A GEMPAK
(General Meteorological Package)
Tutorial
Available Via
NCSA Mosaic,
Written in HTML
_(Hypertext Markup Language)_

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Abstract:

My project entails designing a tutorial for the GEMPAK (GEneral Meteorological PAcKage) software distributed by Unidata, a division of UCAR (University Corporation for Atmospheric Research). GEMPAK analyzes, diagnoses, and displays geo-referenced data, usually meteorological data. The tutorial is designed using HTML (Hypertext Markup Language). HTML is a language that assigns structural elements to text, such as: emphasis, address, citation, code, etc. [CTAN, 1993] HTML documents are read and displayed using a client application called a browser. I worked primarily with Mosaic, one of the most common browser applications. It also can imbed images, sounds, video, and “links” to other documents. The browser, therefore, can be programmed or configured to display these structural elements as the programmer or user chooses. With Mosaic, links appear as text or bordered images highlighted in blue or purple. The user can select a highlighted object (with the mouse if using Mosaic) to view another document. The GEMPAK tutorial uses “next” and “prev” (previous) icons to link the sections so the user can progress sequentially, and it has a detailed table of contents so the user can skip around the document. At the end of each section is a set of exercises that test users’ understanding and the tutorial can display the correct answer so that users can check their results.
This interactive quality of HTML documents makes it an excellent medium for tutorials.

Introduction

Hypermedia and HTML

The emergence of hypermedia, or multimedia, has accelerated the ease of access and availability of interactive documentation. Hypermedia encompasses all types of media including moving video, still images, audio, and text. Multimedia serves a greater social purpose than simply being visually and aurally interesting, because it allows one to experience great and even not so great works of art, culture, and science in their true form. Descriptions of famous operas, speeches, symphonies, or jazz solos can be incorporated with the actual recorded sounds. Similarly, famous paintings, travel brochures, sculpture, and even movies and music videos can be accessed from various hypermedia libraries. Nearly all of the senses take part in the experience, rather than just through one’s imagination.

The WWW (World Wide Web) was created with the power of hypermedia in mind. The idea was to use the Internet to join a variety of multimedia sites. Using the NCSA (National Center for Supercomputing Applications) Mosaic, users need only to click the mouse on the highlighted information that interests them and they can access other documents by means of links. Each link is like a fork in the road of the “information superhighway”. By means of these links, users can choose information that interests them. The increased interaction between user and document begins to simulate a student/teacher relationship. In a classroom setting a student may ask the teacher to expand on an unclear subject or a interesting topic. Likewise, the links in a well-designed tutorial can give users that same ability. The author of a document can anticipate questions on certain topics and imbed links to more detailed information on those topics. The imbedded links appear as highlighted text that users select if they want to know more about a topic. This freedom of choice, along with the ability to imbed images, and links to images, empowers even a novice HTML writer to make a tutorial that is helpful to users with a wide range of experiences.

GEMPAK 5.2

Unidata, a division of UCAR (the University Corporation for Atmospheric Research), distributes and supports a software package called GEMPAK (GEneral Meteorological PAcKage) to universities. Each year new students, primarily in the atmospheric sciences, begin to use GEMPAK. So twice each year, Margaret “Peggy” Bruehl, head of GEMPAK user support at Unidata, holds a seminar on how to use GEMPAK. Because not every new
user can attend the seminar in Boulder, Colorado, she receives many questions about the software through email. To save the new user time and plane fare, and to save Peggy time answering email each morning, my project was to create a tutorial for GEMPAK that would use HTML, and eventually be available over the Internet.

GEMPAK TUTORIAL

One advantage of an on-line tutorial over a live seminar is that users can go at their own pace, instead of compacting the whole process into an intense two-day period. The tutorial will be made available, as a document in progress, or “under construction”, from the Unidata homepage's GEMPAK information index, whose URL (Universal Resource Locator), or Internet address, is

http://www.unidata.ucar.edu/packages/gempak/index.html

With the goal of making a tutorial that users can easily skim for information, I included a number of icons designed with the CorelDraw! graphics software. These icons break up large sections of text, allowing the user’s eye to rest while going through the tutorial. Icons are used for: warnings, tips, viewing windows, exercises, moving to the next or previous page, accessing the table of contents, and indicating commonly asked questions. “Next” and “prev” (previous) icons allow the user to move through the tutorial sequentially without returning to the table of contents. The “T of C” icon returns to the table of contents from anywhere in the tutorial. These icons are links that allow someone who jumped into the middle of the tutorial to go back to the beginning or progress to the end. The “view window” and “view answer” icons are also links. Oftentimes, for large images, “thumbnails”, or smaller versions of the image, with links to the larger image are used. With thumbnails, users do not have to download the large images every time they view the document, which can be time consuming. The “view window” icon is a generic thumbnail for any large image in the tutorial. It appears primarily at the end of each of the exercise’s answers. The tip, warning, and exercises icons are merely visual cues, without any link, that draw users’ attention to important text. Some browsers, however, do not have the capacity to view images, for example LYNX. So alternative text that LYNX could display is included with the image code, explaining the image in words.

