

URBAN PILOT
A Dynamic Mapping Tool for Personalizing the City through Collective Memory

by

Aradhana Goel

M.Arch., Department of Urban Design (1997)
School of Planning & Architecture, New Delhi

Submitted to the Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Architecture Studies
at the
Massachusetts Institute of Technology

June 2001

© 2001 Aradhana Goel. All rights reserved

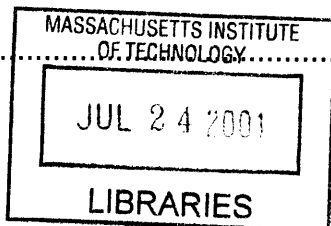
The author hereby grants MIT permission to reproduce
and to distribute publicly paper and electronic copies of
this thesis document in whole or in part.

Signature of Author
Department of Architecture
30 June, 2001

Certified by
William J. Mitchell, Thesis Co-Advisor
Professor of Architecture and Media Arts and Sciences
Dean, School of Architecture and Planning

Certified by
David Rose, Co-Advisor
Director, Viant Innovation Center
Boston, Massachusetts

Accepted by
Roy Strickland
Principal Research Scientist in Architecture



ROTCH

Urban Pilot:

A Dynamic Mapping Tool for Personalizing the City through Collective Memory

The Readers of this Thesis are

William Lyman Porter

Norman B. and Muriel Leventhal

Professor of Architecture and Planning

Carol Strohecker, Ph.D.

Senior Research Assistant

MERL - Mitsubishi Electric Research Laboratories

Anne Whiston Spirn

Professor of Landscape Architecture and Planning

ACKNOWLEDGEMENTS

I would like to acknowledge

Daniel Greenwood for having faith in me
Bill Mitchell and Bill Porter for their guidance and support
David Rose for his interest and valuable insights
Carol Strohecker for her encouragement and critique

I am grateful to

Mark Schuster for being a valuable resource
Lira for her incisive critique at the conception of this thesis
Gregory Beck for his encouragement

Special thanks to

Sanjit for believing in my work and his intuitive thinking
Franco for his valuable help and for being my worst critic
Luke and Lora for the EBQ status and being friends
Ken for helping me with the design prototype
David for making the thesis studio warm and welcoming

I am indebted to

My Puji for being everything to me
My parents for their continuous love and support
My baby Vaanee for making life so beautiful!

URBAN PILOT

A Dynamic Mapping Tool for Personalizing the City through Collective Memory

by

Aradhana Goel

Submitted to the Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Architecture Studies

ABSTRACT

This thesis investigates the use of handheld mobile devices as exploratory personalized tools for dynamic navigation of the cityscape that go beyond cartographic limitations and yellow-page directory services. One needs to capture the hidden information patterns of the city in order to experience it in a meaningful way. The volatile, unpredictable randomness of the city life and its ever-changing patterns need dynamic navigational means.

Unfortunately, existing devices and their applications do not fully address the impelling potential of real-time interactivity generated by Wireless and Global Positioning Systems (GPS). This study proposes a tool, which encourages personal perception and collective experience of cities by providing a dynamic information space that overlaps the city with individual users, both spatially and temporally.

The tool is characterized by a three-tier structure of Personal Filtering, Social Networking and Information Layering. It filters the information through personalization, shares the personal perception through social networks and layers the information with collective, thereby creating a regenerative system that allows for the creation of new patterns and interpretations

Thesis Co-Supervisor: William J. Mitchell
Title: Professor of Architecture and Media Arts and Sciences
Dean, School of Architecture and Planning

Thesis Co-Supervisor: David Rose
Title: Director, Viant Innovation Center
Boston, Massachusetts

Acknowledgements

Abstract

CHAPTERS

1. Introduction

2. Context

2.1 Traditional Guidebooks

2.1.1 Urban Cartography

2.1.2 Guidebooks

2.2 Digital Medium

2.2.1 Web Cartography

2.2.2 Digital Guidebooks

2.3 Mobile initiatives

3. Hypothesis

4. Design Theory

4.1 Filtering

4.1.1 Pre-Screen Filters

4.1.2 Temporal Filters

4.1.3 Collaborative Filters

4.2 Layering

4.2.1 Core

4.2.2 Services

4.2.3 Notes-to Myself

4.2.4 Notes-to-Share

4.3 Networking

4.3.1 Social Networks

4.3.2 Regenerative Information Cycle

5. Design Prototype

5.1 Proposed Design

5.2 User Scenarios

5.2.1 User Scenario - 1

5.2.2 User Scenario - 2

6. Conclusions and Recommendations

7. Bibliography

1. INTRODUCTION

The phenomenon of the city as an interpreted identity is an intriguing concept. It encompasses a myriad of patterns – social, physical, metaphysical - the list is endless. These patterns are constantly changing with time. At any given moment in time, the information is interlaced with hidden patterns. As our mind engages the city at various levels to decipher these hidden patterns, it creates dynamic perceptions. Urban exploration of the city can be heightened if one can capture this highly volatile relationship between the city and the individual. What peripheral systems can aid individual's mind to amplify cognition of the space around him/her? The existing exploration tools somehow fail to capture this phenomenon. The author believes that the potential of real-time digital interface can be tapped to heighten individual experience, both spatially and temporally. This thesis would like to address this challenge and propose an alternative theory to design an Urban Sextant [1].

What would be the characteristic of this Urban Sextant? To find an answer, one needs to ask the right questions. How is the information generated? How is it updated? Who updates it? How is it retrieved? Is the retrieved information customized to the user? What information is the most relevant or appropriate? Giving traffic information to somebody who does not own a car and is sitting in her workspace writing this thesis is as irrelevant as giving submission deadline information to someone sitting in a car in a traffic jammed route I-94. When is the information appropriate and when is it excessive? Does the tool output obvious data or does it reflect patterns (leaving scope for interpretations)? How and when does this information become knowledge? 'What', 'Who' and 'When' are important questions that one need to answer before visualizing the information database or its retrieval mechanism.

The author recognizes two important characteristics. It should be able to map the individual himself, since his personal and contextual information affects the relevancy of information retrieved for him. It should also be able to represent the multivariate data of the city and to somehow reflect the regeneration of information patterns in the city. In short, the tool would need to reflect the individual's experience in space and time.

Digital medium with its properties of time and mutability provides an opportunity to address these complex questions. But the existing digital information landscape assumes a lowest common ground from where a city could be understood by all. The opportunity to read and understand the city in all its uniqueness and absurdities, in all its colors and shapes is lost. The large updated databases address the issue of scale and redundancy of information, but not of capturing the volatility of cities and its changing perceptions. Having access to abundant information data is different from accessing the relevant data. The static black and white information is neither personalized nor is open to interpretations. Moreover, how and when this information is accessed can alter the experience of a place? So it becomes important to be in the right place at the right time to access the right kind of

[1] **sex·tant** (*plural sex·tants*) *noun*
navigational instrument: a navigational instrument incorporating a telescope and an angular scale that is used to work out latitude and longitude. A celestial body is viewed through the telescope and its angular distance above the horizon is read off the scale. The data is then used to calculate the viewer's position.

information. What would be an appropriate technology to experience the phenomenology of space?

Present wireless initiatives that involve the use of mobile handheld devices provide an opportunity for anyone to access information anytime, anyplace. Though the wireless technology roadmap is still very unclear, it does provide an interesting and challenging opportunity. Could the technology be used to bridge the gap between the city & individual and between information & knowledge?

It would be interesting to perceive this Urban Sextant, not as information retrieval system, but as a connector between the city and its people. The tool should be able to reflect the dynamic patterns in the city that are a function of its people. The thesis would like to visualize a system that can capture the collective experience of people along with the individual perceptions. Hence, this thesis is about developing a regenerative information system that captures personal and collective memory in order to personalize one's experience of the city.

2. CONTEXT

Exploration of cities is a three-way process of communication between the user who has particular needs and characteristics, the information that is a representation of a set of spatial and temporal relationships (Information might be in the form of Cartographic maps, Guidebooks, Directory services) and the physical place around the user. The thesis would elucidate information access through different media and its forms of representation to aid an individual's exploration of the urban landscape.

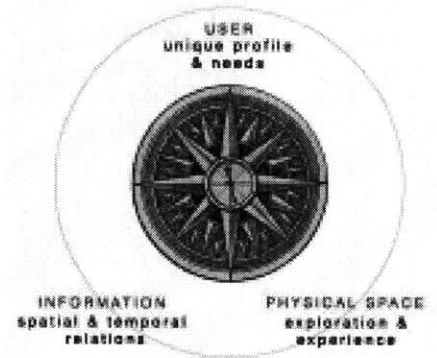
Looking at a very broad categorization, there are 3 different media/forms of information access;

- the traditional paper medium,
- the digital medium,
- and the current mobile initiatives in this field.

It is interesting to note that there exists a wide range of cartographic maps and paper guidebooks; from highly specialized guides like Jonathan Routh's 'Good Loo Guide' to the objective catalogues like the 'Official Guide to New York'. These are static representations but offer dynamic perception since they are relevant in particular context and time. It has inherent in itself the concept of versatile audiences and customization of information for the target audience.

The digital guides, on the other hand, provide large amounts of up-to-date information with retrieval based on a hierarchical system or keyword search. It solves the problem of scale and redundancy of information, but not of information anxiety caused by excessive information and irrelevancy to the user. Dynamism is limited to updates and customizing this information arena to the user is a difficult task. This is a static representation of a dynamic phenomenon in a medium that has inherent in itself properties of time and mutability. Digital information in this form is not portable like a simple paper guidebook and the information needs to be assimilated, downloaded and printed, to eventually become an updated guidebook.

Current Mobile handheld technology and applications are addressing this issue of portability of digital information. Cities are repositories of knowledge and sometimes being in the right place, at the right time, with access to right kind of information becomes a key factor in experiencing the physical space meaningfully. The unprecedented connectivity generated by the wireless and GPS technology, has led to research initiatives in location-based, context specific application. But the existing roadmap of technology, device industry, applications and services is still disintegrated. The challenge this thesis addresses is to tap the potential of this real-time interface to generate a dynamic information structure for urban explorations that can reveal hidden patterns and create new patterns.



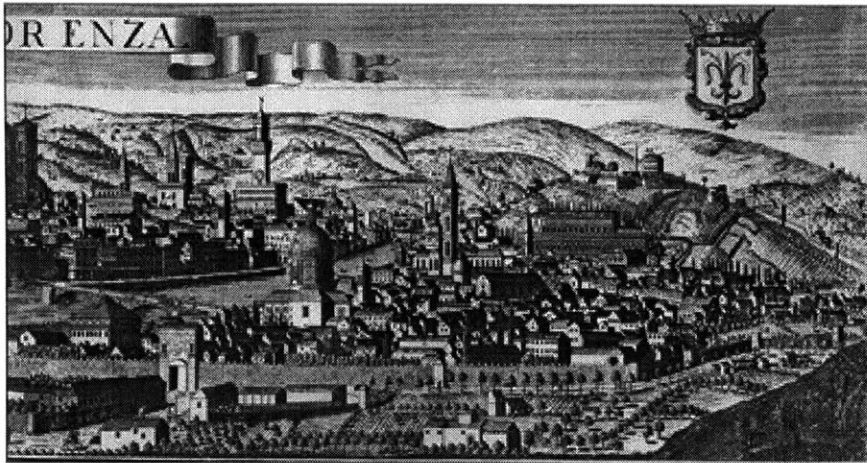
2.1 Traditional Paper Medium:

Urban cartographic maps and traditional paper guidebooks have aided city explorations by both traveler and residents.

2.1.1 Urban Cartography

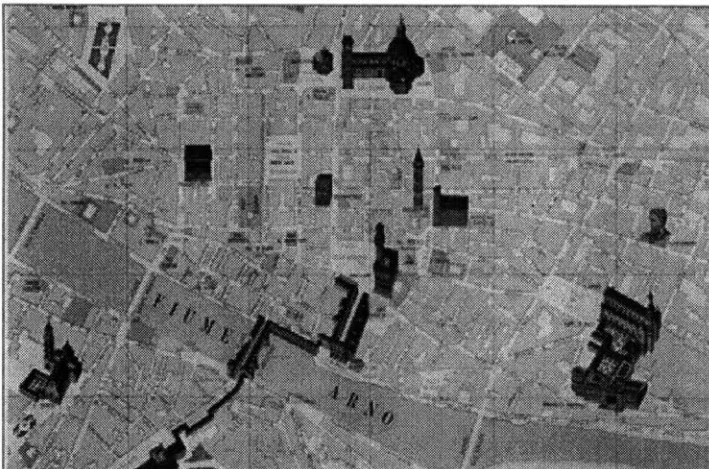
All maps are basically a set of spatial and temporal relationships. Most basic elements include the user characteristics, locations and connections, space and time, symbolism, orientation and finally scale. A map can be seen as a bearer of information, as a graphic means of communication or as a means of potential discourse. These could be purveyors of objective reality or subjective interpretations. And the technique of representation of these maps is a direct function of its user characteristic and the purpose of use. The author has compiled a matrix between the purpose of a map and its representation technique in urban cartography. This research provides a resource for this thesis to suggest appropriate visual representations for a user when he/she retrieves information.

2.1.2 Guidebooks



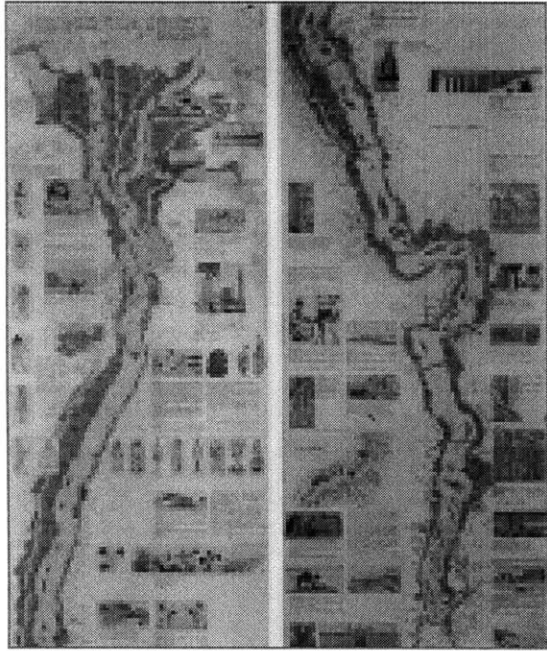
I.

*I. Panoramic View of Florence
Purpose: General Orientation
Representation: Panoramic View
showing City's Skyline, Landmarks
and Cityscape relationships*



II.

*II. Plan of the City of Florence
Purpose: Legibility for Navigation
Representation: Combination of 2D and
3D, Major Landmarks delineated in 3
Dimensions against the Backdrop of a 2D
Street Map, Balance between impor
tance of Information and its Graphic Strength*

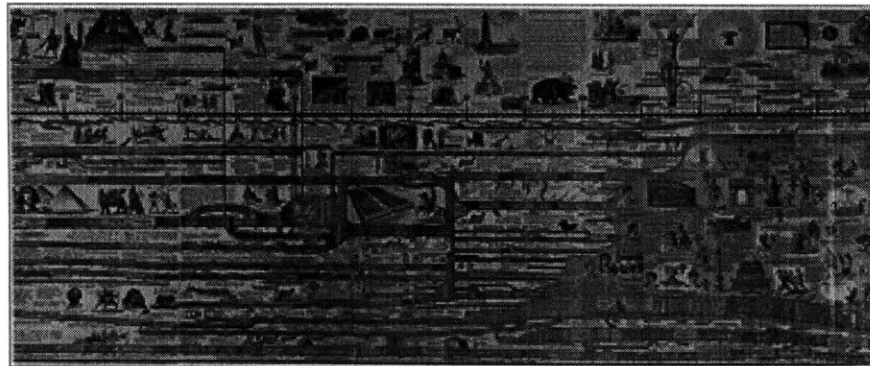


III

III. Pictorial Route Map of Nile

Purpose: Illustration

Representation: A simple map surrounded by images that are keyed to it



IV

IV. A Chronological Chart of Ancient, Modern & Biblical History

Purpose: Temporal Pattern

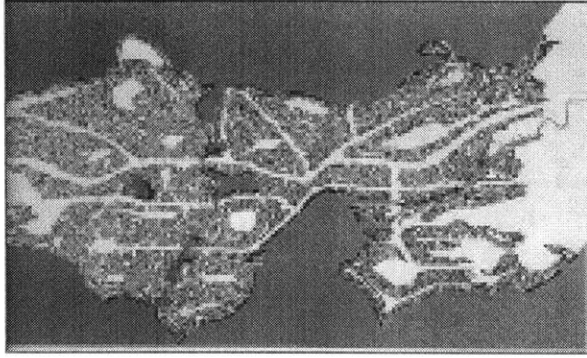
Representation: Combination of various forms as a narrative



V

V. Floating Landmark of Cambridge

Purpose: Image Map for Visual Exploration
Representation: Graphical representation of facades, landmarks & symbols interpreted by the designer

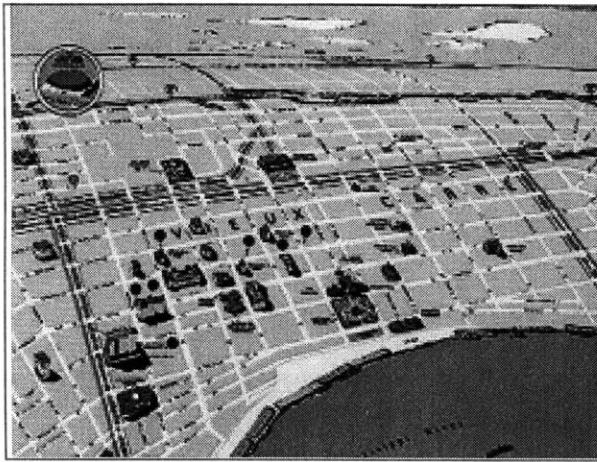


VI.

VI. *Word Map of Seattle*

Purpose: Symbolism

Representation: Mapping places with non-location elements.



VII.

