INFOBazaar: Electronic Shopping and Service

Providing for the masses

by

Rupert C. Young

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Author ....

Department of Electrical Engineering and Computer Science
Jan 26th, 1995

Certified b ....

Ralph Hill, Member of Technical Staff
Bellcore
Company Supervisor

Certified b: ....

Walter Bender, Associate Director of Information Technology
MIT Media Laboratory
Thesis Supervisor

Accepted b, ...

Frederic Morganthaler, Chairman
Department Committee on Graduate Studies
Eng.

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Abstract

Electronic shopping will be a large industry within a few years. Both the interactive TV and on-line service providers are rushing to bring this application to the home. Systems that have been built so far have a number of serious flaws that will limit their success. They are designed to support only a few vendors when vigorous competition to produce innovative "virtual" store design is needed. They are meant for efficient directed shopping, while many shoppers prefer to browse. The social component of shopping has been completely ignored by these systems. To be more interesting to browse we need to include not only vendors but also information providers. This thesis will describe the INFOBazaar system designed to solve these deficiencies and others. The INFOBazaar is a free-form, ever changing collection of vendors of goods, information, and services that encourages directed shopping and browsing that introduces socializing to electronic shopping. After expressing the ideas behind this system, the results of building a prototype interface will be examined. The prototype system, despite the limitations of the development environment, successfully recreates important aspects of the functionality of the INFOBazaar.

Acknowledgments

Contents

1 Introduction

1.1 Initial Motivations

It seems inevitable that electronic home shopping will soon be an enormous industry. Already catalog shopping in the US is a sixty billion dollar industry [1]. Electronic services such as Prodigy and CompuServe have paved the way for on-line shopping by providing simple low-graphic-content shopping with some success. Although customers find the current computer based services to be very efficient and convenient in comparison to mall shopping, they rate them as less interesting [2, 3]. This limits their potential market to a small part of the retail industry. Potential successors are lining up from the on-line industry, Internet service providers, and interactive TV supporters. There is much interest in building systems, however, there has been little public discussion of the issues behind them. One goal of this thesis will be to address this deficiency by presenting the considerations behind a new system.

1.2 The Players

There are three groups pushing electronic commerce at this time, the low bandwidth on-line systems, the medium bandwidth Internet providers, and the cable companies and RBOCs[1] with their high bandwidth trials. Low bandwidth systems range from CD-ROM based catalogs such as *The Merchant* or *En Passent*, to on-line providers like eWorld, America Online, and the soon to be launched Microsoft Network.

Medium bandwidth systems are composed of Internet based systems built on top of the World Wide Web such as CommerceNet, Open Market, DigiCash, First Virtual's InfoHaus, Internet Shopping Network, and marketplaceMCI. They allow smaller vendors to offer wares but have yet to present a decent interface for searching multiple vendors, mainly because of the limitations of WWW interface design tools (there is only good support for making lists and some limited graphical layout possibilities).

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[1] Regional Bell Operating Companies (e.g. Nynex, USWest)

At the opposite end of the spectrum, we have proposed systems from Time Warner, TCI, Viacom, USWest, and others limited by choice and not by protocol or interface design tools, to a few famous vendors such as JCPenney, Macy's, Nordstrom, Spiegel's, and Saks Fifth Avenue.

Since most of these trials and systems are still press releases[2], it has been hard to truly critique these systems and their interfaces. eWorld, Apple's foray into the on-line arena, said it would provide easy access for all vendors, but examination of the shipped product showed that the user interface precludes easy access by users to more than a few publishers. Microsoft's recently announced Microsoft Network is designed to be populated by small vendors, but few details have been released. Bill Gates, the head of Microsoft, claims that today's on-line systems are not easy to use and boring and Microsoft Network will be an improvement.

Shopping is the second most important leisure activity behind TV, so a combination of both will be powerful. Recognizing this potential, combined with efforts to find interesting services to utilize spare bandwidth, a number of proposals have been reported in the media to include electronic shopping in the suite of interactive TV applications from various vendors (content providers) and bandwidth providers. All the big players from the network and CATV industries (e.g., TCI, USWest, etc.) are trying to find the right combination of "buzzword" features to put in their press releases about interactive TV and to make feasible the initial investment[3] in high bandwidth connections to the home.

Video-On-Demand, interactive games (Sega Channel), and electronic shopping are frequently toted as the "killer" applications needed to pay for this investment.[4] It has been hard to figure out how much customers are willing to pay for which offerings because of the few precedents. The Sega Channel, soon to be offered on cable systems everywhere, uses a proprietary box connected to a TV and Sega game machine to allow users to play Sega games over the cable network rather than from a game cartridge. For a flat fee, users can play many different games

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2   Only Time Warner has started and it is operating in just five houses (by Dec. 1st) a year after it was supposed to start.

3   Estimated to be $100 billion or more [1].

4   Cable and phone companies are rapidly being restricted by rate setting organizations from passing on any of the cost of upgrading their networks, to customers.

unlimited times. Because it utilizes unused bandwidth, this service can be added to any cable network without loss of channels. Considering the size of the game cartridge industry, this service should be highly successful. With larger bandwidth to the home, games could load quicker, and more interactive multi-player games could be created.

Providing Video-On-Demand service requires a "video server" to send digital video streams to users with a decoder box, or advanced set-top box, connected to their TV. There are many claims about the capabilities of these servers to handle multiple MPEG[5] video streams but few real world results. Most Video-On-Demand architectures require significant client processing power, thus there is plenty of hardware capacity in the set-top for other applications. The result is that in announced trials, visually rich graphics (e.g., 3-D landscape using texture mapping in the Time Warner trial[6]) and a small number of carefully chosen vendors [1], play an important role in electronic shopping applications.

We only see interfaces and architectures designed to support a few vendors in the announced trials for several reasons. It is much easier to find a small number of big vendors to provide substantial financing than many smaller vendors or cash poor mail-order firms interested in being part of a trial. Malls are funded similarly, with large "anchor" tenants being recruited before construction begins. Even most of the "smaller" vendors in malls are now owned by a few large umbrella companies. If anchor stores are guaranteed to have little competition and a controlled customer flow into their store, they are willing to commit to a system before it is built.

Small vendors do not have the spare cash to invest in trials, where, at least until we move from trials into large scale offerings, the costs are high and the reward is experience, not revenue. However, it is not clear that as systems move out of the trial stage, the small vendors will be allowed to join. Unless designed from the start to support many vendors, both interface design choices and architectural limitations will make it hard for many new vendors to be added. It is clear from the rapid growth of commerce on the Internet, led by small entrepreneurial firms,

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[5] MPEG is a particular compression format that is popular for encoding video.

[6] One of the first Interactive TV trials, being conducted in Orlando, Florida.

that experimentation will come from the bottom not the top. To create a viable commercial environment, I believe that the system must be designed to be open to all vendors, thus it must be made so that it is easy to shop a "mall" with many stores.

1.3   Missing functionality

Both the lack of access to a wide range of vendors and the minimal consideration of communication and social aspects are important limitations that may hamper the success and potential impact on society of any of the announced trials. These predictions are based on both the current "failure" of electronic shopping and the virtual takeover of systems such as Prodigy in the US, Minitel in France, and even the COARA system in Japan, by user-to-user communication, despite the intentions of the designers[7] [4]. For the announced systems, the only type of social activity being discussed is exemplified by the BBS-styled community center or E-mail functions in eWorld. The central theme, in interactive TV trials, is a model of user interaction where a request is made and the system dumps out data in response.

There has been scant discussion of the importance of making it "easy" to offer services or in the current political jargon, making everyone an information "giver" not just a "have". Giving access to small providers will create a far more interesting, fun, and vibrant system, not only because there will be more places to browse but also a greater number of new ideas being explored. Thus, I suggest that we should model the electronic marketplace after a "bazaar" or an "Athenian Agora" and not a mall.

Reading the "professional" retail literature it is clear that malls are viewed as a "rigidly controlled shopping environment," where placement of stores and even lesser concerns such as store front designs have to follow strict guidelines [5]. The large retailers that populate the early trials are using their influence (money) to keep the status quo [1]. However, electronic commerce will change the face of the retail industry and it is important to try to support the "best" set of potential victors, even though initially, it is today's large vendors that most systems will

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[7]   In fact, unexpectedly high E-mail usage has lost Prodigy a lot of money because of how they support it.

cater to. It is much harder to build a system that doesn't have at least a few major vendors backing it from the beginning.

A bazaar engenders images of a retail "free for all" with stores coming and going by the week and few constraints on the presentation, style, or, most interestingly, size of offerings. In a bazaar, a customer is not surprised to find a small stand offering a few dozen eggs that a local farmer had extra that day. Likewise, a small vendor in the electronic version may offer some information they have collected as a hobby. This model is very different from that of the mall, where there are cookie cutter instructions followed by the designers to control the flow and attention of the shoppers.

For electronic marketplaces, we should not limit ourselves to just the highly constrained mall design methods, because the bazaar needs to be more enjoyable to flourish. It has yet to be proved how to make them this way, so we need to breed as many new ideas and allow consumers to choose the winners and losers. Consumers deserve a more equal role in the shopping experience. We should build a bazaar, that will create a suitable environment for both big and small vendors of physical goods, the many thousands of information providers, distance learning services, electronic banking, and "chat" halls for people to talk and meet.

In studying the structure of the bazaar, starting with the above assumptions, I will try to keep several issues as the central focus — how vendors can differentiate themselves and how we will support many "stalls", how users will navigate the bazaar, and how to incorporate social features. The bazaar should be a place people enjoy using and exploring, yet still efficient for those with a directed shopping goal. We must always keep that in mind that there is a great opportunity to change society and retailing for the better.

1.3   Overview

♦ Chapter 2 — The starting point will be a critical examination of current systems and press releases related to electronic shopping and other systems that may not be related to shopping but that exhibit some of the necessary features.

- Chapter 3 — Having looked at what has been designed today, an investigation will ensue of the various parameters of a system focused on facilitating the social aspect of shopping, new paradigms of shopping and retailing, and integrating as wide a range of services as possible. In considering the individual issues, slowly a holistic vision, something called the INFOBazaar will emerge as something that could be built today or in the near future.

- Chapter 4 — This will lead into how a prototype of the INFOBazaar was created to try out some of these ideas and discover the design limitations of today's technology.

- Chapter 5 — Finally we will discuss what was learned, where we should go from here, and how we might get there.

- Appendix — We will compare, in six different areas of functionality, the various systems considered.

2 Real Systems and Press Releases

We examine various systems that have been built and others that have only been talked about in press releases. These systems are considered both to see the problems with the current state of the art and as inspiration for the system discussed in the next chapter. The systems discussed will include systems with functionality for electronic shopping and other systems not related to shopping, which contain examples of techniques that could be applied to shopping. There are many ways to organize systems for our discussion, however, we will concentrate on the amount of bandwidth each system uses, since that severely limits what can be presented and it nicely groups similar efforts. Because of this constraint, it is important to describe how the different models try to deal with limited bandwidth.

2.1 Low Bandwidth systems — Modem based services

Starting in the late 70's, modem based communication and personal computers appeared. Quickly, many dial-in services called BBS's (Bulletin Board System) appeared[8]. They recreate a public bulletin board by allowing users to leave text messages and files for others to retrieve. It is a simple metaphor that has been very successful. Descendant from the BBS are large on-line services such as CompuServe, Prodigy, and America Online (AOL). They matured as computing technology improved and modem speeds increased. By the late eighties, it was possible to add limited graphical interfaces to these services.

Services such as AOL create this graphical component by downloading art only when the user enters a new area. This means that most art ends up stored locally (cached) and not downloaded thus reducing total transfers, making limited graphics possible. Another benefit is that art can be changed, adding a dynamic aspect to the interface. However, these graphics are still mainly incidental as most parts of the interface remain text based[9]. So most of the interaction remains selecting items from a list. In response, a file may be downloaded or a window created to present some text. List based dialog windows combined with limited

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[8]   Anybody with a modem, a computer, and the right software could and did setup their own service.

[9]   In fact, many areas "open" a connection using terminal emulation (70's technology) instead of the windows based interface available elsewhere in the system.

search capabilities, make it hard to quickly browse or find things. CompuServe is so large, with so many message groups to be involved in and areas to explore, that books are printed of places to go to because it is very hard to find new places on-line. Additionally, scanning a list box is a far from interesting or fun experience. This type of interface design results in low fun ratings as described in several studies [2,3]. Although still not "fun", adding graphics did produce a more friendly look attracting a new group of users. Despite recent rapid growth, new ideas are needed to cause the large majority of computer owners that are not on-line services users to join.

A new service started in the late 80's was Prodigy. Along with the open discussion groups of other services, the designers of Prodigy chose to include a constant ticker tape for advertising as part of their graphical look. This and their actions to censor discussions[10] on their message boards offended a large number of users. There has always been a vocal group of users that are very concerned about privacy, censorship, and having broad access to services for the average individual. As with any new technology, there are still many unanswered legal and moral questions that will have to be answered soon and addressed in any design for an electronic system. The potential for an invasion of privacy and why it should be a concern is not common knowledge to the average user. The vocal minority tries to protect everyone, and must be reckoned with when designing a system because their demands can be hard to satisfy afterwards.

Soon these services began to include vendors to sell goods. The first vendors came from mail-order and phone-based retailing, because it was only an evolutionary transition for them[11]. Instead of calling 1-800-FLOWERS, the customer could place his order on-line. These vendors were already comfortable working with limited interfaces (i.e., phones), and thus less likely to try to implement something radically new. Even if they were, potential interfaces are severely limited by the transfer rates and the local storage for caching. These systems are very list and icon oriented as mentioned above.

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[10] This censorship was not just for racism or swearing but even comments about pricing of the system!

[11] Prodigy did experiment with a centralized grocery shopping service which failed. Even they admit that it was because of the centralized organization of their service.

Apple's recently introduced eWorld tried to break from the list and text based metaphor replacing it with a graphical map interface. With interfaces such as Magic Cap OS, the current trend has been to build "visual spaces", places that users can connect visual objects with "abstract" computer applications. This effort is likened to memory recall techniques that involve trying to link words or concepts to physical locations. Magic Cap OS tries to create such "natural" links — the word processor shows up as a pad of paper on a virtual desk. Unfortunately for eWorld, this map metaphor is only available at the highest level for navigation between basic services such as the building for meetings and chat groups, and the building for entertainment.

Selecting the shopping building brings the user to the same list box of vendors seen in other on-line services. In eWorld press releases, Apple described how they were going to make it easy for vendors to add stores by providing a complete Application Programming Interface (API). Unfortunately, vendors would just be part of a list of all stores offering a product type (i.e., software), without even a method to search the list. This has yet to be a problem for the few users of the system since there are only a couple of vendors in each category[12]. Decreasing user enjoyment will hamper further growth as more vendors are added. Using a map interface for all the services in each building would be a major improvement. While changing from a list of icons to a map at the highest level did not make much of an improvement for the user, it did bring Apple useful publicity. Users are not flocking to their system, which demonstrates that content is more important than a little high level glitz.[13]

eShop[14] has developed a store building technology for the Magic Cap environment that runs on certain Personal Data Assistants (PDAs). It lets vendors build attractive stores for the PersonaLink Service[15] from AT&T, proving that with some imagination and careful design, breakthroughs are possible even with very limited bandwidth[16]. Though they produced very visual store designs, there is no notion of how to move between or browse for stores. To finding things,

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[12]   For example, selecting Mac Hardware vendors brings up just two vendors (as of Aug. 1st.)

[13]   In fact, eWorld has been nicknamed "empty" world by the user community.

[14]   A small company devoted to creating electronic shopping.

[15]   A set of network facilities for wireless and other devices.

[16]   Currently limited to the 2400-Baud provided by Magic Cap devices introduced to the market.

PersonaLink lets its users run Telescript, an agent controlling scripting language for the Magic Cap OS. Unfortunately, using agents precludes the unexpected purchases often made while browsing stores at a mall. They may work well for directed shopping, which to this point has been the primary use of on-line systems.

At the high end, eShop has designed some prototype stores for Intel's cablePort technology[17]. Using their store building toolkit (complex enough that they have a team of consultants to help design stores for vendors), they created a Tower Records store. Entering this store, the user sees the racks of CDs and the TV monitors overhead playing videos as they would in a real Tower Records store. This may look attractive but it is not very interesting. Why limit the look and functionality to that of the real world? Physical reality does not transfer well to a 2D screen and adds many unnecessary constraints. Then again, seeing "reality" on an electronic shopping system might be more comfortable to novice users.

The social component is another important aspect of "mall" shopping lost in today's systems. Part of the problem lies in opinions such as that expressed by industry consultant R. Macdonald in [2], that people go to real malls for social involvement, while electronic shopping will focus on what it does best — directed shopping. He sees no role for socializing on-line. This reasoning is very dangerous, because there are many reasons for and few against trying to incorporate functionality that electronic shopping is not superior for. While the communication functions of today's on-line systems have improved, they are still treated as a separate operation.

There is no evidence that there are other people on-line unless the user stays in a "chat" room. This is not only a transaction processing capacity and bandwidth problem, but also a metaphor limitation. It turns out that the social aspects of these systems have become quite important. Many services have unexpectedly become mostly or even purely social, such as the widely used The Well[18] and systems in Japan and France [4]. Over the years, there has been a switch from purely the message board style of BBS's to "real" time chat rooms. As an added attraction, on-line services bring in celebrities to answer questions, in real time,

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[17]   Allows cable lines to act as high bandwidth network connections for computers in the home.

[18]   Previously limited to just the California Bay Area but recently made available on the Internet (telnet well.com).

from users of the system. It is a small step to add this communication facility to an electronic "store" yet that leap has yet to be fully taken. EasySabre, the on-line reservation system from American Airlines, does let members send messages to its support staff with questions about the service but it is poorly integrated, requiring the user to enter their ID and password before sending a message.