An important consideration to keep in mind when writing any document is the discourse community [Flower, 1993]. The GEMPAK tutorial should be as flexible as possible, permitting both the experienced and novice user to obtain the information they want, precisely and efficiently. The best way to do this is to write a tutorial structured into various smaller topics that are categorized, listed and described by a comprehensive table of contents [Voris and Bilinski, 1993].
An outline of the existing GEMPAK seminar provides a base to work from, but its topics must be expanded in order to reproduce the oral portion of the seminar course. Similarly, one must simulate the action of the instructor reviewing student progress on specific learning exercises. With the hypermedia protocol this can be accomplished. By using Hurricane Bob data stored in the GEMPAK libraries, and insuring that all other variables are uniform between the tutorial user and writer, the users can check to see if their answer is correct by simply selecting the “view answer” icon. The answer appears as another document mirroring what the GEMPAK user interface would display with comments in red that direct the user’s attention to certain aspects. This is where the tutorial users check to see that all of their GEMPAK variable settings are the same as the one that I entered when I created the answers to the exercises.

Checking that everything is the same will hopefully save the users trouble that could result from getting the wrong answer because of minor misinterpretations of a slightly ambiguous question. If the answer is a list, the variable settings and the list are included in the answer document. If the answer is a graphic, however, the variable setting are still included, but also the “view window” icon is placed at the end of the answer document. It serves as a link to an external GIF image that will display the graphic next to the tutorial. GIF images is a type of format that Mosaic can imbed into documents.

**METHODS**

**Tools**

I used several software packages to create the GEMPAK tutorial.

Portions of the HTML, or hypertext markup language, documents were written using the TkWWW, also known as the TkW3, text editor. This editor allowed me to generate the hypertext source in a format similar to a word processor. TkWWW is very useful to the new users who know how to use a word processor, but do not know HTML code, because TkWWW generates the HTML code for them. TkWWW can make text as bold, list item, etc., but is most useful in adding images and links to other documents. Its convenient “Generate Source” button, which creates the HTML code, is also one of its drawbacks. I learned several HTML commands that TkWWW did not recognize, such as adding indentation, block quoting paragraphs, and aligning text to images, placing several images next to each other, and inserting alternate text. When I put these tags in by hand, TkWWW would not recognize them, so the next time I saved the file, TkWWW would generate the source without these new HTML commands.

For this reason, I began to use the vi text editor (available on UNIX machines) more than TkWWW. The vi text editor is simply a set of
convenient commands for writing and saving text files. I tried to first write the text and create the links with the TkWWW to avoid writing out all of the HTML code. Then with the vi editor I put in all of the formatting that TkWWW does not recognize.

Mosaic, as stated earlier, is a WWW hypermedia browser. I used Mosaic frequently in the creation of the tutorial as a tool to review and assess other documents, especially tutorials. Likewise, while writing each portion of the GEMPAK tutorial, Mosaic was useful to see how the document looked when formatted. Once it is posted, the GEMPAK tutorial will be available to other sites with browsers, mostly Mosaic, by HTTP, or hypertext transfer protocol.

One more program I used is CorelDRAW!. CorelDRAW! is a drawing program that Unidata has on a test license to determine whether or not to purchase it. It has allowed me to create the logo, page headers, and all of the icons to help the user easily browse his way through the tutorial. CorelDRAW! is a very good tool, but it seems to still have several bugs, for instance exporting GIF images with graphic elements drawn on them just does not work.

Procedures

The procedures for my project were fairly straightforward. Because my task was more of a project than an experiment, the procedures are an outline of my summer schedule and deadlines.

"Surfing the Internet"

The first task was to browse the Internet with Mosaic, looking at various sites, but paying close attention to interesting tutorials and their formats. I was given the freedom to explore any sites that I wished. At the time this seemed frivolous, but I came to realize when planning and writing the tutorial that this was not the completely the case.

While looking around, I took note of interesting sites by adding them to the “hotlist”. NCSA Mosaic has the hotlist option so that Mosaic users do not have to enter the URLs for the sites that they visit most often. By re-examining the hotlist sites that I had saved, I came up with some of my own criteria for a good site. Mostly it had to be visually pleasing, with an emphasis on user interaction. When I came across a well-written tutorial, I would “view the source”. This is an NCSA Mosaic feature that allows one to see the raw HTML code before Mosaic reads and displays it. If there was some code that I wasn’t familiar with, then I would practice using it in my own document. This “surfing”, or searching, around the net could have gone on forever, because of the vast number of Mosaic sites in existence.