VII. *Perspective View of New Orleans*

Purpose: Focus within Context

Representation: Distortion of a map that highlights the area in focus

Image Source I-VII: Maps - A visual Survey and Design Guide, By Michael and Susan Southworth, A New York Graphic Society Book; Little, Brown and Company, Boston 1982

2.12 Guidebooks

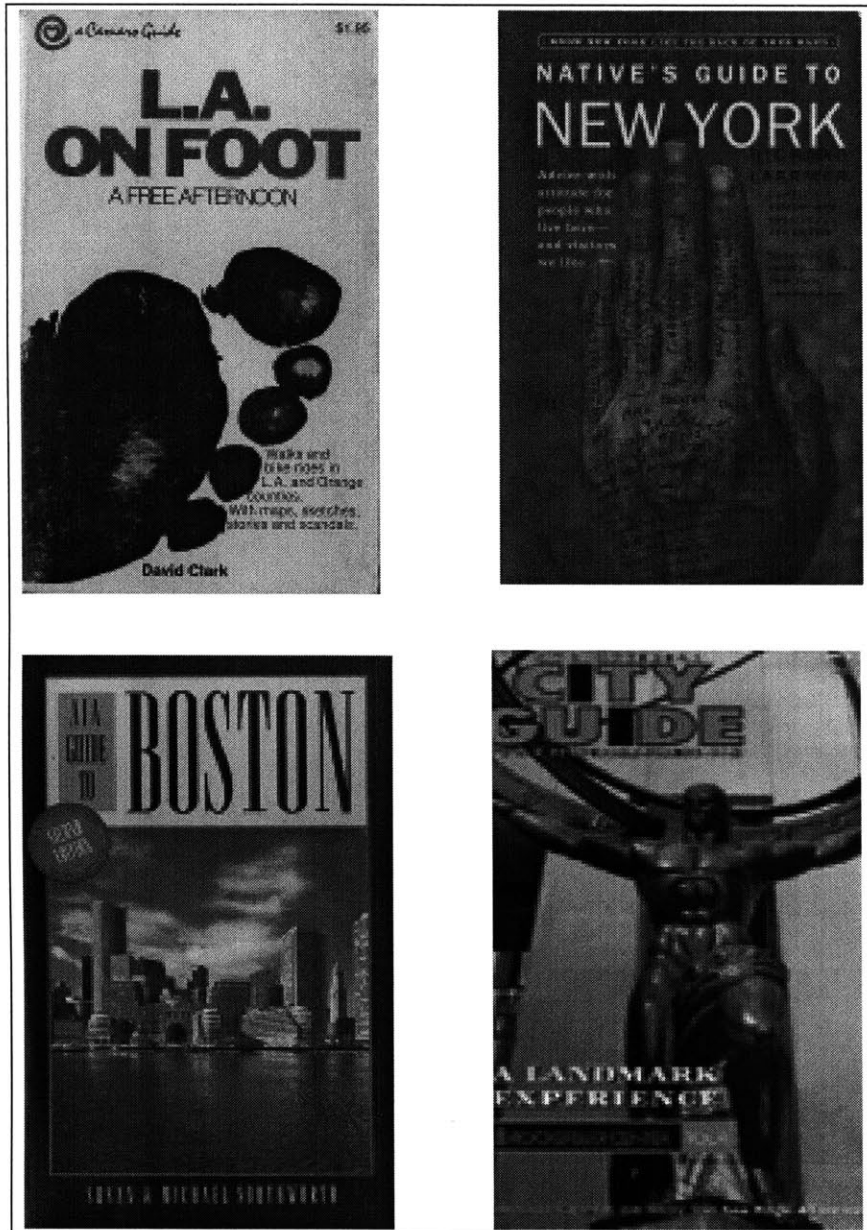
There exists a wide range of guidebooks; from highly specialized guides like 'L.A. on foot by David Clarke' to objective catalogues like the 'AIA guide to Boston by Michael Southworth'.

Some guides are highly opinionated (Nairn's London by Ian Nairn is an opinionated, critical and unabashedly a personal guide), while others tend to aim at a very low common denominator, by assiduously avoiding critical and celebrating comment. Gary Hack and Rob Hollister call these "... bland guides that fall short of sharpening public awareness." [1]

Guidebooks can be catalogues of information which provide the specifics if the person knows what he has in mind; or they can be incomplete but supportive references which encourage the reader to explore. In other words, they can encourage active or passive. An interesting question to ask is: Do these guides allow chances to occur? "Guides which urge active use of the city, must straddle a fine line between delivering programmed experience on the one hand, and on the other, describing the city so even-handedly or providing so many options that the reader does not know how to choose." [2] For example, Lonely Planet guidebooks encourage active exploration, but their condensed pocket versions are meant for passive consumption. The former is a comprehensive guide while the latter is designed for quick reference for audiences with limited time or inclination to explore.

[1] Hack, Gary and Hollister Rob, Cashing in on the Guidebook Boom: It's a long, long way to '76, Landscape Architecture, January 1974

[2] Ibid.



VIII. A Spectrum of Guidebooks Available, from highly specialized to generic

VIII.

The most interesting and relevant aspect of these guidebooks, in the context of this thesis, is the level of dynamism in this range of information. It has inherent in itself the concept of versatile audiences and the information is tailored to a target audience. The middle range of guidebooks that are targeted towards a pluralistic audience rather than a predictable or specialized audience, make an interesting study of choices. Here the author is forced to be selective about their content. The kind of information provided, its categorization and visual representation gives an idea of its intent.

The author has done a preliminary study of a range of guidebooks and has made a matrix between the target audience and the type of information provided. This is by no way a complete matrix of the different guides available but is a start in the direction of understanding the versatility.

Target audience and Purpose of use	Thematic categorization and representation	Examples
Outdoor pursuits for vigorous and adventurous travelers, Exploration and Experimentation	Orientation, events and activities, attractions, off the beaten track, survival guide	Lonely Planet Survival Kit, <u>Fielding's Guides</u>
Cultural and historic sights for the well-heeled traveler	Visual and textual encyclopedic history of the place, important landmark buildings, Timelines	Eyewitness Guidebooks, <u>Rome Walks</u> by <u>Anya M. Shetterly</u> , <u>Nairn's London</u> by <u>Ian Nairn</u>
Budget guides Vs. Upscale guides	Similar themes but arranged with reference to price.	Moon Handbooks Vs. Fodor's Gold guides
Quick time-bound overview for the traveler, Compact guide for walking tours	How to organize time, Top 25 sights, Bests, Where to eat/shop/entertained/stay, Travel facts	AA city pack, Lonely Planet condensed version
Comprehensive mainstream guides, Ideal for residents too, Too detailed for short term traveler	History, By area, Eating and drinking, Shopping and services, Galleries and museums, Arts and entertainment, In focus, Out of town, Survival	Fodor's guides, <u>Frommer's guides</u> , <u>Timeout guides</u>
Comprehensive guide for better orientation of travelers	These are organized by geographical and characteristic areas, Color-code entries to distinguish restaurants, hotels, shops and parks; Notes on history and architecture	Access Guides, Eyewitness guides
Specialized guides that are off the beaten track, Travelers are given the residents' insightful and opinionated view, For keen exploratory travelers wanted to get into the character of the place	Categorized by themes: views, spirit of the city through monuments, bookstores, museums, salvage shops, little known points of interests, viewing the rich, fine streets to walk on, too touristy to take seriously	An opinionated guide to San Francisco by <u>Frank Hansell</u> , LA on foot by <u>David Clarke</u>

IX.

This study of traditional guidebooks and cartographic maps represent a dynamic perception in a static medium. The basic intent is to customize information to suit a particular context and time.

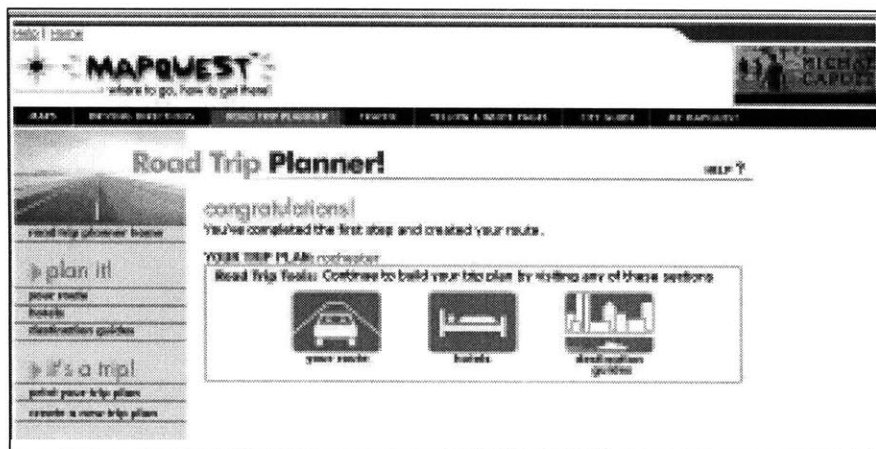
2.2 Digital Medium

The city information landscape in the digital medium is very versatile and complex. It can be seen in various forms like Web-Cartography, Dynamic search engines and online Directory services. The thesis would look at some examples of different types of representations of digital information of cities and then contrast it with the digital city guides.

2.2.1 Web-Cartography

Web-Cartographic visualization process is considered to be the translation or conversion of geo-spatial data from a database into map-like products [3]. These maps are often created for multiple uses including urban exploration. There are some sites providing information on traveling (<http://www.mapquest.com>) by offering information on routing and others that provide time-sensitive traffic and weather conditions. Some sites provide topographical survey maps (<http://www.terraserver.com>) while others give 3-D aerial view of urban spaces (<http://www.skylinesoft.com>). There are other initiatives that have used the interactive and dynamic digital space to produce an analytical model of a city by overlapping physical information with other hidden layers and patterns (<http://www.skyscraper.org/timeformations>).

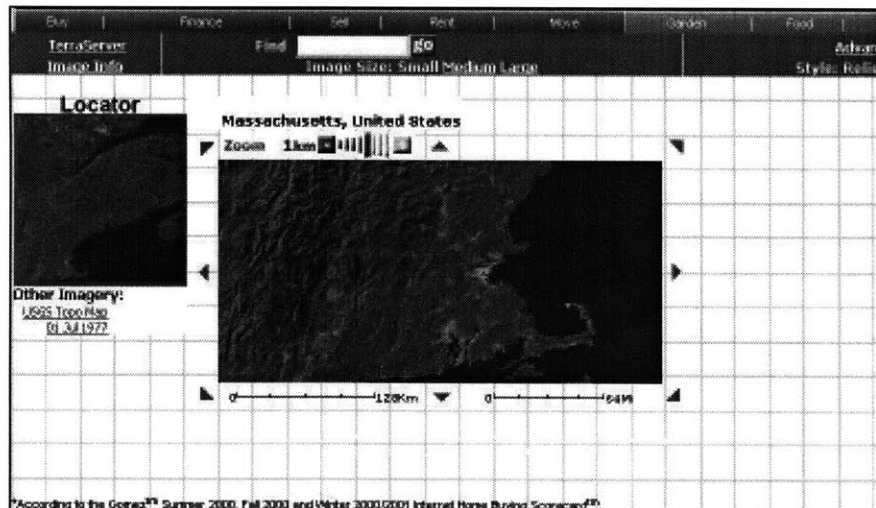
[3] Menno-Jan, Kraak. Web Cartography: developments and prospects



X. A Route Planner

Source: <http://www.mapquest.com>

X.



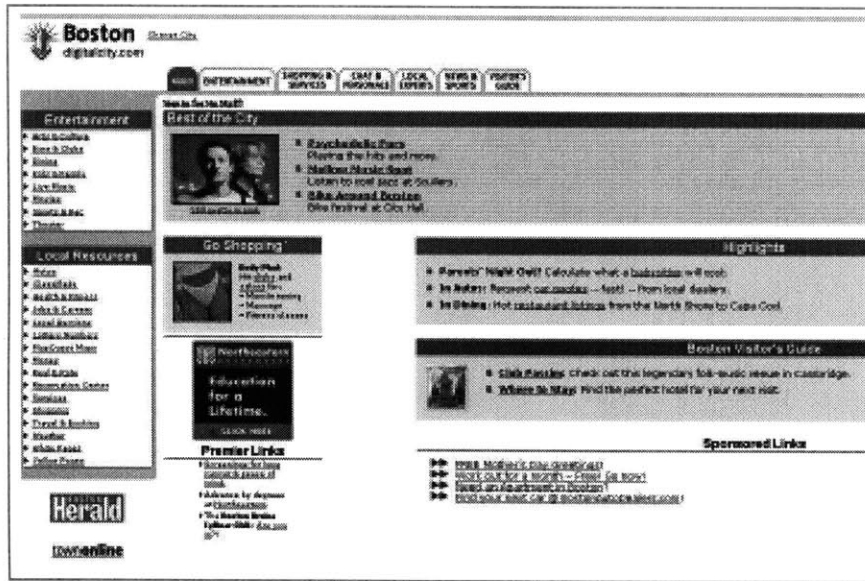
XI. A Topographical Survey

Source: <http://www.terraserver.com>

2.2.2 Digital Guidebooks

XI.

Though the study shows a rich representation of information, research into the current digital city guides is a little disappointing. Most of them still represent a caricature of their traditional paper counterparts where the information is represented as 'black and white' yellow page directory formats. There is no attempt to reveal the subtle urban patterns, but only to somehow represent large amounts of up-to-date information.



XII.

XII Internet Initiative

Source: <http://www.digitalcity.com/>



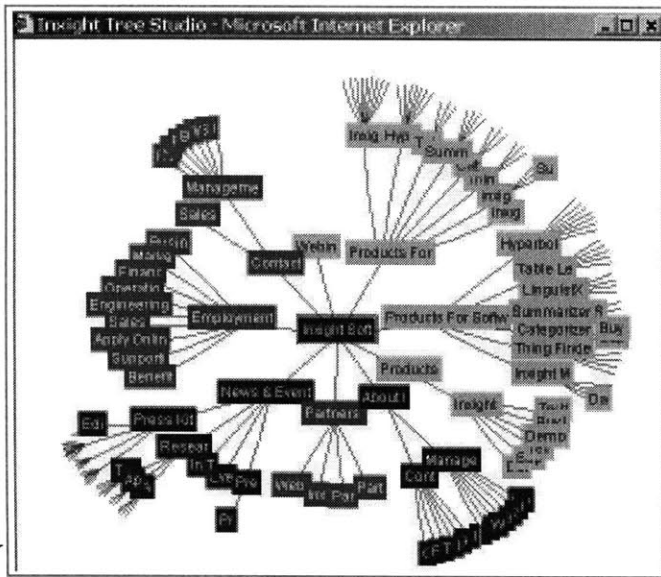
XIII.

XIII. Online Component of a Traditional Guide. It adds a layer of social interpretation over its information base. An attempt to address the dynamic information structure of the city.

Source: <http://lonelyplanet.com/>

Information retrieval is based on hierarchical navigation or keyword search. While the problem of scale and of accommodating the multivariate data of the city is taken care of, the resulting excessive information, non-intuitive retrieval system and lack of customization creates another problem of information anxiety. As Richard Saul Wurman puts it, “We are inundated with data but starved for tools and patterns that give them meaning. In reality there has not been an information explosion, but rather an explosion of non-information, or data that simply doesn’t inform.” [4] Though there are some innovative attempts at information retrieval system, like TheBrain and the Hyperbolic tree by Xerox PARC, but none of such initiatives are reflected in the current digital guidebooks.

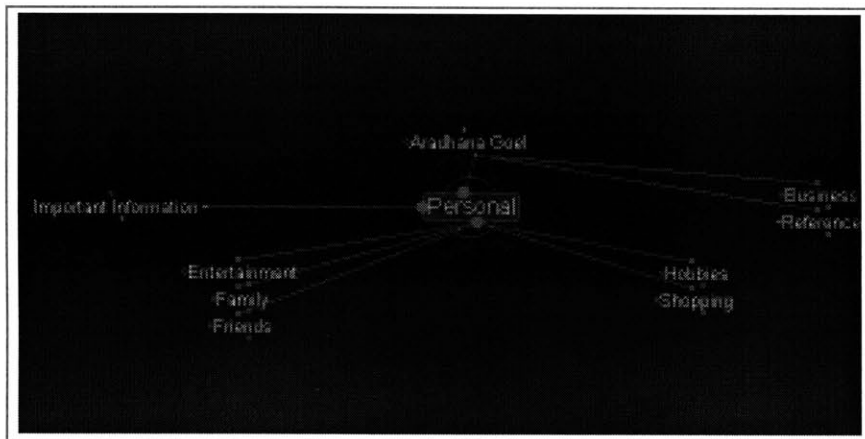
[4] Wurman, Richard Saul. *Information Anxiety 2*. (Indianapolis, Ind., Que, 2001)



XIV.

XIV. This is the 'Hyperbolic Tree by Xerox PARC' that provides an elegant solution to the problem of providing a focus + context display for large hierarchies. The hyperbolic plane has the room to lay-out large hierarchies, and the map provides a natural, continuously graded, focus+ context mapping from the hyperbolic plane to a display).

Source: <http://www.inxight.com>



XV. TheBrain is an easy-to-use system for organizing information that enables you to link files, documents, and web pages across applications and network boundaries. TheBrain illustrates how information is related, provides a visual context for documents and data, and offers a framework for collaboration.

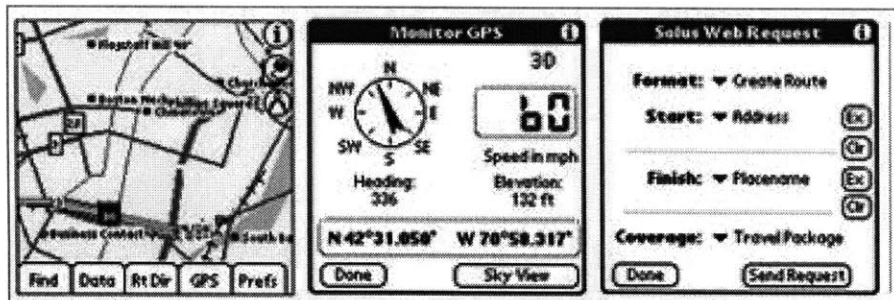
Source: <http://www.thebrain.com>

XV. Does this excessive, non-personal, up-to-date information reflect the dynamic individual perception of urban spaces? Who generates this information? Whose privilege is it to update this information? These are important questions that throw some light at the inadequacy of digital information in its current form. The author feels that most of the digital city guides are unable to tap the potential of the dynamic digital interface and represent a static representation of a dynamic phenomenon.

