



# OCAD University Open Research Repository

## Faculty of Design, Mobile Experience Lab

---

2008

# Designing for mobile: A walk in the park

Ladly, Martha

---

### Suggested citation:

Ladly, Martha (2008) Designing for mobile: A walk in the park. Canadian Journal of Communication, 33 (3). pp. 525-536. ISSN 0705-3657 Available at <http://openresearch.ocadu.ca/id/eprint/336/>

*Open Research is a publicly accessible, curated repository for the preservation and dissemination of scholarly and creative output of the OCAD University community. Material in Open Research is open access and made available via the consent of the author and/or rights holder on a non-exclusive basis.*

# Report

## Designing for Mobile: A Walk in the Park

Martha Ladly  
*Ontario College of Art & Design*

*Abstract:* Design for mobile platforms and the challenges and opportunities inherent in the design of mobile applications and experiences are presented in this research report on the Park Walk Project. Park Walk participants use a specially programmed application on a mobile phone, connected via Bluetooth with a GPS device, to see images and hear stories mapped to various locations, enabling an exploration of the social, cultural, and natural history of Toronto's Grange Park. The intention of the Park Walk Project is to tie information directly to places with the use of mobile technology and to create a narrative space in a public park that is open to collaboration.

*Keywords:* Wireless; New media; Community networks

*Résumé :* Ce rapport de recherche sur le projet Park Walk (« promenade dans le parc ») porte sur la planification de plateformes mobiles et les défis et occasions propres aux applications et expériences mobiles. Les participants au Park Walk utilisent une application spécialement programmée sur un téléphone mobile et reliée à un navigateur GPS au moyen de Bluetooth. Cette application leur permet de voir des images et d'écouter des histoires correspondant à des endroits spécifiques, de manière à ce qu'ils puissent explorer l'histoire sociale, culturelle et naturelle du parc Grange à Toronto. L'intention du projet Park Walk est d'associer des informations à leurs lieux correspondants au moyen de technologies mobiles et de créer dans un parc public un espace narratif ouvert aux collaborations.

*Mots clés :* Sans fil; Nouveaux médias; Réseaux communautaires

### Designing for mobile experiences: The Park Walk Project

*Do you take your mobile phone with you when you go for a walk in the park? And apart from making and receiving phone calls, can you imagine other opportunities for socialising and recreation using a mobile device in the park?*

When our design team embarked on research for the Park Walk Project, these were the initial questions we asked ourselves as well as a diverse group of park

---

Martha Ladly is an Associate Professor of Design and a researcher with the Mobile Experience Lab at the Ontario College of Art and Design (OCAD), 100 McCaul Street, Toronto, ON M5T 1W1. Email: mladly@faculty.ocad.ca.

**Canadian Journal of Communication, Vol 33 (2008) 525-536**

©2008 Canadian Journal of Communication Corporation

visitors in Toronto, Montréal, and Banff. My co-researcher Bruce Hinds and I led the Park Walk Project team out of the Mobile Experience Lab at the Ontario College of Art & Design (OCAD), supported by an engineer, a computer programmer, and an interface designer, alongside a small, dedicated group of student research assistants and interns and working together with three other design teams at the Lab. The Park Walk Project was developed within the Mobile Digital Commons Network (MDCN)<sup>1</sup> and came out of a joint research initiative in design methods for mobile and locative technologies. MDCN projects are devised to address the opportunities provided by locative media for diverse participants to engage in new forms of sociability and recreation in Canada's urban and wilderness parks.<sup>2</sup> Our objective with the Park Walk Project was to build an application using mobile technologies that would enhance visitors' experiences in a park in Toronto.

