

Mobile Technologies in Public Places

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Executive Summary

Thesis:

How are parks, museums, and other public institutions integrating new mobile technologies in order to promote the use of these areas and enhance user experience?

Recommendations:

1. QR codes should be integrated into existing signage in Lynn Canyon Park to enhance visitor experience.
2. QR codes be used to enhance the scavenger hunt experience

Conclusions:

Two key questions should be asked before implementing new technologies into our parks:

- Do these devices take away from the experience by pulling people out of content with the environment around them?
- Are they more a distraction than an aid?

Introduction

My community partner for this research project is Tricia Edgar, an Education Programmer with the Lynn Canyon Ecology Centre. She is an outdoor educator who has taught both adults and children over the past 16 years. She has asked me to explore how public parks, nature centres and museums have been integrating mobile technology in order to enhance the experience of their visitors. Tricia hopes to use this research to help inform her on interesting new elements that she can add to existing outdoor education programs run by the centre for classes of children and teens, including those with special needs. She also wishes to allow people outside of these classes to access these resources on their own, perhaps on their mobile devices,

or from home. She is particularly interested in the use of QR Codes, the UPC-like boxes that have been appearing everywhere recently.

My research question is as follows. How are parks, museums, and other public institutions integrating new mobile technologies in order to promote the use of these areas and enhance user experience? In this paper, I examine two key themes, QR codes and location-based mobile devices. There is a broad range of research being done into mobile technology, but I feel that these two areas give us a good glimpse into the research and investment in infrastructure that has taken place recently in parks, museums, and other public institutions.

Method and Challenges

My key resources are literature from online, electronic sources. One of the biggest challenges faced in this research was finding credible sources. Academic, peer-reviewed articles were difficult to find in this area of focus. Much of what I found consisted of grey literature. However, the best two resources I have come across in my research are reports prepared for Parks Canada and the Canadian Heritage Information Network (CHIN). There is a great deal of research that was conducted by Parks Canada or on their behalf by other institutions. These include the Tracklines and Explora projects. Later in my research, I was graciously pointed in the direction of a plethora of literature on mobile technology use in museums, thanks to my professor. In regards to museums, I found that the Canadian Heritage Information Network was an excellent resource for information on current practices and research of museum professionals in Canada.

1. QR Codes

What are QR codes? A QR code or quick response code is a type of 2 dimensional symbol similar to a UPC, but it holds much more information. QR codes are easily read by

scanning devices such as scanners or QR code readers on smart phones (Denso Wave Inc., 2000-2010). QR codes generated for smart phones generally contain direct links to web based content which open automatically once scanned by a QR code application. QR codes have been applied in many different ways. Most commonly, they are used as a marketing tool, to link users of smart phones directly to commercial content. In this section, I explore how QR codes have been used to link people directly to dynamic content in parks, museums, libraries, classrooms, at tourist locations, and in parks.



*Figure 1. This QR code links to the Wikipedia entry for “QR codes”.
Created using the Kaywa QR-Code Generator
at <http://qrcode.kaya.com> (Kaywa, 2012).*

QR codes are a cost-effective method of linking people with information. Firstly, this is due to the technology being freely licensed by its developers, Denso Wave. Secondly, there are many free services online that help one generate QR codes such as Kaywa (www.kaywa.com), and the generator for Google’s ZXing project (zxing.appspot.com/generator); therefore, they are inexpensive to generate. Third, QR codes can be used to link to pre-existing web pages or media content online. As long as the web address stays the same, the media content a QR code links to can be updated without having to change the code itself. There is one other such benefit of QR codes discussed next.

Through services such as QRpedia, QR codes can provide other benefits. QRpedia (qrpedia.org) is a free mobile web-based service that provides multilingual support for Wikipedia articles (Canadian Heritage Information Network, 2012; QRpedia, 2012). Once QR codes generated by QRpedia are scanned, a server automatically detects the language settings of the user, and sends them to a mobile-friendly version of the article in their target language. This allows venues, such as museums and parks, with a simple method of providing multi-lingual support to their patrons.