2.3 Mobile Initiatives

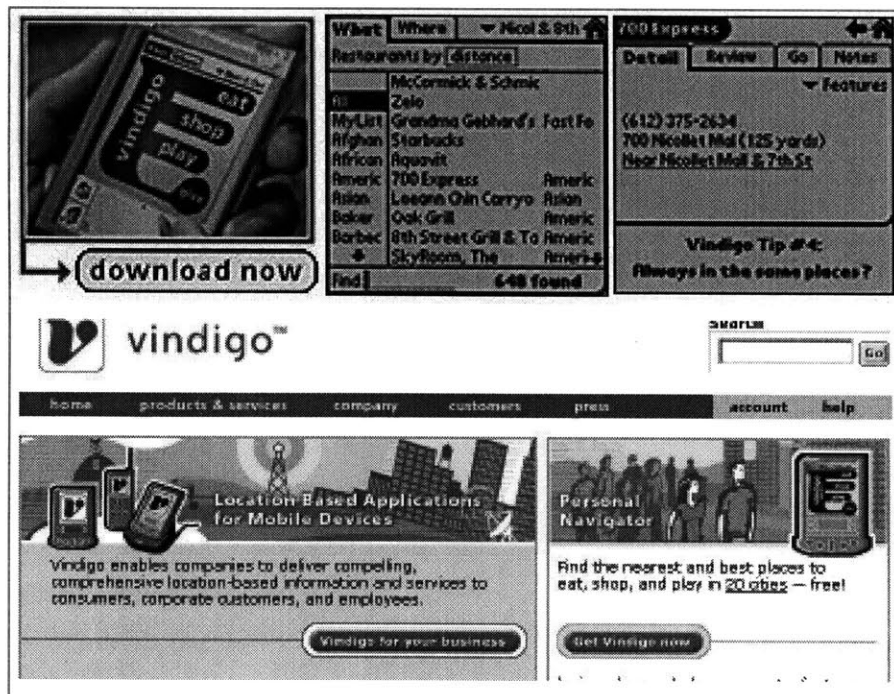
With the new wave of wireless and GPS technology, there is an opportunity to explore a context where one has access to information anytime, anywhere. This unprecedented connectivity has led to research in location-based, context-specific and customized applications for these devices.

This thesis has looked into some of the relevant applications. There are GPS capable mapping applications that provide real-time location information like the services provided by <http://www.delorme.com/roadwarrior/>. There are some applications like <http://www.jungleport.com> that combine these GPS services with the dining guide and the Yellow Page guide to create a specific city information system. Vindigo.com is another company that is providing location-based information and services (m-Commerce) along with the other services provided by Jungleport. Another interesting application is the active messaging component of the cellular phone companies like the Nokia. Though it does not directly pass off as a city guide, it adds a layer of real-time contextual social networking component similar to the Lonely Planet digital guide discussed earlier.



XVI. Global Positioning System
Source: <http://www.delorme.com>

XVZ



XVII. Location Based Services
Source: <http://www.vindigo.com>

XVZ



XVIII.

But the existing roadmap of technology, application and services is disintegrated and confusing. Services have not been bundled for specific customer segments. Also people in the industry have set up customers for disappointment by projecting the wireless as a mobile version of the fixed-line Internet. User interaction, transaction types, and environment differ significantly between the web and mobile devices. There is no value in having web-based services on wireless devices unless they address their contextual reality. There is more to wireless than accessing information “anytime, anywhere”. One needs to distinguish between any/all information and relevant/context-specific information. Important properties to consider might be: Time-specificity, Location-specificity, Person-specificity and Context-specificity.

Another issue that comes up is the inadequacy of the present user-interface provided by different devices. The “anytime, anywhere” context of wireless needs a user-interface that is most convenient and effortless to use. It does not mean “anyhow”. Also the market still needs to decide whether there would be different devices for different types of services or there is going to be one device with different levels of customizable and bundled services. This confusion needs to filter out such that a dominant design emerges with convergence of appropriate technologies, both for the device and its user-interface. For example, Voice-Recognition is one technology that fits in the character and purpose of using wireless devices especially for urban exploration. Handheld devices with their constraints of size could use voice-recognition to augment the textual and spatial data. There are companies like Impulsivity Inc., are developing applications that blend voice and data.

The challenge this thesis addresses is to exploit this real-time and dynamic wireless interface to capture individual’s perception and to amplify cognition in the context of city exploration.

HYPOTHESIS

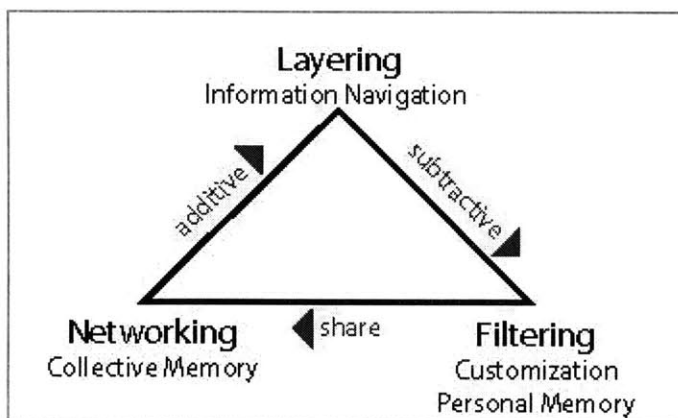
City is a dynamic and regenerative phenomenon. It is comprised of ever-changing people, patterns and connections. These attributes make the relationship between the individual and the city highly volatile. This dynamic perception of the city contains in it the hidden information patterns. Our mind engages the city at various levels and is constantly trying to decipher these hidden patterns.

This thesis claims that this engagement of the individual's mind with the city can be heightened and hidden patterns can be revealed by the appropriate use of a particular technology. Because the experience of the body in space is the most vital phenomenon, and it is equally important to be in the right place at right time, this thesis advocates mobile handheld device technology as an appropriate medium for urban exploration. The challenge is to exploit this real-time and dynamic interface to amplify cognition in the context of city exploration.

But the thesis is proposing a shift in perception here. The city is neither about information accessed, nor about the technology. In fact, it is about the people, their experiences and their connection with the space around them. The proposed tool would thus need to encompass individual perception and interpretations, collective experience of people and a regenerative system of information.

The thesis proposes a tool (named by the author as Urban Pilot) that is conceptually designed as a three-tier cyclic structure of Filtering, Networking and Layering. It would:

**Filter the information through personalization,
Share the personal perception through social networks,
And Layers the information with collective memory**



The filtering of information according to the individual's personal profile would increase its relevancy in a particular context and time. A social networking system could be created where the personal experience of people could be shared with the community on a voluntary basis. A rating system could be developed where some shared notes (collective experience) can find its place back into the core information layers. This cycle adds an interpretive and regenerative layer to the whole system and is the key element that characterizes the ecological property of the city. This design theory has been elaborated in the next chapter.

4. DESIGN THEORY

The thesis proposes a real-time interactive tool for urban exploration and has named it as URBAN PILOT. The tool is an application that can be downloaded and customized to most handheld devices. This chapter lays down the design theory for this tool that is based on a three-tier structure of Filtering, Networking and Layering where the tool:

- Filters the information through personalization,
- Shares the personal perception through social networks and
- Layers the information system with collective memory

This would create a regenerative information structure by capturing both personal perception and collective experience.

4.1 Filtering

One of the most important factors responsible for the volatility of city information is the diversity of its people. This would mean that the Urban Pilot audience is a mix of people and one type of information would not fit all. Hence the system allows the users to input their user-profiles at different stages of use. As the information is retrieved, the system matches the user-profile data with the information system and outputs the most relevant data. This system of sieving the information layers is referred to as 'Filtering' and the input mechanisms are referred to as 'Filters'.

Hence, the information retrieval is based on a system of gradually filtering of data according to an individual's personal profile. These filters progressively update the information with an increasingly relevant view of the city. Personalization becomes more powerful over time, since the longer a customer is retained, the richer his or her profile becomes. It requires a basic framework for understanding the audience, deciphering key differences and usage patterns, categorizing them in user profiles and developing an appropriate information language for each profile. This strategy and design for information personalization is sometimes referred to as 'Experience Architecture' [1].

This thesis proposes three levels of filtration - pre-screen filters, contextual temporal filters and collaborative filters. Pre-screen filters gauge the interest pattern and familiarity level of the person, Variable persona filters capture his context and the Collaborative filters enhances the system's recommendation over a period of time based on peer usage.

4.1.1 Pre-Screen Filters

This initial level of customization of the tool sets the backdrop for all exploration. The user input is done at the time of application download. Input parameters are basic profiles involving 'Context' (time and familiarity with the place) and 'Audience Characteristics' (demographic details of age and gender, interests).

[1] Viant Innovation Center Project, Experience Architecture: The strategy and design of ecommerce personalization, http://viant2-ecdc-3.digisle.net/pages/frame_thought_traffic.html, 2001.

Experience Architecture is a framework for using personalization technology to create personalized experiences for different users. It includes techniques for understanding people, technology platforms and a pattern language that applies the best of off-line design principles to online design.

When the user downloads this application, he is automatically registered into the system as a member of the network. These people are connected directly to each other, any time, and any location. The system categorizes them into three categories.

Friends: Urban Pilot users that match with the user's address book. These are people with whom the user has established 'close-ties'.

Peers: Like-minded people matched by the system using their profiling data. These links depict the weak ties between them where relationships are based on homogeneity, reputation and trust.

Strangers: Broader network of people with seemingly no common ground.

I. Categorization into User Groups
Source: Worli Painting, Maharashtra, India



I.

This concept of 'close and weak ties' is a key factor in generating the social networks and has been elaborated in the third part of this chapter.

These rule-based filters also alter the thematic information landscape, and may change the mode of delivery. At the most basic level, users get categorized into travelers and the residents. For travelers, one could find themes like: Where to eat, Survival Guide, Excursions, Events and Activities etc. For residents, one could customize the themes such as: Bread and Butter, Movers and shakers, Nuts and Bolts etc. The system also begins to customize information by the interest and objective of the user. However, this requires a more elaborate study that is out of scope of this paper. But there are various secondary references where an attempt has been made to categorize users and their behavior patterns based on the above criteria.

An example of one such study is done by Michael Southworth, University of California, Berkeley. He has compiled a Matrix of social factors in map comprehension and way finding based on Literature Review.

Source: Southworth, Michael, 'SmartMaps for advanced traveler information systems based on user characteristics: final report'; Berkeley: Institute of Urban and Regional Development, University of California at Berkeley, c1994.

II.

	Map reading	Map reading and verbal information	Map style: - diagrammatic - illustrative	Three dimensional models
General	<p>When viewing a map, individuals assume that up is equivalent to forward (Levine, et al. 1984)</p> <p>Maps not aligned with the terrain are counter productive (Levine, et al. 1984)</p> <p>Making the transition from aerial views to actual eye level views is difficult (Thorndyke, et al., 1982)</p> <p>Learning from maps is less rich than actual navigation experience, but much faster (Thorndyke, et al., 1982)</p> <p>Good map learners have a systematic approach, this approach can be taught (Thorndyke and Statz, 1980)</p> <p>Experience with maps does not necessarily improve map learning ability (Thorndyke and Statz, 1980)</p>	<p>Written directions were found to be easier to use than a map (Kovach, et al., 1988)</p> <p>The mind processes verbal information and visual/spatial information separately (Paivio, 1986; Amlund, et al., 1985; Abel et al., 1989)</p> <p>Simultaneous input of related verbal and visual/spatial information enhances recall (Shwartz, et al., 1981; Amlund et al., 1985; Abel et al., 1989; Paivio, 1986)</p>	No research available	Three dimensional models viewed simultaneously with sequentially arranged slides have been shown to be effective means of familiarization with new environments (Hunt 1984; Cohen, et al., 1986)
Age related differences	No research available	The conjoint processing of verbal and map information is consistent across age groups (Amlund et al., 1985)	For 10-12 year old children, pictorial representation may facilitate identification and memory (Amlund, et al., 1985; Southworth, 1990) but diagrammatic maps are easier to use (Southworth, 1990)	The combination of a model and slides has been shown to be effective with both children and elderly adults (Hunt 1984; Cohen, et al., 1986)
Cultural differences	No research available	No research available	No research available	No research available
Cognitive ability	<p>Those with higher cognitive ability are faster than those with lower ability (Kovach, et al., 1988)</p> <p>Good readers have better recall from maps than poor readers (Amlund, et al., 1985)</p> <p>Ability to learn map reading techniques is dependent upon visual memory ability (Thorndyke and Statz, 1980)</p>	<p>There is no difference between verbal ability and spatial ability in comprehending directions (Vaneti and Allen, 1988)</p> <p>The conjoint processing of verbal and map information is not affected by reading ability (Amlund, et al., 1985)</p>	No research available	No research available
Gender differences	No research available	No research available	No research available	No research available
Education	23% of U.S. population are not capable of reading maps (Kirsch, et al. 1993)	No research available	No research available	No research available
Visually impaired	No research available	No research available	No research available	No research available

An example is the database of 'Experience Patterns' [2] that has been accumulated by the Viant Innovation Center [3].

[2] Viant Innovation Center Project, Experience Architecture: The strategy and design of ecommerce personalization, http://viant2-ecdc-3.digisle.net/pages/frame_thought_traffic.html, 2001.

[3] The Viant Innovation Center is a research group at Viant, which is a leading Internet consulting firm that helps clients in a broad range of industries plan, build, and launch digital businesses. <http://www.viant.com>

Sample Experience Patterns					
ID#	Pattern name	Learned from	Offline inspiration	Characteristics	Behavioral influence
			<i>Instances in the offline world...</i>	<i>The most differentiating feature of this experience is...</i>	<i>This makes people...</i>
1	See and be seen	Sociologist	Crowded beach, restaurant	Semi-private (people in groups, yet can see others)	...people-watch. And linger.
2	Culture shock	Travel agent	Travel to exotic countries, historical recreations	Unfamiliar culture and environment	...fascinated even by the everyday, which is different and so defamiliarized.
3	Progressive disclosure	Architect	Japanese homes	Japanese houses are divided into many rooms, courtyards, and nooks, never allowing a view of the whole but hiding surprises behind every corner.	...feel peaceful (not deluged with information), yet have sense of abundance, plenty to explore.
4	Dance floor	DJ	Night club	Flashing lights and loud music Dance floor in semi-darkness Alcohol Pumping beat, building and falling tension (if live DJ)	...lose inhibitions, dance, get excited.
5	Captivating queue	Theme park designer	Audio-visual displays tell story of ride	Makes waiting time painless while building anticipation.	...not mind waiting in line.
6	The wave	Square dance	Square dancing, line	Very easy Leader/ initiator required	...enjoy the impressive results of

III.

Source: Rose, David. 'Experience Architecture: A framework for designing personalized customer interactions'; Appendix A, Design Management Journal, Spring 2001

4.1.2 Temporal Filters

Temporal filters are time-bound, contextual variables that give information about the user's position (spatial, temporal and psychological) at the time of use. They filter the information landscape to the next level.

At first, the user chooses an "Urban Lens". The design demonstration shows four categories, The-Works (comprehensive detailed view of the city), Hot-Picks (popular view), Off-Beat (off the beaten track, unique view) and Get-Active (adventurous and activity based exploration). Depending on the current time and context of the user, the individual can choose their persona and vary it as needed. The choice of these four categories by the author is not important here. What is important is that the system is providing an opportunity to input your personality in a particular time and context. Each of these personas has its own appropriate way of interacting with the city and has a unique sub-set of themes that are filtered from the overall information system.



IV. Urban Pilot: Prototype Tool

Urban Lens (The Works, Hot-Picks, Off-Beat, Get-Active)

Urban Variables (Time, Mobility, Sociability, Money)

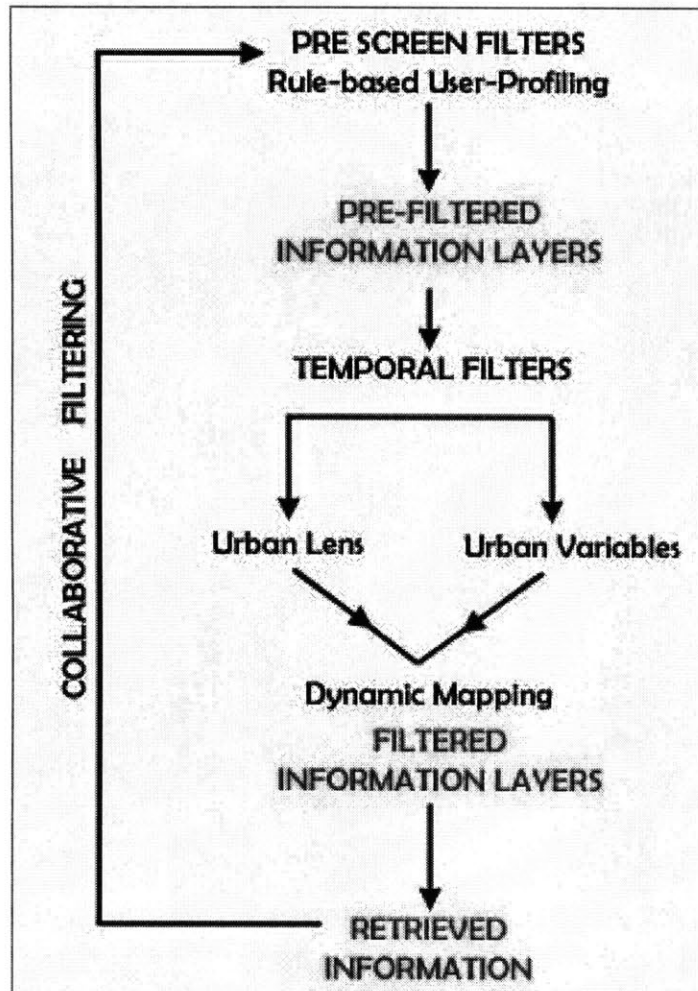
IV.