During the ideation, research, building, and testing of the project prototypes, we used the methodology of iterative design. In this process, designers' activities of designing, prototyping, testing, analyzing, and refining are undertaken in a cyclical way, each step informing the next, as the effort moves closer to a final design. Eric Zimmerman, lead designer of games such as *Loop*, *LEGO Junkbot*, and *SiSSYFIGHT 2000*, describes this process as a way of integrating design research directly into the design process, allowing new and unexpected questions to emerge: "In iterative design, interaction with the designed system is used as a form of research for informing and evolving a project, as successive versions, or iterations, of a design are implemented" (Zimmerman, 2008, p. 25).

Following this process, the Park Walk team engaged in designing, refining, and testing a series of iterations of our prototype. The prototypes were tested and finally deployed in Toronto's Grange Park for an 18-month period, from October 2005 to March 2007.

Our research questions developed and were puzzled through during an initial stage of joint field work and discovery in Toronto, Montréal, and Banff. These are some of the questions we asked ourselves:

1. How can we enhance an urban park experience for visitors and participants with mobile technologies?
2. How do we tell stories and convey specific located information with the use of mobile technologies?
3. How do we design a self-guided experience, so that visitors can use mobile technologies to find information and to participate in activities that would not otherwise be available to them?
4. How can technology be employed in a way that augments and does not impede or interfere with the embodied experience of being in the park? Further, how do we design in ways that will enhance the experience for Park Walk participants?
5. How can diverse participants of varying ages share the Park Walk experience?
6. Can participants engage actively in the authorship and creation of mobile content for the Park Walk Project?

The final two questions would lead our team to the initial stages of research and creation to enable participants to generate their own content for Park Walk.

### **Taking Park Walk to Grange Park**

Research was conducted in a number of Toronto's historic parks to identify the best location for the Park Walk Project. After extensive initial testing and prototyping in the Lab at OCAD and in Toronto's High Park and Grange Park, the latter, adjacent to the OCAD campus, was chosen for its proximity and for its historical importance.

Grange Park is situated in what was Toronto's first elite neighbourhood and is named after Grange House, one of Toronto's oldest extant residential buildings, built in 1817 for D'Arcy Boulton Jr.<sup>3</sup> Grange Park has a beautiful approach from the south, up a long drive through the front lawn of the original estate, which once contained extensive gardens, fields, orchards, woods, and a racetrack. In the early 1900s, Grange Park's large estates were dispersed, and the area was transformed with rows of modest workers' houses. The neighbourhood became home to many new Canadians and has been a place of successive immigrant settlement. Grange Park also provides an outdoor environment of great historical and recreational value for this neighbourhood, as well as for the Art Gallery of Ontario (AGO) and OCAD, which border it. Visitors enjoy walking, running, loafing, sitting on benches, skateboarding, dog-walking, tai chi, and playing with their children in the tree-lined park. It is bereft of contextual or informational signage and offers opportunities for annotation regarding the historical buildings, the park environment, and the cultural events that take place there. The new Frank Gehry addition to the AGO, directly overlooking Grange Park, was being built over the period of our design work and is still in progress at the time of writing. This burgeoning architectural and cultural landmark offers both a new context for visitors to the park and opportunities to document the building process over time, which we included in our design iterations.

