HyperMaps: Telling Your Users Where to Go

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Abstract
While you were trying to figure out how to use on-line documentation effectively, along came HyperText, promising your users better ways to assimilate information but complicating your already chaotic world. If you have the time, look over your shoulder and you'll discover an even newer technology, HyperMaps. HyperMaps will allow you to deliver information in ways you probably have not even imagined — and to users who would not normally use computers.

HyperMaps are databases that include maps, graphics, text, and a means to navigate among all of these. You'll find that HyperMaps provide information that would be difficult or impossible to deliver in even the most complex database, in a way that the most naive user will find simple to use.

Users who currently use your on-line library catalog to find a book might use a HyperMap system to see a map indicating where in the stack of the floor of the building the book is actually located. A HyperMap would also show them how to go from their dorm room to the appropriate branch of the library. But this is only a tiny part of what HyperMaps can do.

At Princeton University we have built a HyperMap system and have looked at many systems built by others. Today, PAL (Princeton Automatic Locator), our HyperMap system, is a working pilot project at a crossroad. There are many directions it can move and we are researching the options. The issues we are considering today are the ones you'll probably be considering in the near future.

Before you abandon the HyperText project (or on-line documentation project) that you are hard at work on completing, here's an overview of HyperMaps. You'll see what HyperMaps are and how they can compliment existing on-line documentation, hypertext systems, and database systems. You'll see how they allow you to get the attention of non-traditional computer users and renew the interest of existing users. You'll also see how they can serve the needs of special groups of people such as handicapped students, prospective students, and facilities managers.

Here's a concise guide to an information delivery system that's likely to be in your future. This guide will provide a road map showing you how to build HyperMap systems that will tell your users where to go.

The USER Center

Once upon a time there was a big, big computer that lived all by itself in a wondrous glass house. The big computer was the very heart of the COMPUTER CENTER and it was cared for by legions of experts who were in turn adored by great multitudes of grateful users. Perhaps that's not exactly as it really was, but it is certainly not that way today.

The big computer has spawned thousands of smaller species. They have left the isolation of the glass house and landed on the desks of users who are more likely to be confused than grateful. But computers have not landed on all desks, at least not yet. This inequity in the distribution of access to computing, while pleasing even some of those without computers, has added to the confusion and turmoil faced by both users and User Services. While the big computer served just a select few of the people at the university, its miniature progeny are a vital resource to everyone on campus, even those most reluctant to approach one.

To support this radically changed user community the COMPUTER CENTER had to be replaced by something where the user was the focus of attention — the USER CENTER. While this is not what many universities actually call their computing department, to survive in the nineties, users, not computers, must be the center of attention.

In this new environment, User Services has to be a proactive purveyor of innovative information services that will aid the confused and the computer phobic without scaring off the computer cognoscenti.

It's A Bird, It's A Plane, It's A HyperMap!

Of course this is nothing new for User Services. They have been in the forefront in offering crisply formatted documents, on-line information systems, and recently, hypertext systems. Though neither users nor User Services have yet fully exploited basic on-line documentation, let alone hypertext systems, newer information delivery systems continue to appear. One of the most promising of these is HyperMaps.

HyperMaps provide a new way to access information. They are easy and natural to use — even by the confused and computer phobic. They can provide information that would be difficult or impossible to deliver even in the most complex database. And your users may have used them already. If you've been to a large regional shopping mall you've probably seen one in a computerized information kiosk, but if you haven't seen one yet, you soon will.

HyperMaps can be used to find the best way to go from one building to another.

- *How do I go from my dorm to the library in the rain and stay dry?*
  They can be used to locate special facilities.
- *Which eating facilities have handicapped access?*
  They can be used to visually identify campus features.
- *What does the library look like?*
  They can be used to choose classrooms, dorm rooms, and meeting rooms.
- *What classroom near the engineering school would be best for an unexpectedly large class on gourmet cooking?*
  Which dorm room offers the most privacy, the best views of campus, and the closest proximity to a computer cluster and an off-campus convenience store?
  What room with handicapped access and the ability to project computer images can be used to host a seminar for 80 phrenologists?
  Maps can be used for orientation of new students, prospective students, and campus visitors.
- *Where is the stadium (and what does it look like)?*
  Where are the computer clusters?
  What parking lot is most convenient to Mackie Hall?
  How would any of these questions be answered using conventional documentation or database systems?

HyperMaps can also answer more conventional queries such as what buildings, services, and facilities are on campus, and what the hours of operation, phone numbers, and organizations of each building are. And HyperMaps can be linked to existing campus information systems such as the on-line library catalog or an on-line campus information system.

A Recipe For HyperMaps

At first glance, a HyperMap is just a bunch of old information technologies — documents, databases, graphics, and so forth — mixed together with some maps. However, in building a HyperMap the technologies are *tightly integrated.* An example of the symbiotic effect of tight integration is what happens when you combine flour, water, yeast, and heat. A Martian might think that the combination would result in hot, damp, flour with a yeasty aroma. But when done right, the fresh baked crusty loaves of bread that appear bear as much resemblance to their ingredients as HyperMaps do to theirs.

Natural Navigation

The primary interface to a HyperMap is via an on-line map (see Figure 1). Queries to a HyperMap are initiated by navigating among the maps and selecting options which often result in other maps being displayed but which might result in the display of text, graphics, additional options, or combinations of these. The maps may be unadorned (see Figure 2) or may include iconic symbols (see Figures 3 and 4) indicating special facilities such as rest rooms, computer clusters, dining halls, or emergency telephones. Maps can be overlaid with several sets of iconic symbols. For example, a map of campus might at one time identify the degree of handicapped access for each building, and at another, identify those buildings that have not been painted in the last five years. As in other information systems, the data obtained from a HyperMap can be manipulated by

sorting, editing, printing, transferring to other applications, and performing other data manipulation functions.

For many applications HyperMaps work so well because the map interface is so natural. Most people already know how to use maps. Maps appear on public transportation systems and as part of building directories. People routinely use them while driving, boating, or explaining to others how to get from here to there. Maps are especially good at displaying spatial relationships and allowing subjective judgments to be made (e.g., what room is *best, most private*, or *most convenient*) that could not reasonably be made through a conventional database system. Though system designers gnash their teeth and stay up nights trying to build user-tolerant paradigms for navigating databases, even computer illiterate users have no trouble navigating maps without much assistance from system designers.

In using on-line maps, users are in fact using a very high level graphical interface to data. Many HyperMap systems continue this high level graphical interface even when non-map data is displayed. For example, if a picture of a building is displayed, a user might select the front door to display the inside of the first floor of the building. Once inside the building, the user might see a button for each floor of the building near the elevator. Selecting a button might produce the floor plan of the selected floor This may seem more like an adventure game than an information system and that's how it may appear to users — if the system is well designed. In fact a serious problem with HyperMap systems is getting people to believe that they are serious information systems, which they are.

HyperMaps solve the problem of the normal, alien, non-intuitive interfaces that are common to most computer applications. That's one reason why HyperMaps appear in shopping center kiosks; people who have skipped your short courses on computer technology can use them. When an interactive map is combined with databases, text, and links to other applications, the natural map interface is leveraged to make many additional functions available in an easier way.

One Day In The Life Of Ivana

Imagine Ivana, a scholar, doing research in her office on campus. Ivana needs to locate books in her esoteric field of study. Traditionally she would figure out how to fire up the on-line catalog, do a search or two, print the results (or more likely write them down by hand), and go off to try to find the book. With a HyperMap system she would see a map of the campus on a computer screen. If she recognized the library by its shape or label she would select it (see Figure 5). If she didn't know which building was the library she might select a *directory of buildings* (see Figures 6 and 7) or *directory of services* option and locate the library in that fashion. Selecting the library, she would zoom in to the area near the library, select the on-line catalog option, and perform a few searches. Suppose the HyperMap system indicated that the book was in the Firestone branch of the library. Ivana would locate the Firestone branch and see what it looked like (see Figure 8) and how to get there. She could also display the operating hours of the library and the phone number (and even a picture) of the reference librarian. If she needed to, Ivana could see floor plans of the library which included the stack in which her book could be found (see Figure 9). While looking at the floor plans she might notice that books in a nearby stack were also very interesting and she might explore them as well.