The TkWWW HTML editor
The next step was to become adept at using the TkWWW HTML editor. Using this tool, I created a homepage, or an HTML document about myself and what I do. The TkWWW editor was to be my only tool to put together the text and links of the tutorial. Nevertheless, it became apparent that though TkWWW was the fastest way to make an HTML document, it failed to create and recognize several functions that I thought would enhance the tutorial. It became necessary to use the vi editor to put in tags by hand.

Creating Icons and Images

From looking over the notes I had written on well-made WWW sites, I realized that the tutorial was going to need icons. The icons from other sites can be easily downloaded, but incorporating those into the tutorial might have brought about copyright infringement problems.

My editor/mentor Matthew Hicks, therefore, showed me the CorelDRAW! application on temporary license. CorelDRAW! was used for all of the icons in the tutorial. Any pictures created on CorelDRAW! could be easily exported to GIF format, as long as all of the graphics were drawn using CorelDRAW!. For the exercise icon, I imported a black-and-white gif background into the CorelDRAW! application and I drew joggers on top of it. This would not, however, export into the GIF format, so I did what is called an X window dump, which is basically a GIF format snapshot of the entire CorelDRAW! applications window. Using xv the CorelDRAW! window was cropped and the icon reduced. The xv application was used to manipulate the size, cropping, and colors of every icon included in the tutorial.

Tutorial Goals

My goal in making the tutorial was to make it efficient and interesting. By efficiency I mean allowing a range of users from beginner to advanced to access quickly and easily the part of the document that covers the aspect of GEMPAK that they are interested in learning. Making the tutorial interesting is important so that the user will want to use it, and hopefully he or she can save time or money by not having to call to ask questions, or fly to Boulder to attend one of the twice-yearly GEMPAK seminars. To maintain interest, I attempted to make the language understandable by using both the technical terms and layman’s descriptions in my explanations. My previous inexperience with both meteorology and with GEMPAK 5.2 was helpful when writing less-technical descriptions, but somewhat of a hindrance with more-technical discussions.

Format

To aid in achieving the goal of efficiency in reading and skimming, a consistent format had to be agreed upon and implemented. The tutorial was
organized into an outline format, with each chapter assigned a number and each chapter divided into subsections assigned a letter. The subsections were all written in individual documents. Progression through each document can be made with the table of contents or with the “next”, and “prev” (previous) icons described earlier. The tutorial’s chapters are the following: 1) Getting Started; 2) What is GEMPAK?; 3) Assumptions, Recommendations, and Warnings; 4) How to Use this Tutorial; 5) Useful Tools; 6) Listing Programs; 7) Mapping Programs; 8) Graphing Programs; 9) Gridded Data Programs; 10) Diagnostics; 11) Objective Analysis Programs; 12) User Manual; 13) Closing Comments

The format of each chapter and subsection was to present the name and number of the section followed by a line break, then a brief description of the section. At the end of each chapter is a chapter summary. At the end of the listing, mapping, gridded-data, and graphing-program chapters is a section of exercises. The tasks for each set of exercises are numbered, and after each appears the “view answer” icon/link. This will link to another document that shows what the user should have entered and what settings the GEMPAK user interface displays before creating the list or image. For listing programs the answer, of course, is a list, which is included in the answer document. For the other exercises the answer is a GEMPAK image, so at the end of the answer document is the “view window” icon/link. As stated earlier, this is a “generic thumbnail”, or a link to any larger image. After selecting this icon, a GIF image appears next to the answer document. This GIF image was made via an X window dump briefly mentioned before. Hopefully users will be simultaneously running the GEMPAK 5.2 applications, so that way they can compare the GEMPAK displayed window they create, with the one from the HTML tutorial.

CONCLUSIONS

GEMPAK is an excellent tool for teaching meteorology, because it displays complex data in a easy to read form. It takes raw meteorological data, interprets it, and displays it as an image (a map or a cross section, for example) by engaging the senses to a greater extent than could be done otherwise. For this reason, GEMPAK has been making inroads into undergraduate teaching arenas, rather than just for graduate level research projects [Bruehl, 1994]. Multimedia also is a great teaching tool by commanding the interest of the student. It is therefore inevitable that the best way to teach a highly visual application such as GEMPAK, in the absence of live workshop, a multimedia tool such as HTML should be used. The advantage of using HTML over a live workshop is that an HTML document can be made available to a greater number of users through the internet and the World Wide Web.
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