The next level of filtering is in the form of time-sensitive and context-sensitive urban variables. These filters are visualized in the form of four sliders (time, mobility, sociability and price sensitivity) that enable a degree of variability.

'Time' flexibility slider would determine whether the tool would "allow chances to occur (more time) or deliver a programmed experience"[4]. The 'Energy or Mobility' slider directly affects the navigation layer and accessibility maps. Together these two sliders affect the scale of the information represented in order to maintain its relevancy to the user in the proposed time and mobility frame. The third slider depicts the 'Sociability Factor'. This would impact the collaborative networking between the user and his peers using the system. Depending on the user's position on the slider, one can turn him into an active, semi-active or a passive collaborator. A low scale of sociability would let each person feel the presence of his peers but would not allow real-time interaction. On the other hand, a high scale of sociability would allow synchronous networking. The last filter records the 'Price Sensitivity' of the user and outputs the recommended.

This slider system reflects that users are aware that they are being profiled and have control over their user-profiles and can change their profiles at anytime to affect the change in the quality of information retrieved.

4.1.3 Collaborative Filters



V.

V. Three Stages of Filteration

[4] Hack, Gary and Hollister Rob. Cashing in on the Guidebook Boom: It's a long, long way to '76, Landscape Architecture, January 1974

This is the third level of personalization that is based upon simultaneous group-use over a period of time. The level of personalization would be limited when the system is used initially. As each person uses the tool and makes choices, a matrix is created that matches the user-profiles with individual behaviors. The collected data accumulates over time through many users, and the tool can decipher patterns between user-profiles and their probable choices. This probability can be captured in a rule-based system such that the initial rules for filtering are updated, thus improving the system efficiency. This is no different from the recommendation system of Amazon.com; but in the context of the proposed Urban Pilot tool, it is coupled with other rule-based filters and hence creates a dynamic filtering system.

Personalization means crafting different experiences for different people. Typically the existing personalization engines match user-profiles with content information to produce custom content that is little more than targeted ads and recommendations. This thesis is proposing a personalized experience that involves re-shaping the site's structure, content and functionality.

4.2 Layering

The information of the city is represented in thematic layers that are organized by its degree of volatility. Volatility of information refers to the degree of change in perception, vis-à-vis time. As one goes through its various layers, one can internalize the object of reference and its characteristic properties.

There is a core information base that represents the periodically monitored data such as the history of a particular place. The next level is the services where the information is accessed from the server in real-time, like the traffic and weather. One's own diary represents the most versatile and personal information. The community-based information data represents the highest level of volatility because this data is regenerative - constantly formed and reformed by social networking. Each of these layers is represented as a wheel that finds its place in corners. The themes of each wheel are accessed through a rotary action.

This thesis suggests that each query or request for information has its own appropriate representation. While spatial maps best represent some themes (Directions, distance, location), abstract textual representations could better represent other themes (Timelines, Soundscapes and Accessibility information). Hence, in each of these layers, the information visualization is appropriated according to the theme.

4.2.1 Core

The core represents the information that is permanent in nature but is updated regularly. These are urban cartographic maps that are interpretive maps (representational in character). Precision of scale and reality is not necessary and distortion is used at times to convey an idea. “The best Visualizations are not static images to be printed in books, but fluid, dynamic artifacts that respond to the need for a different view...”[5]. These visualizations are arranged thematically to reveal different spatial and temporal patterns of the city.

[5] Ware, Colin, ‘Information Visualization: Perception for Design’; Morgan Kaufman Publishers 2000)

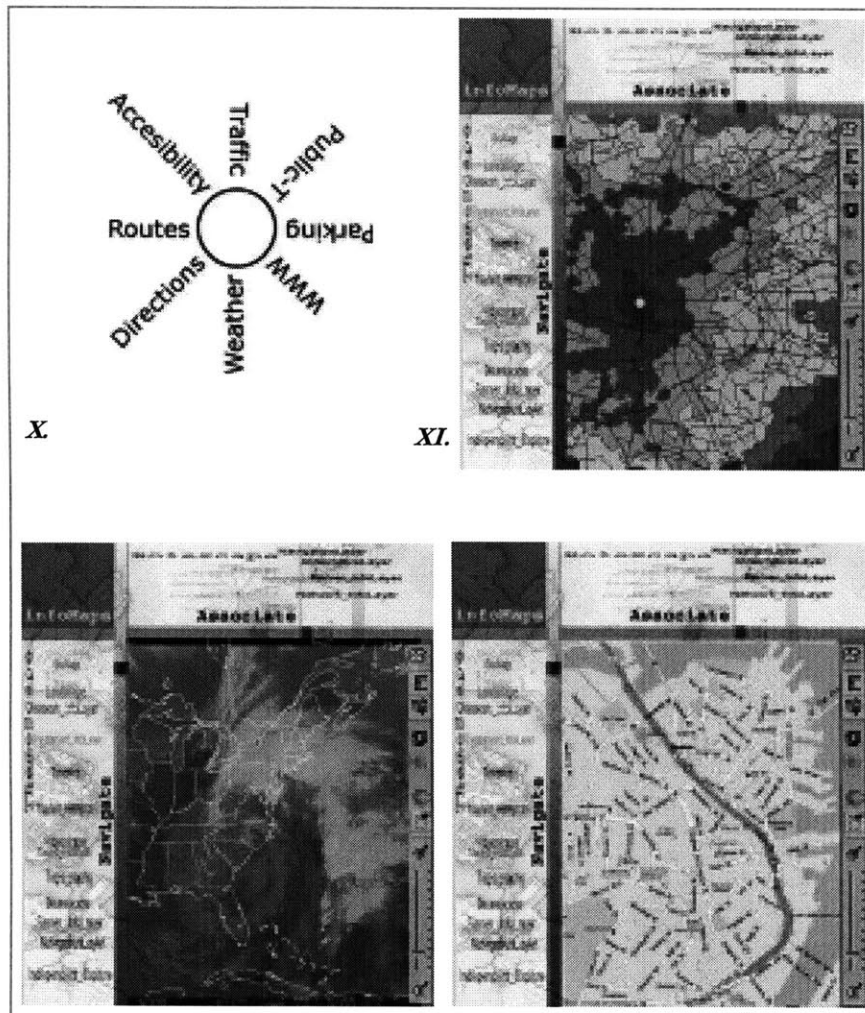


VI. ‘Core’ Information Wheel as represented in the prototype tool
 VII. Fictional Narratives
 VIII. Historical Maps
 IX. Timeline

Some of the generic themes in this core layer could be Timelines, Historic Maps, Fictional Narratives, Topography, Flora and Fauna. Depending on the purpose and the city chosen, one could represent this core layer in themes that best describes that particular city. If the user is looking for an overall view of New England, the appropriate themes could be: Fall Colors, Academia, Music Tradition, Writers and Thinkers, Natives and Explorers, The Revolution, etc. When the user zooms into an area, the themes could change to Restaurants, cafes and bars, Shopping, entertainment, events and activities, survival guide, etc.

4.2.2 Services

These are information layers that represent the volatile information that can be collected real-time from a central server. This layer links the objects of reference to the related services. For example, if a user chooses a restaurant, then this service layer could lead to booking a table through the wireless network. On the other hand, it could give time-sensitive information like traffic and weather, or it could compute directions from point-A to point-B taking into account the user's position coordinates. Another service this system proposes is presenting an accessibility map to the user by computing the multi-variate data of traffic, weather and available mode of transport.



X.

XI.

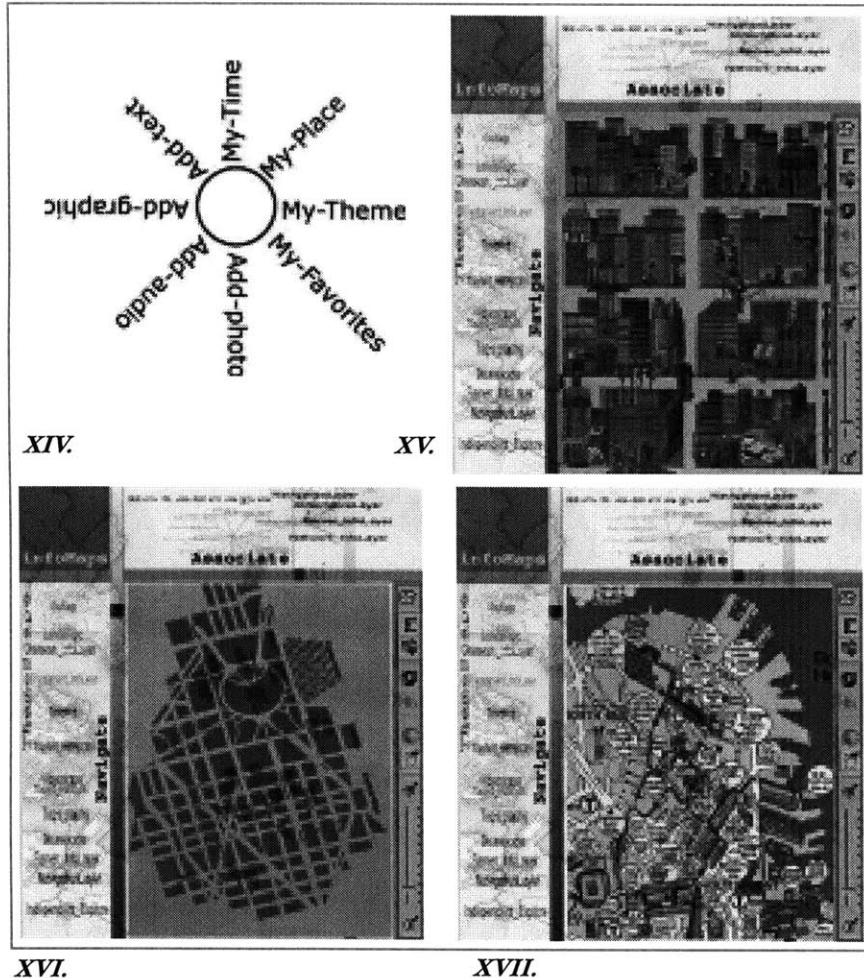
XII.

XIII.

- X. 'Service' Information Wheel as represented in the prototype tool
- XI. Traffic Data
- XII. Weather Maps
- XIII. Directions

4.2.3 Notes-to-Myself

The proposed system accumulates the personal memoirs of the users as they interact with the tool and each other to retrieve, edit and deposit information. When a user begins to explore the space, he/she is given a base map. At the beginning, the system makes some general recommendations. As the user chooses a path, the system records his travel data. The user has a choice of personalizing this data and maintaining a travelogue by annotating this map with text, graphic or audio input. These notes can be accessed by time, by themes or by place.



XIV. *Notes-to-Myself' Information Wheel as represented in the prototype tool*

XV. *Image Map with mixed representations*

XVI. *Textual Annotations*

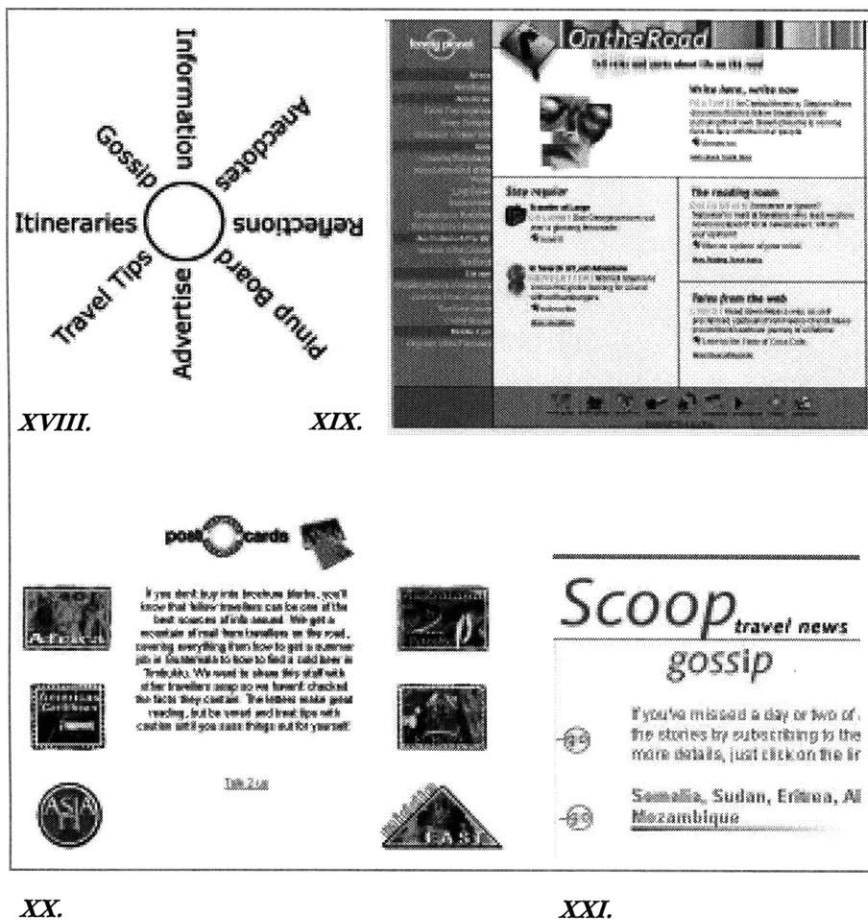
XVII. *Audio & Graphic Annotations*

It is useful here to speculate that some cognitive image maps could result from such a system that can be of various types (Node and Landmark map, Cartoons, Photo Montage, Pictorial, Graphical or Illustrative). These maps are “concept maps or (mind maps, as they are sometimes called)... Usually such maps are constructed informally by simply sketching them on paper... An individual can use a concept map as a tool for re-organizing his or her own personal structure, and it may reveal patterns of relationships between ideas that were not evident when the concepts were stored internally” [6].

[6] Ware, Colin, Information Visualization: Perception for Design, (Morgan Kaufman Publishers 2000)

4.2.4 Notes-to-Share

Users always have a choice of keeping their personal perceptions private, or sharing them with the Urban Pilot community as a collective memoirs. There is also the choice of making all or a part of an individual's itinerary sharable. The personal memoirs are accessible to the user only and can be downloaded onto a remote server, but the collective memoirs go into the database and update the "Notes-to-Share". These annotations are grouped as either Reflections, Anecdotes, Information, Travel Tips or Short-term postings like Gossip and Pin-up-Boards. This is the most dynamic layer, since it is a result of constant evolution of ideas that occur as a result of social networking.



XVIII. 'Notes-to-Share' Information Wheel as represented in the prototype tool
 XIX. Travel Tips
 XX. Reflections
 XXI. Scoops

These representations are customized to each individual (by filtering), such that they become "cognitive systems, or rhetorical devices and inherently take into account cultural dispositions"[7]. These layers encourage active exploration rather than passive consumption, like "...a guide that can provide the specifics if the person knows what he has in mind; or that can be open-ended but supportive references which encourage the reader to explore." [8].

[7] Miller, Naomi, 'Mapping cities'; Boston University Art Gallery 2000

[8] Hack, Gary and Hollister Rob, 'Cashing in on the Guidebook Boom: It's a long, long way to '76'; Landscape Architecture, January 1974

4.3 Networking

Permanent base information needs to be layered with the volatile memory of people in order to present the city as an interpretation, rather than as a stack of static information data. 'Peer-to-Peer' networking [9] would capture spontaneous interactions and use people as knowledge repositories to develop a collective memory of a place. The primary goal is to tap local resources and generate global results. It is analogous to a biological model: simple pieces built from the bottom up to form complex artifacts. The lines between generator and receiver are blurred. Each individual is seen as a knowledge repository contributing to the information landscape in becoming a valuable link in these free-flowing and organic exchanges. "The value of this communication and collaboration is in co-creation"[10].

4.3.1 Social Networks

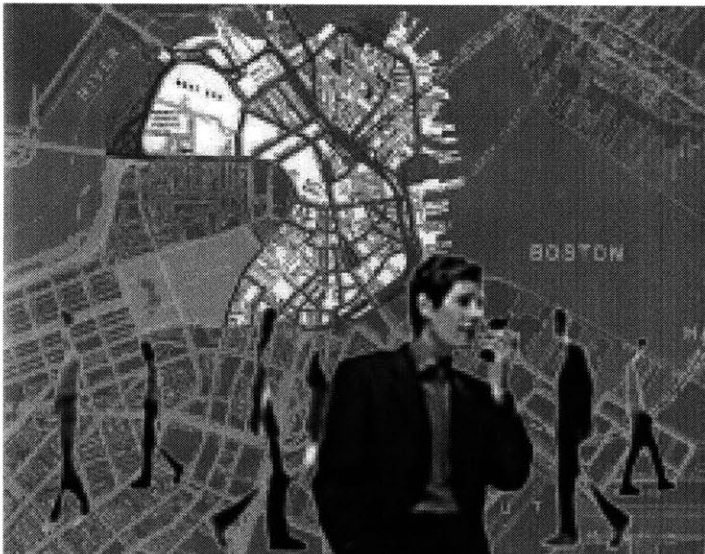
The thesis proposes that these social networks would lead people to develop relationships with others who are similar to them. "Most relationships originate in foci of activity that bring together disproportionately homogenous sets of people. The more homogenous these sets of people are, the more relationships tend to be with similar others." [11] Hence, instead of the obvious networking between people with 'close ties' (represented as the friends-user-category), stress is laid on the cohesive power of 'weak ties', (represented as the peers-user-category). As Mark S. Granovetter explains in his article 'The Strength of Weak Ties', "Most networks deal with, implicitly, with strong ties, thus confining their applicability to small, well-defined groups. Emphasis on weak ties lends itself to discussion of relations between groups and analysis of segments of social structure not easily defined in terms of primary groups"[12] In one way or the other, it is through these networks that small-scale interaction becomes translated into large-scale patterns, and these in turn feed back into small groups. Urban Pilot provides opportunities for both synchronous networking (messaging, voice-link, etc) and asynchronous networking (through the Notes-to-Share).