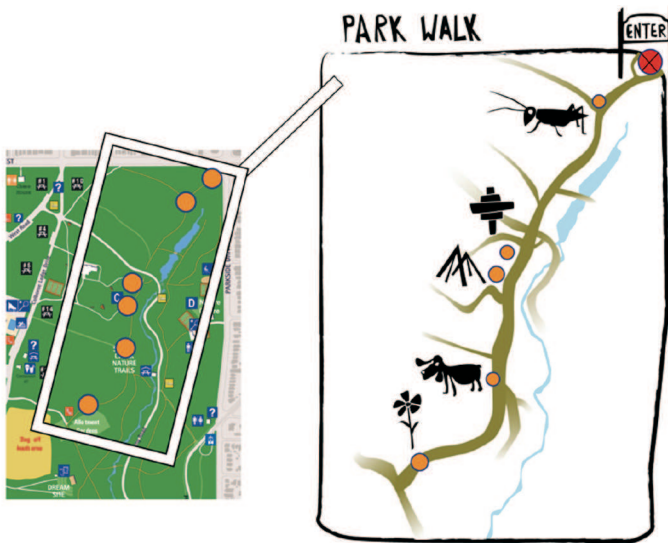
### **Surveying visitors in the park**

In June 2006, a group of researchers and student interns spent an intensive long weekend in a design charette.<sup>4</sup> "Design charette" is a term borrowed from architecture; it refers to a creative process that is used to develop solutions to a design problem within a limited timeframe (Aurand, 2006). During the charette we did a number of small-scale surveys of potential participants to document the range of mobile digital technology devices they used in the park. We verified that park visitors might like to find out more about the history, culture, and natural history of the park. When it was suggested to them, some of the people we interviewed indicated that they would like to collect artifacts or souvenirs of their experience of the park, while others expressed an openness toward leaving a virtual "signature" such as a photograph or audio clip that they could revisit and share with friends and other park visitors. The survey sample consisted of 20 participants, with an average age of 37, of whom 60% were females. One hundred percent of participants had brought some form of mobile technology to the park. Sixty percent of the women and 40% of the men had brought a mobile phone, many of which were equipped with digital cameras. Seventy percent of the women and

40% of the men also had a digital camera with them. Ten percent of the women had a gaming device with them. None of the men surveyed carried such a device. This small survey led us to surmise that a significant number of park visitors carry some form of mobile technology with them in a park setting.

The Park Walk Project proposes that if a visitor were carrying a mobile phone that was loaded with the project application in the park, simply by walking through a zone with specific GPS co-ordinates, they would be enabled to find out information, hear stories, or engage in local activities. Our visitors surveyed all agreed that this would enhance their experience in the park. Our central design concept evolved out of the information garnered from the surveys: mobile and GPS technologies can allow participants to access locative media as though they were literally “in the air.”

Figure 1: GPS hot-spot locations mapped to Spring Creek Trail in Toronto's High Park



### Mobile technologies and the Park Walk Project

Combinations of digital technologies in mobile cellular telephony and the Internet offer powerful tools for the design and delivery of new ways for users to interact with the environment. As socializing and spatializing media, these tools are often used in ways that go far beyond the original goals intended by their developers (Galloway & Ward 2005). Park Walk and other projects in MDCN operate in the context of socializing locative media, in an attempt to break new ground in the use of mobile and GPS technologies for this purpose.

Park Walk uses a standard mobile phone (with the normal built-in features of text editing, colour screen display, audio output, and image, audio, and video cap-

ture), running a specially prepared application, which is linked via Bluetooth with a handheld GPS device. Mobile telephones enabled with Bluetooth<sup>5</sup> and the Global Positioning System (GPS)<sup>6</sup> were the technologies chosen for their availability and uptake in the consumer mobile market. The Park Walk Project employs GPS co-ordinates that are fixed in concentric circles on paths and places of interest identified in Grange Park. Each hot-spot is then mapped directly to a graphic representing its corresponding GPS location in the park. Participants use a prepared mobile phone program running the Park Walk application that is connected via Bluetooth with a GPS device to pick up the hot-spots in the park. The visitor is notified of the availability of location-specific information and stories by the vibration of their mobile phone, triggered by the GPS signal when they pass through the pertinent co-ordinates. Images, graphics, photographs, and animations are mapped to locations in the park, and these along with audiovisual narratives are triggered as visitors enter the concentric circles of GPS hot-spot locations mapped to the site (Figure 1). Images and stories they see and hear on their mobile phone pertain directly to the historical, cultural, and natural characteristics of that location and are designed to enliven and enrich the park experience.

