready for distribution in September, 1992.

How is Matrix Consultants doing? I've been busy with several clients on both sides of the Atlantic, but I know there are more firms who could benefit from what I can offer. What I offer includes:

- ♦ Solid information on how to adapt your business to a changing market for geographic and cartographic products and services.
- ♦ Guidance on which systems and software will meet your long-term objectives and match your budget.
- ♦ A fresh perspective on your marketing approach and your production techniques. What to build; who to build it for; and how to build it.

Remember, I work alone. That's by choice. I've enjoyed being a consultant during the past nine years because I enjoy teaching and learning in a global university. I've stayed in business because I have been able to give my clients value for their money. I do that by delivering on promises.

A recent article in The Economist (March 7, 1992) confirmed what I have been telling clients and prospects for years: small is better. A poll taken of thirty big American firms revealed that there is a lot of dissatisfaction with the large management consultancies. These firms "send in their best people to sell the project. After that you never see them again." The article concludes that the companies polled "seemed to prefer the one-man-and-his-laptop firms because in these the consultant selling the service and making the big promises also carries out the work."

THE MATRIX PERSPECTIVE

Spatial Data: Governmental Policies Do Not Protect the Public Interest

While not always successful, and sometimes viewed as intrusive, federal laws and regulations governing honest disclosure of a product's contents or performance provide consumers with a measure of confidence that they are getting what they believe they are paying for. Unfortunately, for purchasers of digital spatial data produced by governmental authorities, a similar measure of protection is not available.

Long-established governmental policies of maintaining a disinterested and arms-length relationship with the ultimate end users of digital spatial data, the absence of guidelines for measuring and labeling the accuracy of the data that is repackaged and distributed to end users, and the threat of removal of copyright protection for privately-developed spatial data, add up to a situation in which quantity is confused with quality, and availability is confused with accuracy.

Digital spatial data is the product of and the raw material for automated mapping and geographic information systems (GIS's). There are many different categories of digital spatial data, including everything from geographically rectified aerial photography and satellite imagery to very large scale land parcel surveys. The category which has been the principal focus of production by governmental agencies and the primary object of purchase is cartographic spatial data--data that can be used to produce maps on a computer display or on paper. Availability of the data has spawned entirely new industries, including desktop mapping, fleet management, emergency dispatching, and vehicle routing.

Several governmental agencies, notably the Central Intelligence Agency, the U.S. Geological Survey, and the U.S. Bureau of Census, pioneered in the application of computer mapping techniques to the production of spatial data. The CIA developed World Data Bank I and II, small-scale digital cartographic databases of continental outlines, country boundaries, and major transportation features. The USGS is converting its medium- to large-scale maps to Digital Line Graph (DLG) format. The U.S. Census is the creator of the DIME and TIGER street map files.

These agencies have also led the way in a policy of reselling their data on a low-cost, as-is basis, charging only a nominal fee for acquisition and placing few restrictions on its use. As long as the purchaser does not resell the data in its original form, the data can be repackaged and sold at whatever price the market will bear.

That the government should not attempt to profit from the sale of spatial data developed with tax payer's money is a strong argument in favor of setting a low price. Many of the mapping systems that run on Mac and PC platforms would not be possible today if developers had to pay a high price for acquiring or licensing the data, or if they had to create the databases from the ground up. It sounds like a win-win situation. But is it? It is for the government and the reseller, but not necessarily for the end user.

A WDB I or II, DLG, or DIME/TIGER data file that ends up in a mapping system or is used to produce paper maps is a time slice from the agency's database. In the case of a DLG file, it is accurate to the time of compilation, which could be several years prior to its final acquisition by an end user. A Census TIGER file can be years out of date. Some, but by no means all, resellers of these databases will improve the accuracy and offer updates to end users. Most data is resold as-is, and the user is obligated to determine the degree of the data's accuracy.

"You get what you pay for" is not an acceptable excuse, neither for the agencies who sell the data, nor for the repackagers. Consumers, particularly the mass market who use the data in applications packages, have no way of relating price to quality. They have no feeling for the true cost of creating a detailed geographic database. For them, a few hundred or a few thousand dollars is quite a lot to pay, especially for defective goods.

The federal government seems intent on continuing its policy of providing copies of its spatial data to the public without building in a means to pass on improvements in its accuracy. The USGS and the National Institute of Standards and Technology (NIST) published last June a proposed Spatial Data Transfer Standard. The American Congress on Surveying and Mapping, in commenting on the proposed standard (ACSM Bulletin, October 1991) pointed out that "one of the primary weaknesses of the proposed standard is its reliance on batch or one-time data transfer. In order to update a data file already purchased, a user would have to retransfer the entire data set."