[9] Viant Innovation Center Project, The Human Side of Peer to Peer: where technology and people come together, http://viant2-ecdc-3.digisle.net/pages/frame_thought_traffic.html, 2001. "Peer to peer, or P2P, is a network technology where all the nodes have equal access to its peers... that results in a decentralized design which is a powerful tool."

[10] Ibid.

[11] Ibid.

[12] Scott L. Feld. 'Social Structural Determinants of Similarity among Associates'; *American Sociology Review*, Volume 47, Issue 6 (Dec, 1982), Pg. 797-801.



XXII.

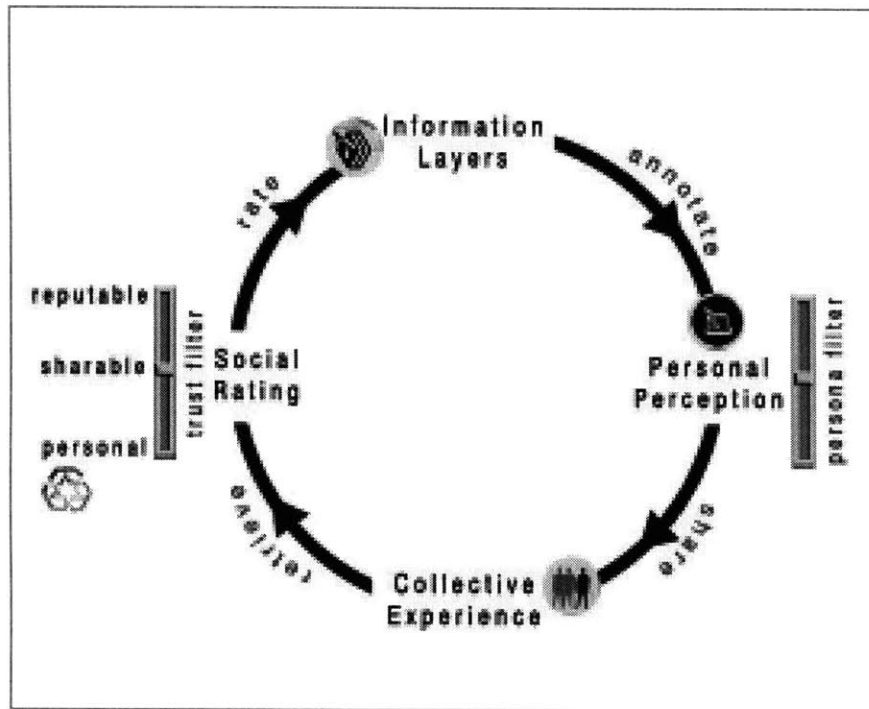
XXII. Social Networks

4.3.2 Regenerative Information Cycle

These social networks are a key to the proposed concept of regenerative information systems. The urban Pilot creates a system where the *personal* notes of people are *shared* with the larger community on a voluntary basis. When a user *retrieves* information from 'Notes-to-Share' (that represents the collective experience of people), he is given the option to *rate* the information on a 'Rating Slider'. This slider is a kind of a 'Trust Filter' that attempts to develop a peer reputation system. There is a social and economic value to this reputation. 'In a system that relies on strong interpersonal connections, branding, in the form of reputation, accrues to the individual rather than the product.' [13] As the referenced information accumulates points, it progresses from being 'Personal', to 'Sharable' and finally being 'Reputable'.

While the personal information degenerates over a period of time, the reputable information finds its place in the core information system. This generates a collaborative system where social networks are created and the information shared is characterized by spontaneity, immediacy and even volatility.

[13] Granovetter, Mark S. 'The Strength of Weak Ties'; American Journal of Sociology, Volume 78, Issue 6 (May, 1973), Pg. 1360-1380.



XXIII. Regenerative Information Cycle

XXIII.

This cycle adds an interpretive and regenerative layer to the whole system, and is the key element that characterizes the ecological property of the city.

5. DESIGN PROTOTYPE

5.1 Prototype Tool

The proposed tool is an application designed for an existing handheld device, the Palm V, with limited changes. The technology and the user-interface has been driven by the nature of services and content. Developing this user-interface (both device and application) has been an iterative process. Eric Bergman in his book 'Information appliances and Beyond' lays down some design considerations for user-interface design that is not exhaustive list but definitely has been an important starting point for the design of this prototype tool. The main criteria listed are:

1. Account for the target domain: In the context of this thesis, the target domain is information access and communication, where the ease of learning, long-term use and efficiency is a key feature in the design of the User-interface (UI).

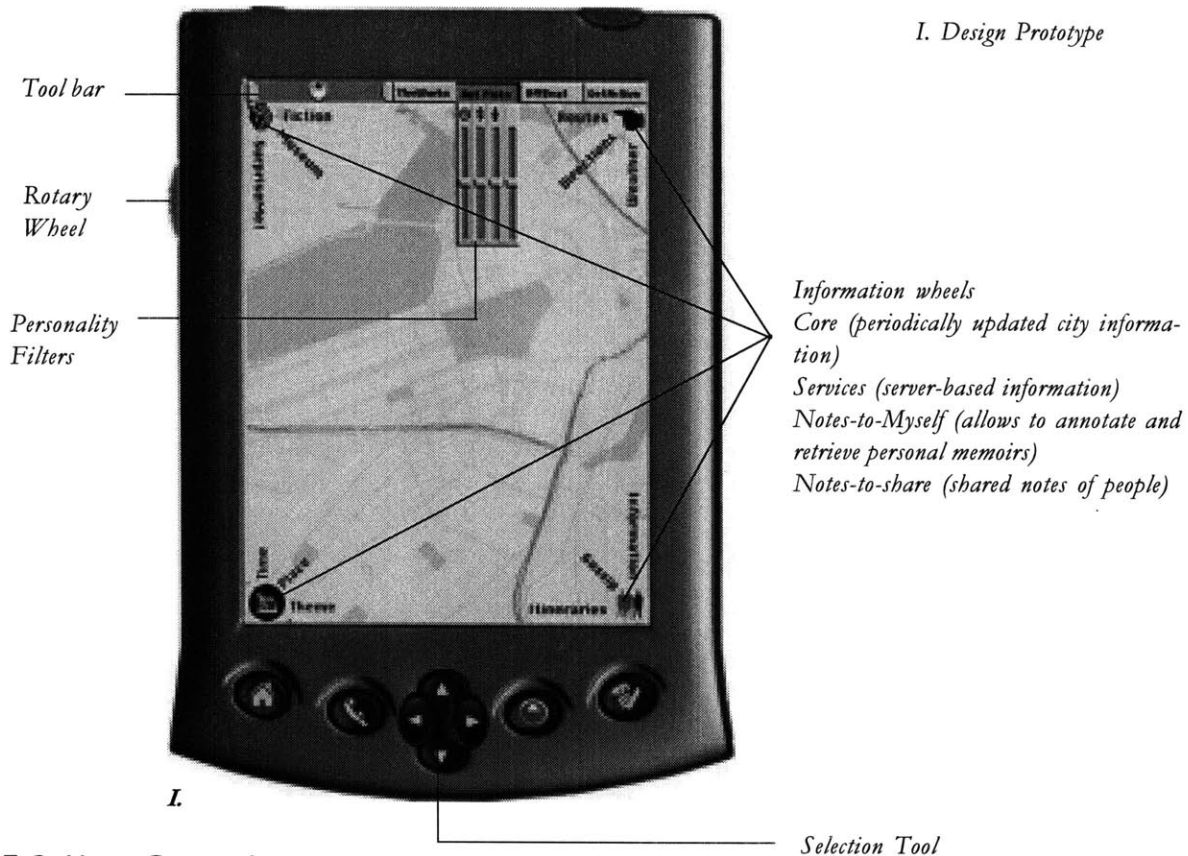
2. Dedicated and optimized User interfaces: This thesis proposes a device based on the convergence of the mobile device technology, Voice recognition system, Wireless and GPS capability and improved Graffiti technology.

3. Allocate function appropriately according to usage frequency and importance: The prototype has a toolbar, a personality bar and four rotary wheels representing the information system. The toolbar provides general tools for orientation, networking and search by people, place or purpose. The personality filter lets one choose an urban lens to view the city and then input data for personalization of information. The four rotary wheels are accessed through an external button and represent the four information layers of Urban Pilot.

4. Simplify: The functionality threshold is an important consideration and one needs to think about simplicity vs. choice and functionality. There is this famous 80-20 rule which suggests, "For each application or feature set, it's helpful to identify the 20% of functions that will meet 80% of the users' task needs [1]. The functions identified in the designed prototype are filtering & retrieving the information, exploring & annotating to personalize information, sharing & rating of information o form social networks.

5. Design for Responsiveness: The two most critical aspects of responsiveness are interruptability and continuous feedback. In the design of Urban Pilot, the thesis has proposed a regenerative cycle of information that is based on information retrieval though personal filtering and information generation through social networking. It has inherent in itself the system of continuous feedback.

[1] Bergman, Eric. 'Information Appliance & Beyond'; Morgan Kaufmann Publishers 2000



5.2 User-Scenarios

Urban Pilot has been developed to allow for spontaneous, serendipitous and real-time explorations rather than to make pre-planned itineraries. The tool has been tested by building user scenarios that are described in two main categories.

1. Careful exploration of a place: The audience addressed is people who have the commodity “Time” and intent to “Explore” the cityscape. This is generally done by travelers and by residents who become travelers in their own city from time to time. The level of familiarity with or knowledge about the place is limited and one wants to assimilate most of the relevant information in the given time.

The intent of this User Scenario::

- Customizing the information through personal filters
- User navigation through the information layers
- Orienting yourself in the space using annotated image maps
- The cycle of collective memory

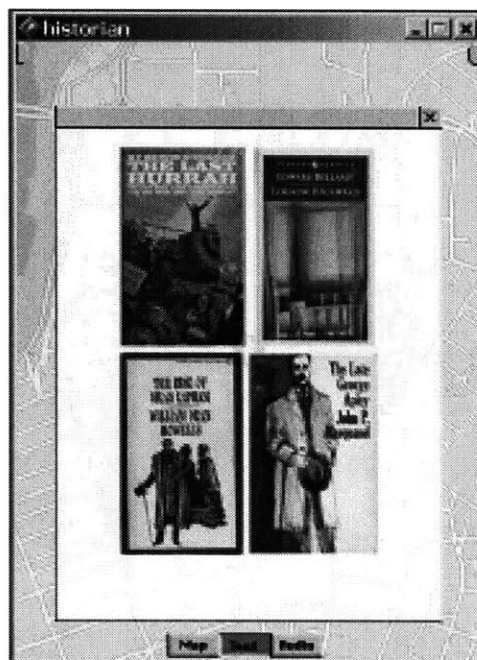
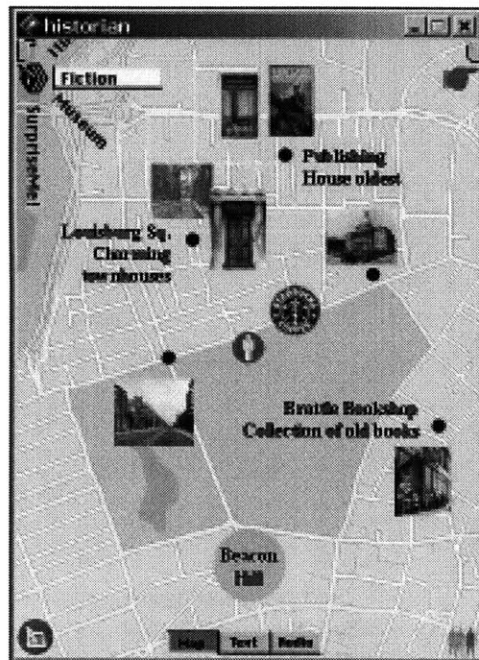
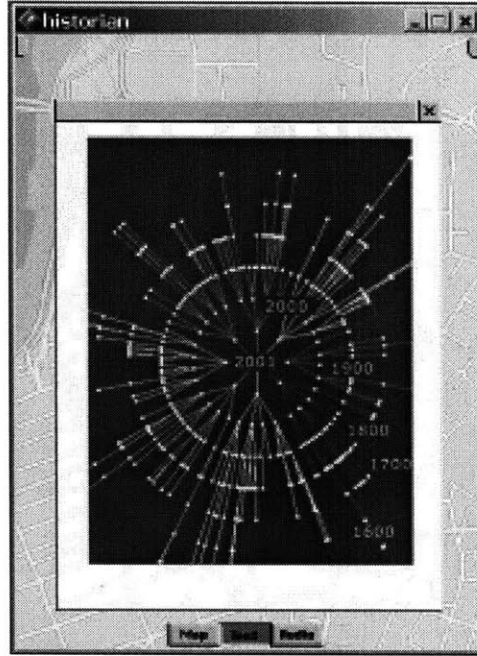
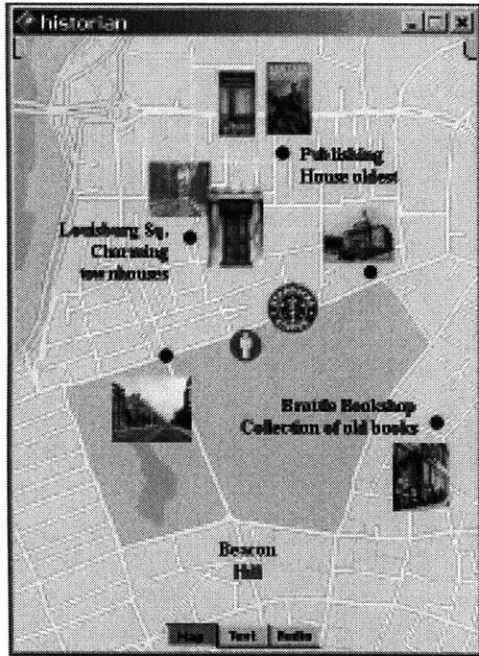
2. Day-to-day relaxed navigation of the place: Here the tool is used to find quick solutions to a query. This would usually apply for the residents or people who are highly familiar with the place.

The intent of this user-scenario is:

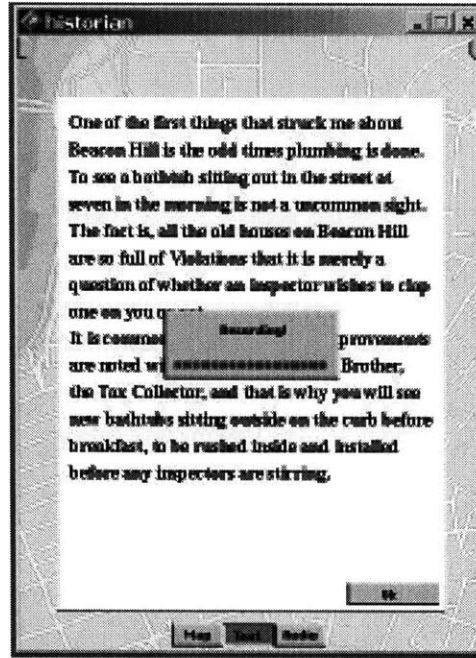
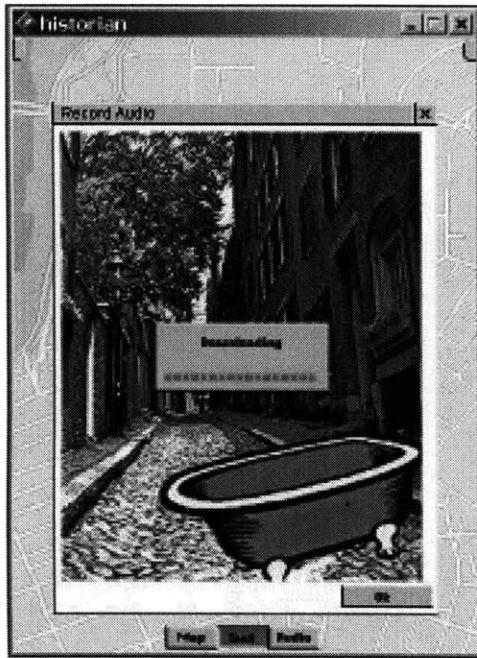
- Networking between close-ties & weak-ties
- Annotating the information and maintaining personal notes
- Voluntary sharing of personal notes with the social community

5.2.1 User-Scenario-1

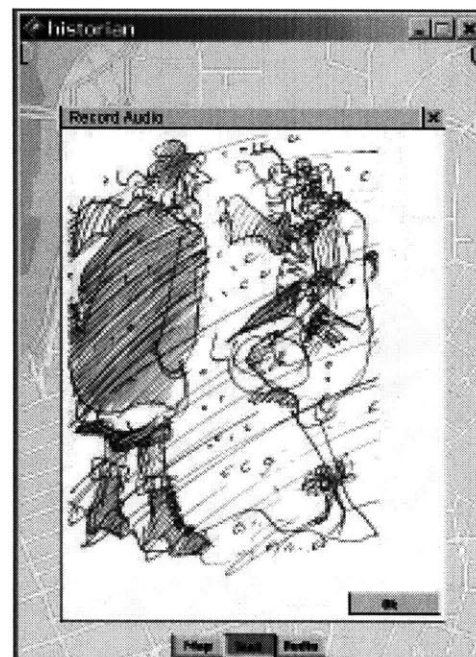
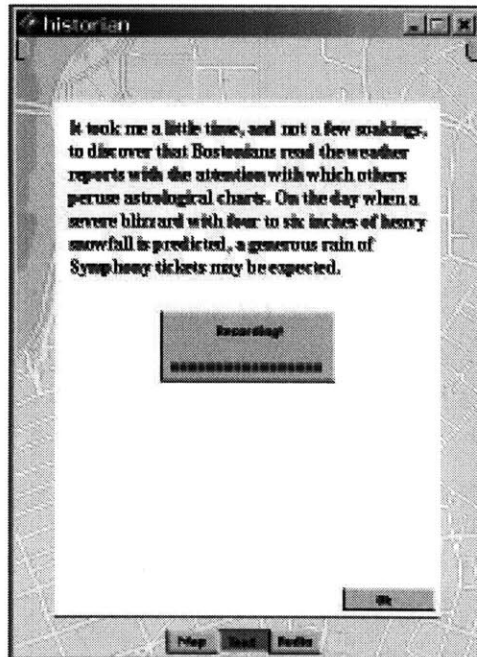
PART I: A New Yorker has come to stay in the Beacon Hill area of Boston. He is interested in the history of the place and has been using the Urban Pilot to maintain his personal dairy. He has been updating his image map using the information layers like the Timeline and the Fictional Narratives.