Hidden Treasure

Most universities already have much of the data needed for a HyperMap system — it's just hidden away and not very easy or natural to access. The hours that the library, computer clusters, eating facilities, etc. are in operation is probably part of an on-line database. So is most of the other data needed for a HyperMap system. It is simply more natural for a user to select a building from a map and find out about it than to enter a series of database queries to accomplish the same thing. Since much of this data is already available there is not much additional work in building or maintaining the HyperMap databases. The maps themselves call for some new technology. While there are many systems that can store, retrieve, and update text, there are few affordable mature applications to manage libraries of maps.

The extent of the map maintenance problem is dependent on the number of maps, the amount they change, and the degree to which maps are cross referenced with other maps and text. For systems with few maps (a few dozen or fewer), little change, and minimal cross referencing, simple manual schemes for managing the maps work quite well. Moderately complex systems can be managed with a basic graphics database package (e.g., FileMaker Pro by Claris) or with CAD systems. Only the largest, most complex systems will require more than that, though sufficiently determined people have been known to manage large systems without powerful software.

PAL — Princeton Automatic Locator

At Princeton we have built a working pilot HyperMap application called PAL — the Princeton Automatic Locator. PAL was written in Apple's HyperCard and is accessible throughout the campus via a file server. A single flat map of campus was scanned to produce an overview map (see Figure 1) and the one level of close-up maps supported by PAL. A perspective drawing of campus was also scanned and was used for views of key buildings as were a few photos of university staff. Other PAL maps were drawn with off-the-shelf draw and paint programs (see Figure 10). PAL uses data that was

obtained from other university systems and converted to HyperCard text files. Currently, PAL does not provide direct access to university information systems.

PAL allows users to wander around an on-line campus map, discovering the location and function of buildings. The information available about each academic building includes its name, the departments that use it and the phone numbers of departmental offices, special facilities such as branch libraries. This information overlays the map without obscuring the building queried (see Figure 11). It can be cleared by selecting the *clear* button on the map or by selecting another building. Figure 5 is the same map as Figure 11 before the information window for West College was displayed.

For key buildings, a perspective view is available. A map showing the location of computer clusters is part of PAL as are floor plans for some buildings.

PAL also allows entry into the system via three directories: buildings, parking, and services. A user can scroll through any of these directories and move from a directory item to a map that includes the building, parking lot, or service selected.

Where Do We Go From Here?

Today PAL is at a crossroads. It is a working pilot system that could move in any of several directions. Here are a *few* of the possibilities under consideration:

A Guide For People New To Princeton

Perspective drawings or scanned photos for all buildings, gardens, and sculpture would be included. Information and photos of the town of Princeton and its environs as well as maps that went far beyond the campus would become part of PAL. Historic information about campus buildings and the university would be made accessible along with information on some of our best known alumni and professors (e.g., when you select the Physics building you might learn about our Nobel Laureates in Physics). This could become a comprehensive guide to the University and the town of Princeton. An excellent example of this approach is *Glasgow Online*, a system developed at the University of Strathclyde (see Figures 3 and 4).

As a campus guide it would also be desirable to use a color display. By replacing the current mouse interface with a touch-screen interface, the HyperMap application could be positioned at key campus locations as a free-standing information kiosk. Preeminent research institutions should be using technology that is at least as good as that found in shopping malls.

A Recruitment Aide

The PAL diskette (or an abbreviated version of it) could be sent to prospective students, faculty and staff. PAL would emphasize educational, cultural, and employment benefits. Student, faculty, and local housing would be shown on maps along with photos and prices. Public transportation systems, schedules and costs could be included. A student using this version of PAL could explore dorms, labs, libraries, eating facilities, athletic facilities and the local social scene by wandering around on-line maps. This would be far more effective than any stack of brochures the university could send out and it would complement visitors' trips to campus by allowing them to replay the highlights of their trip at home. Naturally this would only work for those who had access to a compatible computer at home, but a copy would be available for use by visitors and others via our campus network. Even dial-in and network access would be possible.

A Link To PNN And Other University Systems

We have many university systems that could be linked together using the natural interface of HyperMaps. For example, PNN — the Princeton News Network — which is a general purpose on-line information system, contains data on campus events. By selecting an athletic facility from PAL it would be useful to see the schedule of events at that facility. This could be accomplished either by linking to PNN and extracting that information or by giving the user direct access to PNN.

In linking to other university systems with a HyperMap the basic question is how the HyperMap fits in. Is the HyperMap the top level interface or is it just one of the items selectable from a high level menu? Figure 12 shows a Cornell University application which successfully takes the later approach. When a HyperMap links to another system does the user have to use the interface of the system that has been linked to, or does the HyperMap system maintain its map-like interface even when using other systems?

Making the HyperMap the highest level interface and preserving that interface across other systems gives the user the most ease of use but the system designer the most difficulty. However it may not be appropriate to access all data through a HyperMap interface. An on-line catalog, for example, could be accessed totally graphically via a HyperMap interface, but it is likely that many users would prefer the directness of using the on-line catalog system itself.

A Room Allocation Aide

Students at Princeton select their dorm rooms each year. Faculty move their classroom assignments around all year. Throughout the year everyone is involved in an unending search for the *right* meeting rooms. These difficult choices involve knowing the size, location, facilities, and desirability of rooms on campus. Much of the decision

making is objective (e.g., the room has to be big enough), but there is also a subjective component (e.g., the room has to be *nice* enough). And of course the room must be available.

PAL could include floor plans of every room on campus. The maps already exist, though most of them would have to be digitized in some way. In addition to the floor plans, PAL could include, the square footage, the number of seats, the number and location of electrical outlets, and other physical attributes that would be needed to schedule rooms. When the registrar was asked to find a new classroom for an overflowing lecture he could consult PAL to find the room closest to the existing one (or to the department office or meeting some other criteria) that would accommodate the class. Students could browse around campus looking for the best dorm rooms for their next year without having to visit dozens of rooms (which they do now) and missing the *ideal* room anyway. And it would actually be possible to find an appropriate meeting room without making dozens of phone calls or contacting a long list of insiders who know where there is a good room that's free.

This use of PAL, like the following use, would require a great many more maps and access to a large amount of data, much of which is not available in digital format at Princeton. However, it would provide new and improved services to nearly everyone on campus.

A Facilities Management System

In addition to the students, faculty, and administrative staff, there is a large group of people that maintain the university infrastructure. They view the university as a collection of steam tunnels, conduits, structures, and landscapes — all of which require maintenance. This group of people is largely unserved by User Services, but could see extraordinary benefits from a HyperMap system.

Today, if a new trench needs to be dug on campus (nearly a daily occurrence), maps that closely resemble the dead sea scrolls are consulted to ensure that the new trench will not cut through something unexpected. If an overlay of steam tunnels, conduit, telephone cables, and other buried utilities could be seen on-line, the entire campus maintenance and construction process would be expedited.

Many things require preventive maintenance. One could wait until the wood on a building rotted before repainting it, but it is more cost effective to paint long before there is any damage to the structure. PAL could identify those buildings that needed any particular kind of maintenance and workers could could perform similar work on buildings that were near each other. Workers could display icons of old air conditioning filters, aging smoke detector batteries, and even trees that needed pruning.

This use of PAL would have a direct impact on a small group of people — the facilities staff — but their increased efficiency would benefit everyone on campus. Unfortunately, much of the facilities data is difficult to obtain. Currently at Princeton there isn't agreement on the correct room number for each room or even what constitutes a building. Since a room number and building name are the likely key to the underlying HyperMap database we have some distance to go toward this application.

Each of these directions, and many more we've considered, appear to be good uses of HyperMaps. Availability of data and the commitment of the people who will have to support a particular application though, are more important than any technical considerations. Theoretically it would be possible to do all of these in one application, but that might create a cumbersome and unwieldy system.

Do You Need HyperMaps?

