

Mobile Media and Digital Wayfinding: Strategies for Implementation

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Introduction

Given our inherent mobility, wayfinding can be described as one of the earliest human activities. In a simple environment, the human mind is capable of generating a cognitive map or “the internal spatial representation of environmental information” (Golledge, 1999). Within a complex environment, an internal cognitive map alone may not allow the user to have a successful wayfinding experience and may lead to the formulation of representational inaccuracies (Raubal and Egenhofer, 1998).

Traditional wayfinding solutions rely heavily on the physical features of already built environments to provide navigational cues and a signage system to help users find their way. Given the increasing demand for flexibility in a diverse society, traditional fixed wayfinding approaches no longer satisfy today’s users. The need for developing a customized wayfinding system has become urgent.

Mobile media and interactive design offer an opportunity to improve the wayfinding experience in such a way that traditional, fixed wayfinding systems cannot. In this paper, the authors examine how mobile media can be introduced into a wayfinding system to create a ubiquitous wayfinding experience and offer guidelines for creating a customized, interactive digital wayfinding system.

Ubiquitous computing has long been an issue of discussion amongst theorists and futurists. However, the world of intelligent objects and reactive spaces is becoming a reality as the fields of computer science, architecture, visual communication, and industrial design collaborate to better serve specific human needs. The adaptability and flexibility of digital wayfinding can satisfy these demands simultaneously. Therefore, digital technology can be seen to play a key role for future wayfinding.

Background

Wayfinding Wayfinding as a field of study did not develop until the early 20th century. The term “way-finding” was coined in 1960 by city planner Kevin Lynch in his influential book *The Image of the City* and later became “wayfinding” in the mid-1970s. Lynch’s major contribution to architectural design and urban planning is that he recognized the importance of an environmental image for wayfinding tasks. To define elements of a city, Lynch identified the following terms: paths, edges, districts, nodes, and landmarks. These terms continue to be widely used today in all aspects of environmental design and research.

Another important book, *Wayfinding: People, Signs, and Architecture* was published in order to make an “impact on the design profession” the importance of wayfinding concepts (Arthur and Passini, 1992). In this book, the authors continued to describe wayfinding as spatial problem solving and further specified it as “a term introduced to describe the process of reaching a destination, whether in a familiar or unfamiliar environment” (Arthur and Passini, 1992).

Architects, urban planners, landscape architects, environmental graphic designers as well as behavioral and cognitive psychologists have been involved in the multidisciplinary study of wayfinding. Good designers have been able to solve wayfinding problems comprehensively always beginning with a thorough analysis of the environment: entrances and exits, circulation paths, districts, nodes (decision points), vertical circulation (stairs, elevators), and landmarks. In some cases, these architectural attributes are emphasized for wayfinding purposes. Signage systems are then implemented which provide users with site orientation, directional routing, building identification, and regulatory instructions.

Since Lynch first introduced the term *way-finding* nearly a half-century ago, this concept has now become a commonly applied design strategy in developing static signage systems. Despite this milestone, limitations remain even in the most successful solutions.

Limitations of static wayfinding solutions The proliferation of the internet has enabled users to receive information on demand and on nearly any subject imaginable. Due to the proliferation and growing popularity of online mapping sites such as *Mapquest* (<http://www.mapquest.com/>) and *Google Maps* (<http://maps.google.com/>) or the 3D interface *Google Earth* (<http://earth.google.com/>), people can get detailed visual and textual information on how to drive from location A to location B before their actual visit.

In the physical environment however, it may be more difficult to find maps within a site or to access such displays within a particular building complex. With fixed signage systems, users must stay on routes that have been designed by wayfinding designers. Without consideration for how certain people move through space in search of a particular room or service, traditional signage elements offer little aid to a specific user navigating a complex structure. Is it possible that users can have access to information at anytime based on their own, personal search criteria?

Within existing static wayfinding systems, there is no way for users to access information in a personalized manner. One of the most recognized problems relative to this need is language difference. In international public spaces such as airports or sporting venues, a multi-language signage system is an immense challenge for wayfinding designers. International symbols have been developed and put to use for years to eliminate use of multiple languages on signs, but symbols alone cannot communicate adequately all the time. And, when multi-language information is provided, the amount of information inevitably crowds the display and slows down the process of information searching even with well-organized information design.