### **Engineering Considerations**

The Park Walk application was designed outside of the mobile phone programming environment, using conventional digital data capture and editing software. MDCN projects employed the Mobile Experience Engine (MEE)<sup>7</sup> to translate and engineer the application back into the mobile phone. MEE is a proprietary software engine developed by engineer Tom Donaldson and his team<sup>8</sup> to simplify the process of creating and managing media-rich interactive mobile applications, and in particular, location-based, context-aware applications employing GPS and Bluetooth.

MEE enables designers to design and create complex applications that are then transcribed into simple XML language, which MEE translates into platform-specific Symbian C++, one of the most commonly used mobile operating-system coding languages. By taking engineering out of the design cycle, MEE can help designers and artists develop rapid prototypes, test and refine their designs, and build stable applications for mobile device-based experiences. MEE was an ambitious project in a rapidly moving technology landscape, which only partly delivered what it promised and required a great deal of improvisation on the part of designers and engineers. Throughout the life cycle of the MDCN projects, MEE was also being designed and adapted to new ambitions and requirements and developed in much the same iterative manner as the projects for which it was engineered.

### **Using constraints and challenges to create better mobile designs**

Mobile locative experience design must engage with location in a meaningful way, but cannot become so complex or immersive that the experience results in loss of attention to one's surroundings. There is a danger of losing contact with the physical locale through immersion in virtual space or by being distracted by the use of mobile devices.

When doing research for the audio design of Park Walk, we discovered that audio data that incorporates naturalistic sounds becomes indistinguishable from

ambient background noise (hence the efficacy of the traditional ringing alert). We wanted to avoid phones ringing while walking in the park and also to avoid confusion with an incoming phone call. In an early design iteration, we recorded a birdcall on the trail and then incorporated that recording into the interface design, using it as an “alert” to tell the participant that they were passing through a GPS zone. This naturalistic alert alerted no one and was consistently heard as a real birdcall and ignored. So we designed a system of audio alerts that used the mobile devices’ in-built “vibrators,” which responded to a signal from the GPS device to notify the participant that they were entering the GPS co-ordinates of an annotated “zone.” Whether or not to use headphone ear-buds to enhance the audio experience was a subject for debate with all of the MDCN project teams. We concluded that a highly immersive audio experience was really not desirable: too much immersion with a mobile device breaks the flow of embodied experience and could also put the participant in peril.

A constraint of GPS-enabled mobile devices is that they need to be open to the sky, protected from the weather, and carried safely, easily, and discretely. We wanted to design the Park Walk application so that we could use technology in easier and less conspicuous ways in the park. The GPS unit was external to the phone and had to remain detectable, so a number of solutions were tested involving mountings on hats, arms, legs, belt straps, and walking sticks. We did not want visitors to be peering constantly at a mobile phone while they were trying to enjoy the outdoor experience of the park. The mobile phone could be kept in a pocket and only needed to be taken out when the vibration set off by the GPS co-ordinates indicated that there was something of interest nearby that the user may wish to discover.

Another constraint of designing for mobile devices is the difficulty of seeing and reading screen displays in the outdoors, especially in conditions of bright light. Through a series of iterative redesigns of our screen interfaces, we quickly realized that nothing reads on a dark background in daylight, while darkness presents the opposite challenge for legibility. Text was not really a good option for delivering information in any sort of light. Audio was much more effective for extended narrative; it also allowed participants to walk safely and survey the site while listening to the phone.

### **A locative experience for diverse participants in the park**

In the Park Walk Project, participants were oriented with a short audiovisual introduction to the park, delivered on the phone when they entered the first GPS hot-spot. Visitors were then presented with a map on the phone to locate the GPS hot-spots in the park (Figure 2).