One interesting on-line service is the Sierra ImagiNation Network, an interactive gaming and communication "hangout". Because this was designed purely to be entertaining, it is an important example of some ideas for making on-line services more enjoyable to use. The top level of the interface is a cartoon world, similar to eWorld. Each building contains services such as the chat hall, gaming parlor, etc. Users design their own on-screen persona very much like the MUD (Multi-User Domain) and MOO (Mud Object Oriented) worlds built on the Internet, described in the next section. This is very valuable in producing in the users a "warm fuzzy feeling" of personal involvement. The lack of this feeling is a major reason why electronic shopping is seen as useful, because it is more efficient, but not as an important tool for conducting our daily business or as a way to spend our spare time using.

Electronic Shopping is still too prosaic and difficult to use for the average person to enjoy using[19]. Unless they enjoy it, it is not likely to become a large component of the retailing industry [6]. Today, the key interfaces are no more than glorified lists — technology from the days of ASCII terminals. However, as modem speeds increase, services such as America Online start providing direct Internet conductivity, and Intel's cablePort service becomes widely available, the complexity of the interface will improve, becoming more "natural" and visually focused in its design. Because the competition is fierce, the functionality of these services will rapidly improve. With new heavyweights such as Microsoft joining the market, this group of competitors has a strong start in the race to bring electronic services and commerce to the average person.

2.2   Low to medium Bandwidth Systems — The Internet

While modem based services were growing to several million users, the government sponsored Internet was expanding as well. At first it connected just

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[19]   Only 11% of users described today's systems as fun to shop with.

scientists at a few labs, but with exponential growth over the last decade, there are now millions of users[20] around the world. While there had been previous attempts[21] to provide ways to move around the Internet, the World Wide Web (WWW) is the first user friendly application. Within months of its introduction, there were hundreds of WWW servers appearing and shortly thereafter the popular press pounced on the story. Now everyone seems to be creating a presence on the WWW, from large companies such as NorthWest Airlines, MCI, HP, and Pizza Hut (who uses it in a trial to sell pizza on-line in Silicon Valley), to hundreds of smaller vendors who see this as a new and relatively easy way to find customers.

The WWW and its formatting language HTML[22], allows authors to include graphics, images, movies, sound, and hypertext links in a text document. The forms of interaction are still very limited and the formatting capabilities of HTML are fairly constraining, however, amazing new uses of it appear every day. Even though it is possible to include multimedia in documents using HTML, it is not optimized for anything except text presentation. In the Internet community, HTML and the WWW have great momentum behind them, almost to the point of exclusion of other ideas. Even Prodigy, one of the top modem based services recently announced that their new Windows based interface will be composed of HTML documents to better integrate it with Internet-based offerings.

The decentralized nature of the WWW allows a flourishing of unrestrained entrepreneurial spirit, quickly pushing the envelope. Although good for the fermentation of new ideas, the unstructured nature of the WWW is a major drawback. It makes finding an item hard for the user who does not know what he is looking for. There are Web crawlers that scan the web collecting titles. The user can then search through the resulting list in different, and for the most part confusing, ways.

More stores and services appear every day on the WWW. It is hard to find these offerings, requiring users to start by reading announcements on the "What's New in Commercial Servers."[23] Searching this list is a start, but not an efficient method.

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[20] How many is unknown but estimates range from several to 30 million users.

[21] Archie (ftp site searching tool) and Gopher are some of the more recent technologies.

[22] HyperText Markup Language, SMGL based language chosen for authoring WWW documents.

[23] http://www.directory.net/

A number of virtual malls are now available to create a central location and give a consistent front end to all their stores. Net-Mart[24] uses an overhead map with a number of product categories that the user can choose from. Searching within a category, like on eWorld, is not yet a problem because there are only a few stores.

Because of the recent purchase of the Internet Shopping Network (ISN)[25] by the Home Shopping Network (HSN), it has the most clout behind it and can already claim 600 stores as occupants. Although ISN includes some graphics and advanced search capabilities, the main activity remains, when shopping with it, looking through many lists until the right product is found. Another problem, which will improve with higher bandwidths and a more powerful server, is that the service is very slow. This is not fun to use, and there are even no product demos to spruce it up. Besides the interface limitations of Net-Mart and ISN, a major fault in both of these systems is the lack of security behind transactions. This makes them no more than glorified mail-order catalogs.

If the user manages to find a suitable vendor, there is no security or privacy for transactions[26]. Seeing this crippling fault, several groups have introduced systems in the last few months of 1994, trying to bring secure electronic commerce to the Internet. It is also being addressed by industry collaborations such as CommerceNet[27] and W3O, however it may be some time until each chooses a protocol and even then there are likely to be competing standards.

While we wait, several interim solutions have been announced for secure transactions. These solutions are being sold to users not by the technical details of the security protocol but rather the retail interface layered on top. Although one will be able to convert easily to the final security protocols chosen by W3O or CommerceNet, none may be able to compete with soon to be introduced retail interfaces such as marketplaceMCI based on Netscape's Commerce Server[28]. Despite the claims of First Virtual discussed in the next section, the payment model

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24   http://netmart.com/

25   http://www.internet.net/

26   There is no encryption and no way to detect if an unauthorized user has read the information on its way.

27   http://www.commerce.net/

28   Netscape is a member of W3O, so they may convince that organization to use their standard.

is mostly transparent to users. It is the shopping interface that will be the deciding factor among users.

Each effort takes a radically different approach to the facilitation of electronic commerce. First Virtual's Infohaus[29] is based on the assumption that there will be many incompatible security measures and they will be unnatural and confusing to users. After the customer has provided their credit card information over the phone, in First Virtual's approach, all subsequent transactions are based on an E-mail "challenge."[30] The user orders an item by picking it from a list. The payment system is notified that the item was downloaded and asks by sending E-mail if the customer is willing to pay. If the customer replies with E-mail saying he does not want the product or that it is a fraudulent[31] request for payment then there is no payment.

This payment system is based on the idea of shareware, something most vendors are not going to be attracted by, since the only obligation on user to pay is a moral one. It is also unlikely any vendor will send out "physical" goods without payment. So the most likely vendors for this system are small scale information providers. Stores in the Infohaus are listed alphabetically on their server. The only store building technology is standard HTML. No good browsing, store building technology, or vendor services have been included — their focus is the payment system.

The DigiCash[32] effort also uses HTML documents for store design. In this system, the fundamental idea is that the user buys untraceable electronic cash securely from a bank and then uses it with any DigiCash accepting store. This requires only one secure transmission to purchase DigiCash and then all subsequent transactions with stores can be public. It has been commonly suggested that electronic cash will soon be quite common, which seems likely considering the fast growth of credit cards, Automated Teller Machine (ATM) cards, and debit cards. It is not much of a switch from these cards to using electronic cash. The main difference is the privacy that electronic cash affords, a major concern to some users. Like paper

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[29]   http://www.fv.com/infohaus.html/

[30]   They assume E-mail addresses are secure enough for users to send acknowledges with.

[31]   Someone ordered something in the users name but the user did not receive the product.

[32]   http://www.digicash.com/ecash/shops.html/

money, it is untraceable, since no one can tell whom it came from. On the Internet today, it is easy to collect information about users so anonymous transactions may become very popular.

The most interesting current effort is the Open Market system[33], recently purchased by CUC International. They use a number of different transaction protection methods from challenge based[34] to PGP[35]. Unlike other systems, they have thought carefully about services for the vendor and not just the payment plan. With a StoreBuilder kit to help vendors build consistent stores quickly and a number of very useful services such as usage and traffic reports, document fingerprinting, pay-per-page packaging, and even subscriptions, they have provided some of the services required to run an on-line company. For users, they plan to offer personalized information and agent technology to help in searches. Despite their efforts, the StoreBuilder kit is still no better than fitting a square peg in a round hole — it is possible to build a limited multimedia interface but only with much effort.

CommerceNet and Commerce Servers from Netscape Communications Incorporated may make such efforts as First Virtual obsolete because of the power of the backers and the widespread usage of their software. The Commerce Server will allow secure credit card authorizations over the Internet. The main problem then will be finding the stores that use the technology. If it is integrated into something as broad as CommerceNet or Open Market, this problem will disappear. In fact, MCI[36] has recently signed up to use this technology in their marketplaceMCI service. Since MCI, with their soon to be introduced internetMCI, plans to become the largest Internet provider, this may become the central site to find stores.

Still, the problems of WWW will remain — the difficulty of finding things not at the user's local site, the fact that the more graphics added to a page the more things break (server protocol scales poorly as more data is handled), the limited

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[33]   http://www.openmarket.com/

[34]   The creditor challenges the user by asking him to supply a piece of information they agreed on as being private knowledge between the two parties.

[35]   Pretty Good Privacy, generates keys so encrypted messages can be sent between two parties.

[36]   Currently the number two long distance carrier in the US.

control the author has over how his page will be displayed (HTML limitations), limited interaction modes (e.g., with HTML, the server cannot tell what the user has his mouse over), and finally the lack of any social interaction. The user can open up his own communication channels, however that is not the same as integrated support.

HyperText Transport Protocol (HTTP)[37], does not scale very well especially when the requests are for the large chucks of information used in a multimedia document. Efforts are underway to try to distribute the load over several machines, load balancing, while presenting a single "virtual" server to the user. Another problem is the limited and variable amount of bandwidth available for the transportation of information. The protocol does not fail gracefully (unacceptable in the consumer marketplace) and does not yet allow the amount of information sent to be scaled to fit the available bandwidth as in MPEG II[38].

When the information is received by the user, he can decide to change the fonts used to display text and the size of the view window. As a result, the author cannot know when creating the document how much screen space he can use. For example, The Rocky Mountain Mall[39] uses a technique where all the information is in a single document but there are hypertext links at the end of a "screen's" worth of information to move around the document without using the scrollbar. Given the large variation in screen sizes on Mac's, PC's, and UNIX workstations, the user is unlikely to have the right size window, which then leads to great frustration for her as nothing lines up.

On the other end of the spectrum from Internet commerce efforts are MOO's and MUD's, virtual worlds designed for people to socialize and explore (browse), activities that are crucial to the future success of electronic shopping. Because of the lack of bandwidth, they had been limited to textual descriptions until recently. MOO's are based on an object oriented language that allows users of the system to build virtual spaces and objects that they control in these worlds.

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[37]   HTTP is the native protocol of the WWW, although most browsers can connect to ftp , Gopher, and others.

[38]   MPEG II, is a flexible video coding for variable bandwidth.

[39]   http://www.hardiman.com/malls/mcm/

There have been a number of horror stories about how MOO's and MUD's have taken over some individuals' lives [4], however, this only proves how powerful making on-line services "personal" can be. One WWW example of this type of virtual world is WebWorld[40]. It is a fully graphical world with a limited number of building blocks that allow individuals to build towns and buildings. In a building, a user can place links to other WWW pages. Although very powerful in its presentation, it shows how badly a WWW host serves a very graphical presentation to a large number of users by the number of failed request messages received during a short session. This quality of service is unacceptable for the general public.

2.3 Interactive TV trials

The final set of solutions comes from the entertainment, cable, and telephone industries. In contrast to Internet efforts mainly produced by software writers, this is a collaboration of hardware, content, and bandwidth providers telling the software engineers what they should do. Their plan is to provide large bandwidths to a set-top box[41] and the customer's TV. Since this bandwidth to the home does not exist yet outside of trials, there are some interesting initial applications based on CD-ROM to discuss. CD-ROM content, except for less reliance on video, is essentially the same as what they would use for interactive TV.

Apple produces a CD-ROM, *En Passent*, sent out quarterly, that is a collection of high-brow mail-order catalogs with an interactive front end. *The Merchant* from Magellan Systems is a similar product that claims, "Shop in a Virtual Mall where your feet never get tired." Although full of videos and pictures of merchandise, there are very few products making it frustrating to browse or even buy specific items. There is no network behind these systems so they depend on phone, fax, or paper mail for ordering.

Interaxx Television Network, being tested in Florida, is a combination of CD-ROM and cable network system. The interactive component is over a low-bandwidth connection[42] with all the images stored locally on CD-ROM.

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40   http://sailfish.peregrine.com/wb/ww/

41   Becoming more and more a computer every day, yet they display on a TV despite its resolution limitations.

42   The system running over a standard cable system and thus has a very small "upstream" capacity.

Although this is a big step, the problem with CD-ROM is that it takes time to produce and ship to the user so the data is fixed and stale before it even leaves the pressing plant. On the other hand, an interactive backbone means it is possible to find out current pricing and product availability without resorting to phone based services.

To finance bringing fiber to the home, bandwidth suppliers want to provide all sorts of "interesting and exciting" applications, including Video-On-Demand, interactive gaming, news, on-line banking, and electronic shopping, among other applications. AT&T's study showed that the most important success criterion was constant action and impressive visuals, not application functionality [7]. On-line systems need work in this respect. It has been shown that users of electronic shopping services feel that they are more efficient, although boring to use [2,3].

There are several important characteristics of shoppers which are only partially being addressed by these interactive TV systems. A third of shoppers say that price is their most important consideration and while 60% shop around before purchasing [6]. So a third to two-thirds of the potential customers will be not be happy with these systems given these statistics. A majority of users say they like a great deal of information before they make purchases [6]. The lack of informed sales people is one of the major complaints that shoppers have with today's retail environment [6]. Because of the limited resolution of TV, and no option to communicate with salespeople, interactive TV shopping applications are unlikely to satisfy this desire of customers for more information although Time Warner is giving a color printer to every user in their trial to try to satisfy this need.

Announced trials, from the sketchy details of press releases, present a small number of famous name vendors with as visuals as fancy as the technology allows to try to meet AT&T's requirements [13]. Considering that no one knows how to build a successful store right now, the vendors want as much protection from competitors as possible. A large vendor has much money invested so they want no competition in the system. Electronic shopping makes comparison shopping potentially trivial, which is dangerous to these big vendors not known for low prices. This is an issue I will discuss at great length when I debate design choices. The easiest solution is to lock out competitors.

Software for these trials is proving to be the hardest challenge [15], not the unavailability of hardware, as the delays of the Time Warner trial in Orlando exemplify. All the major players are lining up to collaborate in trials, starting early in 1995 and picking up dramatically as the number of users is increased and new solutions from hardware and software vendors appear, at least that is the current hype. Many new ideas need to be tried, however the expense of running a trial and the closed nature of the systems means very few players will be involved. Time Warner will not allow comparison shopping on their system, because their merchants fear it might transform their wares into commodities [1]. Just as commerce on the WWW has vastly improved because of the many potential players, this openness is needed in the interactive TV trials.

Today's designs are being created by the same people that create TV ads and store layouts. Solutions suggested by this group have so far tried to mimic reality. Because it is easiest and requires the least thought, the little detail discussed so far (ads for Time Warner's system and USWest's US Avenue) shows that the systems being talked about will look like the user is walking alone through the real store, except it will be a virtual store. It will be a store recognizable to the user because the vendors chosen should have high familiarity with potential customers. They want to create a "cybernetic theme park that keeps things controllable by limiting consumer choice." [1] There is no need to virtualize reality to this extreme and it does not make sense to do so.

The power of the interactive TV technology is the increased choice it could allow, new more efficient and informative presentations it could deliver, and better matching of customer to vendor it could enable. There are many smaller niche markets that would benefit greatly from the improved ability to find potential customers. Having a small number of vendors only recreates today's most limited shopping experience — the mall. To capture more than a small share of the market, electronic commerce must bring a revolution in the ease and enjoyment of the shopping experience. This is something not yet understood by any of the proponents of announced interactive TV trials. Just as USWest's first Video-On-Demand trial was a failure, because it brought limited benefit to users and was not as fun or socially engaging as going to the video store, the first set of electronic shopping trials could fail for the same reasons. However, with the

increasing strength of catalog shopping and home shopping channels, there is a decent market for these trials as they have been designed.

2.4   The state of the art

Hopefully, it is clear that although solutions are being created, there seems to be little work considering the design of a shopping system and its role in an on-line world from the ground up. It is just being tacked on top of different transport models. Each model has its own strengths and weaknesses. The purpose of the this thesis is to discuss the issues more from what is needed to make this successful and have as great a positive impact on society as possible, than how to best fit a system on a transport network we already have to try to take advantage of a latent market. Fundamentally, we desire the vitality of the WWW but the infrastructure of the interactive TV trials and the hard-core user base of the on-line systems. There are many difficult issues to be discussed and if they have been carefully considered, it has not been public knowledge because of the proprietary nature of the systems involved. To help guide practice, we need well thought out theory and a prototype.

3 Design issues

Having exposed weaknesses in current efforts, we suggest ideas to solve these deficiencies. Some ideas may be unconventional, however that is required at this early stage in the development of electronic shopping. First, we consider why we are building this system and which customers we are trying to attract. Then we consider how marketplaces work today and what types of vendors we hope to attract to the INFOBazaar. This is followed by a discussion of the INFOBazaar's specific look and how users might move around it. Stores are the next topic with an examination of how they should be built, how users will connect to them, and what they will see. Finally, we consider how people might shop by considering browsing versus directed shopping and several usage scenarios.

3.1 Goals of the INFOBazaar

The overriding goal is to make a system with the maximal positive impact on society while creating a profit for the providers of the service. By being widely used, the system should achieve this goal. The system must be fun yet efficient for customers to use. Efficiency in shopping, is measured by how quickly someone can locate a store with the required merchandise and purchase the item. The system must be broad and open like the WWW yet, at least appear to users to be centralized. It should have strong socializing features yet, it should protect privacy. It must attract today's vendors by protecting their interests yet, users should have more control and new modalities of retailing must be allowed to flourish. It should allow small providers to enter the system while not scaring away large vendors. Simply put, it should try to balance the needs and goals of consumers, small vendors, and large vendors. In examining each issue, we will try to better understand what tradeoffs are necessary and where seemingly opposing needs can be simultaneously satisfiable.   To find suitable examples of potential approaches, we will borrow ideas from such diverse areas as entertainment products and mall designs.