Wholesale exchange of data is much easier for the sender than the extraction and processing of update transactions. It is also easier for the resellers of the data to offer completely new databases than to track customers and provide these customers with updates. This practice forces users to forego improving the data themselves or to pass up new releases of the data if they have made major additions to the originally purchased data.

A third, and perhaps the most flagrant disregard for the rights of end users to receive accurate spatial data, is the prospect that spatial data will not be afforded the protection of a copyright. In 1991, the U.S. Supreme Court ruled that telephone companies cannot copyright the listings in their white pages (Feist Publications v. Rural Telephone Service Co.). Facts, the court ruled, are not copyrightable. Since this ruling, cases have been heard in lower courts challenging the protection of copyright for maps.

Such an interpretation of copyright would be misguided, if this law is indeed intended to protect the public interest. Although it may appear that copyright laws shield the creator of an original piece of work, and inhibit an individual from monopolizing facts that should be in the public domain, these laws actually protect both the creator and the user of the creation. By identifying and protecting the source, it is also possible to attribute responsibility for the contents of the creation. In the case of spatial data, that responsibility extends to incorrect as well as correct representations of geographic facts. That a database is copyrighted does not necessarily imply that it is truth. However, in the absence of copyright, there is no way to reward the truth seeker, or to punish the perpetrator of inaccuracies.

It's time for the federal government to take a more active role in protecting the public interest with respect to spatial data. A truth in labeling regulation is an immediate need. All spatial database purveyors, including private and public sector organizations and database resellers, should explicitly state the currency of the data and its measured degree of accuracy. An independent testing authority should be established to verify accuracy claims and to ensure that the public is informed about varying levels of accuracy.

Spatial data transfer standards should be supplemented with exchange standards. Governmental and private database producers who sell to the public should adhere to a transactional update standard that extends to the end user. End user software should be included in the initial database purchase which processes update transactions.

If current copyright laws are not adequate to cover digital spatial data, then new regulations must be adopted to provide the public with assurances that database developers are accountable for their products. Incentives must be provided to private developers to increase the accuracy and precision of spatial data, above that which is currently available from governmental sources. The best incentive is the ability to sell their data at a market price without fear that it will be copied.

TRANSFORMATIONS

"We are not only responsible for what we do, but also for what we do not do."

Molière

On the issue of crediting maps used in advertising, there are the **Good Guys**--those who list a credit, and the **Bad Guys**--those who don't. Among the Good Guys are AT&T and Franklin Group of Funds. At&T's add gives The National Survey in Chester, VT prominent copyright credit and a well-reproduced map. Franklin devotes one-half of a full page to a satellite map of the U.S. provided by the National Air Survey Center Corp. Both ads were in the March 16, 1992 issue of Business Week.

Austrian Airlines and Union Bank of Switzerland use a globe motif covering most of their full-page ads in the March 14, 1992 issue of The Economist, but offer no credit to the globe makers. Maybe these companies' art directors or ad agencies feel that placing a credit for the globe would detract from the message. The Good Guys prove that this just isn't so.

From Barb Petersen of Interarts in Cambridge, MA we hear that her company's lawsuit against the purloiner of her **Wearin' the World** jacket has been settled out of court in favor of Interarts. The story begins with a photo of U.S. President George Bush stepping off his plane in the Soviet Union wearing what looked to all like a Wearin' the World jacket. The photo was carried by all the major news services. Not one to pass up such a golden opportunity for publicity, Barb contacted the White House to find out where the President had obtained the jacket.

Mr. Bush, it turns out, was not wearin' the world, but a knock-off of the original. It wasn't made of DuPont Tyvek and, unlike Interarts' design, the jacket was of heavier construction. The problem, however, was that the manufacturer used the same map as that used on the Interarts model. Dumb? Inconsiderate? Yes, and illegal to boot.

The idea of using a map as a design motif, whether it's on a jacket or in an advertisement, isn't new or unique. What is disturbing is the gratuitous copying of map material as if it has no value. I know there are companies that aggressively pursue copyright violators, but the fact that these violations continue and that they are so widespread--I believe they are growing!--means that we aren't doing enough to control the practice.

Maybe ad agency staff and art directors don't know that they're stealing your work when they use it as a prop. If that's so, then let's educate them. If you're interested in helping to find a preventive solution to this growing problem, give me a call or drop me a line.