Had we but world enough, and time,...
—Andrew Marvel

HyperMaps let users get at information in an easy, natural way. They make information available that would be very difficult to quantify in a conventional database. They are flashy systems with a high technology look and feel that you'll be proud to show off. They make good use of the power and graphics available on many workstations and attract non-traditional computer users to computing.

Users have become extremely diverse in their needs while at the same time the information resources of universities have greatly expanded. Having all the world's knowledge about one large computer isn't sufficient anymore. How can User Services find the time to solve the complex problems that users have when users have so many little problems that need solving? Of course the solution is to automate solving the little problems. *How do I do text processing?* Go to the on-line documentation. Try the on-line tutorials. Look at the on-line short course schedules. *Where's the nearest computer cluster with a laser printer and a scanner?* Go to the cluster location database. Cluster schedules are on-line. Check the on-line cluster descriptions. *How do I find out about psychokinetic programming?* Go to the on-line library catalog. Library hours are on-line. The complete guide to using the library is on-line.

This is a good start, but many users don't even know where to go for information or how to use the information systems that have been built. Many information systems built to help users result in users needing more help just to use them. And at a university, about a quarter of the most knowledgeable people — those you've spent four years teaching how to use your information systems — leave and are replaced by beginners. No wonder it seems like your staff can't keep up.

HyperMaps can help get you out of that trap. While they are actually fairly high-tech, they don't seem that way to users. They answer users' questions that many other groups on campus — including User Services — would otherwise have to answer. HyperMap based information systems don't require much help to use so they will actually reduce the need for support rather than increase it. Much of the data that HyperMaps use is already available. Here's your chance to give users easy access to it.

Users are drowning in a sea of data while User Services groups are swamped with user demands. You don't have the time or staff to help all of your users nor can you entice potential users to take advantage of the powerful, but complex, information systems you've built. You can't tell users to go away, but HyperMaps can tell them where to go for help and can in many cases actually provide the help they need. HyperMaps will keep your users informed, enlightened, educated, and entertained. All you need is a few maps and a dream.