As we consider different aspects of shopping, a vision of a system called INFOBazaar will emerge. Fundamentally, the INFOBazaar is like a traditional bazaar in that most vendors are small and may come and go with every visit by consumers. It is a place that is constantly changing at the edges, so that browsing

is interesting yet, it is more stable at the core where users are more likely to find the larger vendors because of higher volume of potential consumers that pass through. So the INFOBazaar also combines aspects of what would conventionally be considered a mall.

3.2   The target audience — the customers

In building any large system, one must first consider the users of the system while not losing sight of the needs of the clients, or "vendors" in this case. First are the traditional users, people that have been using on-line services, mostly upper-middle-class white males [2,3], and the college students and scientists that grew up on the Internet. In recent years, the size of the "communities" using these systems have increased rapidly. Despite this growth, they still are a small distinct minority of the population, numbering only in the few millions. Regardless of the level of interest of these users, it will be insufficient in generating enough revenue to make any large scale interactive TV service a success. We need to further expand the user community.

A natural user community to target are the customers of mail-order firms and TV based home shopping. These industries have become multi-billion dollar earners, still small in comparison to the overall retail industry, but significant. They are growing rapidly, however, they tend to be restricted to the sale of certain items such as clothing, jewelry, and electronic equipment. There are important reasons why these new forms of retailing have been so successful.

TV based home shopping is strong because it is based on TV. The average American already watches about four hours of TV a day, so users are comfortable with the presentation of products on TV. Presentations of products are both informative and entertaining, this is a very successful combination. The main drawback today is the limited number of products that can be viewed in a given programming slot because of the broadcast distribution. Sales presentations cannot be customized to individuals.

TV based home shopping also brings a social aspect to watching TV an important innovation, as exemplified by one interesting group of shoppers from Home Shopping Channel (HSC) and other TV based home shopping, the elderly. It is

hard for many of them to reach the store and they are often lonely, so home shopping channels have become a social outlet for some of them. Instead of calling phone operators, the lonely can call sales people, who are paid to be friendly. Electronic shopping has been very impersonal, this example makes clear the potential, if a social component could be incorporated. We will discuss this possibility in detail in a later section.

Catalog shopping is a great success, despite the inability to feel and touch the products in person. Its advantages are that it is more efficient, lower pressure (customers look at catalogs in the privacy of their own home with no salesperson hovering over them), generally cheaper, and simpler to locate hard to find items (if the customer is placed on the right mailing lists). Also there is likely to be more information available in a catalog ad than from trying to ask a sales clerk. The difficulty in getting product information while in a store, is a major complaint of mall shoppers [6]. These advantages of catalog shopping map directly to the abilities of electronic shopping.

A critical problem for catalog shopping, that could be addressed by being available on-line, is that it is a very directed business. Potential catalog recipients are carefully culled from various lists by their "supposed" interests. Despite the best efforts of the marketers, copious amounts of what people consider "junk" mail are still delivered. Customers are forced to filter what comes to them rather than actively searching for vendors they are interested in. Despite this, the industry succeeds because the vendor only needs a small hit rate when the potential market is part of an estimated 100 million catalog shoppers and not just customers within driving distance [8]. Consumers can find vendor's whose product lines are very focused because of the size of the customer pool the vendors can draw from. Being on-line, with suitable searching capabilities, would create vast new markets for these vendors, since the cost of finding potential customers is their biggest problem. Not having to produce as many excess catalogs would be a major boon to this industry and the environment.

There are almost as many styles of shopping as there are people. Some people love to shop while others hate it, wishing that it were as fast as possible. This latter group would prefer to leave choices to intelligent agents, whether human or computer to avoid shopping. Some browse until they get the best price, going

miles out of their way to save a small amount, while others always shop at one place for its atmosphere and or level of service almost independent of price. Others go to stores to see and be seen, and a substantial group use shopping together as a bonding experience.

Certain "visionaries" claim that given access to personal agents people will no longer need or want to browse. A problem with using agents to search is that it is very hard to quantify service and quality and not everything can be treated as a commodity item. Because the agent queries vendors looking for a price, comparison shopping becomes likely. This conflicts with the fact that most consumers do not use price as their key choice when making a purchase [3]. To provide other information to agents beside price, we could imagine a rating service where customers could rate a store or product after buying something. Extreme opinions dominate because of low response rates. Although hard for an agent to handle, a user understands these problems and can adjust for them.

These varied needs of buyers and the resulting stores that cater to them must be supported in the on-line environment. Store presentation style should be designed around a set of customers, not constrained by the user interface in the application. This is a lofty goal. It is clear that certain aspects of the shopping experience become easier on-line, like comparison shopping and finding a vendor with the required item, while others, such as a store recreating its atmosphere and level of service, become harder.

An important consideration is that most of these styles are today not supported by the on-line environment. The customers with these unsupported styles are mostly computer illiterate as well, although this is rapidly changing. Current marketing trends also make it harder to design a system with broad market appeal. Advertising in the computer game age has become very visually complex — many quick camera cuts, the "MTV style," as attention spans decrease. This has set a very high standard for video and images in the minds of the general population.

A small group of users will always put up with a new technology as it evolves, either because the functionality is important to them, or because they treat technology as a "toy", always wanting to stay on the leading edge. However, it is the technophobic customers and those unlikely to change how they do things

unless they see great advantage in doing so, that are the hardest to attract and yet critical to the broad success of electronic services. We could say why bother, why not just build a system for the smaller, computer literate population, but solutions for them already exist and I feel that with a small amount of additional effort, we can build a system for a larger audience. Should we really give in and let the producers of the home shopping channels be accurate in their claim that "consumers will respond best to the regularly scheduled half-hour shows" on these channels because it is already part of common psyche [14].

3.3 Adding service providers

Many potential on-line applications are not directly related to shopping for products. These could include distance learning, electronic banking, and various information sources. These alone could provide significant revenue for the system. By including information services we can not only attract additional users because of these offerings, but also because it will result in a broader and a more varied environment in which to browse and explore.

Distance learning has the potential to be a huge and lucrative industry considering the success of paper and video-based correspondence classes. Having a high bandwidth connection would allow a video link between a teacher at a single location and students at many remote locations, thus bringing scarce resources to a larger audience. In this rapidly changing age where employees are expected to continually learn, distance learning will ease the burden on the few experts in new technologies, spreading new information swifter than is possible today. Presentations could be stored and watched when convenient to people's busy schedules and disparate locations. This is a rapidly evolving industry that should be a clear winner for an integrated on-line service.

Electronic banking will also be widespread and successful, if it can be made "appliance-like". Banks always have such limited hours and having to go in person to fill out a form to transfer money from one account to another is inefficient. We only have to look at the success of automated teller machines (ATMs) to see the size of the latent market. It is not a great leap to bring this functionality to a home computer application or even add the full functionality of a bank. Unfortunately, it is not possible to make deposits or withdrawals of physical cash at home, however,

it will only be a small step to fully convert to digital currency for most transactions. Even without cash the user can still pay bills or make investments by transferring electronic currency. Every day, we see new services to remove the actual passing of physical currency in daily transactions.

Information services are another large latent industry and one especially critical to the INFOBazaar. Already popular are such services as weather, movie, and stock information that can be presented fairly efficiently even by phone based Interactive Voice Response (IVR) systems or on dedicated TV channels. Because of the broad market appeal of these offerings, they are likely to be offered under the umbrella of a few large general information suppliers. However, broad interest information services are only a small part of a new major industry. A network connection between a user and a database or server facilitates a whole range of new types of services.

The simplest would be small information repackagers, that make a user's job easier by collecting and sifting information. A second group would be services that provide information as experts, so that we can learn more about something. This second group is tightly bound to services that will offer advice and other agent-like capabilities. Also exciting would be the ability to test software and hardware remotely. To better support these offerings we need to more carefully consider the issues behind them.

Exciting in its potential impact and growth is the market for small niche filling information providers. They mainly provide information a user could collect and produce himself if he had the time and money. These small vendors add value by doing the leg-work. Some will be probably be research companies like those already appearing today on the Internet[43]. For example, one of these services sells a list of all the ad agencies with an Internet connection. There is probably a small market for this information but at the same time it is easy to collect, so the main cost and concern is distribution.

Other directed information sources will include picture and document archives, already popular on on-line services. The picture archive is an interesting example because it brings to the fore a serious problem that results from the inclusion of

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[43] For example, the Internet Info company available on First Virtual's InfoHaus

these services. Picture archives are particularly problematic, because of the likelihood that their images are scanned-in versions of copyrighted material and thus cannot rightfully be offered on-line. How to protect information in a digital world is a very hot topic, but we are far from any consensus. One of the most obvious solutions is to control the activities of the "stalls" in the INFOBazaar. This is not a simple task, and thus used as a reason to limit the number of stores. Why should an electronic mall be treated any differently than policing a traditional "marketplace", where police do the best they can by attacking the most flagrant violators? How serious a consideration policing will be for mall designers depends on where the courts fall on the issue of whether an electronic mall is like a publisher and thus responsible for any offerings of its tenants, or more like a phone network, which is considered a common carrier to all traffic no matter what its content may be.

Another large potential market is the selling of expertise. The best existing examples of this type of information are the hundreds if not thousands of FAQ's[44] available for free from their authors over the Internet. If it were possible for the creators of these documents to receive a small remuneration for their efforts everyone would be better off. More time could be spent collecting and improving the information. Today, it is treated as a hobby to be an expert in most of these fields, but there is no reason why people should not be able to make it their livelihood to collect information, repackage it, and offer advise about it. We expect this information to be offered for a small fee.

The main problem with supporting cheap information transmission is the minimum handling charge involved in doing electronic commerce. For example, in the InfoHaus, vendors pay twenty-nine cents on every transaction to the system. Many things are probably not worth that much to the average person. "How much will the average consumer be willing to pay for information?", is a serious question that needs to be studied.

A number of the information services will offer recommendation and agent-like services. Customers might ask, "What movie would I like to see given my previous opinions? What car would best fulfill my needs? Where should I buy my next camera?" Or the request may be, "I need a new suit, please buy it for me."

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[44]   Frequently Asked Questions — which include basic ideas and answers for "newbies", or new users.

Results of asking 500 shoppers show that about eleven percent are very willing to pay more for an item if they receive the item quicker and with less effort [6]. Again this result shows that customers have many different ways of shopping and there is a place for vendors that serve all these specific needs.

In making these requests, the consumer has chosen to rely on the greater experience of others to make a suitable decision for him because he does not have the time to make an informed choice. Today, he may read magazines for reviews. A recent study has shown that for a large part of the shopping public, having much information before making a decision is very important to them [6]. It has been suggested that, "People will continue to shop in stores but may first educate themselves about products through home shopping." [14] Given the right system, it makes sense to sell reviews and comparison tests separately as well as lowest cost vendor information.

The ability to test software running remotely on a server is very exciting. Shareware software has become a successful industry[45]. If it were possible to remotely test before purchasing a piece of software, there would be no uninstall process and the customer is more likely to pay the producer on the spot, where before they may not have bothered. The success of CD-ROM's, such as SoftBank, that let customers sample hundreds of applications before buying them, proves the concept. The ability to test software over the network has been demonstrated by Carnegie Mellon University for its Andrew suite of applications. Going the other way, DEC lets users run their applications on its machines remotely, allowing the user to test the hardware before deciding to buy an expensive workstation.

For users of these services today, the costs are often quite high both monetarily and in time spent trying to find the appropriate information provider. Because of the small market for most information and the difficulty in collecting and transmitting it, information providers often charge prices only institutions could afford. If we could provide easy mechanisms for users to find the information and for providers to efficiently supply it to them, we could drastically reduce the costs involved.

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[45]   Shareware is distributed freely under the assumption that people that use it will want to pay for it.

Agent technology may in the future provide the key for users to easily find providers whether by actively searching or filtering new service announcement given the preferences of its user. However, just creating an environment where services could be found directly by searching or indirectly through random browsing, should be equally if not more useful and feasible today while using agents is not. A key task then is how to present a large number of information providers and goods vendors in a visual environment that is efficient to move around, visually interesting, and lets entities differentiate themselves easily and in interesting ways.

3.4   The retail environment today — The Mall

Malls were developed to solve the problem of how to create an indoor marketplace that was efficient to shop and fun to browse, while bringing the most profit possible to its occupants. Because this is the same problem we are trying to solve, it is important to understand how malls work. To build a traditional mall today, first a layout is chosen to suit the interests of the anchor stores (there are six standard shapes for a mall depending on the number of anchor stores) that will make up usually 60% of the floor space in the 100 store mall (a size considered supportable in most areas). After anchor stores have signed up, space is sold to smaller stores. Even though there will be 100 stores, each with carefully positioned market segments and images, they are usually owned by no more than ten parent companies [5]. Store layouts are then carefully designed following a set of basic guidelines such as, "make people enter through department stores and never put *up* and *down* escalators next to each other." [8]

Over the years, mall design has become a careful science:

> Developers and designers of the retail built environment exploit the power of the place and the intuitive understanding of the structuration of space to facilitate consumption and thus the realization of retail profits. They strive to present an alternative rationale for the shopping center's existence, manipulate shoppers' behavior through the configuration of space, and consciously design a symbolic landscape that provokes associative moods and dispositions in the shopper. [5]

Much thought goes into how to move people around to stores that they are likely to buy from. In the extreme, the larger malls are composed of sections or floors with a particular feel designed to attract one set of mall goers. For example at Bridgewater Commons, a mall in Bridgewater New Jersey, customers enter on the third floor where the food court is and as they progress down the floors, store facades become more upscale in an attempt to direct customers to a floor they

should feel more comfortable on and with stores they are more likely to purchase items from.

Mall of America is split into sections each with a certain theme using structural design, finishes, and lighting to make it appear to be a European city, or New Orleans. The effect is made complete by "Knott's Camp Snoopy", a seven acre indoor amusement park that lies at the center of the mall. The designer's goal is to make the mall into a vacation spot [22, 26]. Not only do consumers spend more the longer they stay, but they are even "looser with their wallets" on vacation [27, 26].

Although jokingly called the "defining signature of our civilization" [16], the designers of this the world's largest mall, at close to 400 stores, were intent in creating just that. This quotation from a Mall of America promotional brochure shows this; "Anyone who thinks that Mall of America is just a big mall probably also thinks that the Grand Canyon is just a big hole in the ground." [19] So far they have succeeded bringing in a large number of vacationers, 3000 tour buses and a total of 35 million shoppers visited in 1993 and they predict 200,000 Japanese tourist will visit annually within a few years [9,20]. With the addition of hotels there is no reason to leave and explore Minneapolis, which surrounds the mall.

Malls are designed to be self contained worlds that are clean and new, without the decay of the downtown shopping areas they have supplanted. However, crime is up at malls and shoppers are turning away from older malls in favor of newer malls and increasingly outlet stores, power centers[46], off-price stores, and even revitalized downtown areas (especially in Europe and Canada). Shoppers either want price or atmosphere and malls have "become very ordinary. A mall is a mall is a mall." [29] During the 1980's building boom, more mall space was built than could be filled, so instead of being refurbished, many slightly run-down malls are just abandoned.

The problem of the "dead mall" is becoming a great enough concern to mall owners that all sorts of new ideas are being tried to entice people back (mall visits and visit times have continuously declined in recent years [8]) or at least utilize

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[46]   A couple of specialized superstores (e.g. Home Depot, BJ's, and Wal-Mart) around a large parking area.

unused space for non-shopping related activities. Empty shops are being converted into daycare, libraries and other town services; food courts (a recent but already widely used idea) are being added; and, the mall is even being presented as an indoor track for morning jogs.

The latest trade journals suggest making the mall a multipurpose center — an enclosed "town center." [8] It has been claimed, "the regional mall stands at a crossroads. Those that choose to become true town centers may be taking the road to lasting success." This statement is applicable to the electronic mall environment as well. If it does not clutter the interface or confuse the purpose of the environment, why not attract as many different users as possible by including as wide a range of activities and services for the individual to utilize. People want a one-stop 24 hour activity center.

Before the first malls were built in the 1950's, "Mom and Pop" stores in the downtown districts were the main retail outlet. The arrival of malls brought browsing, since before them, the customer went to a store and told the clerk what she wanted and he gave it to her. This was just the first change over the last forty years. Big department stores like Sears and Macy's moved from downtown areas into the regional malls. Department stores could claim a wider range of different products and better service. The mail-order and power centers stores, that are replacing malls, have destroyed even more small "Mom and Pop" stores. The success of power centers results from an increased emphasis on price and large selection of a certain type of product over service by the general public, better transportation networks, larger potential markets, just-in-time inventory management, and a new aggressiveness by retailers.

This rapid evolution in the retail environment is important for several reasons. The rapid growth of the superstore and decline of malls and their department stores, has shown that today's retail giants can be out of business within a few years. So when designing an electronic mall, we must not let the interests of today's retail giants completely rule our design choices. The interactive TV trials announced so far have environments designed using the out-of-date principles of today's malls. This is foolhardy because, as this quotation from the popular press suggests:

Just as railroads opened the West, the highway will open wide the electronic frontier. Whole industries will be destroyed and new ones born; productivity will leap and competitive advantage shift in the direction of small business. The pioneers have found that the

electronic frontier, like the frontiers that preceded it, is at once a realm of boundless opportunity and a harsh, brutal place. [13]

Although, a new type of retail outlet may emerge that better suits the electronic medium, the current set of mall replacements is interesting because their model of retailing (large selection, low price, little service or atmosphere) fits nicely with the simplest on-line environment. We want to bring the "democratization of browsing" brought by malls [28] to the next level through a successful electronic shopping system.

Current malls have become a closed system, designed to serve large vendors' interests. They have no reason to let their competitors have any chance. However, variety is in the best interests of our system. It is this compromise, between protecting the interests of today's powerful vendors and building a system that will let a new class of small vendor succeed, that is crux of our design problem. There are two key components to this problem that need to be addressed: how stores are presented and the movement model provided for users.