PIXEL POINTS

Map Making on the Mac...and DOS-based PCs

Map makers, large and small, have been flocking to the Apple Macintosh in recent months. Large firms, many of whom already have expensive electronic map publishing installations, are using the Mac to expand capacity. Small and medium-sized firms who can't afford the bigger systems from Intergraph and Barco Graphics are finding that the Mac, combined with the right software, can provide a cost-effective alternative to these systems and to traditional manual production.

The Mac became the preferred solution for bargain basement map production for two reasons:

1. Powerful graphic software packages, like Adobe Illustrator and Aldus Freehand, as well as high-end page integration software like Quark Express, were originally developed only for the Mac. This gave the Mac a head start in the graphic arts industry and led to its overwhelming choice among industry professionals.

2. Scanning, file manipulation, and PostScript output to laser film recorders were standardized so that users could purchase their own equipment or use any one of a large number of service bureaus set up to serve the graphic arts market.

DOS-based PCs are quickly gaining ground on the Mac. Microsoft's new Windows 3.0, and the soon-to-be-released 3.1, give DOS-based PCs the look and feel of a Mac. Illustrator, Freehand, and Express are all available for Windows. Corel Draw is already well established. Text handling and peripheral interfaces are not yet as highly developed as on the Mac, but all signs point to DOS-based PCs quickly catching up to the Mac in functionality.

Although I like the results that can be achieved with Illustrator and Freehand, either on the Mac or on the DOS-based PCs, I have never been very comfortable with the way this software has been used to produce maps. It's similar to the way Scitex technicians originally (1978-79) promoted the use of their Response 250 Cartographic System: Scan an existing map; using the scanned map as a backdrop, digitize the centerlines of features; place text interactively.

By the early 1980's, this approach was replaced by the conversion to Scitex raster format of vector data digitized on computer mapping systems specially designed for geographic database creation and maintenance. Scitex wrote a Standard Interchange Format (SIF) program to read SIF data for lines, areas, and text produced in computer mapping systems, and to convert this data into Scitex vector (DIGIT) format. Later, Scitex opened up its DIGIT format so that users could create DIGIT files directly, bypassing the SIF process. This innovation freed the geographic database from the constraints of the Scitex system, while offering unrestricted access to the system's major strengths: cartographic symbolization and high quality, large format film plotting.

The difference between the Illustrator/Freehand solution and the Scitex solution (and more recently, Intergraph's and Barco's solutions) is that the user is able to pre-define and build complex line specifications, which translate into color and tints, and to define the way lines and symbols will interact when placed together on a "pattern". Assignment of these raster graphic specifications to vector data is automatic.

Creating a double-cased road on a multi-megabyte Mac today is far less sophisticated than it was over a decade ago on the 64Kbyte Scitex. As far as I know, there is no way on the Mac or DOS-based PC to convert vector centerline data created on a GIS or computer mapping system and to automatically assign predefined cartographic symbolization, including intersection rules, to this data.

My bias is for using highly accurate and geographically precise digital databases in map production. Except for small, special purpose maps that may be used only once as an illustration in a book or newspaper, it doesn't make sense to draw geographic databases with a graphic design package. It's also not the only way to use a Mac or a DOS-based PC for map production.

Just as SIF became the gateway between mapping systems and Scitex, DXF and PostScript interpreters are opening the door to the elegant graphics capabilities and laser film recorder output offered by Mac and DOS-based packages. DXF, for Drawing Exchange Format, was developed by AutoCAD to allow users of its system to transfer their files to other CAD programs. DXF, like SIF, is a neutral file format for transferring data from one system to another. AutoCAD became the de facto standard for PC-CADD, and most other CADD vendors were obligated to write DXF input and export programs.

The widespread use of AutoCAD for technical illustration has resulted in new products which convert DXF format into PostScript format or

into Adobe Illustrator vector format. AutoScript, from Preco Industries, Lenexa, KS, is a DXF to PostScript translator. When an AutoCAD file is properly set up, the file can be run through AutoScript and line widths defined, areas filled with dot frequency and screen angles defined. For high quality output, the file can be processed on any PostScript-compatible film recorder after it has been color separated with a program like Adobe Separator.

PowerDraw from Engineering Software, Inc. is a Macintosh-based package that translates a DXF file into an Adobe Illustrator vector file. Once in Illustrator, lines can be edited and grouped for symbolization and area fill. The keys to using PowerDraw are careful setup in the originating program and selective conversion of files via DXF so that entire feature classes can be grouped in one operation.