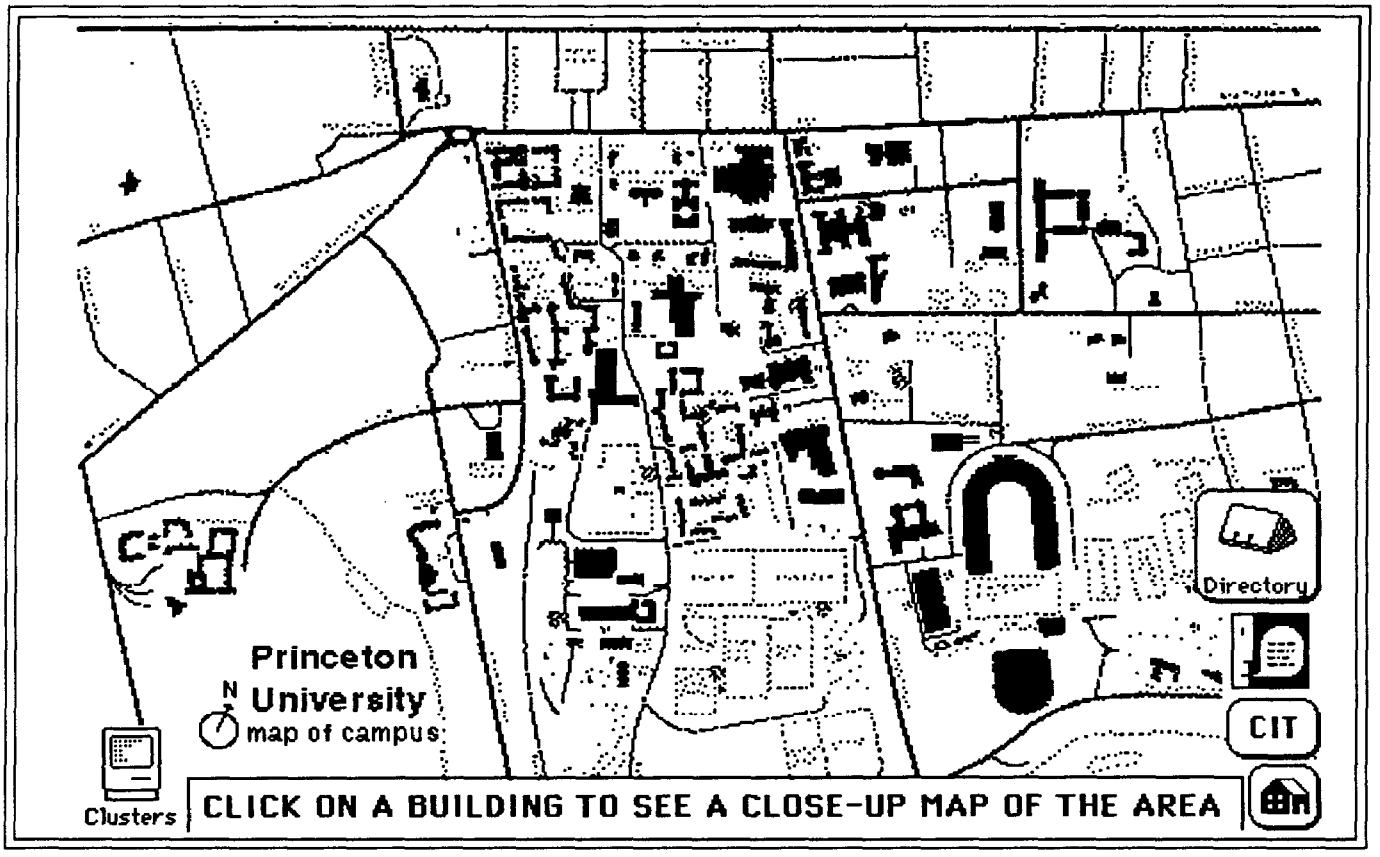

Figure 1 — The Highest Level PAL Map

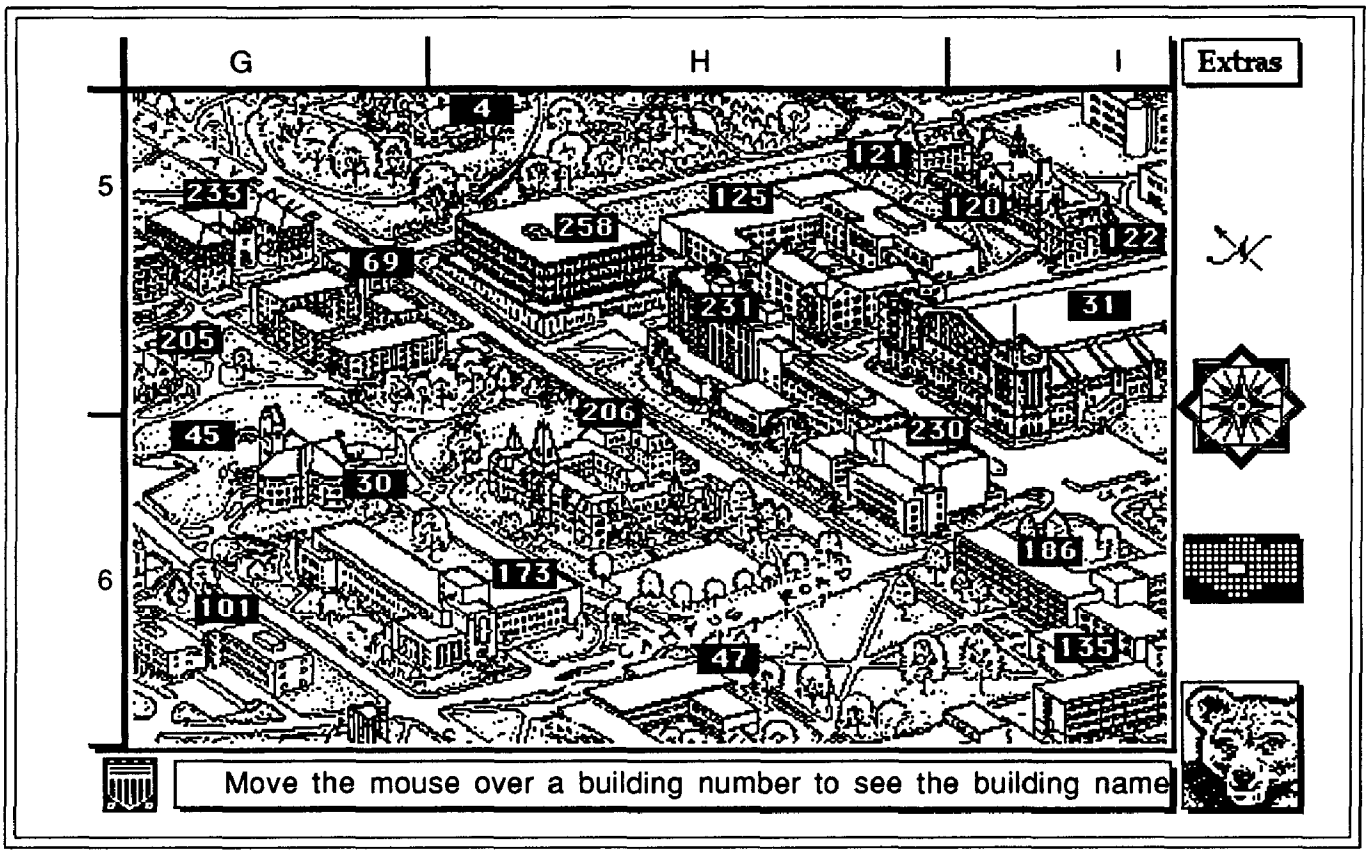

Figure 2 — An Unadorned Map - From Cornell University

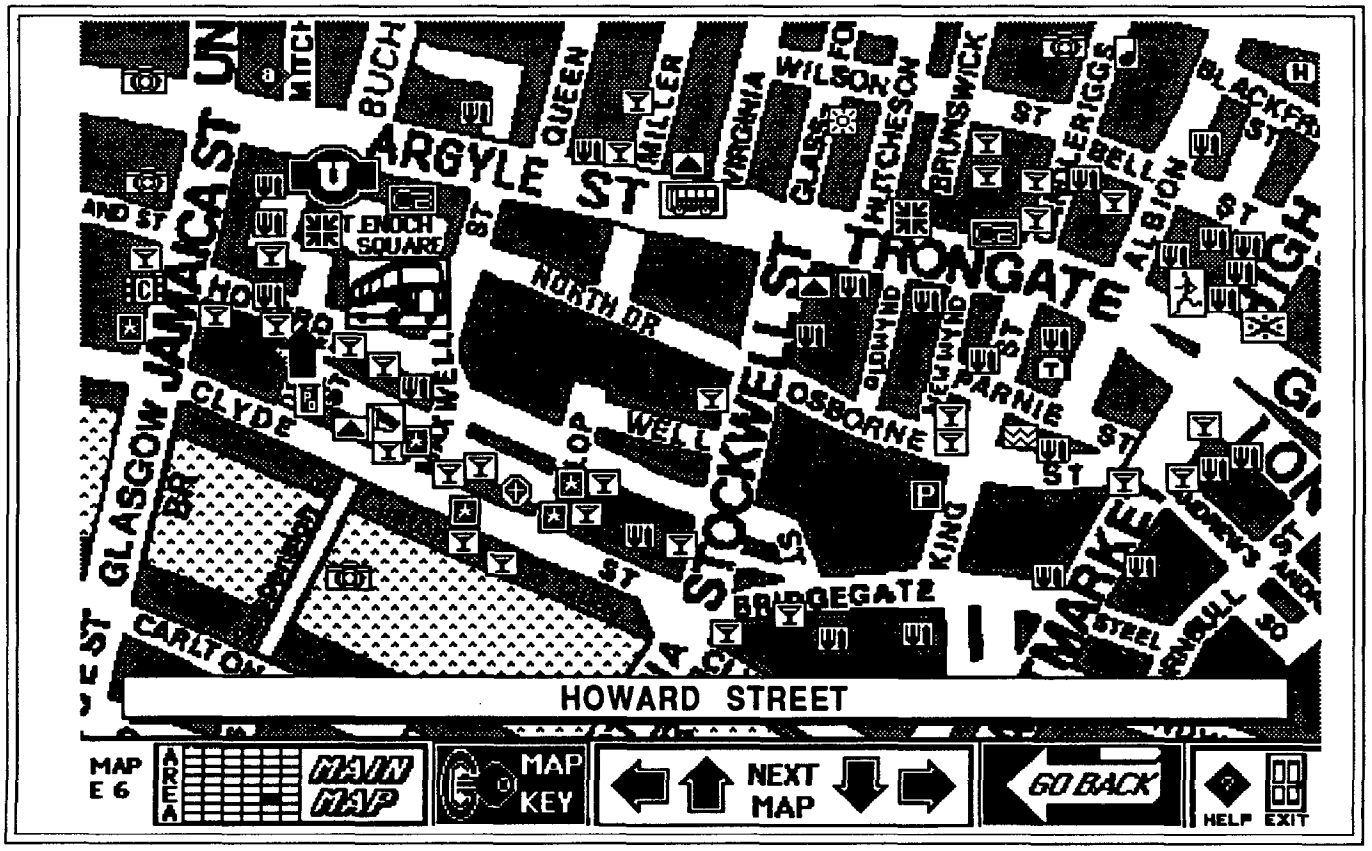