3.5 The retail environment today — the marketplace and downtown

Opposing the model of the mall are marketplaces and downtown shopping areas. For many years, the downtown area was the center of commerce and shopping. As towns grew to cities in many places, the downtown became overcrowded and inaccessible to pedestrians. This was usually a problem of poor zoning. Certain places in the United States of America still have a successful downtown, and in many parts of the world, central marketplaces still dominate. Crime also became a problem in these areas. With the development of suburbs in the post World War II era, dense populations lived a fair distance from the city center so regional malls made more sense for them especially since everyone drove to shop. There is an effort today to try to bring back the downtown area in many cities as the love affair with the mall subsides.

In most of the world, the marketplace or bazaar plays the crucial role in the retail industry. Most European towns still have a "market day", when the town center is closed off to traffic and filled with small stalls offering all sorts of items. These range from freshly collected agricultural products, to clothing, to all sorts of local manufactured goods. Since the tradition is many centuries old, local customs and practices concerning who can display goods and where, have become quite varied.

Some marketplaces are completely free-form, while others have become as fixed as a mall. There is a rough vitality in a marketplace just not found in the sanitized mall environment. Vendors travel around to different market days throughout the week selling whatever products they have on-hand. The prices are low, bargaining is a required art, and people pack the streets. Although many people are buying daily necessities, there is also much browsing because of the ever changing configuration of stores and their offerings.

3.6 The INFOBazaar: How it should look

Having considered the types of customers and vendors we want to attract, and how marketplaces are built today, we are ready to consider what our system should be like. First a few assumptions about the environment so that we have a footing to start designing for. We are trying to design a "public space", a place to spend time exploring the landscape, browsing the many stores, and socializing with other users. It must not be just a personal catalog-like interface for shopping. Gehl [17], gave this outline of the activities that define a public space:

(1) necessary or compulsory activities, such as walking to work, shopping, or waiting for a bus; (2) optional activities (i.e., strolling sitting, sunbathing) chosen only if the conditions and the place are inviting; and (3) social activities, such as talking, people watching, and community events, that depend on the presence of other people.

To make it inviting to explore, it should be appealing to look at. To be interesting to use repeatedly, parts of the display should frequently change. Creating successful browsing relies on designing a suitable metaphor that allows users to see and navigate between stores in a pleasant manner. Although, we stress browsing, we must not ignore directed shopping, so to enhance product location efficiency, there should be a store index searchable by keyword (possibly a product category). Additionally, directed shopping could be bolstered by building store loyalties, places the user stops at first, because he likes some aspect of the store and knows where to find it. By including representations of other shoppers, this could be a place for socializing as well as shopping. With these features, the INFOBazaar will become a successful "public space", if we can attract the users and vendors.

Since we want to include a large number of stores, any design, using the artistic technique of first person perspective, would make finding a store into an

"adventure game" because of all the exploring the user would be forced to do. Only so many stores can be seen at one time when looking out at street level and even fewer with a usable piece of the field of view. However, first person perspective is the most visually impressive and most like the real world we shop in. It also provides the most "screen space" if we are focused on a store, for a vendor to recreate or create their image with. This image lets vendors attract customers, so maximizing it is very important.

We could create a virtual 3-D world of "stalls" with streets going in all directions, unfortunately, that would lead to sensory overload. The more things visible in different planes, the longer it takes to see any one item and the more difficult it becomes for vendors to make themselves stand out. Just consider the result of a 3-D attention grabbing arms race in a street in Boston's Chinatown. On such as street, there are so many signs and decorations that it becomes impossible to see what stores lie furthur down the street. Computationally a 3-D world would be very hard to create, so instead, we should consider a 2.5-D three-quarter perspective (see section 4.2 for example from prototype). Its overhead view lets us look out over a small number of stalls. Even with just sixteen stores on a screen, there would be 1024 stores in the sixteenth ring out from the center[47]. This is a compact representation. With texture map based zooming, the shopper could easily move out to see more and in for greater detail.

Can a small "3-D chuck" of the 2-D screen space provide enough room to make an impression on the user? Looking at SimCity[48], we can see how effective this view can be and how much can be done with a small piece to make an impression on the user. Roof-top space is enough to display a company logo. A number of polls have shown that company logos have permeated the culture so that recognition is possible from the style (color, shape, etc.) even when the letters are changed. A small 2-D space should be enough to create a valuable impression. This is one of the hypotheses to be tested by building a prototype.

Screen space is a valuable commodity, so it makes sense to provide different size storefronts to vendors. By offering smaller sized storefronts, we will decrease the number of streets that users have to navigate. The small information provider will

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[47] Generally — bazaar with n blocks of m stalls has n*m stores, but is only sqrt(n) by sqrt (n) blocks in size.

[48] A very popular computer game that lets players build and manage their own city.

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only purchase enough space so that they are visible, while the large vendor may buy the largest amount of screen space available.

Since this is a virtual world, we can do things to change the way stores appear given the preferences of the user. For example, the user can decide they are primarily interested in music stores selling CD's and stores with candy, and any store registered as carrying those items could be made "taller" or be highlighted or modified by some other mechanism to standout. These simple techniques make the on-line system more informative and as a result more powerful. However, these techniques change the economic advantage of screen space. This is a sacrifice that owners of large amounts of "flat" screen space will have to live with because of the gain for the user.

Another method for adding character and sensory stimuli, is to sell the ability for vendors to present changing information to the user. For example, when the user moves the cursor over a particular store he could receive textual information about current sales and specials, a moving version of the store logo, and even real-time video or sound from that store. These could be "new" every time the user moves over the store, to keep the experience fresh. This would vastly enhance the feeling of vitality, excitement, and "fun" in the mall. It would also create many new ways for vendors to try to attract the attention of potential customers.

Having adopted a layout metaphor of 2.5-D stores, it follows that we should have streets, blocks, and even neighborhoods. To help the user navigate, there should be as many reference cues for location as possible. Streets are a very natural way of giving directions, so that instead of saying, "three screens right and two screens up", the location could be given as 40th and west 20th. Not only will users have no problem figuring out where that is, but an absolute location is useful for future reference. Instead of going directly to the store, they may decide to make a detour somewhere else. This is extremely natural to users because in the real world, they have also imposed a Euclidean grid, in the form of streets.

Keeping to a rigid Euclidean space, unfortunately does rule out a number of interesting ideas. For example, to help make large screen space even more valuable, we could imagine having multiple levels where at the top level the user sees those vendors that bought the largest spaces, with the smaller stores

miniaturized between them. However, this would cause complex "curvatures" in space, unless we made the problematic restriction that there would be a fixed number of large stores on symmetric locations about the center of the mall. This curvature would make it difficult use observed positional relationships between large stores when we changed to a lower level.

Because image is so important in retail, neighborhoods play an important role. Research has shown that "chain image is an important determinate of store choice.... across income groups and racial groups." [18] Just as there are upscale streets like Fifth Avenue in New York City or Newbury Street in Boston, we want to provide mechanisms so that areas in the INFOBazaar can develop reputations. A certain store may become hip, attracting many people to the street and yet this customer flow would be wasted if the stores on the street were not interesting to these new users.

This brings up many interesting questions, such as can entities buy up spots and then sell them for a profit? Fundamentally this question asks do we allow speculation in real estate, greatly complicating how the system might charge for screen space. The system operators would collect on the rents being charged, through a "property-tax." Should the vendors already on a block have a say in who can move into their block or can we trust vendors to only move in where they would be compatible? Can the vendors decide they want more "eye-candy" on their block and ask to have an empty store space converted into a park? How does the system regulate the types of stores it allows, i.e., can there be "red-light" districts, with the ability for parents to "block" out certain sections of the INFOBazaar. Does a neighborhood develop purely because of location and land prices? As we saw in Mall of America, one way to create neighborhoods is to have "landmarks," differing colors for the streets and other items of "eye-candy" specific for a certain region such as parks, trees, fountains, or even gargoyles. These items will not only make for a more interesting browsing experience, it will make navigating much easier.

3.7 The INFOBazaar: Concerns about movement and navigation

The main fear of any vendor is their competition. If it is simple to move from one store to another, comparison shopping becomes dangerously effortless causing

great difficulty for vendors. So we are faced with design questions such as, "Do we have a fully searchable directory always available as part of the interface?" A searchable directory combined with an easy "jump" facility would allow users to quickly visit all the stores carrying a certain item. Do we have virtual "subways, buses, and teleportation stations" to move around quickly but at a cost. Although users paying to move appears extreme at first glance, we expect some vendors would subsidize movement to them. Only at the cheapest places would a customer have to pay to get there, just as he would today if the vendor did not have an 800 number. An interesting consideration is what role third party INFOBazaar support services could play in this situation.

Buying and tour services might appear, that would, for a small fee, automatically take users to different stores or find the best price for an item. Phone and on-line based services such as AutoVantage from CUC International, already show that this could be successful. From their "storefront" on America Online, it is possible to view new car summaries — reviews they have written about most cars. They charge a moderate yearly fee, which gives members access to reviews, including very complete product information and dealer pricing for various options. By calling their phone service, the caller can get a special pre-negotiated quotation and the name of the dealer to go to test the car and buy the car from. Services such as these are perfect for the INFOBazaar.

Manufacturers already produce plenty of glossy product information, and given a new place to display it, they would quickly provide plenty of fancy content free to anyone that would show it. Some services may be subsidized by the vendors they recommend, while others like a *Consumers Report* would just collect the information and give users "unbiased" information for a small fee.

Given the choice of going to a vendor and seeing a limited set of products (those they carry), or going to a review service that has information about every brand they can collect information about, the customer would likely choose the latter. Even worse from the vendor's point of view are services that will "shop" the competition for the consumer and either get the best price or tell him what prices they were quoted from different vendors. Potentially, vendors' product information could be better than that from the review centers, or they may provide excerpts from "unbiased" reviews for free, something a review provider is not

likely to do. More likely though, the vendor will need some way to add value to the shopping experience beyond that offered by review services.

One group will compete purely on price assuming customers will find product information somewhere else. Although it would upset their normal dealer channels, manufacturers might sell directly to the consumer. We expect that electronic shopping will reduce the role of the middle-man in the retail industry, since it will be much easier to sell directly to customers than ever before. Also competing on price will be the cutthroat mail-order firms like those in the back of computer, camera, travel, and other user magazines.

A second group might try to compete on service and atmosphere. One advantage of being on-line is the reduction in required support staff, however, some places may differentiate themselves by providing people to answer questions on-line (either through text messages so they can support multiple people at once, or direct voice or video channels over the system.)

An easily recreated component of atmosphere is the type of products carried by a store. A harder to capture, yet more interesting piece, would be the look and feel of a store. In the on-line environment, stores can compete on a different sort of atmosphere, the quality of their visuals and the cleanness of interface to browse their products. Another part of a store's atmosphere are its customers. A store for connoisseurs is likely to have an expert clientele, from which a naive customer could learn by observing what people are buying or ask for recommendations before purchasing.

3.8 Adding a social component — the Ants

Another important concern for the INFOBazaar interface is how to add a social component to the shopping experience. One very intriguing idea to facilitate increased social contact, is to see other shoppers. Everyone would appear as a small dot or "ant." Ants could be color coded to represent how long they have been in a certain location, what their current activity is, idle time or all sorts of other information. Using color and shape are powerful ways to increase the available information without increasing the complexity of the interface. Not only might this information be useful, but like in SimCity, where part of the fun is

watching the tiny cars moving around and buildings being built and torn down, seeing other people moving around could be an interesting activity.

Some shoppers will desire their privacy (even if not available in the real world) so there should be multiple levels of privacy from fully available, to totally hidden, to only visible to those on a personal "friends list." People could have their own "icons" that anyone from their friends list could see by subscribing to them. Some people may follow friends around while others may decide to escape the crowds by exploring the back streets. Users can click on an "ant" to request a text, audio, or video conversation with that person depending on the capabilities of the system, how much the user is willing to pay, and whether the clicked on party will respond.

An important aspect of shopping to recreate is group shopping. Shopping in a group has been shown to increase the amount of time and the size of the "load" purchased in a store over that of a lone individual [21]. Group shopping will involve watching friends icons move around while using the various communication channels to converse. While seeing other shoppers may recreate some of the feeling of shopping with other people, the system will still allow any shopper the privacy to shop on her own if that is her desire at that time. Being able to hide oneself, will reduce the potential for stalking.

A popular activity with some users, typically teenagers, is not shopping at all but instead going to the mall to see or be seen. This could be supported if the teens put each other on their friends lists. Although knowledge about who was on a friend list is private, the information about whom individuals were watching would be subject to much teasing among the teenagers.

These ants will be available at all levels of the system, although at the map level, the user would see a density overlay over the map, because will be too many users to be shown individually. A density map would still have interesting uses though, and the most important group of other users, the friends, could be shown as icons. One interesting use is the "blue light" phenomenon, where people see other people looking at something and then go over thinking there must be something interesting there.

We can expect vendors to try to take advantage of the system as best they can and the "blue light" phenomenon could lead to an interesting ploy. Potentially, vendors may pay for a group of logins and pretend to be shopping at their stores to try to attract the crowds. However, it should not be difficult to detect these shills. This type of abuse has already shown up on Usenet groups with vendors having employees say good things about new products from an address unconnected to the company.

Other social activities would be more like the chat halls or phone services of today. Although as we described above, users could socialize at any level of the INFOBazaar, we expect certain stores to be designed specifically for socializing. These might include a virtual "blues bar" where users could mingle while soft blues is played out their speakers. Or maybe a more political or topic specific discussion is desired. Stores could exist to support each of these interests as well. With proper security so that the identities of users could be trusted, private conferences could be held in rented spaces. It is possible to do many things with a store in the INFOBazaar. Some may argue whether users want to do all these things because of efficiency or complexity or consistency, however, the market should decide what is a good idea and not the system designers. As long as a suitably sized data connection can be provided, what is done in the store should, within social limits, be up to the vendor.

3.9   Directed shopping

It should be clear that this is a "mall" designed for browsing and fun. But, directed shopping is still very important. It may be the form of shopping most suitable for the electronic environment since often the consumer knows what she wants and her main concern is to get the item quickly. Speed is the obvious advantage of electronic shopping. How might users find things swiftly in the INFOBazaar? At first, the user may stick with large familiar vendors at the mall center. Later, after more exploring, most shoppers will develop store loyalties. Once they find a store they like, most shoppers are unlikely to stray far from it. This loyalty is something that vendors are relying on, to help foster a stable customer base. For less frequent high-value purchases, people are willing to invest more time searching for the best value because they feel there is more to gain [10].

For those without any loyalties or for customers in the greatest hurry, there should be a more traditional searchable directory. It would contain store listings, searchable by product categories. For products, there are familiar categories in which they fit, even though in a large metropolitan Yellow Pages, there are still some 1000 different index labels. Since the directory will be a searchable relational database, we can have many more keywords, maybe down to the exact model or item type. The vendor is responsible for signing up (and potentially paying) to be listed under the correct keywords.

Another activity that will require searching is looking for a specific piece of information, however, this type of searching is very different from finding a particular product. For information sources, a searchable information library like the Lycos[49] system would be very useful. Lycos searches the WWW collecting entire documents that it then allows users to search using keyword matching. They collect entire documents and not just titles or URL's[50] like other systems, because the more of the information available to match on, the better the results. Since it collects the whole document, the information provider needs protection from people getting a free copy. There are all sorts of more intelligent best match ranking methods such as Bellcore's Latent Semantic Indexing that can make the results of these queries better. With information, we are looking for content, and content may not contain the keyword that best describes the document in the mind of searcher.

The Lycos WWW crawler is like an agent except it does the searching before it is asked for the document and it knows about all data available, making results available almost instantaneously to customers[51]. The user is still asked to figure out the right keywords and process the results of the search. Searching for information is not easy, so there will be a market for people or in the future possibly computer agents that find items for a small fee.

The other question is, "What sort of vendor information is returned by a search?" Should bigger stores be listed first because they pay more for space like in the physical Yellow Pages. Should they be listed alphabetically, ranked by annotations

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[49] WWW Crawler developed at Carnegie Mellon. It has collected 800,000+ documents as of Dec. 1st.

[50] Universal Resource Locator, a hierarchically structured label for everything accessible through the WWW.

[51] It does not have to travel the network every time something is requested by the user.

from friends, ordered by inclusion in all the user's friends' favorite store lists, or sorted by traffic through the store. There are almost limitless ways to present the information. Are these different sorting methods fair to the vendors, or even useful to users? Having many different sorting methods might overwhelm and confuse the average user even if useful to the experts or more fun for the experimentalist users. Certain sorted lists might be better offered as third party services. For example, a company might collect "testimonials" about both vendors and products like those available from the Usenet groups today. These human agents are still far superior to computer agents, but they are more expensive.

Is the result of a search just a text list; items composed of an icon, store name and description; or in the extreme full multimedia ads. There is a careful balance between providing as much information as possible up-front to make choosing easier, while not making it too hard to quickly scan the list of vendors. Also, the result could be returned as pointers on the "map" of the INFOBazaar that the user could then click on to visit, or receive a description of the store by moving over the pointer. As described in a previous section, such a map could make comparison shopping very easy. Hopefully, we have provided enough ways for vendors to differentiate themselves before price is considered.

3.10 How stores will be built

While the interface to find the stores is very important, the quality of the stores and what they offer will be just as important to the success of the system. Without interesting stores, users will leave the system. "What should stores look like" and "How will vendors create a store interface" are complex questions. These are questions that require careful thought, presented below will be a brief discussion of each.

A significant problem today is that, no one knows exactly what services people will find interesting[52], what they are really willing to pay[53], or even how the services should look. To discover the answers, we need experimentation. To this point, the pervading philosophy has been to announce interactive TV trials with a set of

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[52]   Until something exists for people to try and integrate into their daily lives, it is very hard for them to understand and predict what they would use. Marketing is able to sell all sorts of things to people, like CD-ROM's for example, but the percentage actually used is typically very low for sometime.