While this experience will appeal primarily to the target audience of mobile phone users in the 20-plus age range, the intention is that variations and iterations of the application should appeal to an audience as diverse as the park users themselves. In the Park Walk prototype, the mobile phone is deployed as an audiovisual guide and can be used by single participants in normal audio mode or by groups who may gather around the phone to hear the built-in speaker and view the images on screen. Information is varied and particular to the different interests of visitors to the park. Although young adult visitors and parents with their



children are the primary imagined audiences, activities generated by the mobile application specific to the park were also designed and built for different age and interest groups (see Figures 3A, 3B, and 4).

**Figure 2: An aerial view and corresponding map showing GPS hot-spot locations of the audiovisual narrative sites selected for the Park Walk Project in Toronto’s Grange Park**



A feature of the Park Walk application is a pictorial identification system for the local flora and fauna, installed on the mobile phone (Figure 3A). A far cry from a didactic “field guide,” the identification system lays a veil of relevant information over the geographic area, rooting it firmly to the locale and to specific locations of interest. Building on this innovation, games that would appeal to a younger audience involving the identification of flora and fauna in the park

**Figure 3A: Pictorial flora identification and information**

**Figure 3B: Flower identification and counting game**





were also developed for the Park Walk Project (Figure 3B). A dog-counting “zapper” was also developed for children; it takes advantage of the opportunity to observe dog-walking and the playful activity that is intense at all times of day in Grange Park (Figure 4).

Figure 4: Dog-counting “zapper” game designed for Grange Park



An interactive demonstration of these and other features of the Park Walk Project application can be found online at the OCAD Mobile Experience Lab website.<sup>9</sup> The Park Walk illustrations were created by student research assistant Nevena Niagolova.

### **Park Walk and the potential for mobile user-generated content**

In addition to enabling participants to access site-specific content, our research team was interested in the notion of mobile user-generated content. Most new mobile devices are equipped with image, audio, and video capture and enabled for multimedia message service (MMS), and users seem eager to seize the opportunities these innovations offer (Leung & Wei, 2000).

Mobile researcher Rob Shields is interested in the ways that users create content on their mobile devices. This content is mostly what Shields describes as “digital glances”: snapshots and short videos that act as mementos and testify to the relationships of their subjects to each other and to the environment (Shields, 2008). We imagined that our park visitors would like to create similar content. Given the high cost of uploading content to the Internet via a cellular telephone in Canada, we anticipated that our participants would prefer not to pay charges to share their data with other participants when using our application.

While almost 60% of Canadians are using their mobile phones to access the Internet (Kinsella, 2007), the cost of uploading and downloading data via mobile devices still prohibits widespread use of the mobile Internet in North America. This has become an inhibitor to growth, restricting research and development and the rollout of new applications, and leaving the North American 3G (third-generation) mobile market trailing Europe and the Far East (Charney, 2004). A competition between device manufacturers and service providers for control of the mobile Internet will likely ensue (Mitchell, 2007) that may or may not be of benefit to its users. Whatever the outcome, we anticipate that the mobile industry will continue to develop new, embedded mobile tools that will enable device-specific and data-specific editing of user-generated content, and indeed, new applications and protocols appeared during the course of our project that addressed some of the very challenges we encountered.

Using the wireless communication enabled by the Bluetooth capabilities of most cellphones may provide an alternative means to share data locally, with the advantage that data upload and download to other devices via Bluetooth avoids costly airtime on the mobile Internet. However, in designing and engineering for the Bluetooth-enabled cellphone, we found that integrating the native data-capture applications of the mobile phone into the Park Walk application was more technically difficult than we had anticipated. Mobile device manufacturers tend to keep their proprietary coding for these applications closed and unavailable to open source developers, so it was a matter of trying to hack the phone or find work-arounds.

In the end, we began experimenting with methods for data capture native to the mobile device and simply created our own “libraries” for different types of captured data (images, audio, and video). The data in these libraries can be downloaded from the phone to a computer via Bluetooth, which enables them to be organized and edited locally by end users, avoiding airtime charges. User-generated data can then be uploaded to the Internet or loaded back into the mobile device by designers given access to the data. These digital glances and observations, if captured by participants, could then be layered virtually over the real place using the Park Walk application.