Figure 3 — A Map With Icons From The University Of Strathclyde

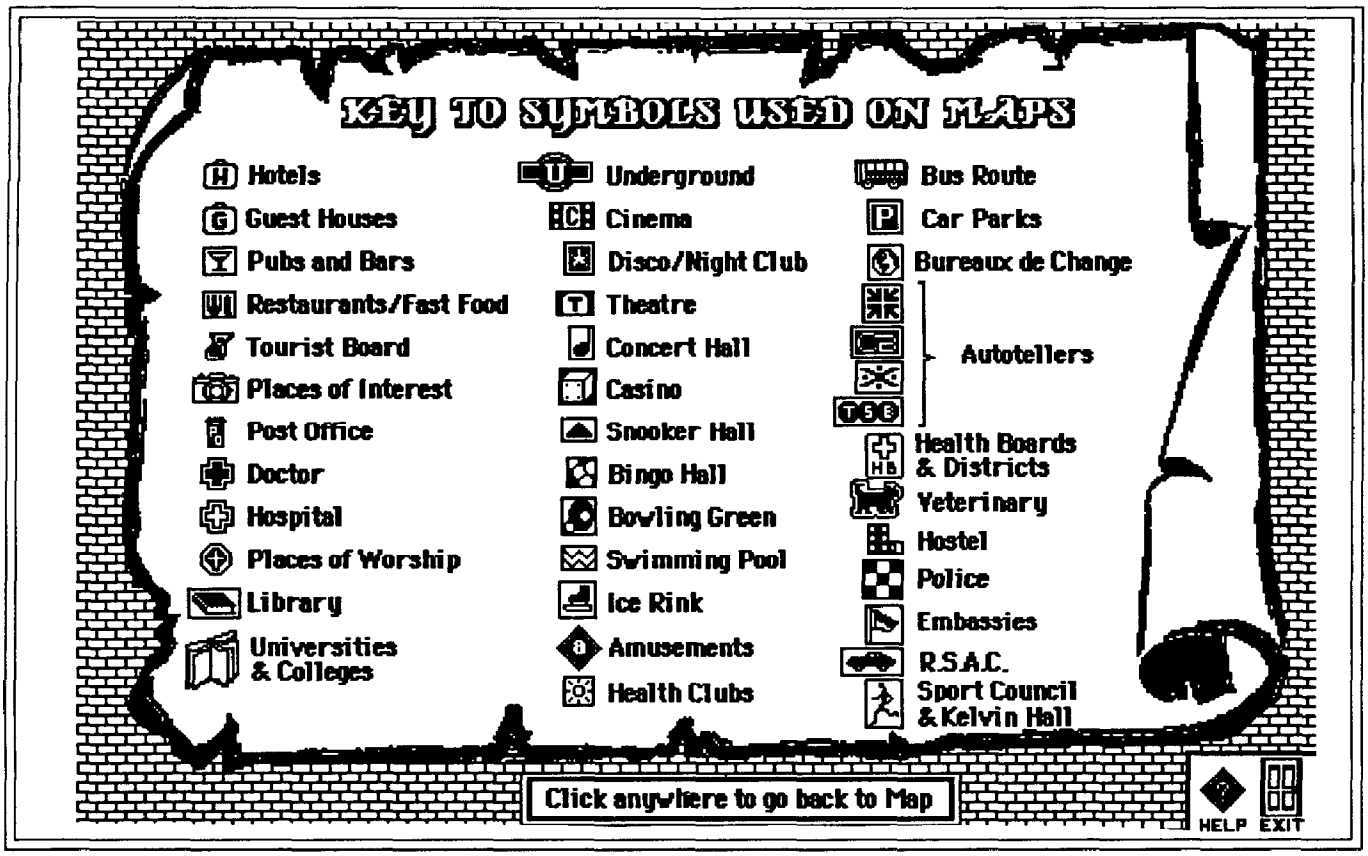

Figure 4 — A Key To Icons From The University Of Strathclyde

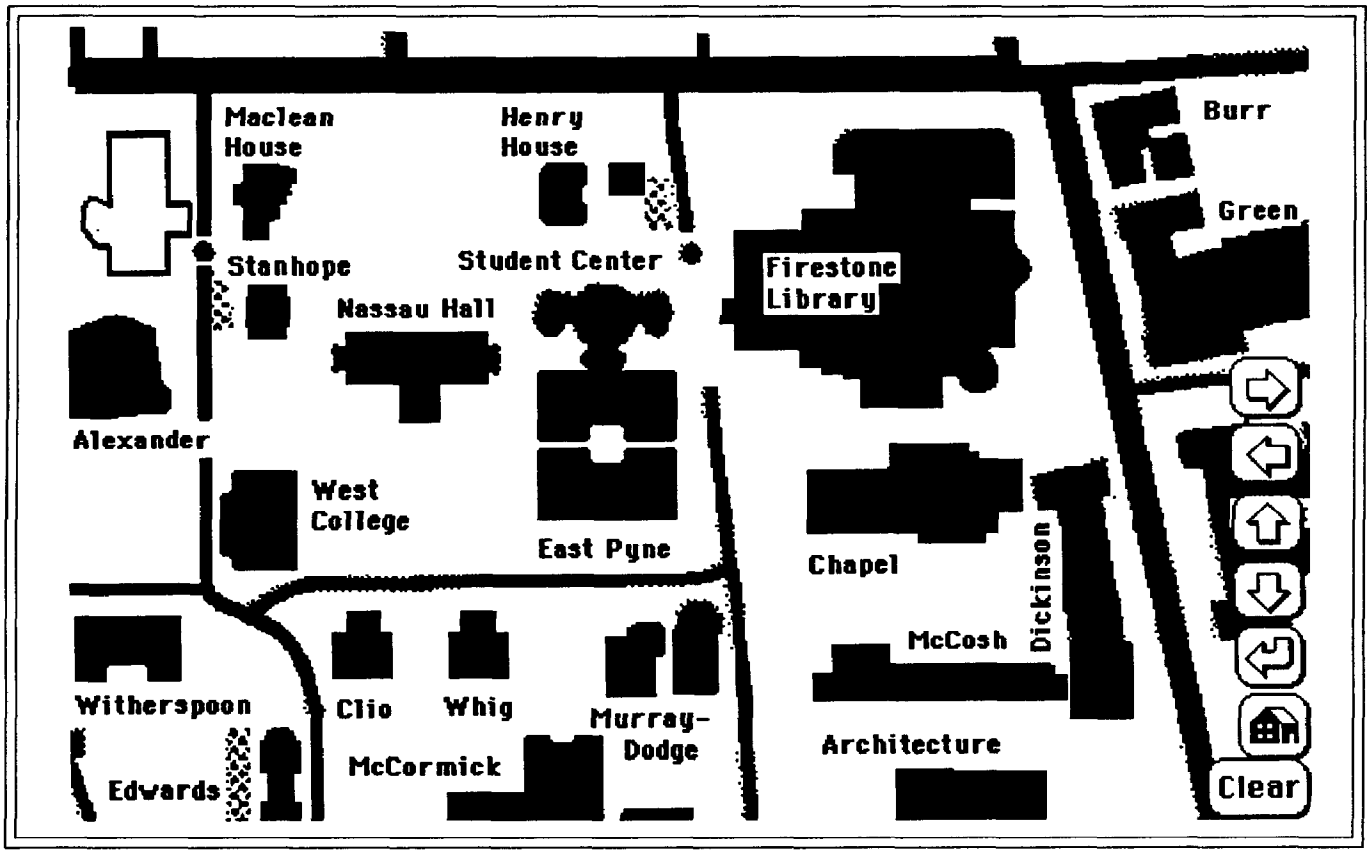