A program called Azimuth from Diehl Graphsoft, Ellicott City, MD is a map drawing package for the Mac. Its primary use is for very small-scale map illustrations, such as those that would be found in a world atlas. Included in the package are low and high resolution maps of the world and a high resolution map of North America. Files are in latitude and longitude so it is possible to integrate larger scale maps in true geographic coordinates. Files can be imported and exported in DXF and PICT formats. Encapsulated PostScript export is also available, making it possible to transfer files directly to programs like Quark Express for page layout.

The possibilities are growing for using Mac and DOS-based PCs as electronic map publishing systems. In our excitement to use them, let's not forget the importance of the database for update and maintenance. We do not have to use these less expensive systems only as drawing tools; we can make them part of an integrated map publishing environment.

PROJECTIONS

Portable Maps

> "How long will it take before the atlas, as we know it today, is obsolete? If the world and all of its political and geographic boundaries are stored in a computer and data is stored, updated, and available for all scales, will it be possible for the individual to 'dial' the particular map [he] wants to see on the console?"

These are the musings of a naive, thirty-one-year-old, newly appointed manager of a small research and development branch office of an international map publisher. When they were written fourteen years ago, they were less questions than statements of a belief in the

inevitable, penned by a fledgling manager optimistic that he and his colleagues would invent the replacement for paper maps.

Fourteen years later and the atlas as we knew it then, and as we still know it today, is not obsolete. It's alive and well and living among an assortment of consumer electronic gadgets. But we're much closer today than we were in 1978 to a new type of personal navigation system.

During the five years that I worked with Barb Petersen, Rich Grady, Jeff Donze, Matt Poole, Alistair Dinwiddie, among others, I put my ideas aside for an electronic map, and concentrated on the more immediate problem of trying to get a host of computers to produce maps which looked like they had been hand scribed. Since 1983, when I began my own consulting practice, I've focused on the practical solutions of converting manual cartographic methods to computer methods, and of helping organizations realize cost and production efficiencies through automation.

All the while, I've continued to be intrigued by the concept of a portable electronic map. Over the years, I had collected clippings from magazines and newspapers on electronic devices that might serve as a base for a portable map: Time '81, Japanese automakers unveil in-vehicle navigation systems; Changing Times '81, Computers in Your Car; Popular Science '82, Wristwatch TV (shades of Dick Tracy); Time '83, Sony Watchman TV unveiled; Popular Computing '84, Color Liquid Crystal Displays.

I followed the developments in pocket calculators. Finally, in 1990, Hewlett-Packard introduced the HP48SK, a programmable calculator with a screen large enough to display a map. Sharp's Wizard and Casio's Digital Diary appeared around this time. A full keyboard and program software cards made these systems a promising platform for the portable map. Sony's Data Diskman Electronic Book, which I first saw in an InfoWorld May 1990 issue, was introduced a year later in the U.S. A CD-ROM with a keyboard and display. This looked more than promising; it looked downright usable.

During our move to Stockholm a little over a year ago, I misplaced my collection of portable map articles (along with most of my fishing gear). Recently, while rummaging around for something else I had 'lost', I discovered the file among some old papers from the Esselte Map Service, USA days. (My dear wife uncovered my fishing gear just before Christmas while searching for our wedding album. I found this to be an odd connection since my time on the water in search of salmon and trout has been reduced to a tiny fraction of the hours devoted to the sport prior to taking the vows eight years ago.) In the file was the above quote from 1978, and a diagram of a Pocket Map Computer that

I sketched in 1981. I guess I saved these papers because I thought that someone would ring me up one day and ask me if I had a good idea for a pocket map computer. No one ever did. (No one ever calls to make you rich and famous; if you want wealth and fame, do the calling yourself.)

Although I did nothing to advance the concept--there are plenty of smarter and more entrepeneurially-oriented inventors around than I--a portable electronic map has been produced. In the April '91 issue of the Swedish computer journal, Data Teknik, I found a single column titled "Pocket Calculator and Notebook". A photo of a woman holding what looks like a notebook organizer is captioned: Refalo from **Kyocera** (a Japanese manufacturer of printers and calculators, among other electronic devices) is the world's only analog and digital time management system. It is also the world's first portable electronic map.

The Refalo system comes complete with a map of Tokyo's streets. Since the system is not sold in the U.S., and I haven't been to Japan, I don't know how the system works or what it uses for a map storage device. I have a feeling that before long we're going to see the Refalo system, or a similar pocket calculator, showing up with a map of a U.S. or European city.

The 3" x 4" (76mm x 102mm) screen size may be too limiting for the wide acceptance of a pocket map computer like the Refalo as a paper map substitute. Also, I feel that the simple stick maps that are possible on the small screen are not as useful as a cartographically symbolized map. Nevertheless, I believe that for some uses the small pocket calculator or mini-notebook-sized electronic map are an excellent alternative to a sheet map or atlas.