To date, we have field-tested working prototypes of the Park Walk Project eighteen times over six iterations in four locations: the Hoodoos Trail in Banff National Park, and High Park, Windfields, and Grange Park in Toronto. With each subsequent refinement, the application’s usability and performance have changed and developed, as has the user experience. We are able to report that the application performed under a number of different conditions: in varying weather situations, at different times of year, and with different sorts of participants. Park Walk researchers were frustrated by the vagaries of GPS reception during cloud-covered, rainy, or snowy days, during which GPS hot-spot co-ordinates could shift by as much as 10 metres. This problem was overcome by widening the GPS locations, which made the co-ordinates easier for the devices to find, and by creating concentric rings of GPS concentration, which alerted the participant from further away as they approached the designated hot-spot. The concentric rings form a multidirectional array of GPS alerts, so that participants may wander as they will

and do not need to follow a designated path. As noted by MDCN researcher Kim Sawchuk, weather is a big factor in mobile locative experiences, affecting the ways that we behave and use our mobile devices (Sawchuk, 2007). Although the Park Walk application functioned, few participants enjoyed the project in the winter, when testers were required to stand or tramp around trying to locate GPS hot-spots and when the manipulation of the device necessitated the removal of gloves for long periods in freezing weather.

Different sorts of participants presented different sorts of responses. Research colleagues assisted us with testing, and aware of our challenges through their own prototypes, helped us to find solutions. Two classes of undergraduate students adapted the application to play a game of hide and seek in the park and enjoyed a new experience. A group of graduate students at the Canadian Film Centre imagined differently guided experiences and created rapid prototypes using the application. A family group including two parents and three children thought that it worked better for adults, so they helped us imagine the fauna and flora identification and dog-zapping games for children. A group of scholars and mobile industry experts who tested the application in March 2007 were both critical of the project's shortcomings and excited by its potential.

The Mobile MUSE network, based in British Columbia, also uses community-generated media to enliven open public spaces and promote mobile-enabled social interactions (Vogt, 2008). In so doing, projects like Park Walk and Mobile Muse try to tie experience directly to place. The hope is that by offering information and activities and inviting contribution, these projects may create a narrative space that is open to collaboration, enabling interactions between the diverse community of users of parks and public spaces and the located space of the park. In this way, user-generated content could be made available to be accessed as new, psycho-geographic layers of personal or community experience.

Through our research, we discovered that there are many challenges and barriers to the creation and deployment of locative media, which cannot be minimized. For us these included the costs of development on the research side and the costs and charges to users of mobile networks, combined with low interest in innovative research on the part of mobile service providers. There are looming issues regarding intellectual property and data-sharing currently engaging users and players in the mobile and communications industries, and many wait to see how these arguments will resolve. There are also issues of personal choice regarding the ubiquity of mobile devices in public space that we must continue to address through our research.

## Notes

1. The Mobile Digital Commons Network connects research, arts, and industry, focused on mobile, wireless, and digital technologies in Canada. URL: <http://www.mobilelab.ca/mdcn> [May 7, 2008].
2. Locative media experiences employ mobile technologies to deliver communication media that are bound to a specific location.
3. For further information about Toronto's Grange Park, see [http://www.torontoneighbourhoods.net/regions/toronto\\_downtown/22.html](http://www.torontoneighbourhoods.net/regions/toronto_downtown/22.html) [May 7, 2008].