Figure 5 — The Area Near Firestone Library In PAL

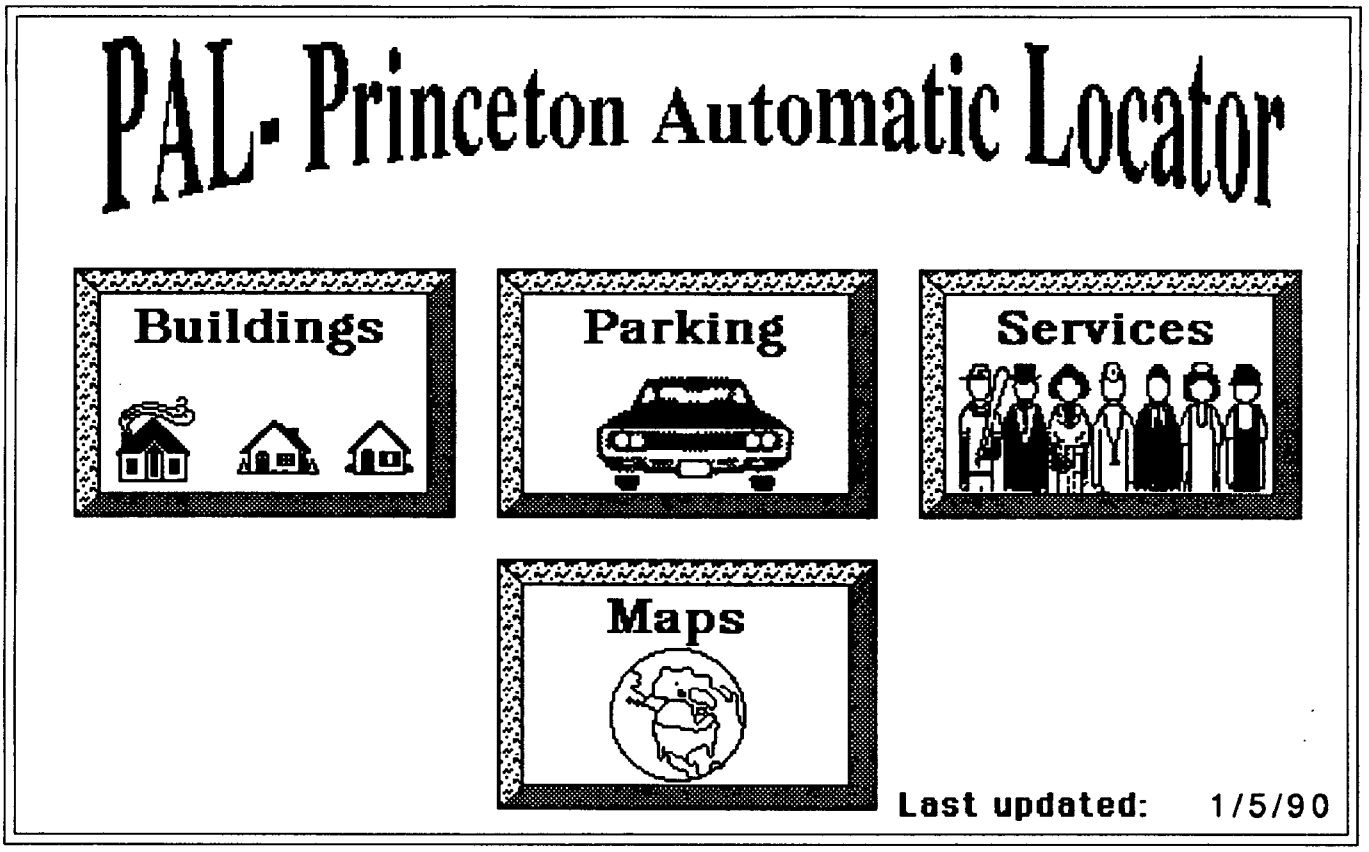

Figure 6 — The PAL Directory

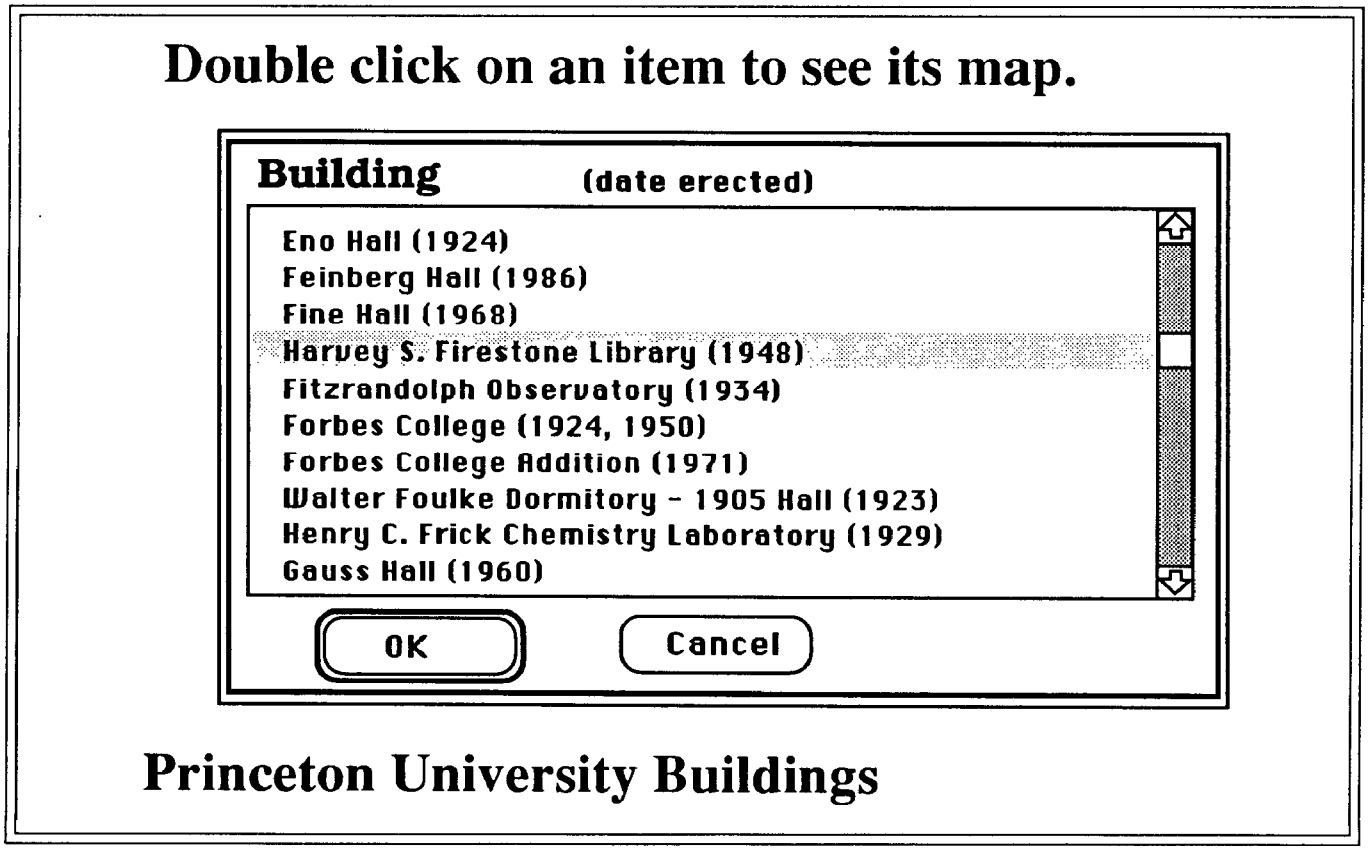

Figure 7 — The PAL Building Directory

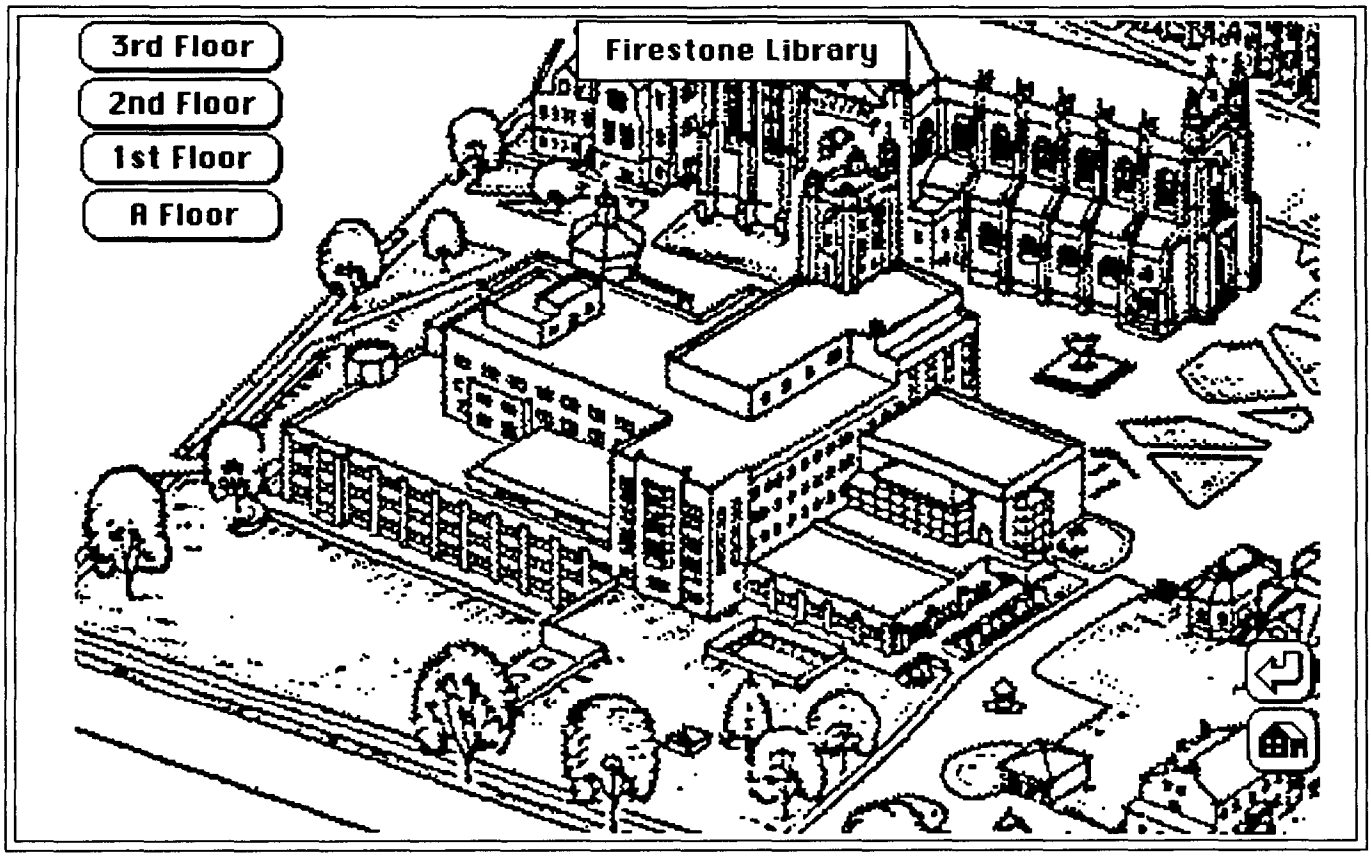