He personalizes some parts of his image maps through annotation tools in the Notes-to-myself information layer. And also would like to share them with the Urban Pilot community. The design demo shows him adding his reflections about 'the odd plumbing times in Beacon Hill' with a photograph and some audio input.

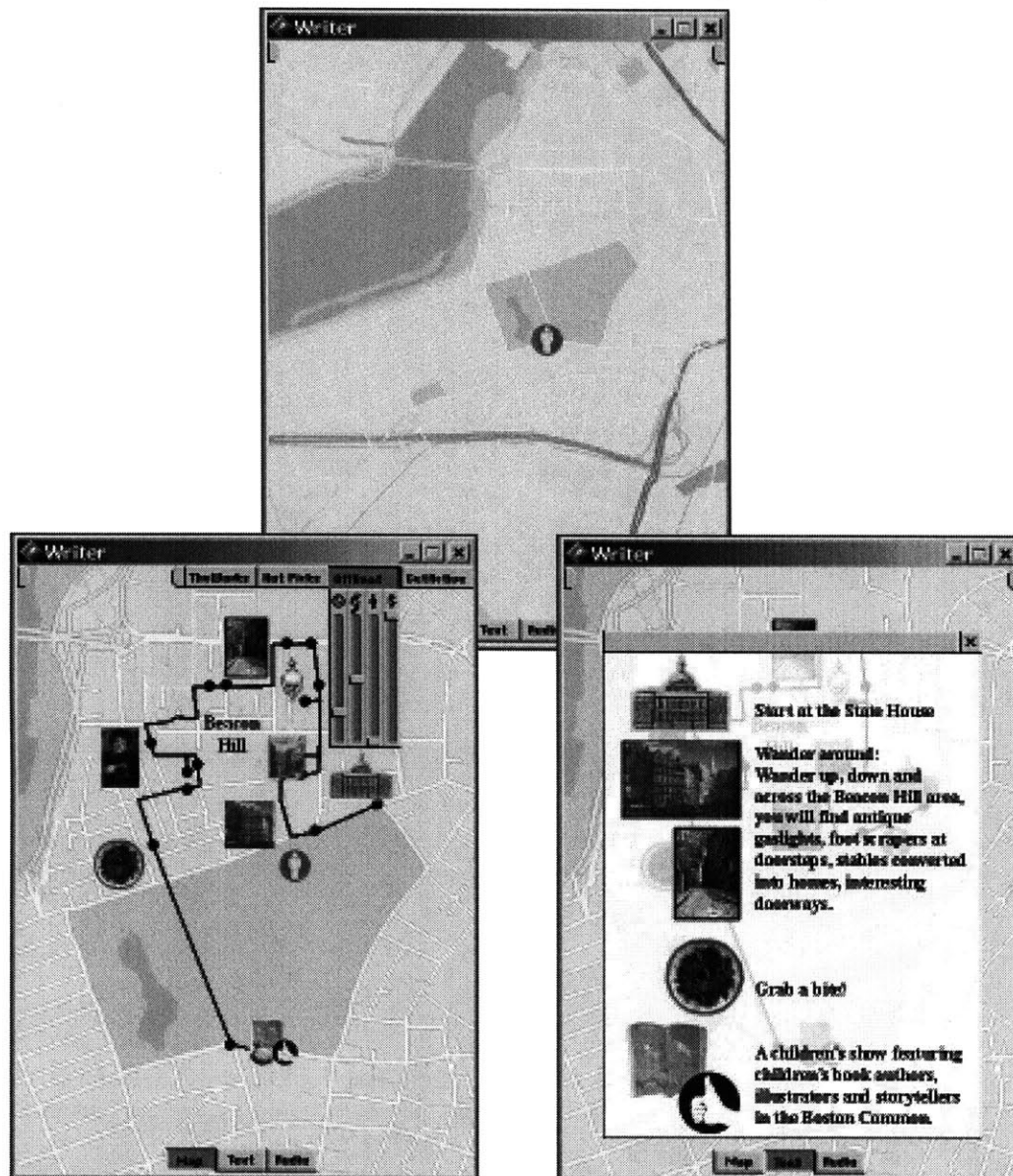


Also he adds an anecdote regarding the weather of Boston by annotating his personal map with audio and a graphic.

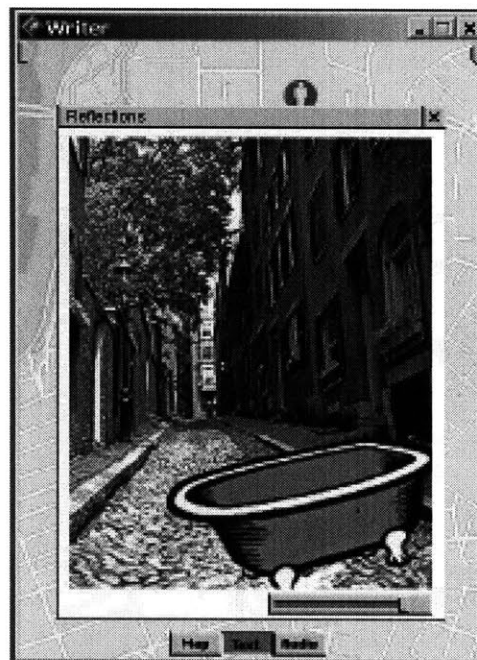
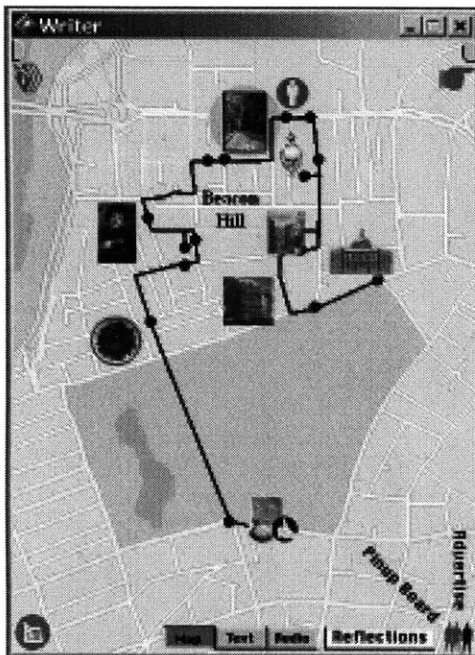


PART II: A 40-year-old Italian woman writer is in Boston on a conference. She is traveling with her 5-year-old child. The conference ends on Friday and she wants to explore Boston over the weekend before she leaves for Italy. The system would thus need to cater to both the personality types, of a writer and of a mother. This information is fed into system at the time of download or the hot-sync process.

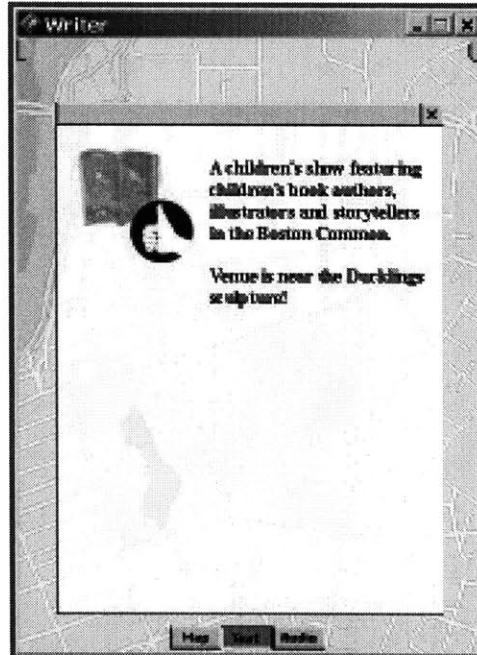
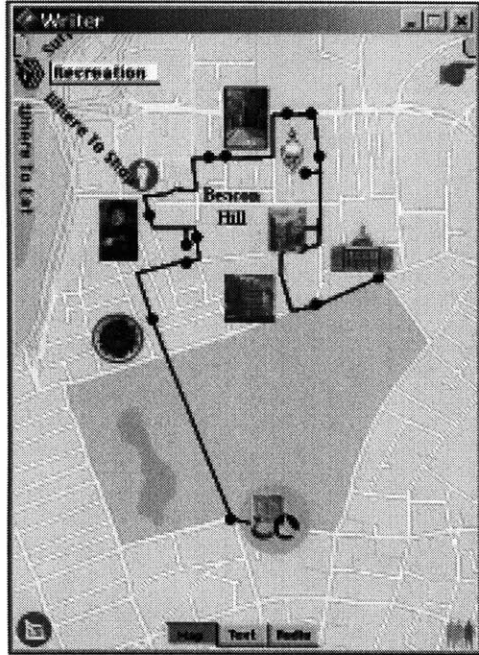
She is in the Beacon Hill area and plays with the personality filter and chooses the given variables: Off-beat, 8-hour time window, medium level of energy, unwillingness to socialize and a high value of money slider. The system changes the scale of the map and outputs a recommended itinerary for her. These are both writer-specific and child-specific, with some common activity suggestions for both of them. She explores using the itinerary. Wanders up, down and across the Beacon Hill to find antique gaslights, foot scrapers at doorsteps, stables converted into homes, interesting doorways.



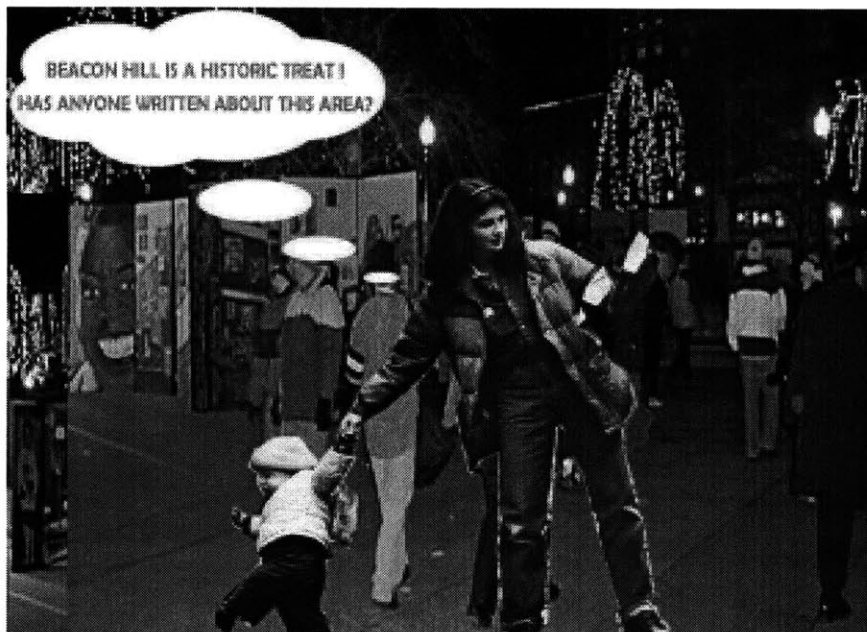
She spends some time at the Louisburg Square that has 4 story brick homes and a central garden with statues. There is a house-no-4 of William Dean Howells, an editor of the *Atlantic Monthly*, and a house-no-10 of the writer Louisa May Alcott. She would like to know, how is it to presently live in a neighborhood like this? She accesses the reflections layer of 'Notes-to-share' and comes across the personal notes of the historian about plumbing in Beacon Hill. She rates this information and moves on.

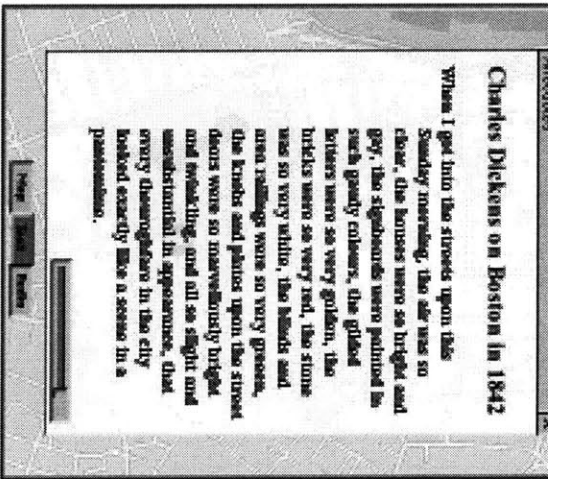
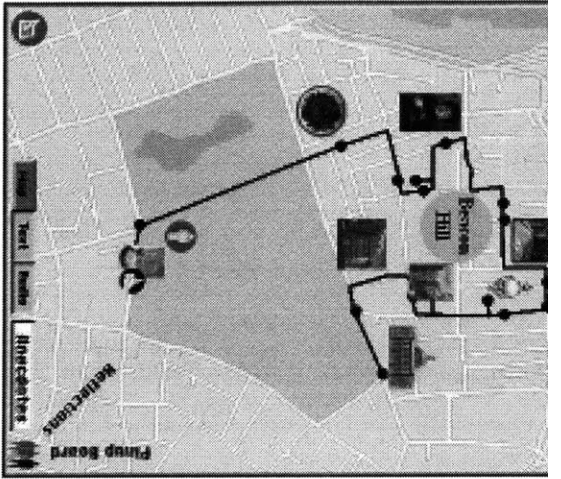


She checks out the system recommendation regarding a children's event in the Boston Common. It says: 'A children's show that features children's book authors, illustrators, and storytellers in the Boston Common'. The venue is near the Ducklings sculpture and she heads there.

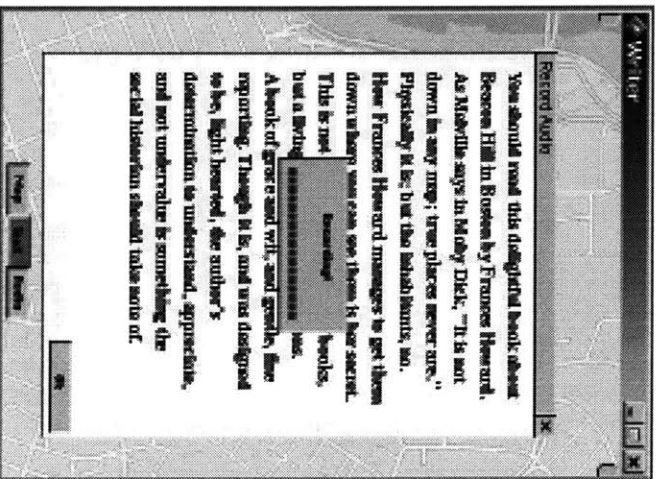
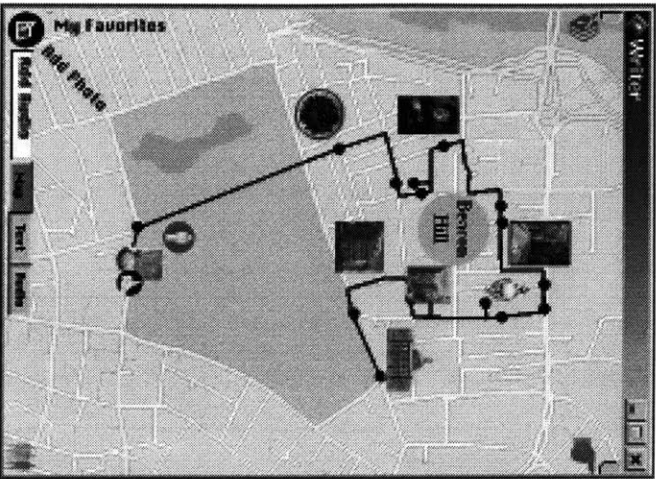


Once her child is busy and happy in Boston Common, she wonders if she can get some interesting anecdotes about Beacon Hill from Urban Pilot social networks.

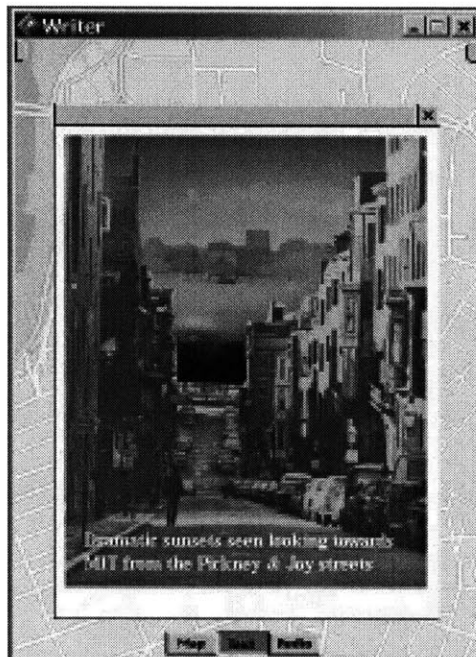
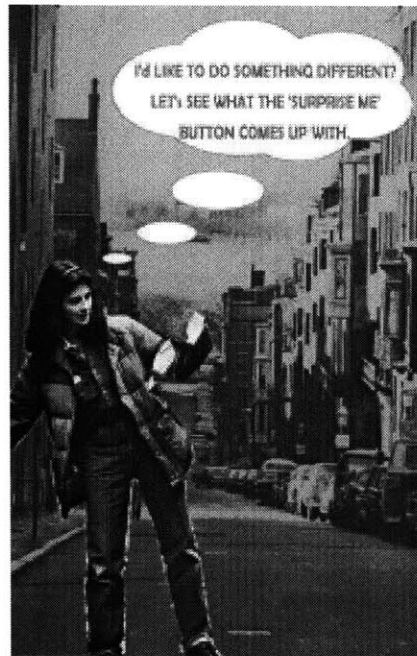
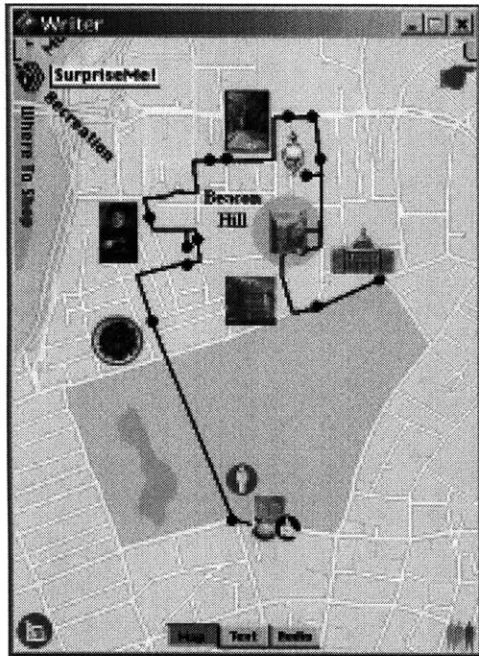




Also she wants to share some information about a famous book on Beacon Hill with others.