[53]   Everyone knows that users will want to pay nothing, and that they will have a very hard time estimating for something they have no experience with.

applications designed to test how customers will respond. However, it would be more efficient, both in cost and time to allow vendors to have as much freedom as possible in designing their stores and let them take the risks.

With increased flexibility comes greater design complexity; yet, it must be easy to open a store. We want to minimize the skills necessary to open a store while maximizing the potential flexibility. One solution is to create a toolkit to build stores with and to define a "style" sheet to keep some consistency between stores.

The toolkit should include prebuilt components such as lists, video display windows, and order entry forms. It should also include programming language support for those vendors that want more control over their interface. Even at this lower level, there should be an available set of basic API calls, such as secure transactions support. Since such a kit is complex to built it makes sense to try to add the necessary prebuilt functionality through "libraries" for Visual Basic, Powerbuilder, or even a "non" programming environment like Macromedia's Director[54]. eShop has created a comprehensive non-programming toolkit, yet because it is so complex, they still have a consulting group to help vendors build an interface using it. We would expect that many vendors would contract out to a design and marketing group for their storefront as well as content production.

Consistency of interface between components is a much heralded concept for application software, however, how much consistency is there between stores in the real world? There are a set of guidelines for behavior and preconceptions about the existence of certain types of departments — help is available from clerks and items are purchased at a sales-counter. The real world imposes some constraints over how things can be laid out and how we can move around. There is a different set of constraints for the on-line world. Success will come to those stores that use knowledge of these limitations to create an intuitive and user friendly interface. As a starting point for this exploration of interface, the only required consistency for a store should be that users know how to enter and leave, how to order and pay, and how to get help.

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[54]   A developer of Director told me I should have implemented the INFOBazaar using Director!

3.11 The architecture to support stores

The final question to be asked about stores is what system architecture is necessary to support them. The basic concern is where to store the data and how deliver it to the user. We want to minimize delay in responding to user actions. Splitting the INFOBazaar into many local ones will both reduce latency and increase bandwidth while limiting the number of stores and users in each local bazaar as well.

By connecting to a local service, we reduce latency because of a reduced distance for the data to travel. With a highly interactive system, low latency and consistent latency are both very important. By having a local access point we can lower both. Low latency is also dependent on the ability of the server to handle requests. Splitting the bazaar, reduces the number of users each server has to serve, thus making it easier to serve the remaining users.

Since we also reduce the number of links to traverse and the number of users sharing those links, we have a better chance of getting a maximal bandwidth connection. How much bandwidth is enough? There can never be too much since excess bandwidth can always be used to send pieces of the interface in advance to reduce latency and better handle a variable bandwidth link. As we lower the available bandwidth, we drop full motion video, then CD-quality sound, and finally high-quality images. Depending on the media types supported, the required bandwidth could range from several megabits per second down to modem speeds[55]. It is a question of quality and compression technology. As RCA's DSS system shows it is possible to send CD audio quality sound and TV quality video with MPEG II at 6Mb/second. This is only TV quality video so we would need more bandwidth for HDTV or computer resolutions.

Even if the system server can deliver the bandwidth, it may be old data. For many situations, it is important to have current information, such as the seating wait at a popular local restaurant, weather, or current product availability. Vendors should have the choice of storing information on the system server, thus their data would be relatively upto date, or opening a direct a connection to the vendors local server when a customer enters their store. By connecting directly to a store, the user

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[55] As has been proved with Bellcore's DEMON system it is possible to send good-looking still-image presentations with limited audio over high-speed modem bandwidths.

relies on the network characteristics of the connection between him and wherever the vendor's server is located.

Considering only the needs of the vendors, there are good reasons to split the mall. Joe's local pizza house is not interesting to anyone outside of his delivery area. When a customer orders a product, he wants it delivered from the closest vendor, since if close, he could even visit in person if necessary. We want to see only local vendors. An opposing trend will be the creation of more buying collaborations between vendors to increase their buying power and lower publicity costs. Systems like 1-800-flowers and AutoVantage already do this. With an on-line system, we expect even more buying cooperatives. This is one way that small "mom and pop" shops could survive. If we want to buy something we go to a single store front and then it is farmed out to the local vendor. On the other hand, each vendor may want to present themselves individually as well, to show the non-standard items they may carry.

Considering just the needs of users, there are good reasons to split the INFOBazaar. As described before, we want to represent other users on the system. If there were just one central system that all users were linked to, it is likely that it would be overwhelming to watch because there would be so many users on a particular street or in a store. By splitting the mall, we reduce the number of users to numbers of blocks that could be reasonably displayed. If we had 10,000 users and a 10x10 grid that would be 100 users per screen on average. Some of these users would be in the stores and while the others would be browsing the screen. A hundred users could be shown without covering the screen too densely. We do not want traffic to be overwhelming; if it is, the user has the option of turning of the traffic. If most users were local, it would be possible to become friends with them outside of the system. This might help placate the concern of many thinkers that we will become a society unable to function face-to-face.

Given multiple bazaars to visit, we expect that there will be a group of users that will brave the unknown deciding they would rather shop in the Seattle branch rather than their local bazaar. They may imagine that the "grass is greener on the other side", thinking that stores there will be more hip, more interesting, and more likely to have a better selection of a locally relevant product. If this was their only

reason, we would probably not support it because of the increased system resource usage, however there are more interesting reasons to support moving between bazaars. For example, the user may be planning a trip so he wants to reserve a room at a local hotel or a spot at a restaurant at his destination. He may wish to buy a gift for distant friends and so wants to buy from a place they can return the item to or get the item serviced easily.

The major problem with splitting the INFOBazaar is the pricing of screen space. Certain vendors will only want to be on the local bazaar. Unfortunately because of the general nature of their offerings, most information providers will to want to be on as many systems as possible. If vendors store their data on each system server, they would tie up additional system resources, for which they would have to be charged. Alternatively, if their store were only available as a remote connection then they tie up extra network resources. We could charge for network usage through a distance based handling charge.

It might not be economically feasible for information sources to have a stall in every bazaar. Instead, they could be listed cheaply in a master directory for all bazaars allowing them to be found whether by agent or other search mechanisms. If the user is looking for a specific piece of information, using an agent may make sense given one smart enough for the task. This should be a third party supported service until the technology proves itself. If we plan for the possibility that at some point in the future it is proved that agents can do the job, then the technology could be added without too much effort.

Today, Internet transport is free for many users so places like the First Virtual InfoHaus, charge a flat transaction fee and an extra charge to store data locally. Open Market requires all data to be local, but charges three different rates depending on how much data is stored on the server. It is wide and open competition that will drive such systems to a supportable pricing structure. Careful analysis of what to charge is required because there are many different ways to make a profit but each leads to a different type of system.

Even such simple questions as how to price screen space can be difficult so what about more advanced services such as having an animated store roof? A reasonable assumption is that anything using more bandwidth should be cost more.

Some questions are more complex, for example, do we want vendors to have multiple storefronts or a single large one? To help build neighborhoods and provide more places to look at, we want multiple storefronts. Yet, we want a price structure allowing large vendors to buy a large piece of screen space and feel they have something more valuable than two smaller stores. We expect that like today, vendors will desire many different store fronts to better target different market segments.

3.12 What you will shop on

How will the INFOBazaar come to the consumer? This is a question that cannot be answered today. The players from the computer industry (Microsoft, Intel, Netscape Communications) prefer a computer based solution [24] while those from the entertainment and bandwidth providing community (HBO, USWest, Viacom) [25] want to supply interactive TV to the home. The stakes are high and the players plan to spend large amounts of money providing a solution because they feel that if they do not, it could be the end of their business. The computer industry has an early edge because electronic shopping is here today on the Internet and on-line modem based services. But, only a small lead since their solutions are not of the type described above and their penetration is minuscule compared to the retail industry as a whole.

The question is why would we even consider bringing the service to the user on a TV, when the hardware is already or will be in the home computer so no expensive set-top box would be required if a PC were used. One reason is simply that only a minority of people have computers in the home and even among those that do, a smaller number uses them. Computers are seen as something related to work, impersonal, unfriendly, and used alone. Who wants to come home from a hard day at the office, likely spent in front of a computer, to spend more hours on a computer browsing and hanging out? Some people will. Others would rather be entertained by TV, many of this group are the so called "couch potatoes." As Penn[56] of the magic team Penn and Teller says, if people really wanted interactive TV, storytelling would have died out millennium ago. We do not go to the movies to choose the path of the plot and we do not watch TV to have to think, or so one

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[56] He also writes a column in a top computer journal and spends his spare time visiting research labs tracking technology.

study has shown [23]. Still TV is viewed as an entertainment device, so shopping over TV will have an initial edge.

Watching TV is something done by families or couples as a social bonding event. For most people, having someone else around makes the event more interesting as they feed off one anothers outward reactions to what they are watching. TV's are "appliances", something that everyone knows how to use and is comfortable with. Most modern sets have many extra features, but they can be ignored by users that do not care to experiment.[57] Being an appliance is considered key to designers of mass market devices. Computers are not an appliance in the minds of most users. The backers of interactive TV expect that people will feel more comfortable using a "smart" TV, a TV with a complex set-top box, than a computer to do their shopping and that they can be convinced to interact with their TV.

There is already a small market for interactive TV applications, such as those found in the Interactive Network system. This system combines radio and telephone with a complex handheld device to let users win money predicting the next move of their favorite quarterback. It also lets them play along with their favorite game show. The customers for such services are unlikely to want to pay enough for these services to fund the upgrading of the cable infrastructure. It is a niche market that given a suitable infrastructure will be relatively successful.

If we are building a fun and friendly environment for the mass market, why consider using a computer to display it on, given the discussion above? Electronic shopping is already here on personal computers while upgrading cable systems for interactive service will ultimately cost providers about $1000 per home [15]. Although limited today, computer based shopping can simply evolve as bandwidths to the home increase, first with the penetration of high-speed modems and Basic Rate ISDN, and later even faster connections. While bandwidths to the home increase, the hardware to display acceptable quality full screen video, potentially based on MPEG II playback, will become very cheap.[58]

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[57] Although viewed completely differently, the TV, in many cases, has not only a serious CPU but as much memory has a household computer.

[58] MPEG II is used in DirectTV decoders and, given its success we expect, MPEG II chips to become consumer commodities. Brooktree has already announced a chipset combining advanced sound generation, modem services, and MPEG I playback that will be available in boards for under $300 by Spring of 1995.

Another advantage for the computer is that users of PC's are already familiar with interacting with the device so it will not be a large change to start using interactive services [24]. The computer also, unlike the TV and its remote control, can easily support a wide range of different interface interaction modes.

The resolution of TV is very poor, so only small amounts of text can be displayed at a time. This is okay for visual products, but for vendors selling information this is a major problem. Since many customers want as much information about a product as possible, shopping by TV might not satisfy many users [6]. Some may question how much information people want to see,[59] but the choice should be up to the vendor and the user, not constrained by the technology.

Although we could wait for HDTV to solve these problems, it is likely to be ten years before there is a broad penetration of HDTV into the average household. Store builders will not build different versions of their stores based on the resolution of the customer's display, so stores will be designed for the lowest common denominator technology. Adding to the resolution problem of the TV is that people watch TV from a great distance, so text size has to be even larger. For these reasons, a color inkjet printer is supplied in all the homes in the Time Warner Orlando trial, to print out text.

All the parties involved will supply their best solution and one technology may come to dominate the shopping arena. Instead, the marketplace may fracture making it harder for vendors and users since any sort of standard is unlikely. Shopping on TV may remain the realm of large vendors and home shopping channels, while Internet shopping may remain the domain of everyone else. Everyone will lose if this is the outcome. Worrisome are short-sighted statements from top cable industry executives that, "The big difference we see between applications for the PC and those for TV will be about 100 percent." [12] The cable industry leaders predict that first they will provide more channels and interactive programming guides [30]. Home shopping channels will become interactive and consumers will be allowed to pick what they watch through Video-On-Demand.

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[59] Since this is entertainment, people do not want to read. There is a question of how great a role product literature will play in the future because of the increasing importance of "appearance" over functionality.

The next couple years will be of key importance in this struggle between TV and computer based applications. Major new players in the computer based shopping world, such as Netscape Communications and MCI, Microsoft, Novel, and others that have yet to announce systems will bring secure electronic shopping to a large new market. They may build a substantial user base before technologies such as interactive TV have a chance to pass from the world of press releases to large scale availability.

3.13 Usage scenarios

Having considered how to build the INFOBazaar, it is time to consider some usage scenarios to see if the model will fit the average user's needs. There are at least four main scenarios to consider — pure browsing, product limited browsing, product directed shopping, and specific model or item focused searching at the extreme. Each of these styles should be supported. The interface developed above makes compromises on the side of making browsing more interesting because as we argued, computer aided shopping inherently aids directed shopping.

In pure browsing, the user starts at the "home" block and wanders around looking for interesting things as his whimsy suggests. This type of shopping results in much time spent on the system with little purchased. This activity will be very important to the revenue stream of the system, if we charge for usage time. The system could make its money from transactions, like the first group of Internet shopping systems, or from time spent by users on the interface like today's on-line services. Charging for both makes sense because of the wide range of ways people are likely to use the system.

Although vendors may not make sales during these browsing periods, it is time to use for advertising and building recognition among users for when the users are later looking for a specific product. Part of this browsing activity is socializing with other users. The visual nature of the interface and the Euclidean movement model should make this form of shopping enjoyable and productive.

More customers will want to look only at certain types of products. Although, these users do not have any specific items in mind to purchase, they may decide that they are more interested in stores carrying CD's, men's clothing, or electronics

— positive information. Alternatively, they may know that they are definitely not interested in jewelry stores — negative information. How should we collect this information and what should be done with it?

The user in the positive case could select icons representing different product categories he is especially interested in. Stores matching these categories could be doubled in height. The user could also select icons he is not interested in. Given this negative information, the system could either remove stores selling items the user is not interested in or "gray" them out in the interface.

Removing stores would destroy the Euclidean basis of movement. Because people generally have poor map skills, users may prefer this model. A potential compromise is to leave empty lots where the stores were. However, little efficiency is gained over doubling those stores that are interesting, and any chance is removed of visiting a store that was not expected to be interesting when browsing began. Testing is needed because it is even hard to predict whether people are interested in most things and thus removing categories would be more efficient than users adding interesting categories. Fortunately, it is easy to allow both styles at the same time. This style of browsing would be easy to aid.

Sometimes users have a specific type of product they are interested in purchasing. For example, maybe the user wants to buy a new car. They might start by seeing what was available, asking friends for advice, and then talking to a specific dealer about price. A searchable store directory would work quite well for them. They only want to search by broad category, so even a graphical interface for queries could be built as described below. Some users may look at stores on the main screen or only those they have liked working with before (favorites). Also important for these users will be the new "review" services described previously. This will probably be a fairly common style of shopping.

Finally are users that have decided what they want and need to know where to find the item at the best mixture of price and service given their specific needs. Because of the detailed nature of what they are looking for, it is hard to build an efficient index for a directory. Customers desire simple yet powerful searching techniques. A friendly interface may allow users to build queries from specific

images. This is an idea hinted at in several interactive TV designs, and suggested in Oracle's Epcot display of interactive TV applications.

Taking their idea farther, we have a scenario such as the following. If shopping for clothing, the user is first presented with a picture of a body on which they select the part of the body the item goes on. Next, they are presented several specific items for that body part to pick from. The result of such a query would be a list of stores that carry that type of item. This should work nicely as an interface tool inside specific stores because we can probably find the right set of conceptual building blocks for any specific type of item. However, to be general enough for all possible products would require many levels of indirection to be navigated and many different types of query parts to be chosen from in building a query, when the user could just type in the name of the item they want. Given a powerful searching capability, this final group of users should be satisfied.

A common set of tools would be available from third party providers for all these different users. These might include review services, testimonials from other buyers, human or computer based buying agents that given a basic set of preferences choose items and purchase them for the user. Although useful to each group, specific users will use these services differently.

3.14 The INFOBazaar — a summary

Many ideas have been described around several fundamental choices — making a fun, open, and browsing focused environment with a social component to contain all sorts of vendors and service providers. Some of these ideas will be very hard to implement, others will be much easier. The purpose was to propose some guidelines for building an actual system, and expressing some ideas to be incorporated throughout the product lifetime. Vast changes in retailing and shopping are required for parts of the system to be successful. To really understand a system, the best thing to do is to try to build a prototype.

4 The INFOBazaar prototype

Having described the various issues behind the INFOBazaar system, this chapter discusses how the INFOBazaar project developed. After a brief history of the project, I present the interface of the prototype. Functionality considered includes displaying a single screen, moving between screens, creating the Favorites box, faking the ants, and finally tracking mouse movement.

Then we examine in greater detail several parts of the interface to compare the implementation with ideas from the previous chapter, to describe design choices and to consider lessons learned. Details of the implementation are included to make a comment on the programming environment, so that the reader can better understand the difficulties resulting from making certain design choices and whether this was a suitable environment to build the INFOBazaar interface in.

4.1 Building a system

My involvement began during my summer internship of 1993 with a meeting of various people from Bellcore's applied research area to explore electronic shopping. Given the varied background of the participants many different issues were brought up, however, the emphasis remained on trying to attract traditional large vendors and not on building a revolutionary system. One useful idea proposed that a social component should be considered as the differentiating aspect of Bellcore's system. It was agreed that more thought was needed, especially considering the interest being shown in the industry. While they tried to build a real system, I decided to carefully consider the issues. The effort to implement the official system is still in a very early stage.

At first the ideal "mall" was considered as the focusing metaphor, but it quickly became clear to me that a "bazaar" better captured the less structured and planned, and mainly more random nature of the offerings that I wanted to be available as described in previous chapters. Given the idea of a bazaar as a starting point, the various issues described in the last several chapters were researched and evaluated, as well as discussed informally with my fellow group members. Finally, the

required PC arrived so it was time to make part of the INFOBazaar vision real by building a prototype of the interface.