Figure 8 — A Perspective View Of the Library In PAL

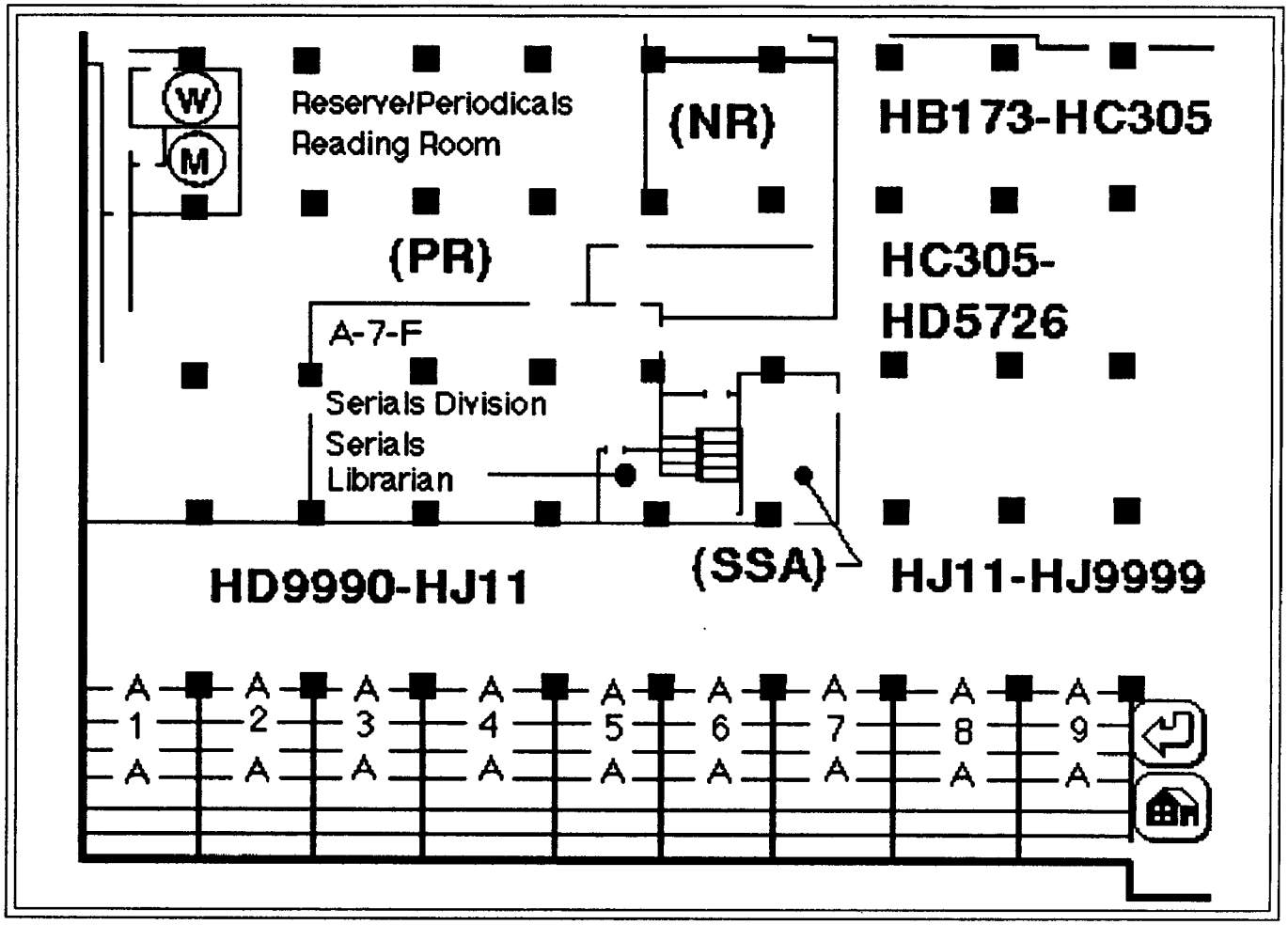

Figure 9 — A Floor Plan Of Firestone Library In PAL

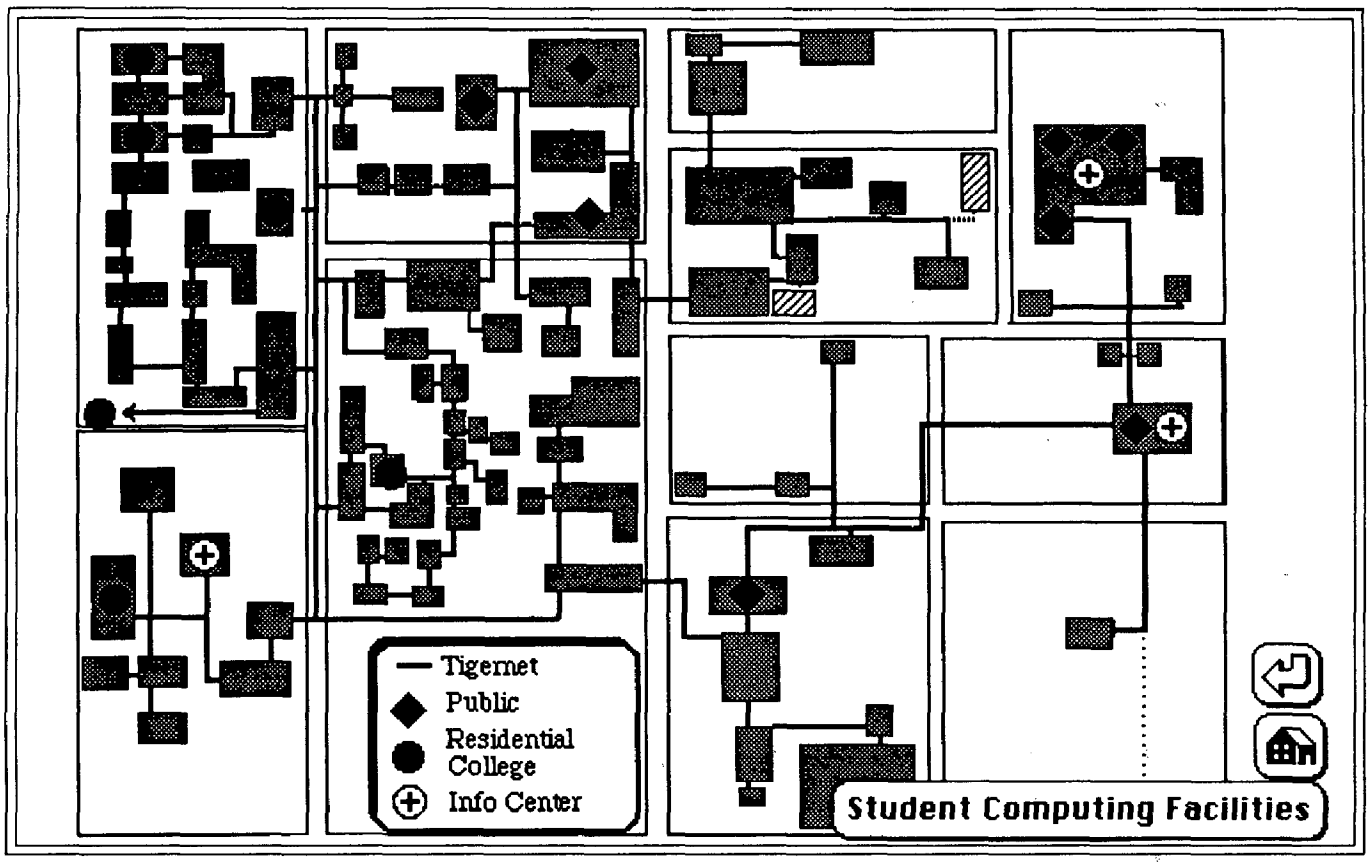