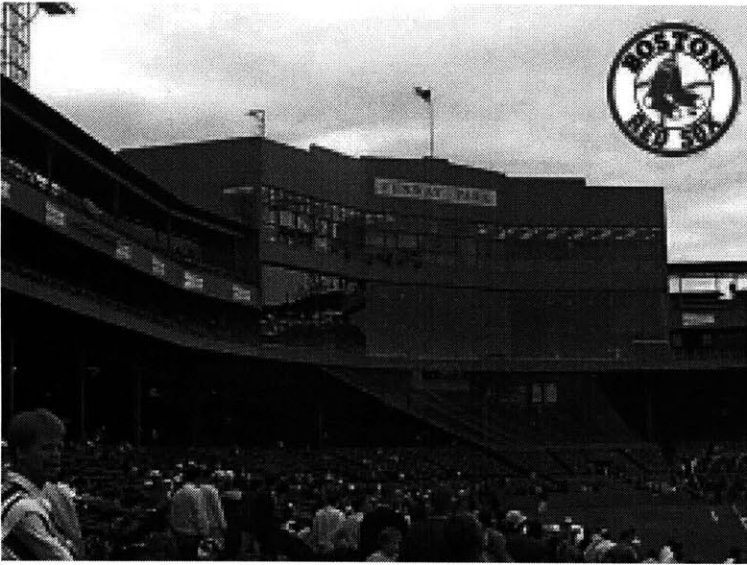


Time for her to head back to her hotel and she would like to see if the system can offer her any surprises. She uses the 'Surprise me' button in the core information layer. This is an active recommendation button that tries to capture the uniqueness of the place, based on the user's interests. The system tells her that 'there is a dramatic sunset to be seen looking toward MIT from the Pinckney and Joy streets, where the river is framed by buildings on each side of the hill'. She is right there and stays on to check it out.



5.2.2 User-Scenario-2

A 28-year-old Boston college student, Pete, has gone to the Fenway stadium to watch a Red Sox game. He opens the application, and the system shows him his last used map of fenway that he had annotated (an orientation mechanism).



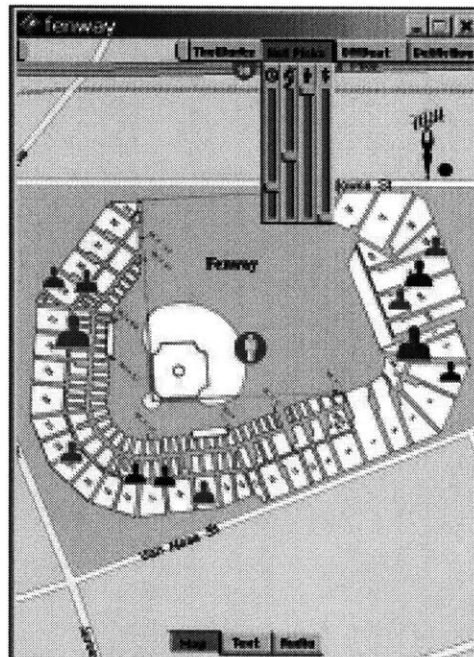
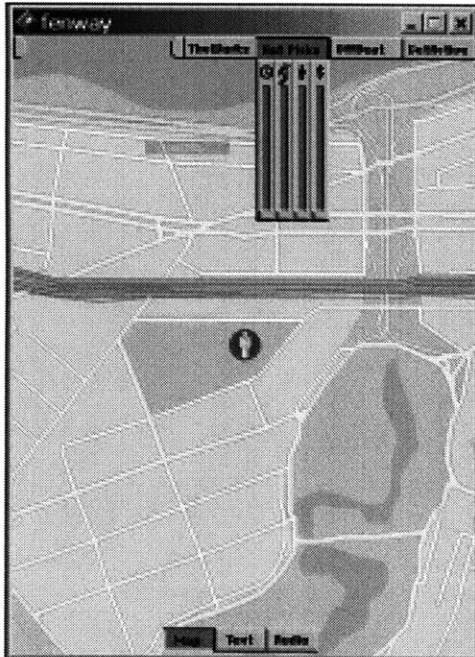
Before he begins to use his Urban Pilot, he inputs his preferences through the personality filter. He picks the 'Hot-pick' urban lens with input variables as 8-hour time window, a medium mobility level, a high level of sociability and very low money value. The system outputs his image map of the area showing people icons that allow networking opportunities.

Icon Variables:

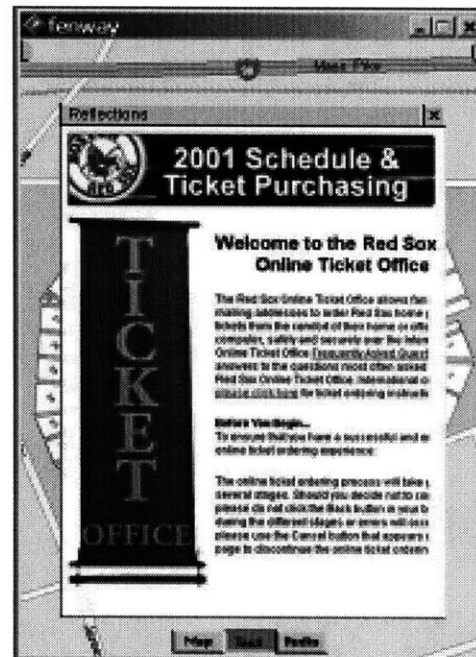
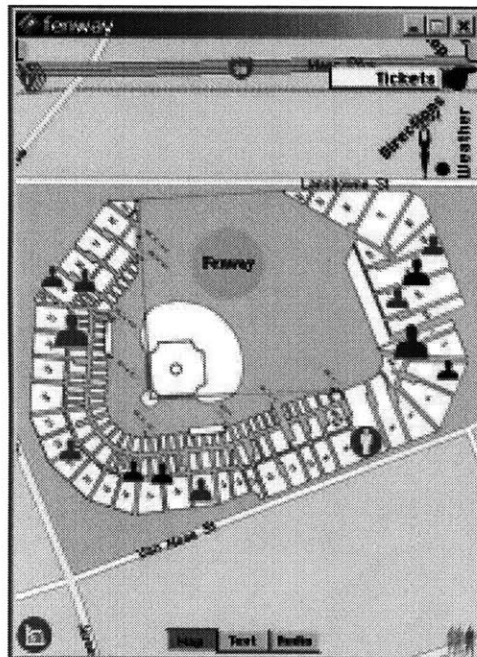
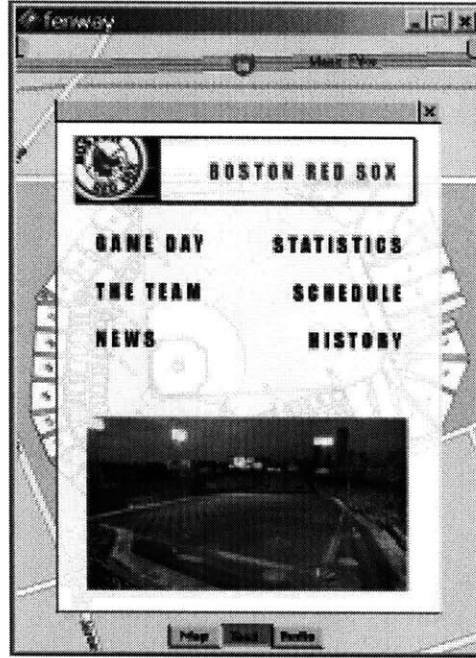
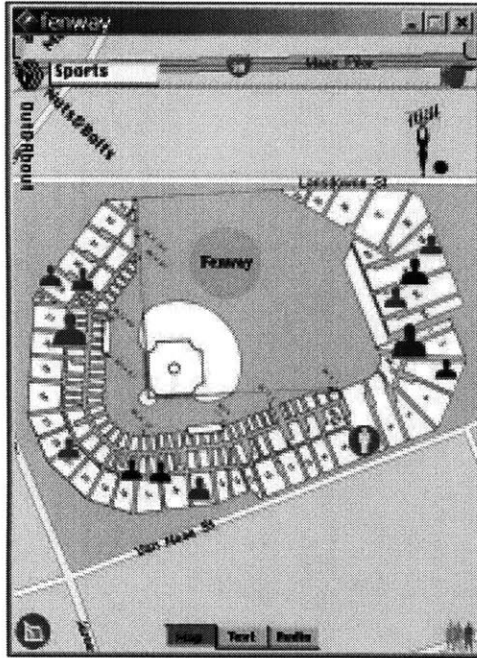
Color: Affinities (Blue-'Friends', Green-'Peers',Black-'Strangers')

Size: Familiarity with the place

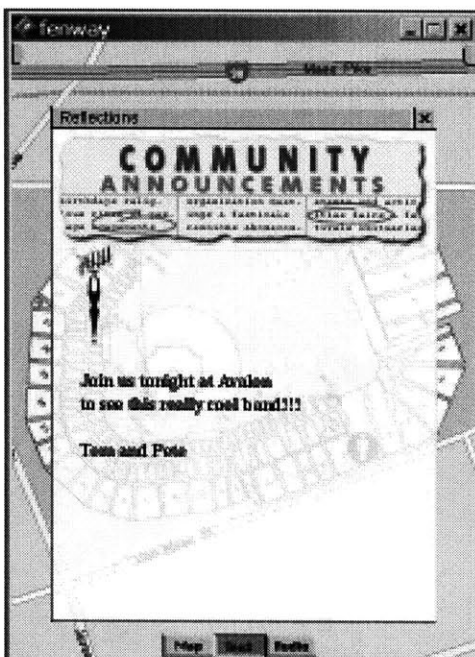
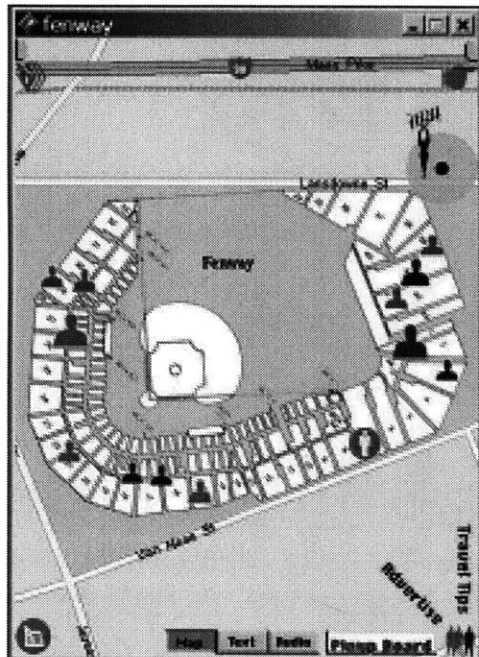
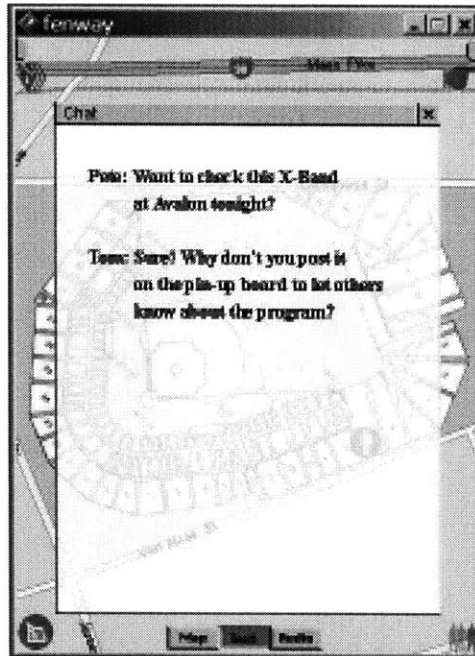
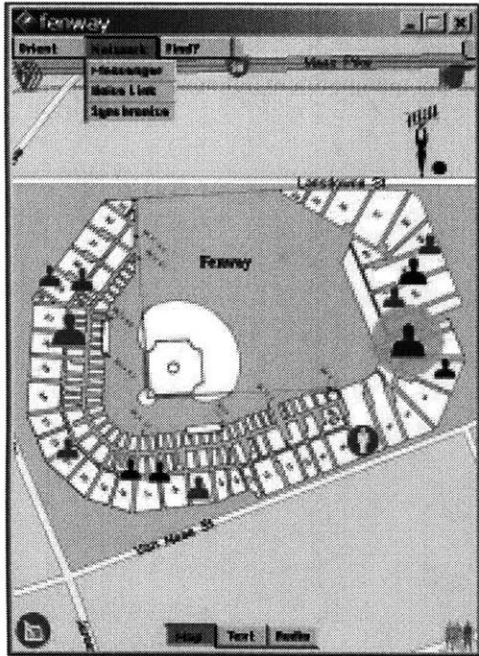
Highlight: Level of sociability



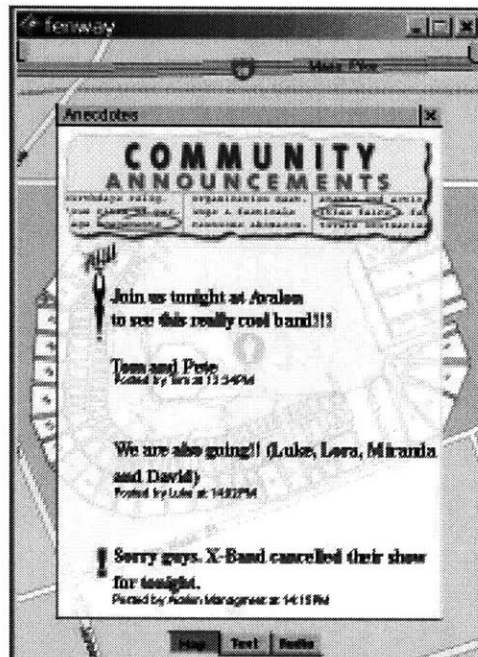
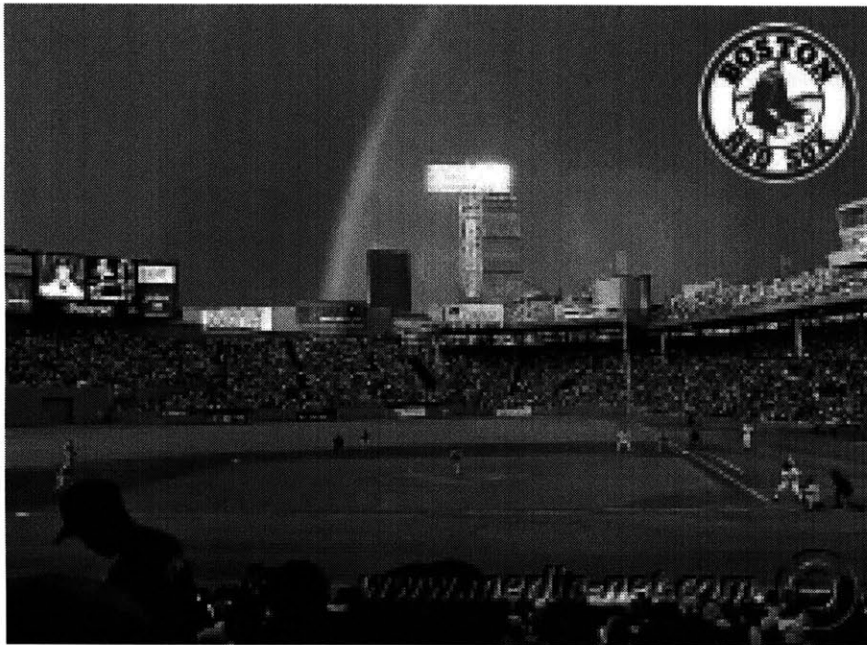
He has used the core information layer to get some information about the Red Sox game and also had used the services layer to buy tickets for himself.