Although what hardware the INFOBazaar will arrive on is far from decided, the PC is the most commonly available platform that has the necessary capabilities today. Although high-end at the time, a Pentium based PC was chosen because it will soon be the main-stream platform. Content was created using CorelDraw 5 and Corel Photo-Paint for basic artwork, Adobe Premiere for simple movies and animations, and some simple sound capture and video capture software. Although content was just a side issue in this project so it could not take too much time to produce, it had to look as visually stimulating as possible to produce a good prototype. Stores were created purely for discussion and example purposes and are not based on anything real.

On the PC, Microsoft Windows for Workgroups 3.11 was chosen as the operating system, and Visual C++ version 1.5 was used as the development environment. MFC, or Microsoft Foundation Classes, included in Visual C++, is a set of classes designed to make building a windows program both easier and more compatible with the object-oriented viewpoint of C++. I feel it is critical to consider the implementation environment because it strongly effects the interfaces that are chosen. The result of selecting this development environment will be discussed starting with section 4.8.

I was interested in whether we could have four or eight stores on a screen. I wanted to build some methods for movement, basic directory listings, and the look for a couple of sample stores. The task also included seeing what the "ants"[60] might look like. I chose to make my system run from my local machine, with no clear client-server architecture, to try to limit the problem I was tackling. Additionally, there was no database backend to handle search queries or build stores with more complex data storage requirements.

Because the focus of my prototype work was the interface, there remain a number of difficult issues that will need to be considered to make this prototype into a fully functioning system. Issues include the network architecture, the store building

[60] The ants are my name for a representation of other users of the system. In this prototype they appear as colored circles at street level and as a density map at the map level.

API, incorporating a complex database backend for the data, the business model and the pricing structure, and the specific technologies needed to present content.

4.2 The starting screen

To begin considering the interface, I will describe the first part of the application the user sees, the starting screen (see figure 1). On startup and exit, the system plays a short segment of audio to welcome and bid farewell to the user. When the application starts, the user always starts at the same screen, the "home block". From this block, a user can enter a store or move to another block, using any of the techniques described below.

A block is composed of an overhead view of several stores, currently only four or eight, although the implementation could support as many as twenty-six without

Figure 1: A view of the "home" block. See the command panel at left, message panel at bottom and the view area filling the rest of the screen.

modification. The user looks down at a three-quarter perspective view of the stores. A store is a 2.5-D block, with a flat roof. This roof-top provides the vendor an area to place an image to try to attract users to his store. The stores are

placed at the intersections of "streets". Blocks are given a label based on their location on the Cartesian plane. A block might be labeled "North 1, East 1," meaning that the user is one block east and one block north of the "home block". We also could label the streets and use them as direction pointers. A block is just one component of the INFOBazaar screen, filling the view area. The view area is used to display the insides of a store, the block view, or the map view of the bazaar.

The INFOBazaar screen evolved into three main areas that fill the user's entire screen, the largest being the view area just described. By covering the entire screen, the interface separates the user from the rest of their machine to try to focus attention on the INFOBazaar. It also guarantees that we always have a constant and maximal amount of space in which to display stores.
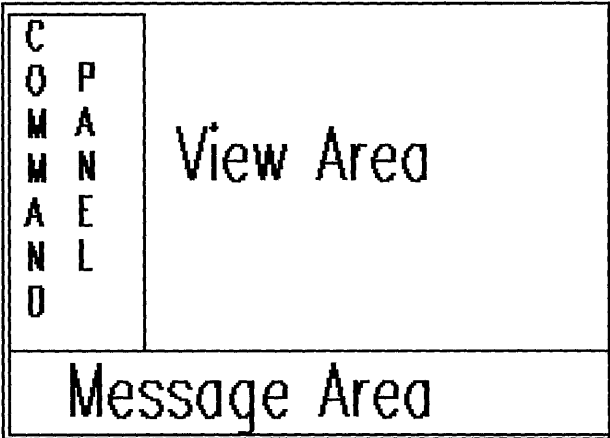

Figure 2: Outline of the areas of the screen

At the far left is the command panel with a set of buttons for controlling the interface. On each button is a picture that tries to represent the functionality resulting from pressing it. Buttons include, from bottom to top, an exit button to quit the application, a people button to add or remove the "ants", a master store index button, a "go home" button, a movement control box, and a Favorites List button to bring up the dialog box described in a later section.

The movement control box is composed of four arrows surrounding a level change button. This level button switches the view between the street and map levels. Although not currently possible, it would also change to the global level for moving between INFOBazaars. Another navigation tool, is the "go home" button that takes the user
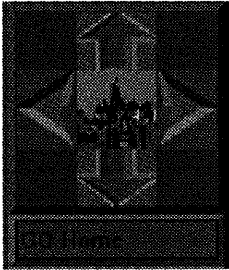

Figure 3: Movement control Box

to the starting block at anytime, so that however lost he becomes, he can always easily jump back to the starting block.

Along the bottom of the screen is a message and status panel. By using this message box, information can be given to the user without bringing up a pop-up window used in many Windows applications. The problem with pop-up windows is that they force the user to pay attention to what may be insignificant messages because they obscure the view and take all user input until closed. There is a standard status bar available to Windows applications, however, it is too small (a single line) to present the information I wanted to display. The left half of the box displays messages to the user — he just changed to a new screen, clicked on a store, and so on. It also displays short advertising messages as will be described in the section on immediate feedback and mouse tracking (section 4.7). The right half of the panel displays system status information such as which screen the user is looking at, and whether traffic is currently being shown. Traffic being the moving "ants", as will be described in section 4.6.

To make a direct interaction style interface, all commands exist as clickable buttons on the control panel and some also as keyboard keys (arrow keys for movement), not as pull down menu items. This is not consistent with the standard Microsoft Windows application model, which expects all commands to be found on the "toolbar"[61] or in pull down men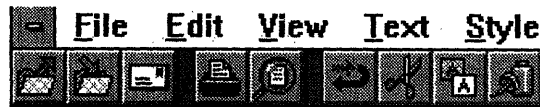us found at the top of the screen. A direct interface makes its quicker to use and more like a game than a traditional application.

Figure 4: Traditional application interface

4.3   Moving between screens — keyboard, mouse, and maps

Having created a single screen, it was time to make it possible to use the keyboard or the mouse to move from one screen or "block" to another. The simplest way to move around the INFOBazaar is to click either on the arrows in the movement

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[61]   The toolbar if used, appears just below the menus. Its main problem is the small amount of space allocated to each icon. Without the "balloon" help to tell the user what it is as he moves the mouse over each icon, they are hard o decipher and typically intimidating because of the vast number in most applications.

control box or to use the arrow keys on the keyboard. The arrows were placed together to try to make it possible to complete a series of movements quickly.

When an arrow button is clicked on or an arrow key on the keyboard is depressed, the screen is redrawn to display the next block of stores in the selected direction. It is not possible to incrementally scroll stores across the screen. There is no information at the block level to tell the user in which directions they can move. So, if they select an invalid direction, a message is displayed in the message area, and auditory feedback is given as well. If the block exists, they hear a swishing noise before redraw occurs.

Because of the length of the screen redrawn process (three to five seconds), stores are built incrementally in front of the user, providing immediate feedback and something to watch. When redraw is complete, the status information in the message box is updated and a message is presented to the user to tell him which direction he chose.
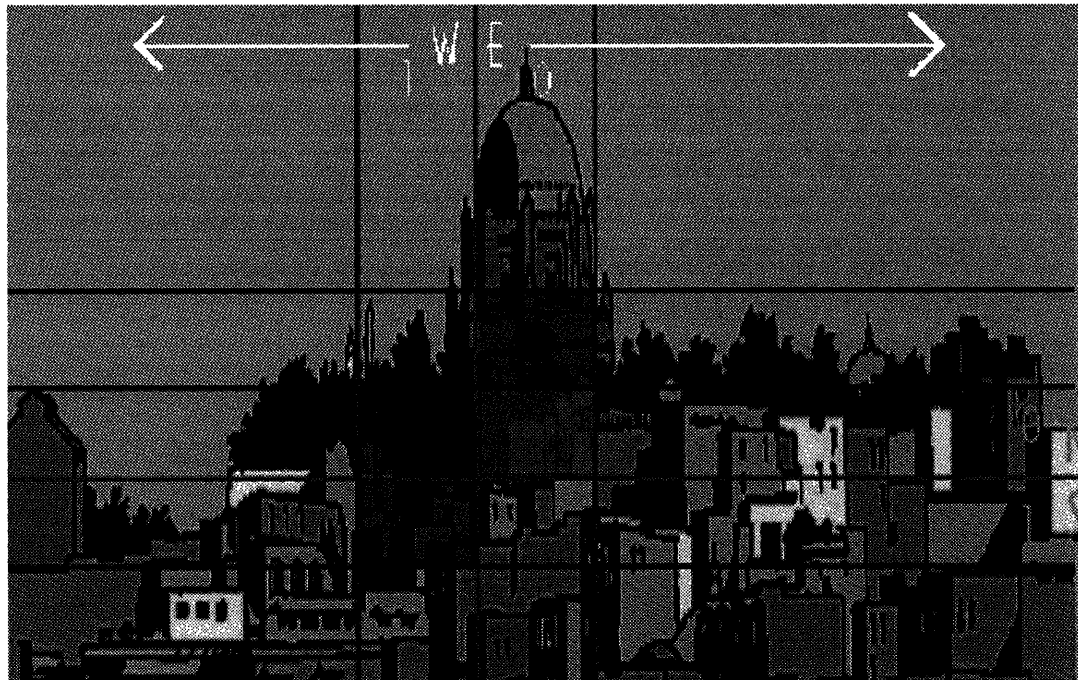

Figure 5: The bazaar map level, existing blocks are colored in, arrow and grid labeling do not show up well in gray-scale. The user is at North 1, East 0.

Using the INFOBazaar map (see figure 5), the user can quickly move to another block. When the change level button is clicked, the current level is alternated between map and block views. Without the ants turned on (see section 4.6 for discussion of map with traffic), the map is a grid displayed with squares filled in for those blocks that exist and a red circle marking the current position of the user. The home block is a different color and is positioned in the middle of the screen. Although currently represented by a square of transparent color, existing blocks should be signified by a miniaturized version of each block.

At this time there are no landmark features (described in the previous chapter) because of the limited number of blocks created — four. The starting screen has four stores as does the one north of it. The screen to the west and southwest of the home screen, both have eight stores on them. At this point, the map screen can only display six squares to the north and south and twelve or so to the east and west of the home block but that could be made to depend on the number of existing blocks. The user can click on a specific square to move back down to that block. This is a quick way to move around.

4.4   The store directories

Directory information is likely to be very important, so a fair amount of effort was put into creating an attractive looking prototype. Without a database backend, it does not make sense to do any work on searching or the master directory so instead work focused on a "Favorites List" management tool. Using the tool, the user can select from his current list, get information on any store in the list, go to any store in the list, delete stores and add new ones from the full list.

On opening the box there are several sections each with their own controls over a color coded background. At the bottom is a message box for giving feedback to the user such as reminding him to select an item before hitting the "Goto!" button. Above it are the "favorites list" section and the "full list" section. The full list is a complete list of all the stores in the INFOBazaar. Both have a combo box control[62] in which the user can scroll through and select items. To select an item they can either click on it directly with the mouse or they can start typing in the

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[62]   One of the basic list and selection controls included in MFC. It has an edit box at the top for typing in text and below it is a scrollable list.

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[62]   One of the basic list and selection controls included in MFC. It has an edit box at the top for typing in text and below it is a scrollable list.

edit box at the top of the combo box control.

I implemented a function to create a completion based edit box so that once the user types in enough text to have an exact match, the rest of the text is filled in and the name is selected in the list box portion. This required some tricky uses of the built in search capabilities, however, the goal of trying to reduce the amount of required scrolling was a specific interface design choice throughout the system.

Next to the edit box in the full list section is the "Add" button to add the currently selected item in the full list

Figure 6: The favorite store dialog box with the info portion open.

to the favorites list. Just above the "Add" in the favorites section is a "Delete" button to remove the currently selected item in the favorites list. At the top of the favorites area, the user will find the "Cancel" and "Save & Quit" buttons. The user, by clicking the cancel button, has the option of discarding any changes made since the box was opened. The final two buttons in the favorites section are the "Goto!" and "Info!" buttons. Given a selected store, "Goto!" will redraw the view to show the block with that store on it, while "Info!" will display information about that store.

When the user clicks the "Info!" button, the dialog box is lengthened to show two new sections at the bottom of the box (see figure 6). One is a four line display showing a short advertising message from the vendor and the other area below it is

a small edit box with the current personal annotation about the store in question. Clicking on another store name will update the information section to match the new store. It will also save any changes made to the annotation. Clicking the "Info!" button again shrinks the window back to its starting size.

Hitting the information button on the main control panel brings up the INFOBazaar Directory box. This box lists all the stores in the INFOBazaar and has a "Goto!" button to take the user to the block with a certain store on it. Although

Figuire 7: The INFOBaszaar Directory

the "Info!" button is currently non-functional, it would have the same effect as the one in the Favorite's List box.

4.5   The sample stores

One enjoyable part of building the prototype was creating its look and the little marketing statements while trying to be wacky and funny at the same time. Trying to find an interesting information statement or creative store design makes browsing more fun. Fortunately, these two actions complement each other. Because they are trying to be humorous, most of these sample stores are unlikely to exist — even more varied are how the stores might look inside.

When a user clicks on the roof-top of a store, that store opens up to fill the view area. The vendor is allowed to do anything with that area. Two stores were created as prototypes of what a store might look like. The first store created was *CD's and Moe*, featuring Moe, CD's and assorted candies. The goal in creating this store was to fill it with video, audio and to be as odd and unusual as possible.

The *CD's and Moe* store is made up of two areas, a control panel on the left and a view area (shaded to look like a 3-D surface on the rest of the screen) in the
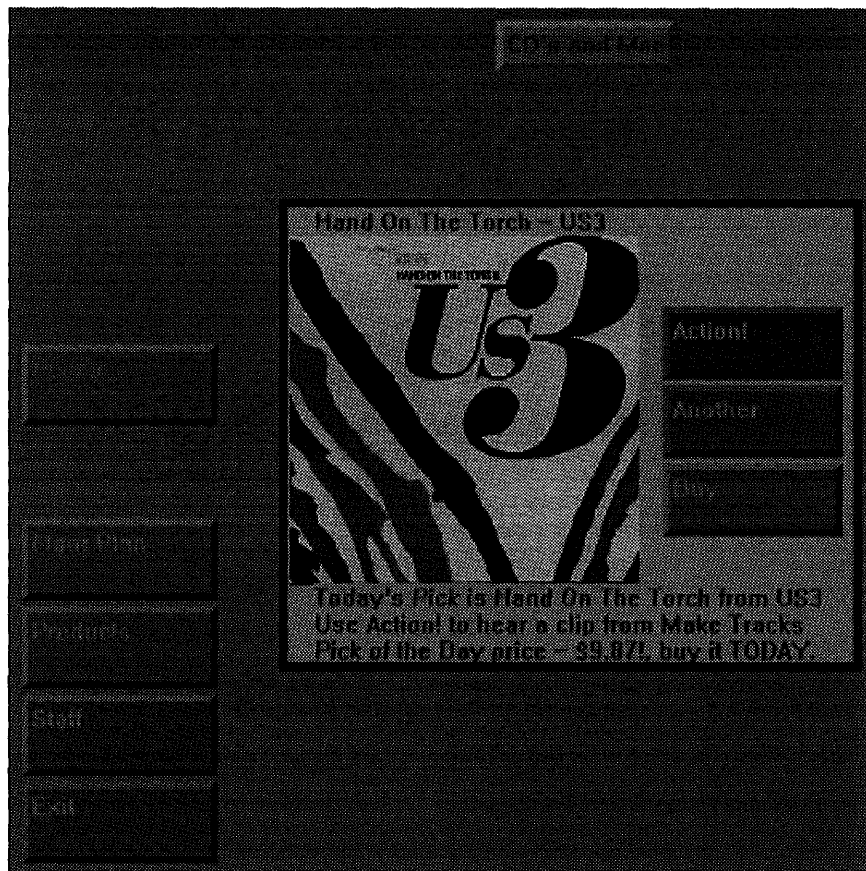
Figure 8: The inside of CD's and Moe. At this point the products button was pressed and US3 CD was "pick and showed."

middle of the screen. When the user enters the store, he is welcomed by a short video clip of Moe played on the view area. To the left is a group of control buttons. Although, I chose to use more traditional text buttons instead of the iconic representations used in the main control panel, the buttons are colored

becoming a darker shade from top to bottom. Just as on the main control panel, there is an exit button at the bottom. There is a "staff" button that brings up a dialog box with a list of staff members and a couple of questions for the user to chose from. After
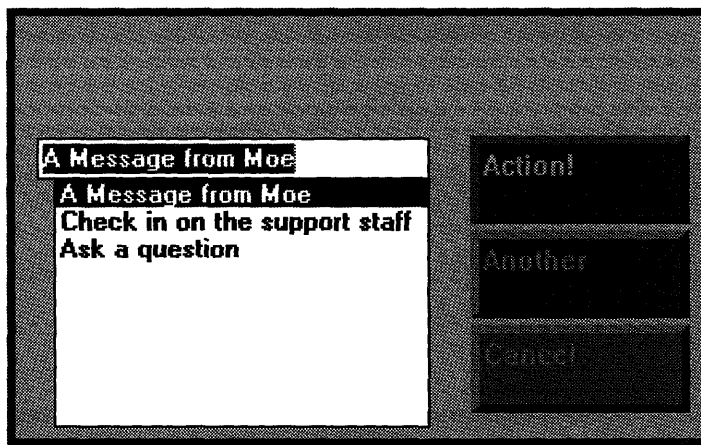
Figure 9: Staff dialog box

selecting an item from this list, the user can then hit the "action" button to play a small video clip associated with it.
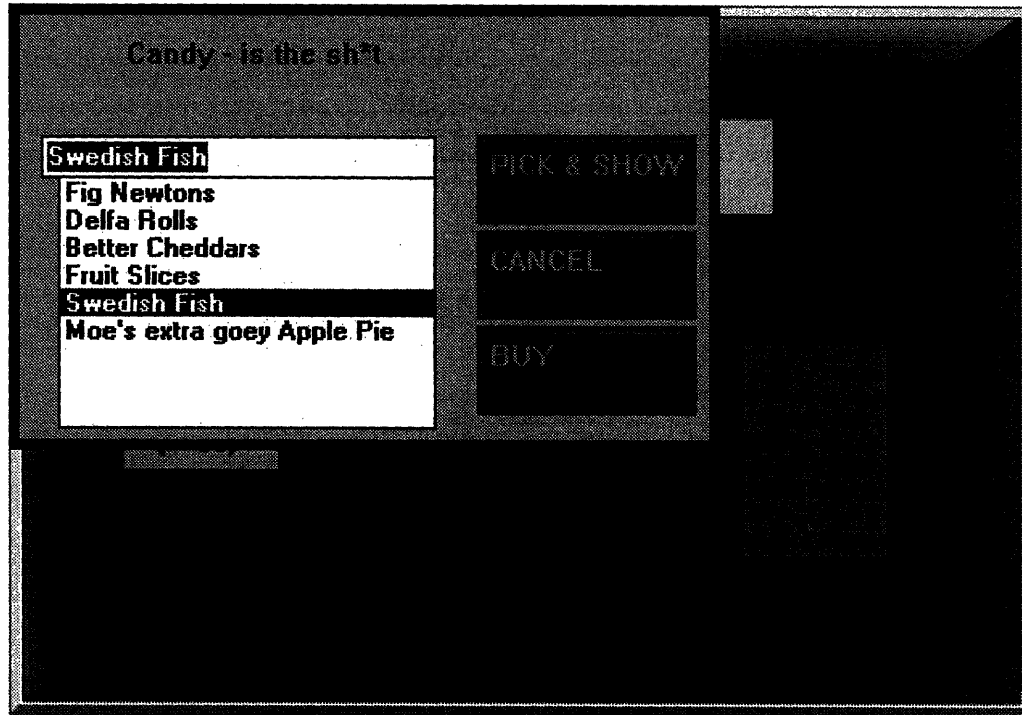
Figure 10: Floor plan with candy products list overlayed.