Figure 10 — Computing Facilities At Princeton In PAL

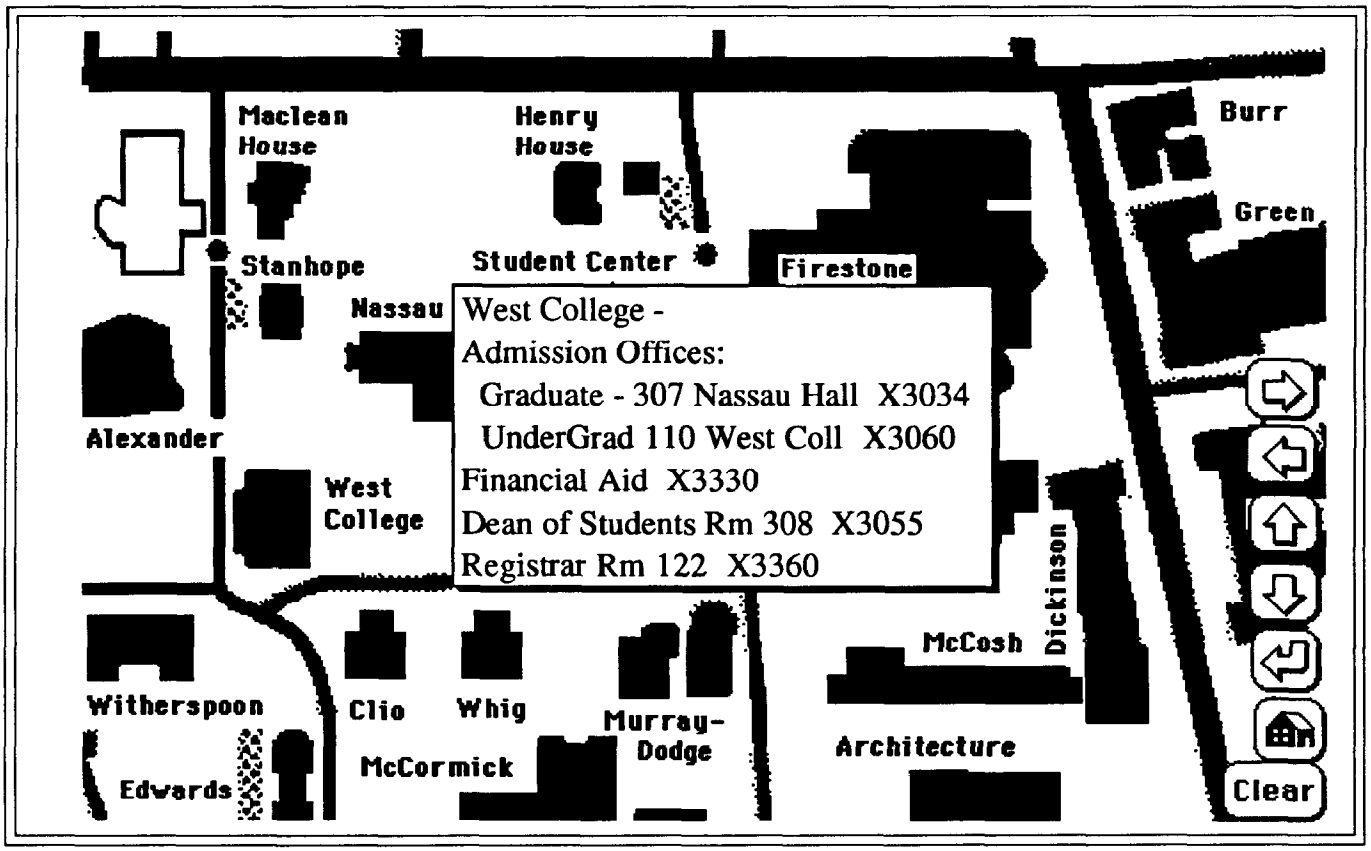

Figure 11 — An Information Window In PAL

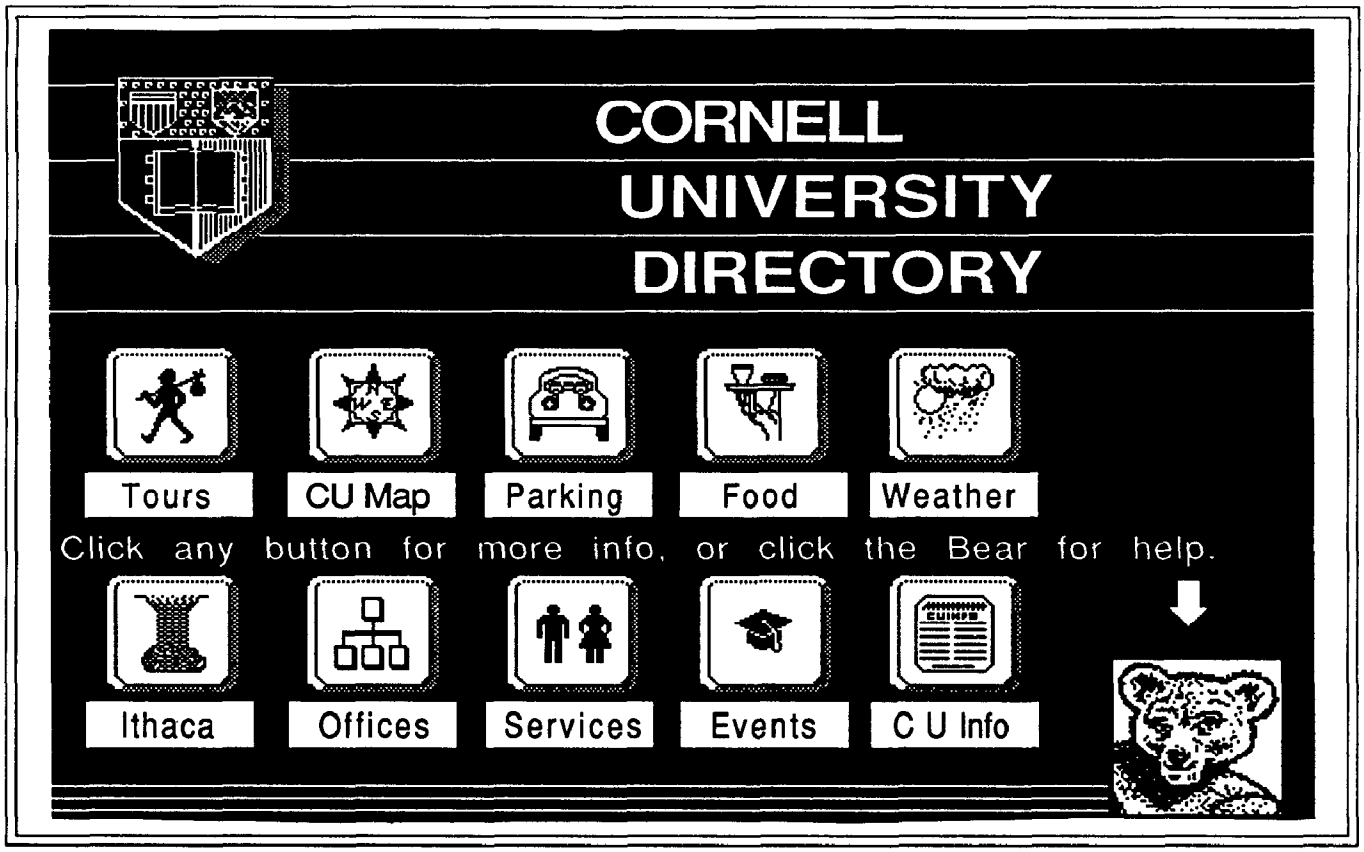

Figure 12 — A Lower Level HyperMap (CU Map) From Cornell University