Visual directives from signs are of little use to people with visual impairment who rely on other types of sensory input such as aural or tactile devices. Braille messages, for example, are available only on the nameplate of some destinations, and minimally by law only on permanent room designation signs. As the pattern owner of *Raynes Rail*, a Braille and Audio Handrail System questioned: “How could we honestly label doors with Braille without providing a directional link from the entrance of the building to the designated door?” (McKee, 2003). With the special needs of a diverse group of users, is it possible that wayfinding information can be more easily adapted personal needs?

An additional limitation with static wayfinding is the inconvenience, time consumption, and extra costs involved in updating a fixed signage system. Before maintenance was recognized as a crucial part of wayfinding design, outdated information was a big problem: “Wayfinding systems must respond with speed and sensitivity to changes, or else they become more than outdated: they become liabilities” (ID, 1989). With better management and foresight, information can be updated whenever there are necessary changes in building information or as a response to changes in the organizational structure of the facility. The cost of physically changing a sign is found in both manpower and material; re-design of parts of a signage system may lead to inconsistency in overall, uniform signage if the original material can no longer be specified or the manufacturing contractor changes.

Digital Media & Wayfinding Digital media and interactive design now offer opportunities to improve the wayfinding experience in a way that traditional, static wayfinding systems cannot. For example, airports and other multi-modal locations often use electronic signage to create a dynamic relationship between a constantly changing schedule of events and a very diverse group of information seekers.

In a sense, a digital wayfinding system is no longer a static component of the environment. It is flexible and dynamic in nature, at times responding to both the user and the changing environment. Because active technology for wayfinding systems depends on human input, the environment may be able to communicate on a more personal level with the user through alternative auditory and visual cues.

GPS-Enabled Tours The Global Positioning System (GPS) was designed and is controlled by the United States Department of Defense. Although its primary application is for military

research and documentation, the system is now used by countless civilians as well. Low cost GPS receivers are often used together with a PDA, laptop, and vehicular devices for navigation purposes. Since 2004, prospective students at Arizona State University are provided a set of headphones and a handheld computer for a GPS-enabled, self-guided tour (Carlson, 2004). The handheld computer will ask the student about his or her interests on campus and adjust the content of the tour accordingly. At the same time, a paper map is also provided for users. When a user arrives at a hot spot on campus, the location is supported by an audio narrative, music, and a sample of sounds from campus life. While the handheld computers are providing a service for the campus tour, there are concerns for privacy of the location of its users. Additionally, the GPS system is only able to provide locational information for those navigating exterior zones of the campus, and does not track interiors.

Information Kiosk The i-Site Information System used by Johns Hopkins University's Homewood Campus creates an interactive digital wayfinding and communication system. Sixteen i-Site kiosks were installed on the 128-acre campus to help visitors, students, and parents find their way around the campus. The kiosk includes a static map, LCD monitor with five buttons, a hidden microphone, and speaker for audio content. Usability tests of the prototype were conducted by environmental psychologist Dr. Peter Hecht to determine what information should be included and where the kiosks should be located (Greer, 2003). In addition to the two-dimensional map, users can touch the screen for information or push the *Help Desk* button to activate a hands-free telephone which dials out to live assistance via campus security. Even if power is disrupted, users can refer to the two-dimensional map to find their way. As one of the jurors who awarded the SEG Design Award to the project stated: “The kiosk demonstrates the power of interactive digital communications media to tailor wayfinding to the individual needs of a diverse range of users” (Greer, 2003).

OAD Systems Developed by the Guide Dogs for the Blind Association in the UK, Orientation Assistant Device (OAD) systems provide users training with guide dogs the ability to link with information provided about a space through a portable handheld unit. The system relies on radio beacons placed at strategic positions along a route which communicates information about the environment to the mobile device, usually in the form of simple directives and instructions. When the user encounters a beacon, it sends a signal to the device that then indicates its presence with an audible cue that directs the user through the space. This system has received wide accolades because it allows the trainer to focus on working with the dog and not the complexities of navigating their environment (Hind, *et al.*, 2000). The OAD systems trainers can record successful wayfinding throughout a building, thus enabling a later user the ability to choose from a series of specific journeys based on their needs and preferences.

PhoneGuide *PhoneGuide* is a museum guidance approach that uses camera-equipped mobile phones and on-device object recognition. The research project conducted by Föckler, Zeidler, Brombach, Bruns, and Bimber (2005) offers guidance to visitors within a museum by allowing them to take a picture of any exhibition in the museum with their cell phone. When the image is recognized by the device, presentation and information about the exhibition are displayed on the phone. Laboratory experiments and field surveys show that photographed museum exhibits can

be recognized with a probability of over 90% (Föckler *et al.*, 2005).