Then there is a "floor plan" button that increases the size of the view area and presents an overhead view of the store with a front counter, a candy counter, a CD area, and a door to exit the store through. Each of these can be clicked on. There is a "products" button in the main control area that brings up a dialog box listing all the products. The clicking on the candy counter (see figure 10) and CD counter in the floor plan view brings up the same dialog box, but it only lists the subset of products matching the chosen product counter. This dialog box lets the user select an item, use buttons to "pick and show" it, to "buy" it, or "cancel" to close the dialog box.

Pressing the "Pick and show" button expands the dialog box and presents a small picture of the product with an advertising message and price (see figure 8). Available commands from this expanded window are "another" to go back to the list view, "buy" to buy the item (currently non-functional), and "action" to get some sort of presentation of the item. This presentation is a short audio clip from

the displayed CD or a short video clip of the candy product being digitally manipulated.

The final button, in the main control area, is the "people" button. At this point this button does not do anything, however, it would bring up the floor plan view with "ants" such as those seen on the block view and a set of controls such as talk, set privacy, turn on friends (these enhancements are described in section 4.11)

For my second store, I decided it should be a very different type of place. So *Repairs For Lesk* was chosen because it is an information based vendor unlike *CD's and Moe*, however, not one that would require complex database capabilities to implement. Opening the store brings up two large picture buttons, one of a programmer to handle code repair and the other of a computer technician to handle electronics repair. Clicking on either button brings up a problem specific form to be completed by the user describing their problem in detail so that the repairman can then help effectively. The form comes up offset from the problem
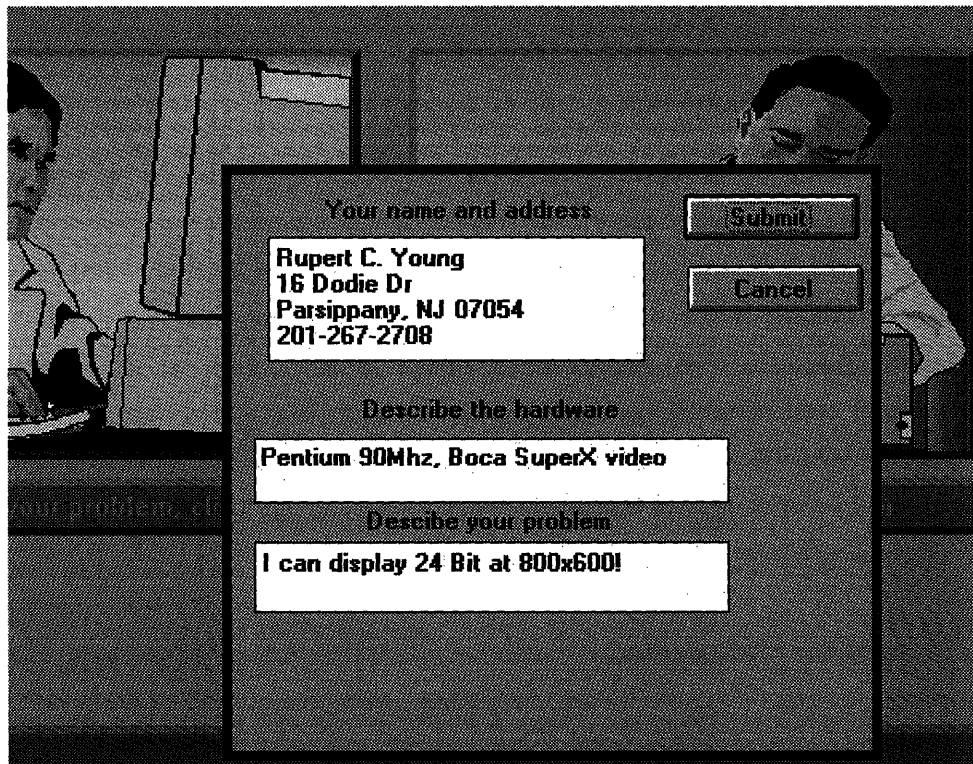

Figure 11: Repairs for Lesk — at this point the hardware engineer has been selected and the problem description is being filled out by the user.

button clicked on. Below these picture buttons is a long red exit button that closes the store.

Although this is a very simple store interface, it serves its purpose. A store such as *CD's and Moe* would require much content creation and thus would be time consuming to create. Not all service provider stores will be this easy to create.

4.6   The Ants

Without a network component to interact with other real users, it did not make sense to try to create any of the interaction technology. The effort here was just to try to create a representation of other users.

People buttons are available at all levels — from inside certain stores, at the block level, and at the map level. The ants will be displayed differently at each level because the number of people visible at each level is very different and thus has to be represented differently.

If the "people" button has been pressed, traffic will be shown at the map level (see figure 12). We cannot hope to display as many ants as there will be visitors to the INFOBazaar without completely covering the screen. Instead of showing individual ants, we will present a translucent customer density (by block) overlay on the normal geographic map. This density overlay will allow users to see what blocks of the INFOBazaar other people are visiting. This view is not only opaque, but also static in the current prototype.
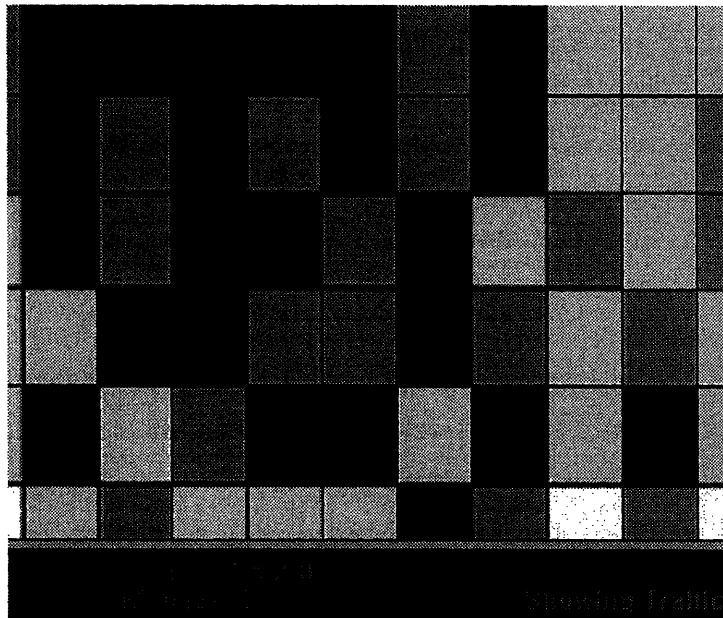

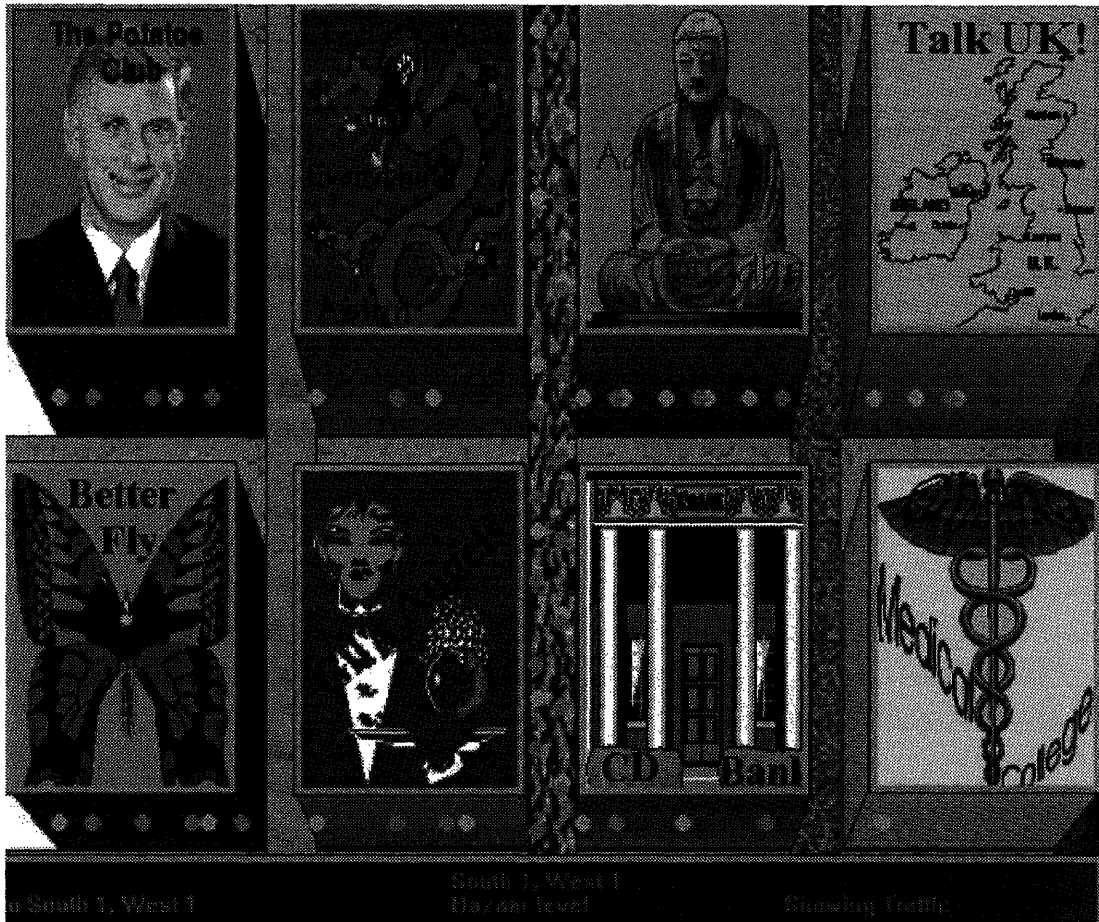Figure 12: Traffic density map at bazaar level.

Figure 13: Block with traffic on. Colored circles, the traffic, do not show up well in gray-scale.

On the block view, ants are small circles of differing colors and placements (see figure 13). Ants placed over the building part of a store represent users that are in that store. Users just looking at the block are represented as being in the street. Since there are no users at this time, this is all static information. The ants are displayed in two colors to represent how long users have been in their current locations.

What the user will see in the store is up to the vendor. As described above, no actual traffic display was created for the sample stores. Although there are many different possible representations, a useful ant display for *CD's and Moe* would not have looked any different from the block level ants so creating the functionality was not a priority in the prototyping effort.

4.7 Instant feedback — tracking the mouse

The final piece of functionality added was to track the mouse as it traveled across the screen. Although this works well enough to show the concept, it needs to be improved to react better to user actions. The major problem is that video is not interruptable making animating a roof-top a serious problem (described in detail in section 4.12).

As the user moves the mouse around the screen, different things can happen. I only built sample functionality for two stores. When the mouse is moved over the *CD's and Moe* roof-top, a short audio clip is played from the *CD of the day*. Also a short advertising message about the store, is displayed in the message box. This allows the user more immediate information, besides what can be gleaned from the roof-top image about the store, without having even to enter the store. For the other store, *Ralph's Odd Art*, a short video clip of some of his products is played inside the store roof-top when the mouse is moved over it.

4.8 Evaluation — design despite the environment

A number of interesting ideas were described in the last chapter for building the INFOBazaar. However, ideas are no more than words written on paper. Building a real system makes the designer aware of the constraints of the environment chosen to implement the system in. Although in the ideal situation anything is possible, we have to compromise our ideals because of time constraints and implementation details.

My plan was to try to flesh out a real version of the most basic parts of the INFOBazaar. I will describe how that developed and some potential enhancements. Along the way, I will describe how hard it is to build "multimedia" under Windows unless a design is chosen that matches the high level functionality provided by MFC. The MFC environment makes building Windows programs much easier than before, however, it lacks support for things that turned out to be important to this interface.

To do some basic things, I had to come up with clever "hacks" because there was no clean implementation available. For this reason, I think it is important to describe how I tackled some of these problems. This will also emphasis how hard

certain seemingly easy things were to do. These difficulties make a strong case for using a higher level implementation tool than Visual C++. The current crop of application building toolkits are generally very weak in their media support but the authors of products such as Oracle Media Objects and Script X are trying to remedy this.

4.9 Building the screen

The goal in building the block was to produce an overhead view that was graphical. The first task was to create this view by placing a number of images on the screen. I began the task of learning Visual C++ and the MFC style of writing Windows programs, by trying to load a single bitmap image[63] from a file and display it on the screen.[64] There are no MFC calls for this simple operation. MFC expects bitmaps to be compiled into the program as "resources" but this clearly was not acceptable because of the large number of images and their dynamic nature (vendors should be able to replace their roof-top without waiting for a new release of the application to be distributed). After some struggle with the details of the bitmap file format and display routines, an image was displayed successfully. If I had not felt using images in this way were not so important, I would have decided to fall back to simple text boxes or the use of video, for which there is support.

Having loaded a single image, it was time to combine them into stores. To display the stores on the screen required an unorthodox solution. Each roof-top icon is displayed in a dialog box[65] that lies on top of the "view"[66] window. This dialog box, unlike those found in most applications, is surrounded only by an immobile simple frame. The dialog box acts like a "button" by being clickable. The reason for putting the image in a dialog box was the automatic handling of basic window events it provides. For instance, instead of having to check the location of mouse

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[63]   Bitmap is a image file format native in the windows environment. I chose to use the 24 bit color version of this standard.

[64]   I chose to make the screen 800x600 in resolution since that was the highest resolution I could run with my combination of graphics card and monitor.

[65]   A basic MFC window class. There are two types of dialog boxes, modal and modeless. Modal are the most commonly used type in standard windows applications and take all user input until closed. This is not be acceptable, given how dialog boxes are used in this interface. Fortunately, modeless dialogs pop up a new window which does not grab all user input.

[66]   A View is a class provided by MFC to display part of the current Document.

clicks, the mouse click event is sent directly to the dialog box object clicked in for processing.

Although it might seem more sensible to use the button class, buttons are unable to accept all the necessary events.[67] Each class type has a set of events it can "subscribe to." A button, being a control, cannot check such events as mouse moves, something necessary to allow mouse tracking. Painting an image in a dialog box is not the expected operation, so repainting has to be managed directly. Dialog boxes are designed to put controls in. This is just another example of having to use interface classes in unexpected ways to get the required functionality.

Each roof on the screen is an instance of the base class that contains an identifier so that clicks on a certain roof can be handled correctly. To eliminate the need for complex management of which subclasses are currently active because of the variable number of stores on a screen; there is only a single class for all roofs with any special functionality selected for, using the identifier. The identifier is set when the instance of the class is created at run-time. An object for each store is created when a block is first displayed.

In App Studio (used to design interfaces in Visual C++) and the resource file, the location and size of the dialog box are measured in dialog box units (that change with the size of the application window). This was not acceptable, so instead roof-tops are sized and placed directly given the information in a file describing the block loaded at runtime. Again, this was a necessary hack even though this seemed like a rather basic thing to be able to do.

Since a "block" has a number of stores, each requiring three images — the mask to cover the background, the building over the mask, and the roof, and placed over a background image of the streets — there are many files to be handled. So an intelligent naming convention had to be created, because in the MS-DOS file system, there are only eight characters to encode the required information.

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[67]   A button is treated as a Control in MFC designed to be in a dialog box or other display class subclassed from WND, the window base class, and thus window events are not handled by it.