Several new technologies will, in my view, usher in a broader acceptance of the portable electronic map. These are pen-based computers and credit card-like "smart cards". Pen-based computers look like the top portion of a notebook or portable computer, the flat panel display screen without the keyboard. A user interacts with the computer with a pen or stylus touched or pressed to the screen, and with buttons along the side of the display. The pen is used to select command icons from a menu. A word is spelled or a number is entered by selecting the characters from an on-screen keyboard, rather than by pressing keys on an actual keyboard. Some systems will recognize characters "drawn" on the screen.

(This latter feature, automatic character recognition, is being written about in computer journals as if it is a marvel of the latest invention. In fact, a system called Applicon, which was one of the first computer-aided design systems, had automatic character recognition in the early

1970's. We used the Applicon system to produce the first maps made at Esselte Map Service, USA. Schlumberger bought Applicon in 1983 and ported the system from the DEC PDP11/XX platform to the VAX and eventually to the Apple Macintosh. Automatic Character Recognition was not included in the port.)

Pen-based computers are light-weight and can be held in one hand like a clipboard. This is a major advantage in situations where a user is standing up or walking around, rather than sitting down at a desk. These computers are great for insurance adjusters investigating a damage claim, for police at a traffic incident, for nurses or doctors making the rounds in a hospital, or for tourists doing the sights in a city.

My current favorite pen-based computer is the PoqetPad, from **Poqet Computer**, maker of the Poqet PalmTop. The PoqetPad weighs only 1.2 pounds (0.5 kg), has a 4" x 6" (102mm x 152mm) display, and has two 4 megabyte memory card drives. It costs around $2,000 retail, but that price will surely drop as quantities increase.

Quantities will increase. The pen-based computer market in 1991 was $700 million. That is projected to grow to $13 billion by 1995 (Dataquest; InfoWorld, January 6, 1992). I don't think that anyone believes that mapping applications will create this growth. It's the data collection agents mentioned above who will buy the system. Another hoped-for area of growth is the 'electronic book'. Publisher's Weekly (Sept. '91) carried an article on how light-weight, pen-based computers will replace tree-eating printed books, magazines, and newspapers in a matter of years. The idea is compelling.

A system called **Bookmark**, currently under development in the Boston area, seems to be garnering backing from major book publishers. The system has an 8" x 10" (204mm x 254mm) display with the capacity for color graphics. Type is 12 point Times Roman, and the point size is adjustable up or down. Buttons turn pages, a search window identifies chapter headings, it has a built-in sound option for multi-media presentations, a printer port, and an adaptor for CD-ROM and video.

The concept is simple. Instead of buying a book or checking one out of the library, a Bookmark user would insert a re-usable "smart-card" into a vending machine called a Bookbank. Bookbank machines would look and function like automated teller machines (ATM's). The user would first select a desired book from an electronic catalog. The digital contents of the book would be downloaded to the smart-card's memory, and the user's account debited. The smart-card is then inserted in the Bookmark computer and the user reads the pages on the screen.

It doesn't take a great deal of imagination to think how such a system could fit into the daily routine of obtaining a day's reading material. It's also not difficult to conceive of how maps or tourist guides could sit beside books, magazines, and newspapers on a Bookbank vending machine.

There may be those romantic souls who cringe at the thought of holding a computer when settling down in a favorite chair under the perfect light by a fire, rather than feeling the words printed on paper and watching the progress of the event of reading as the bookmark is pressed flatter by the increasing weight of finished chapters when the book is set aside for the night. There may be some who would miss the tactile experience of tearing out leafs from magazines skimmed during an airline flight or in a waiting room, then surreptitiously slipped into a briefcase for later, more leisurely, consumption. There are certainly hordes of seasoned commuters who have perfected the art of newspaper folding for tight-quartered reading, and who view their ink-stained fingers as a sign of distinction that they would do battle to retain. And surely there are die-hard map readers who regularly rise to the challenge of getting the map to fold back to its original form after it has been carried around for a day's tour of the city.

Remember the 45 RPM record? Remember the LP record? We loved them--until something better came along, like cassette tapes and audio CD's. (I still love my bamboo fishing rods, but I don't use them much anymore since I bought my first graphite.) The jury has yet to be assembled on the portable map, let alone to deliberate or reach a verdict. But, rest assured, the portable map is coming. I've been an observer of this phenomenon for too long; it's time to become an active participant. Anyone interested in joining me?

Your letters are always welcome and appreciated.

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