Malicious QR Codes: Be Smart

QR codes are a useful tool, but people may not realize that they also have the potential to cause harm. Users of smartphones must be aware of such dangers and act accordingly. A key safety issue with QR codes is that not all QR Code readers ask for user confirmation before redirecting the phone to a hyperlink or executing an action. Scanning a QR code without a confirmation prompt could be considered on par with opening email attachments without scanning or examining them. When the confirmation prompt for a QR code reader app is enabled, a user can see what action the code is asking the phone to perform (see Figure 2). Without it, a person cannot know where a QR code leads by sight alone. Therefore, the confirmation feature should be enabled on QR code reader apps in order to increase user security (Percoco quoted by Vuong, 2011).



Figure 2. The confirmation prompt for QR Code reader apps should be enabled for increased security and peace of mind (Photo taken by Author, 2012).

An example of the potential harm that QR codes can pose to users comes from Russia. Last September, malicious QR Codes were discovered on some Russian websites by Kaspersky Labs (Maslennikov, 2011) QR codes were posted to allow users to easily install an instant messenger app, “Jimm”, on their Android smartphone. However, in this case, the app came with a nasty side effect. Once installed, an embedded trojan would cause SMS text messages to be sent to a premium account number, charging the phone’s owner \$6 per text. Kaspersky notes that this was not an isolated incident, but seems constrained to Russian websites only.

QR codes that have been posted in public areas need to be monitored and maintained. Modifying a QR code is as simple as placing a sticker over top of the existing sticker. Thus, routine observation is needed to ensure that the visitor or user gets the content they want and not a nasty surprise.

QR Codes: In the Park

Fort Smith

In Fort Smith, Arkansas QR codes have been used at both their Visitor's Bureau, and the local Fort Smith National Park (Cramer, 2010). The park superintendant, Bill Black, wanted to use QR codes to promote the park after a series of conference sessions he had attended. Black worked with the National Park Service website coordinator, Daniel Evans to generate a QR code for a park orientation video that is hosted on YouTube. The QR code was freely generated via Google's ZXing project. Afterwards the QR code was placed in posters located on exhibit panels outside the park entrance (see Figure 3). This helps visitors access information outside the Bureau's regular hours. They also plan to host another video of the firing of the cannon in the park, as it can only be fired twice a year due to budget constraints.



Figure 3. Poster outside Fort Smith National Park, Arkansas (National Park Service, 2012).

Long Beach

In Long Beach, Washington, QR code signs have been placed around the town at points of interest so that visitors with smartphones scan the codes to get more information (Richard, 2010). Along the 8.5 mile Discovery Trail, these signs provide visitors with a smartphone guided walking tour. The smartphone guided tour is also something that could be applicable or useful in promoting or education for the users of a nature park.

QR Codes: Scavenger Hunts

In the fall of 2010, the Topeka and Shawnee County Public Library (TSCPL) in Kansas created a community-wide scavenger hunt based on the book *The Maltese Falcon* (Porter & King, 2011). The library wanted to promote the Big Read initiative, a grant funded fall reading program. In preparation, QR codes were placed around the community in local businesses. Participants began the hunt by scanning a QR code located on *The Maltese Falcon* display in the library. This sent them to a web page which gave them the location and directions to the next site after answering a question correctly about *The Maltese Falcon*. In the end, 323 people began the hunt, but only 8 finished it. It was believed this was because the scavenger hunt locations were spaced to widely across the city, requiring people to travel there by vehicle. The event was still counted as a success as it created public awareness, and was a good learning experience. This is a good example of the use of QR codes as tools in scavenger hunts.

2. Location-Sensing Handheld Devices

Location-sensing handheld mobile handheld devices are mobile phones or PDAs (personal digital assistants) that contain software designed to sense a user's location and "push" media content to them. The devices and software examined in this section have been used to provide users with mobile media content to enhance the experience people have with the

environment around them. The examples I look at in the following section use these devices act as tour guides, providing users with information on local history and geography, scientific facts, and historical artifacts. However, do the benefits outweigh the costs? First, I will look at Tracklines, a series of projects based in Banff, Alberta.

LSHD, In the Park

Tracklines

Tracklines was a media research project that created a location-based story-telling experience for hikers on the Hoodoo Trail in Banff National Park. Tracklines is also a software application developed by the Mobile Digital Commons Network (MDCN), 2005-2007, using the Mobile Experience Engine (MEE) location-based media platform (Advanced Research Technology Mobile Lab, 2007a, 2007b). The project was conceptualized and drafted by the MDCN in 2005 to test out this new software platform. Between 2006 and 2007, the ART Mobile Lab, part of the Banff New Media Institute (BNMI), developed and produced the project for the MDCN. Next, we will examine the specifics of Tracklines.