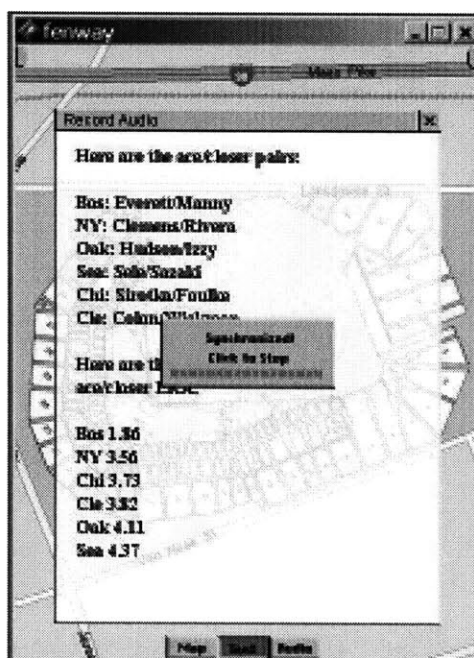
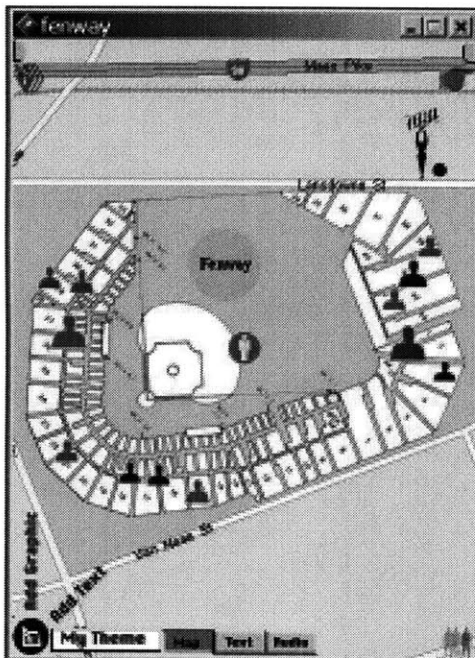
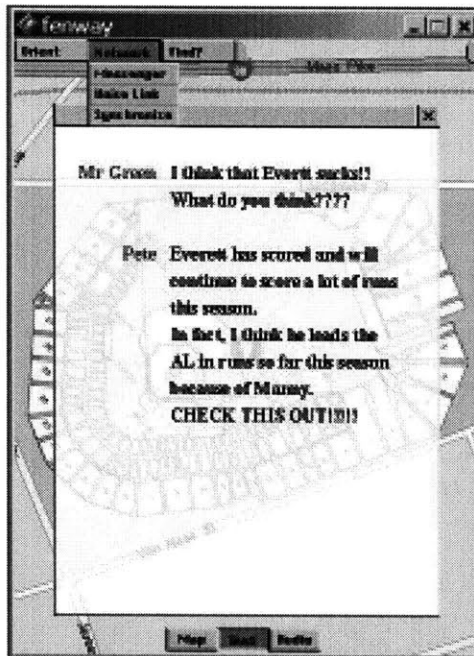
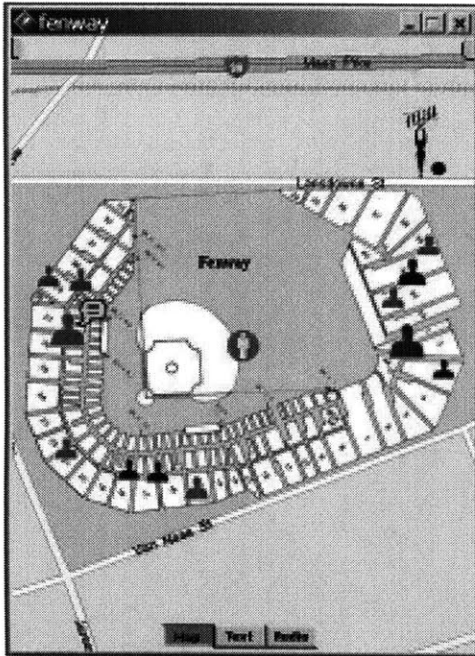
PART I: One of his friends, Tom, is going to be there but Pete did not have the time to plan his evening with Tom . Hence wants to network with him using the synchronous networking tools. He uses the find tool to find his friend and instant messages to him. They both plan to go to Avalon after the game and decide to put this information on the pin-up-board for others.



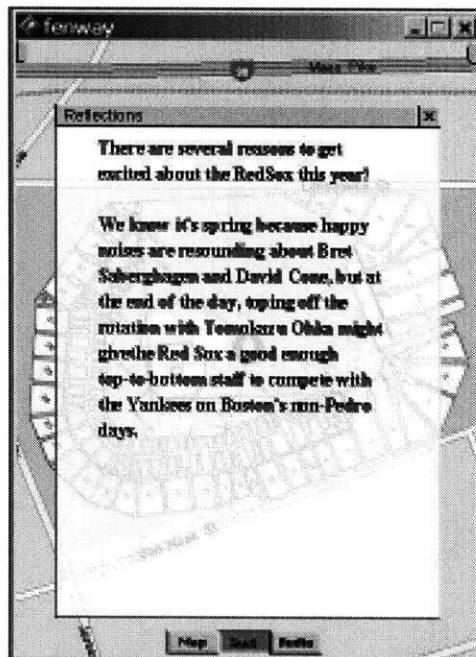
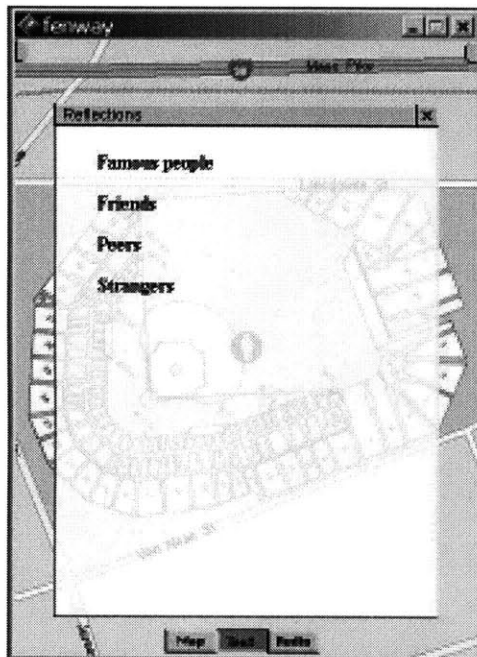
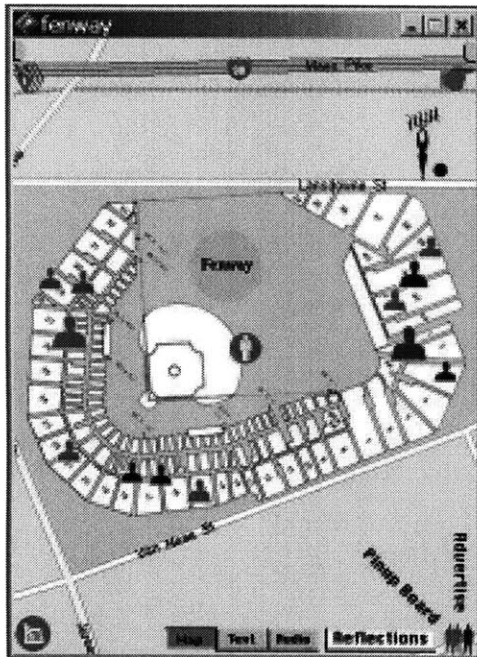
The game continues and the Pete checks the board at the end of the game. There is message posting on the pin-up-board by Avalon that suggests a last minute change of Plans! This highlights the dynamism of the real-time information that is retrieved at the right place and at the right time. This suggests a business model where Avalon might have the rights to post these notes directly into the Urban Pilot System.



PART II: One of the peers Mr Green, would like to chat with Pete. Pete accepts his chat request and answers his question. To make the point more clear, he accesses his personal notes and sends a synchronize request to Mr. Green. This is an example of networking and knowledge exchange between weak-ties that are linked by homogeneity.



PART III: Pete might want to know what people, in general have to say about the current game. He decides to access the Notes-to-share and take a peep at the reflections posted by people. This is an example of asynchronous networking and tapping on the collective experience of people.



These story boards have been made to highlight how Urban Pilot captures individual perceptions and collective experience, thereby creating a volatile information system.

6. CONCLUSIONS AND RECOMMENDATIONS

There is a clear and definite opportunity to harness the volatile information patterns of the city in order to experience it in a meaningful way. The research showed that the real-time digital interface provided by the mobile handheld technology could be transformed into an appropriate technology to provide a dynamic information structure. The proposed tool - Urban Pilot - is an application for a handheld device where the information system is based on a regenerative cycle of Filtering, Networking and Layering. The focus is on the shift in perception from 'information and technology' to 'city, its connection with people and their experiences'. The tool captures the individual perceptions and collective experiences by filtering the information through personalization, sharing the personal perception through social networks and layering the information with collective memory. It not only updates the information, but also creates an ecological system that allows for the creation of new patterns and interpretations. The Urban Pilot tool acts as a mediator between the individual and the physical, emotional and collective space around him/her.

Though this thesis focuses on a system of exploration (demonstrated by the user-scenarios), the tool offers the potential of being an analytical system. While personal memory could generate a self-analyzing tool, it is collective memory that can be seen as a social mirror reflecting the ever-changing patterns of urban life. It is interesting to speculate that these personal memoirs could generate interesting cognitive maps that, if shared, could add a rich layer of information to the collective experience of the city. The thesis in its present scope of time has not been able to research into how these maps are generated, but provides an opportunity for further research. Urban Pilot is based on a system of filtration for personalized information retrieval. Hence, the system maintains a dynamically updated database of user-profiles. This user-profile database, when related to the choices of individual users in a matrix, can provide interesting visualizations. This important piece of data could be used resourcefully as a social mirror.

Future work might involve investigation into the business model and the infrastructure needed to maintain such a system. One business model could be based on advertisement, where the system is linked to physical objects in space that offer time and context sensitive services to the user (m-Commerce). One would need to add another filter that maps the degree of intrusiveness that a person would allow. This model is very commercial and would like to explore other possibilities too. The above-mentioned discussion on user profiling gives important clues to a possible business model. Monitoring and trading of the dynamic user-profile data (in a way that respects the individual's privacy concerns) with key companies could be a plausible business model to maintain such a system.

It is important to carry out usability tests on the design proposal and further develop iterations based on the user- feedback. The strength of this thesis is the proposed regenerative system, rather than its particular design approach. There is a whole spectrum of design possibilities. The proposal for detailed exposure to information, voluntary choice mechanism and an active input of user-profile data could be contrasted with a design that caters to fewer choices and more system control. Another approach could be a customizable interface that reduces the number of control points as the system is used over a period of time.

The author would also like to further investigate the user-interface of such a device. Is it an ergonomically designed Personal Digital Assistant (PDA), or is it a cellular phone, or is it the third generation (3G) device. Or it might not be a singular device at all. The display could be hidden in the city as the hidden information patterns. The information system could be embedded in the physical objects of the city and one could download the relevant information onto any handheld device that the individual is carrying at that time. This thesis has explored one approach and is open to other plausible scenarios.

Who would be the different stakeholders in such a system? The key components would be data-management, user-profiling techniques, networking tools, convergence of wireless and GPS technology, mature mobile device industry and key applications like the voice recognition technology are important to the success of such a tool. Wireless technology and services are in the process of evolution and diffusion of wireless would take its time to mature. The service provider and the handheld manufacturer will have to work closely together in order to provide services and products that provide value to the user and respect the specificity of the wireless. A thorough research into the spectrum of device and application design needs to be done to propose a convergence of useful technologies. The present is far away from realizing the dream of 'accessing information by anyone, anytime, anywhere'. This investigation assumes a technology landscape that is not yet available, but strongly recommends that directed research for supporting technologies would be a step in the right direction.

7. BIBLIOGRAPHY

7.1 Books

1. Appleyard, Donald, Lynch, Kevin, Myer, John. *The View from the Road*. (MIT Press, 1964)
2. Bradford, Peter, ed. *Information Architects*. (Graphis Press Corp., 1996)
3. Bergman, Eric, ed. *Information Appliances and Beyond*. (Morgan Kaufmann Publishers, 2000)
4. Boorstin, Daniel J. *The image : a guide to pseudo-events in America*. (New York : Vintage Books, 1992)
5. Calvino, Italo. *Invisible Cities*. (Harcourt Brace Jovanovich, Inc., 1972)
6. Card, Stuart, Mackinlay, Jock, Shneiderman, Ben, ed. *Readings in information visualization: Using vision to think*. (Morgan Kaufmann Publishers, 1999)
7. Harley, J.B. *History of Cartography*. (University of Chicago Press, 1987)
8. Helal, Abdelsalam A. *Any time, anywhere computing : Mobile computing concepts*. (Kluwer Academic, 1999)
9. Howard, Frances Minturn. *Beacon Hill, hub of the universe*. (Dublin, Yankee, 1977)
10. Jacobson, Robert E, ed. *Information Design*. (MIT Press, 1999)
11. Judd, Dennis, Fainstein, Susan. *The Tourist City*. (Yale University Press, 1999)
12. Kay, Jane Holtz. *Lost Boston*. (Boston, Houghton Mifflin, 1980)
13. Krieger, Alex, Cobb, David, Turner, Amy, Bosse, David, ed. *Mapping Boston*. (MIT Press, 1999)
14. Lynch, Kevin. *The Image of the City*. (Cambridge, The Technology Press & Harvard University Press, 1960)
15. Lynch, Kevin. *City Sense and City Design*. (MIT Press, 1990)
16. Lynch, Kevin. *What Time is this Place?* (Cambridge, MIT Press, 1972)
17. Miller, Naomi. *Mapping cities: Boston University Art Gallery*. (University of Washington Press, 2000)

18. Okie, Susan, Yee, Donna. *Boston: The official Bicentennial Guidebook*. (Clinton, Mass, Colonial Press, 1975)
19. Southworth, Michael, Southworth, Susan. *Maps, a Visual Survey and Design*. (Boston : Little Brown, 1982)
20. Southworth, Michael. *City Learning: Children, Maps*. (Berkeley, CA : University of California, Center for Environmental Design Research, 1988)
21. Southworth, Michael. *SmartMaps for advanced traveler information systems based on user characteristics: final report*. (Berkeley: Institute of Urban and Regional Development, University of California at Berkeley, c1994)
22. Tufte, Edward. *Envisioning Information*. (Cheshire Graphics Press, 1990)
23. Tufte, Edward. *Visual Explanations: images and quantities, evidence and narrative*. (Cheshire Graphics Press, 1997)
24. Tufte, Edward. *The visual display of quantitative information*. (Cheshire Graphics Press, 1983)
25. Ware, Collins. *Information visualization: perception for design*. (Morgan Kaufmann, 2000)
26. Wildbur, Peter. & Burke, Michael. *Information Graphics: Innovative Solutions in Contemporary Design*. (London, Thames and Hudson Ltd, 1999)
27. Wurman, Richard Saul. *Follow the yellow brick road : learning to give, take, and use instructions*. (New York, Bantam Books, 1992)
28. Wurman, Richard Saul. *Information Anxiety 2*. (Indianapolis, Ind., Que, 2001)
29. Wurman, Richard Saul. *Making the City Observable*. (Cambridge Walker Art Center, MIT Press, 1971)
30. Wurman, Richard Saul. *Boston Access*. (Access Press, 1993)

7.2 Articles

1. Field, Scott. *Social Structural Determinants of Similarity among Associates*. (American Sociological Review, Volume 47, Issue 6 (Dec., 1982), Pg. 797-801)
2. Granovetter, Mark S. *The Strength of Weak Ties*. (American Journal of Sociology, Volume 78, Issue 6 (May, 1973), Pg. 1360-1380)
3. Hack, Gary, Hollister, Rob. *Cashing in on the Guidebook Boom: It's a long, long way to '76*. (Landscape Architecture, January 1974)
4. Rose, David. *Experience Architecture: A Framework for Designing Personalized Customer Interactions*. (Design Management Journal, Spring 2001)
5. Sponsored by the IEEE Computer Society Technical Committee on Visualization and Graphics. *IEEE Symposium on Information Visualization 2000, Salt Lake City, Utah*. (Los Alamitos, IEEE Computer Society Press, 1996)
6. Sponsored by ACM's Special Interest Group on Computer-Human Interaction (ACM SIGCHI). *CHI 2001, Anyone, Anywhere. Volume No. 3, Issue No. 1*. (2001)
7. Sponsored by the Special Interest Group on Computer & Human Interaction (SIGCHI) and the Special Interest Group on Artificial Intelligence (SIGART) of the Association for Computer Machinery (ACM). *International Conference on Intelligent User Interfaces-IUI2000, New Orleans Louisiana, USA*. (2000)
8. Viant Innovation Center Project. *Experience Architecture: The strategy and design of ecommerce personalization*. (http://viant2-ecdc3.digisle.net/pages/frame_thought_traffic.html, 2001)
9. Viant Innovation Center Project. *The Human Side of Peer to Peer: where technology and people come together*. (http://viant2-ecdc3.digisle.net/pages/frame_thought_traffic.html, 2001)

7.3 Web Reference

Digital Guides

<http://boston.citysearch.com/>
<http://www.digitalcity.com/boston/>
<http://travel.excite.com/>
<http://lonelyplanet.com/>
<http://www.fodors.iexplore.com/>
<http://www.noshit.com.au/nsitt/nsitt/index.htm>
<http://www.timeout.com/boston/>
<http://www.smartpages.com/cityguides/ma/boston/>

Information Visualization

http://inxight.com/demos/tl_walk_thru/index.html
<http://www.visualthesaurus.com/>
<http://traffic.ce.gatech.edu/trafficweather/>
<http://thebrain.com/>

Mobile initiatives

<http://allnetdevices.com/>
<http://www.cooltown.com/papers.htm>
<http://www.pcc.philips.com/mobile/xenium/index.shtml>
<http://www.nokia.com/phones/9210/index.html>
<http://www.palm.net/>
<http://www.delorme.com/roadwarrior/solus3.asp>
<http://www.gpspilot.com/>
<http://www.jungleport.com/scripts/index.pl>
<http://vindigo.com/>
http://www.nokia.com/networks/mobile_internet/download.html
<http://celia.mehaffey.com/dale/pilotgps.htm#maps>

Web Cartography

<http://kartoweb.itc.nl/webcartography/webbook/>
<http://terraserver.homeadvisor.msn.com/default.asp>
<http://www.mapquest.com>
<http://plasma.nationalgeographic.com/mapmachine/>
http://www.skylinesoft.com/corporate/corporate_home.asp
<http://www.usgs.gov/>
<http://www.geographynetwork.com/maps/services.cfm>
<http://www.skyscraper.org/timeformations/intro.html>
<http://mappamundi.net/>

7.4 Illustration Credits:

Unless otherwise specified, all illustrations are made by the author