Miniature, context-aware devices such as the *PhoneGuide* and a similar device developed by Swedish researchers at the Viktoria Institute's Future Applications Lab are being imbedded into furniture, textiles, and other objects. These devices are programmed to rely on communication from the users through a common user interface such as a cell phone or PDA. The format for this graphical user interface is of notable interest due to the potential for the development of context-aware mobile media to communicate information about the built environment; this technology has the potential to revolutionize the way in which we navigate in the built environment and indicates a new approach for wayfinding designers.

Strategies for Digital Wayfinding

Interactive kiosks and electronic presentations are becoming more widely used in wayfinding systems. However, because they are fixtures within the environment, they cannot facilitate a ubiquitous wayfinding experience. By introducing mobile media, such as cell phones and PDAs into the wayfinding system, people can find their way with much greater ease.

In this section, the authors explore the components and principles of digital wayfinding and identify strategies for implementation. For wayfinding within a public building, existing signage is an immediate and available means to test the *PhoneGuide* technology developed by Föckler, *et al.* Powered by the *PhoneGuide* technology, users can take a picture of room designation signs and receive related multimedia presentations such as texts, maps, images, videos, and audio on their own phone. Alternatives include the ability for a user to input (via voice or keypad) information from the identification signs to receive multimedia content.

Components of Wayfinding Information

A comprehensive wayfinding system provides not only information that people need when they are in the environment, but also information that they need before and after the visit.

- **Pre-visit Information** Pre-visit information is useful for people to generate an understanding of the environment before they visit.. There are two different needs for pre-visit information: general information and information for planning the trip.

General information:

General information is especially useful when the user is not familiar with the site. Overview of the site, architectural organization, and facility information will be appropriate for this purpose. User surveys can be conducted to determine what information is relevant to the users of the site. A well-designed overall information design can help to create a cognitive map for wayfinding purpose and establish a sense of familiarity by visual and/or audio representations: texts, graphics, maps, photos, audios, videos, 3d models, etc. The emphasis is not to provide specific wayfinding information, but to establish identity of the site.

Planning the trip:

Specific information such as parking lots, bus stations, entrances, accessible entrances (and elevators) are needed for planning the trip. *Map Quest* and *Google Maps* are commonly used online tools for acquiring driving directions. However, what these sites do not offer is more specific wayfinding information (i.e. location of the parking lot or accessible entries).

- **On-site Information** On-site information should be very specific to help people find their way and can incorporate visual information, as well as sound and tactile surfaces for diverse user needs.

Approaching the site:

For a public facility, on-site wayfinding begins by guiding users to the entrance. Effective wayfinding for this stage provides directional signs from outside the building to the entrance, and provides a clear identification sign to confirm the arrival. A meaningful identification sign will also contribute to establishing the identity of the site.

Reaching the destination:

On-site information for wayfinding should include directives from the entrance to the user's desired destination(s). Examples typically include orthographic representation in the form of a building's plan which has been graphically simplified to provide the user with a clear understanding of the architectural organization. General information included within this signage may include room identification, location of building egress, restrooms and other public facilities, or vertical circulation (stairs and elevators).

With mobile phone or PDA in hand, users can type in or speak out information on the identification sign, or simply take a picture of the sign using the digital camera on the phone. Information related to the users' current location will then display on the phone. With further input, a customized direction will then be created for the user. Compared to traditional static wayfinding solutions, digital wayfinding with customized directives help users to find their way with greater ease.

Finding one's way out:

Wayfinding is not complete when users reach their destination. It is also important to aid in finding one's way out. During emergency evacuations due to fire or other life and safety hazards, users rely critically on a building's wayfinding system. Decisions regarding a building's wayfinding strategy should be integrated within the architectural design process as early as possible, enabling all users to efficiently exit the building at all times.

Guidelines for Digital Wayfinding

Wayfinding design is not just about signage placement and indicating directions. More importantly, it is about creating a pleasant and memorable experience for users. Guidelines and strategies are available to aid designers of physical wayfinding systems, but little has been written relative to the development of guidelines for digital wayfinding. Without proper design considerations for mobile devices and interactive media, users will not only have to find their way in the physical environment but also struggle with the technology designed to make their experience easier. It is important to develop guidelines that ensure new technologies are used to facilitate wayfinding, rather than creating a new barrier.

Guidelines for digital wayfinding are divided into two sections: usability and user satisfaction.