So what was it? The Tracklines project was a software application for mobile smartphones which utilized GPS-location technology to produce audio stories along the trail for hikers at GPS hot-spots. To ensure signal strength, hikers wore GPS devices on armbands that connected wirelessly to users' mobile smartphones rather than use the less powerful GPS functionality of the phones. To make sure that the Tracklines test worked well, hotspots were set as near to the trail as possible, and at navigational bottlenecks. This ensured that hikers got the most out of the experience, and increased the safety of the exercise by keeping the hikers on trails, and not off in the bush. As hikers walked down the trail, escalating sound cues would play on their phone, alerting them to a story-point nearby. Once a hotspot was reached, a visual

dialogue would appear on the hikers' phone, and they had the option of listening to the story, or ignoring it at their leisure.

The Tracklines application was designed with different layers in mind, allowing the individual hiker to choose different thematic hikes which they could explore. The design team mentioned this could consist of themes such as a geology walk, a wildlife walk, a storytelling walk or a poetry walk. However, for this project, the only theme completed was "Geology: A Walk Through Time." The team describes this project as a "mediascape" project as it combines nature hikes, with images and audio pushed to the user at set points along the trail. Tracklines has a small visual component of its application; although, the primary feature emphasized by the research and design was the audio component.

Following the last project, Tracklines was used by Grade 7 students at Banff Community High School to tell stories of the town's past (Banff Mobile History Tour, 2009). In cooperation with the Banff New Media Institute, two Grade 7 classes in 2007-2008 used the software to create the "The Banff Mobile History Tour", an interactive walking tour similar to the Hoodoo Trail project. The project was collaboration between educators, Learning Through the Arts, and the BNMI, and the Banff Centre. It was inspired as a way to spice up the average Grade 7 curriculum.

I admire this research. However, I have qualms with calling it a "mediascape" as the audio component is so strong. I see this as a viable project that could work on any well-used trail, provided the story and information component is developed. This research pre-empts the research done by Tarasoff in 2007-2009, examined in the next section.

The Explora Project

Inspired by the success of the Tracklines project, Camineo helped develop the Explora guide in co-operation with Parks Canada in 2007 (Tarasoff, et al., 2009a, 2009b). Parks Canada was investigating new strategies to attract new audiences to its natural and historic sites in lieu of declining attendance records over the previous 5 years. They believed that portable location-based technologies would be a good fit for Parks Canada sites and sought to explore if these new devices would attract a new audience to the sites, as well as enhance visitor education and experience. The project also sought for a more sustainable method of development for future projects.

The Explora project had specific design criteria. The pilot project was to use off-the-shelf, non-proprietary, GPS-enabled PDA units to reduce costs and access to equipment. The development software had to be user-friendly for non-technical staff, as they were the ones who would develop, update, and maintain the Explora tour software. The project had to make full use of multimedia images, text, audio and video. Lastly, there were two pilot projects developed: one for a national park; the other for a national historic site. The two sites chosen were Kejimikujik National Park and National Historic Site in Nova Scotia, and Signal Hill National Historic Site in Newfoundland and Labrador.

The development cycle for the Explora project was just under 8 months. The people who developed it were initially unfamiliar with the technology. They produced a functional, GPS-triggered tour guide that worked on three trails (see Figure 4). At points along the trails, information was automatically “pushed” to the device alerting users by a sound of upcoming points of interest. The devices were used by over 1000 people of all ages, young and old.



Figure 4. The Explora device (Tarasoff, et al., 2009a).

Half of all visitors were polled on their experience with the device. All responses were very positive (Tarasoff, et al., 2009a). Overall, most users felt the GPS devices helped make their trip more enjoyable, were fun and easy to use, and gave the visitors a better understanding of the history and natural features of the areas. Users typically stopped at all points of interest the device alerted them to, most reciting instructions out-loud to other group members, and many chose to answer small quizzes “pushed” to them at each location. Both young and old were reported to enjoy using the devices. Also, 75% of those surveyed would be willing to pay to rent such devices in the future, and felt that a price of 4-6 dollars was fair.

The researchers concluded that location-based technology was found to be an effective asset to Parks Canada parks and historic sites. Such projects would be somewhat expensive to set up, especially in terms of man-hours, but it may be a good investment in the long-term.