There were three things to encode, the relative position of the store on its block, the image type (roof, store, or mask) and the position of that block on the coordinate grid. A typical filename is ian12e4.bmp where "i" means image file, "a" is the first store on the block (left to right, top to bottom coding), and "n12e4" says that it is the block twelve north and four east of the starting block. We are limited to twenty-six stores on a block, although we could use the numbers 0-5 as well to increase the range to thirty-two. Although there can only be ninety-nine blocks in each of the coordinate directions, that should be more than enough space[68].

For each screen there is a file that specifies how many stores there are on that block and their locations. This design makes it very easy to add new blocks since if the correct files exist, the system allows the user to move to that block. This makes the system very dynamic and allows blocks to come and go and change even while the application is running. I carefully chose a design that would allow a dynamic quality to the system. In the last chapter, I claimed that the system should be fun to browse, and that as a bazaar, we would expect stores to come and go. Hopefully, the file encoding system allows for this.

Generalized routines were created to put ants on blocks with four, eight, sixteen, and maybe more stores.[69] They were colored to represent how long the users have been in their current locations. It might also be interesting to color encode user's idle time. This is the type of information available from MOO's such as LambdaMOO. They also provide a text description of each user that would be easy to support and interesting to use here as well. Also there should be a way to see icons representing the locations of your friends.

Below the block, I wanted to create a message and status area to inform the user of the state of system. The message box is also a dialog box, except unlike those for the stores it ignores mouse clicks. Procedures were created to display text and make sure all the old text is erased before new text is added. Strings are passed to

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[68]   199x199x8 ~ 40,000 stores at 4 per block!

[69]   It has not been tested on a block with more than eight stores so.

the message box with one of several types telling where to display the string. The status area of the message box is updated frequently.

Updating the status area is the responsibility of anything that changes the "status" of the system. At this time anything that changes the status also creates a new screen as well so the status can be rebuilt after screen redraws. To keep current the status display, it is possible poll for changes during idle times in message processing, however, that is not efficient and unnecessary given how often there are status changes.

Another problem is that the message area (the left half of the box as described above) is only changed when a new message is passed to it. So messages remain displayed until replaced so they could become stale. Although a number of solutions were explored to create temporary messages, none worked well. This is not a real problem because the activity of the user causes new messages frequently.

It should be clear from this discussion that support for direct interaction and image based interfaces is very poor in this environment. This is something that must be considered when building an interface. I set very high goals in the idea section to make this an interface as unlike ordinary menu based and list oriented computer software as possible. I feel that the basic screen interface comes close to this goal.

In building screens with four and eight stores, I feel I have shown that this particular way of allowing vendors to display themselves is desirable. I feel that the main screen, unlike other parts of the interface that are missing important technology to support them, fully brings to life the INFOBazaar described in the previous chapter. There are some enhancements that should be added to make it friendlier to use.

One such enhancement, is to shrink the command panel when a store is entered, thus increasing the available space for display. Also the command panel could be "flipped" (changed) since the navigation block does not make sense when inside a store and there may be general commands useful when inside a store that should be available. These could include a "display information about item," "purchase item," "talk to staff" or other similar buttons.

In creating a couple sample stores, there were no such general store commands that worked for all stores, however, that does not mean that there does not exist a certain level of consistency that could be imposed by creating a new master control block. It is also possible to provide a set of different basic control panels selectable by the vendor. This would provide additional context to the user as to what type of store they are in. We could also allow the vendor to replace most of the main control block (except the exit button) with commands useful in his store. These are ideas that will have to be explored as more stores are built.

Currently, all advertising messages, videos, and audio clips are always the same. To make repeat browsing more interesting, these media should change every time they are presented to the user. An impressive visual effect to add would be an animation depicting the user flying in from a global view down to the starting or "home" block. Another enhancement would be to make stores expand out when clicked on. Trees and landmarks (parks, fountains, historical monuments, etc.) should be added to the blocks to make them more interesting to look at.

4.10   Implementing store directories

Another important part of the prototype was my effort to create a Favorites List box and a Master Store index. To build my store directories, I chose to use a dialog box. Standard dialog boxes and controls are normally very plain. It is very difficult to try to change the color or fonts used in a control. Fortunately, by using VBX controls,[70] it was possible to create much better looking dialog boxes for the two store directories in this prototype. The great thing about using VBX controls
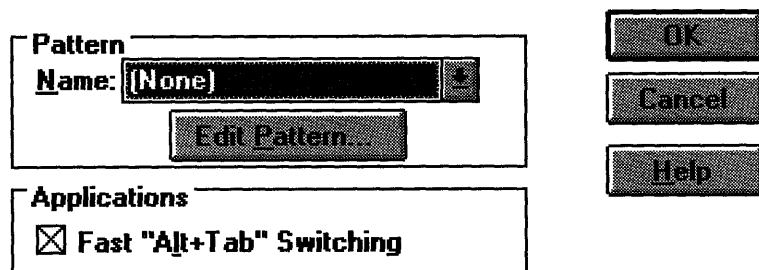

Figure 14: A typical windows dialog box, with a plain white background and black on gray buttons.

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[70]   VBX, or visual basic controls are plug-ins for Visual C++ or Visual Basic that can be used instead of the standard controls in App Studio. There is a large number of these commercially available from simple text boxes to databases.

to paint the background rather than doing it directly, is that they refresh automatically.

Another useful but unusual enhancement to the standard usage of dialog boxes is to modify the size of the Favorites List dialog box while it is still open. When the user clicks the "info" button, the dialog box is elongated to show two new sections at the bottom of the box. A problem with the Favorites box is that it covers part of the view area so I wanted to minimize its size when possible. Changing the size led to a better understanding of how to force refreshes because the text in the advertising area would not display unless refreshed on resize. Having to handle refreshes by hand adds another level of complexity to the entire prototype.

This Favorites List dialog box, although an improvement over standard dialog boxes, is still a "computer interface" with too much text and too little graphical or visual content. Because of this, the box would be particularly unsuitable for TV presentation. A better interface would allow the user to drag and drop stores from the view area to the Favorites List dialog box instead of requiring them to scroll through the full list or type in the name of the store. Once placed in the box, the store icon would be reduced to a smaller size to facilitate quicker scanning.

Given the basic product category icons described in the previous chapter, we could also organize stores by category inside the Favorites List dialog box to help the user organize their favorite stores. Other more visual ideas for finding products were discussed in the previous chapter. The prototype Favorites List stands as a compromise between trying to push the limits of the interface building tools in Visual C++, and the time constraints of this work. These visual enhancements would be very time consuming and difficult to develop using Visual C++. The current Favorites List still is an improvement over the list boxes used in other systems because it is more pleasant to look at and it includes completion based entry to reduce scrolling.

The master directory box is composed of just a list of stores. However, much of the discussion in the ideas chapter focused around the requirement that there has to be some complex search capabilities made available to find products and stores. This would require investigating relational database technology and search

algorithms. This is a key area that needs additional work. Searching and displaying the results are large enough tasks to be the focus of their own thesis.

4.11 Creating sample stores

Having created ways to browse and save favorites; some sample stores had to be created. Before a store could be created, a method for making the stores separate from the main object code had to be found otherwise we would lose the dynamic quality we tried to allow in the file encoding work. The decision was made to use DLLs[71] because they allow the greatest amount of dynamic loading. True dynamic loading in windows based C++ is not possible, however DLLs come close. With a DLL, the calling program has to know the DLL's external interface API, and that the DLL exists at compile time. However, the actual implementation behind that interface is loaded at run-time. So using the store naming convention given above, we can create a standard interface that will be called and let the vendors supply a DLL for the system to run.

The interface chosen at the moment is simply "OpenStore" that opens up a new dialog box, covering the "view" area, and capturing user input until exited. Inside this area the vendor can do anything they want. There are only a few things that must be clear to the user in the interface, how to exit the store and how to purchase an item. Even that may not be necessary, since the main control panel is always available allowing the user to quit the application if they do not know what else to do. This is an extreme case that we hope will not happen.

There are a number of possible enhancements to the stores that were built. The "staff" messages in CD's and Moe are currently prerecorded messages; as part of adding a communication mechanism to the system, users should be able to connect live to a staff member whether by text or video. Also in CD's and Moe, hitting "buy" does not do anything yet. It should bring up a filled in order form for the user to accept as complete or let them add the item to their "shopping cart". This relies on transaction API calls that the system must provide.

Another major hole in this store is the lack of "people" button functionality. It should bring up the floor plan view with the "ants" moving around and a set of

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[71] Dynamic Link Library — very commonly used in windows programs.

controls such as talk, set privacy, turn on friends. "Talk" will allow users to call another person whether on that screen or not. "Set privacy" would let users control whether they can be seen or called by other users on the system. Also part of the traffic functionality is a control to change from no traffic, to only friends, to show all users. Again this relies on a communication API that will have to be created.

4.12   Tracking the mouse

As part of an effort to make the prototype more interesting to use, I decided that I would try to track mouse movements and provide instant feedback to the user about stores through text in the message box, or playing an audio or video clip. The first problem was to tell when the mouse was over a store and when it moved back out onto the street. Unfortunately, there are no mouse enter and exit window messages that can be used to track the mouse cleanly. It is possible, however, to track mouse move events. Additional state was added that held the store location during the last mouse move event. If the current store location is different, then the mouse location is updated, the old action is stopped, if possible, and a new action is started if that store has one.

MCI[72] audio events can be stopped at anytime. So audio can be quickly started and stopped as stores are entered and left. MCI video, however, cannot be stopped except by the function that requests the video to start, once it has been given to the media device for display. A good solution for this was not found.

Another problem with the current design is the ordering of event handling by windows. Unfortunately mouse moves are tracked and acted on before refresh events. Video can start playing before the screen is refreshed if when a store is exited from, the mouse is over a roof-top on the underlying block. To handle this properly would require checking the event queue and making sure repaints were done in time. One possible solution is to have additional state that turns mouse tracking on and off. Unfortunately, any lines of code just after exiting a store would probably be called before the repaint event. So turning on mouse movement tracking would have to be called in another function making knowing

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[72]   Media Control Interface, a windows messaging system that lets you send simple play, stop, etc. commands to control different multimedia devices such as audio (WAV), video (AVI, Quicktime), animations (FLI files), and any other media type that your Windows environment has a MCI compliant player for.

when to do that difficult. Another possibility is to destroy the current block (delete the structures and objects that make up the screen, a process used when we change blocks) before entering a store and recreate it when the store is exited. An unfortunate side-effect of this would be that exiting a store would take longer. This is something to be explored in the future.

4.13 Summary

A prototype was created that had basic movement functionality, some stores, a map level, directories, and displayed static ants. These were the initial goals that were set. This is sufficient to prove that the INFOBazaar is a valid concept. We also showed that using the current tools, implementation is not easy in this environment. Although suitable media handling libraries may make the task easier, a switch to another implementation tool may be necessary.

5 Lessons and future directions

Now that ideas have been presented and a system has been created, it is time to consider what was learned and how the technology might actually move from a researcher's desk to the consumer's home.

5.1 The INFOBazaar

In considering the current state of the art, it became clear that there were serious limitations with the interfaces to these products. Current electronic shopping products are considered boring to use. To fund increased bandwidth to the home, applications such as electronic shopping must be successful. At this early stage, no one knows how to build "virtual" stores. We need to open up electronic shopping to a wider range of users and vendors. If vendors are allowed to experiment, the system will converge more quickly on better solutions. We need to allow small household business to participate.

Humans, as the "social animal", have shown that any time a social component is added to a system it is heavily used (e.g., E-mail on Prodigy, chat rooms on America Online). Shopping should not have to be done alone when it is electronic. The INFOBazaar was designed to solve these problems. The ideas presented describe a place that is more fun and interesting to browse, more inviting to use, more open to a wider range of vendors and service providers, and more permeated by social activity than any currently existing electronic shopping system.

5.2 Prototyping the INFOBazaar

The purposed of building the prototype was to try out several ideas, to produce something that other people can look at and understand what one version of the INFOBazaar might look like, and to push the technology to better constrain design choices for subsequent systems. There are many avenues to take using the ideas discussed above. There were even different approaches mentioned that should be tested against each other in trials. The choices made in implementing the prototype were those that came closest to the vision expressed yet could be implemented by one person in a reasonable amount of time.

One of the best aspects of the INFOBazaar model is that it is fun to browse. The user is presented with a graphical overhead view to look for possible vendors to visit. As users move around the screen they receive additional information from the vendors without even entering the store. The interface is very direct and iconic.

In building the prototype, we wanted to make sure that the overhead view could work and that a direct interface could be included. What was built shows that the overhead view can work and that the amount of screen space with eight stores on a block is enough to present an image and attract users. A direct control panel was designed that both iconically represented and included the desired functionality.

This interface was not tested in a usability lab, rather, by the inspection of a small group of users here and at other locations that saw the system. Building any user interface requires careful testing by the members of the expected user population, unfortunately, the facilities to do this were not available to me. It would also require extended periods of time. So the best that could be done was to model ideas from various other projects, using careful studies of them as examples, and stitch together the pieces into a coherent whole.

Another important result of the INFOBazaar model is the wider range of stores we could expect on this system. Having a broad range of possible vendors not only makes it more interesting to shop but also more likely the user will find what he wants at the right price. A goal of the prototype was to show that we could include and build such stores.

Several interesting stores were built, using simple media editing tools and Visual C++ to display them in a Windows application. For a production trial, it would be necessary to include a high level media building tool for vendors such as Oracle Media Objects or Director, although higher level languages such as Script X or Visual Basic could probably be used by a wide range of vendors with some success. Most toolkits do not handle real media very well, however, that may rapidly improve with the success of CD-ROM and thus the importance of suitable authoring tools.

A final important part of the INFOBazaar model is that it incorporates social activity into the shopping experience. The prototype displays people so that they could be interacted with if there were a communications mechanism added. This part of the prototype is not fully functional because of a lack of time.

5.3 The innovations of the prototype

Visual C++ turned out to be a good but not perfect environment for building the prototype. Given image compression routines for faster image retrieval, the prototype would perform well. Using the MFC classes was a clear win for ease of programming over the original C based Software Development Kit calls. This was clearly a prototype designed with several different coding methods as I learned how to do things better. As it stands now, parts of the application, such as mouse movement tracking, are in a state that can only be used to demo the ideas. Their current behavior would not be acceptable in a real system.

Using this environment, a prototype was built with several unique features when compared to other electronic shopping environments. All other Windows based applications are menu driven and list based. I created a direct interface, without any menus, and without list based selections where possible but one that was not as limiting as used in Interactive TV applications. Another important improvement of this prototype was the immediate feedback mechanisms it includes. This allows the system to react to user focus (indicated by mouse movement) without requiring the user to click on something. The final accomplishment of this system was to build a flexible environment that will easily allow vendors to be added as part of the graphical representation even as the application is being used.

5.4 Where to go from here

The prototype has to be shown to someone to at least make the ideas available so that they can become part of the mainstream thinking on the subject. Network and database backends need to be chosen so that real stores and searchable directories can be built and performance modeling can be done over for bandwidth requirements. A toolkit needs to be created to make building stores easier. The "ant" idea needs to be made to represent real users. A communication system is necessary to allow users to interact with each other. There is much potential

technology that has to be analyzed and added since much of the functionality exists already in other products so that work hopefully does not need to be redone.

At the same time different pricing models need to be created as part of business modeling. I think this will be a very difficult task because this type of product does not exist yet, so users will have a hard time saying what part of their normal activities it will replace and vendors will not know what they need from the system to survive in the environment.

The next stage is to trial the technology in the home. This will be a challenging because of the state of the existing technologies. TV resolution is not great for this application yet TV is the best potential environment given the strength of the cable and phone companies that plan to soon offer large bandwidths to set-top boxes and TV's. Hopefully, HDTV will happen quickly, otherwise the service may have to run using computers. Computers in the home are becoming increasingly common, so there may be a large enough potential market. One way to start would to be to have one bazaar and as traffic increased split it into smaller marketplaces. This may be confusing to users to some extent because of the changing location of the stores, however, it is more important at this time to get the technology out so it can be tested.

There are so many unknowns that trials are of critical importance. Since this is an electronic environment, it can act differently for specific individuals making it much easier to try out different pricing structures. There will be many competitors, however, at this time the market is wide open so any set of good ideas can win. Having a better set of features could give a specific system a great advantage in the early going, the ideas described above make the INFOBazaar such a system. The INFOBazaar model, as portrayed by the prototype, is a viable approach and will be a vast improvement over any single existing system when the prototype evolves into a fully functioning system.

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Appendix

Below is a chart showing a comparative rating, in six crucial areas, between the different systems discussed. With each rating is a short explanation. See the body of the thesis for the full reasoning behind the ratings.

	Extensibility	Social Functions	Browsing Support/ FUN	Directed Shopping	Store Building Tools	Bandwidth Needed to Support
On-line Services eWorld CompuServe AOL Prodigy	(weakness) Limited by lack of searching tools for finding stores	(balance) Separated to special chat and meeting areas	(weakness) Limited to searching through lists of stores	(balance) Limited searching tools	(weakness) Supports only product lists	(strength) Modem ISDN
Interactive TV Time Warner	(weakness) Limited by vendor wishes	(weakness) None???	(weakness) Some ability to choose between the stores on the system	(balance) Few vendors so easy to find a vendor	(strength) Multimedia authoring tools	(weakness) 1.5Mbits or higher?
WWW based ISN NetMart First Virtual DigiCash Openmarket	(balance) Limited by searching tools	(weakness) None	(balance) Ability to choose between stores on the system		(weakness) Limited by HTML (balance) Simple StoreBuilder Kit based on HTML	(balance) Internet 14.4K Baud and higher
INFOBazaar	(strength) Limited only by how large a map users will navigate	(strength) Comm-unication at any time and see other shoppers	(strength) Changing storefronts and many visuals make browsing fun	(balance) Master directory with many searching tools	(strength) Multimedia authoring tools with great freedom of design	(weakness) Higher Internet speeds with 1.5Mbits+ preferable