Usability

- **Consistency** Effective presentation of information relies on clear and organized information delivery; it must instantly reveal information hierarchy and identify an order of priorities. When digital media is introduced into the wayfinding system, consistency in information presentation should consider a naming system, typeface, size, color, graphics, as well as auditory information and spatial animations. Information presented through digital media should be consistent with those data in the physical environment. This consistency and repetition in information presentation (visual, audio or kinetic) helps develop an easily recognized pattern for users to follow and streamlines their navigation throughout the environment.
- **Simplicity** By simplifying the interface, designers can provide information based on user needs and not become overload with too much “raw data”. For example, a building plan that illustrates the entire complex is unnecessary to the relative experience of the individual user. Because their needs would be addressed individually within a digital wayfinding system, extraneous / accessory information is presented to the user on a ‘need to know’ basis.
- **Legibility and Readability** The Americans with Disabilities Act (ADA) introduced comprehensive guidelines for legibility and readability issues for physical wayfinding, yet not much has been developed for digital wayfinding. Legibility and readability issues are especially critical when people are relying on mobile media for wayfinding. With a limited screen size, careful selection of typeface, letterform size, color, and contrast are crucial.
- **Alternatives** While digital wayfinding incorporates new technologies for wayfinding purposes, traditional wayfinding means such as landmarks, maps, and signs should be an integrated part of the system to help people find their way when the technology is not available, which is especially true when users are finding their way out in emergency.
- **Environmental Cues** Environmental cues such as landmarks are readily-identifiable feature of a site that are important for wayfinding. It is much

easier for users to remember a landmark in the environment and find their way based on its location. When digital media is applied, physical landmarks should be integrated into the system to help people navigate.

User Satisfaction

- **Feedback** The major difference between a static wayfinding system and a digital wayfinding system is dynamic interaction between users and information. Feedback may be indicated as a change in color, size, movement, sound, etc. within the interface. Tangible and immediate feedback to a user's action is crucial for satisfaction.
- **Customization** While traditional wayfinding approach doesn't allow people to customize the content and presentation of the information, digital wayfinding enables people to find information based on personal needs and presents it in a way that is best suited for the user. A customized information presentation can help people to focus on their task and not distract them with irrelevant information. Guiding users through a building involves understanding who will be using the facility and designing for variations in age, education, language, physical mobility, etc. Providing alternatives for information retrieval will make the process easier and instill within the user a sense of control over their environment. For example, a user can choose to see information in different sizes and color, still image presentation versus animations or videos, and aural versus visual information. Customization empowers people and therefore, leads to greater user satisfaction.
- **Non-visual Senses** Combination of visual information (static or kinetic), sound, and texture for the wayfinding system allows people to access information from various senses. Traditional wayfinding approaches emphasize static visual information display. Tactile surfaces are used mainly for Braille messages and available only on the nameplate of some destinations (and minimally by law only on permanent room designation signs). For a digital wayfinding system, it is much easier to incorporate sound, movement (vibration of a cell phone, for instance), and texture to help people find their way with more options.
- **Interpersonal Communication** As social beings, we rely on interpersonal communication. When people get lost, they tend to ask for help. A digital wayfinding strategy can provide a needed human counterpart to the frustrating experience of being lost in a foreign environment. Trained personnel can stay on line to answer wayfinding questions or talk to users directly on the phone.
- **Privacy** People want to know where they are and where they are going, but they don't necessarily want to let others know their location. It is important to consider privacy within the design of the digital wayfinding system.

Summary and Conclusions

The digital wayfinding system is no longer a static part of the environment and is becoming an integral partner with static systems. It is flexible and dynamic in nature, at times responding to both the user and the built environment. Compared to traditional static wayfinding, digital wayfinding offers environmental information that is ubiquitous, customized and flexible. With mobile media connected to a wireless network, people can find their way around without spatial and temporal constraints. Additionally, a properly designed interface enables people to get information based on their diverse personal needs and instills a sense of comfort with the task of navigating a complex environment.

As building functions and designations change, wayfinding systems must be updated. Digital systems can be easily adapted to the needs of users through interface programming at a fraction of the cost of updating physical systems. Additionally, digital systems are easily updated for users with special needs, as technology can more easily accommodate the needs of special user groups.

A handheld mobile device provides the opportunity for wayfinding designers to examine the spatial components of a building to create a customizable interface that can provide users with choices as to how they want to move through the building. Incorporating mobile media and digital technology within a building's wayfinding strategy allows for ubiquitous, customized wayfinding experiences and may offer a more efficient wayfinding experience.

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