4. The researchers and student interns who worked together during the June 2006 design charette to create documentation and conduct surveys for the Park Walk Project are Janet Bewell, Amanda Cooley, Sara Diamond, Tom Donaldson, Bruce Hinds, Garry Ing, Martha Ladly, Ken Leung, Nevena Niagolova, Bryn Reed-Ludlow, and Jagmit Singh.
5. Bluetooth wireless technology is a short-range communications system intended to replace the cables connecting portable and/or fixed electronic devices. For more information, see "How Bluetooth Technology Works." URL: <http://electronics.howstuffworks.com/bluetooth.htm> [May 7, 2008].
6. The Global Positioning System is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was intended originally for military applications, but in the 1980s the government made the system available for civilian use. See "About GPS." URL: <http://www8.garmin.com/aboutGPS> [May 7, 2008].
7. For more information about the Mobile Experience Engine (MEE), see <http://www.mobilelab.ca/mdcn/mee.html> [May 7, 2008].
8. The MDCN engineers who worked with Tom Donaldson on the design and implementation of the Mobile Experience Engine (MEE) are Amitava Biswas, Rupinder Deol, Armen Forget, David Gauthier, Sukhmeet Singh, Jagmit Singh, and Alexander Taler.
9. More information and an interactive demonstration of the Park Walk Project application can be found at <http://www.mobilelab.ca/mdcn/parkwalk.html> [August 1, 2008]. Further information on the MDCN, its projects and people, and our research can be found at <http://www.mobilelab.ca/mdcn> [August 1, 2008].

## References

- Aurand, Martin. (2006). What is a charette? *The Charette*. Pittsburgh, PA: Carnegie Mellon University Library. URL: <http://www.library.cmu.edu/Research/Arch/Arch/Charette/what.html> [May 7, 2008].
- Charney, Ben. (2004). Europe and Japan sprint ahead in 3G race. Mobile working toolkit. *ZDNet*. URL: <http://news.zdnet.co.uk/communications/0,1000000085,39147275,00.htm> [May 7, 2008].
- Galloway, Anne & Ward, Matthew. (2005). Locative media as socialising and spatialising practice: learning from archeology. *Leonardo electronic almanac*. MIT Press. URL: [http://leoalmanac.org/journal/vol\\_14/lea\\_v14\\_n03-04/gallowayward.asp](http://leoalmanac.org/journal/vol_14/lea_v14_n03-04/gallowayward.asp) [September 12, 2008].
- Kinsella, Warren. (2007). The next not-so-big thing: The force behind new media? Old media. *National Post*. URL: <http://www.canada.com/nationalpost/columnists/story.html?id=2657eccc-7dce-4522-a64a-d10de1a2ea51> [May 7, 2008].
- Leung, Louis, & Wei, Ran. (2000). More than just talk on the move: Uses and gratifications of the cellular phone. *Journalism and Mass Communication Quarterly*, 77(2) (pp. 308-320).
- Mitchell, Robert L. (2007). The iPhone, AT&T and the battle to control the Internet. *Computerworld blogs*. URL: [http://www.computerworld.com/blogs/node/5837?from=10&comments\\_per\\_page=10](http://www.computerworld.com/blogs/node/5837?from=10&comments_per_page=10) [May 7, 2008].
- Sawchuk, Kim. (2007). Locative research for locative media: The 5 D's of user-integrated testing. Paper presented at the Mobile Nation Conference, March 23, 2007, at the Ontario College of Art and Design, Toronto, ON. URL: <http://www.mobilenation.ca> [August 1, 2008].
- Shields, Rob. (2008). Mobile phone imaging as gesture and momento. In M. Ladly & P. Beesley (Eds.), *Mobile nation: Creating methodologies for mobile platforms* (pp. 47-48). Waterloo, ON: Riverside Architectural Press.

- Vogt, David. (2008). Adventures in mobile culture media. In M. Ladly & P. Beesley (Eds.), *Mobile nation: Creating methodologies for mobile platforms* (pp. 157-158). Waterloo, ON: Riverside Architectural Press.
- Zimmerman, Eric. (2008). Play as research: The iterative design process. In M. Ladly & P. Beesley (Eds.), *Mobile nation: Creating methodologies for mobile platforms* (pp. 25-36). Waterloo, ON: Riverside Architectural Press.