More recently, Explora has been launched at other national historic sites and parks within Canada. In May of 2011, Explora was launched by Parks Canada at Lachine Canal National Historic Site (Lanktree, 2011). Explora devices can be rented for \$5 which contains archival photos, video, audio, and text to supplement the visitors’ journey through the canal giving them

information on the canal's extensive industrial past. There is even a free Explora iPhone app for the Lachine Canal Historic Site (iTunes, 2011). Explora tours were also developed for thirteen other national historic sites, including Cape Spear, La Mauricie, and Fort Rodd Hill (Lanktree). However, the Lachine Canal Explora app is the only version released for smartphone to date.

What are the take-aways from this project? The Explora GPS technology seems to be a well-received, relatively easy to maintain, and an asset to many parks and historic sites. However this type of project is perhaps too large for Lynn Canyon Park. The survey questions used appear to have had a positive bias, perhaps skewing the results. These apps cannot completely replace human guides (Lanktree). However, human guides can also make use of similar applications to accentuate tours. This is a good example of Canadian uses of new technology to promote parks by Parks Canada. Also, the Lynn Canyon Ecology Centre appears to pride itself on being a free resource for the public, unlike the Capilano Suspension Bridge; therefore, adding a fee-per-use guide may not be feasible.

Both Tracklines and the Explora project have a wide reaching, positive response from the public. As long as the funding and resources are available, these seem like viable and user-friendly systems. However, this may not be a viable solution for Lynn Canyon Park due to cost concerns.

LSHD: In the Museum

VUEguide

Another indoor example of location-based handheld devices is the VUEguide device which was developed for the Museum of Anthropology (MOA), here at UBC, by Ubiquity Interactive in association with the MOA, the CBC, Telefilm Canada, and the Canadian Museum of Civilization (Barney, 2010). VUEguide was in use at the MOA from 2005-2007.

VUEguide was a handheld multimedia guide, or PDA (personal digital assistant), which used a touch screen with attached earphone. The device displayed images, text, audio and video clips, and computer generated models of past structures. The users' locations were tracked by each device using 39 infrared sensor beacons placed in the museum. Topics to relevant nearby content were automatically suggested to a visitor as they moved around the museum. For example, as one walked the rotunda, around *The Raven and the First Men*, an image of the artwork also rotated on the VUEguide screen. Touching one of the various carved figures on the screen would bring up relevant background information.

VUEguide was generally well received. It won multiple awards (Museum of Anthropology, 2005). In 2005 it won the award for Excellence in Media and Technology, from the American Association of Museums, and it also won the Canadian New Media Award for Excellence in Culture and Lifestyle in 2006.

One critique of the guide stood out. "You're giving me PBS-quality documentaries when I'm standing in front of this 100-year-old totem pole, and it's making me look at the screen, not the totem pole" (Leora Kornfeld from Ubiquity Interactive, recalling an industry professional's response, quoted by Gudrun, 2005). This comment points to a key debate in the literature surrounding the use of such handheld guides. Do these devices take away from the experience by pulling people out of content with the environment around them? Are they more a distraction than an aid?

Location-based Mobile Devices: Costs

Do the benefits of such devices outweigh the costs associated with their development and maintenance? Location-based mobile media devices have been shown to be an effective and useful tool. They have been especially well received by those of all ages. All of the devices were

found to be easy to use, minus a few quirks. However, these projects were somewhat costly. Location-based mobile media tours do come at a cost. It is costly to develop the software, and pay for the proprietary devices which the platforms run on. But there seems to be an effort to reduce such costs for future projects. Of all the projects, VUEguide seems the most expensive, sitting at around \$600,000 for software development and \$25,000 for the PDA devices (Griffin, 2005). It was also only in use for about 2 years. VUEguide contained much richer media content than the other two projects, but was restricted to the confines of the Museum of Anthropology.

The Tracklines and Explora projects seem to be an attempt at making a more sustainable process and product. Tracklines and Explora were more compact and portable, which is better for their intended use outdoors. These two related projects made use of cheaper devices: Tracklines used mobile phones, and Explora used less costly PDA devices. Explora was exported as an app for iPhone, in the case of Lachine Canal. Initial development costs were high for Explora, but future projects were estimated to cost much less (See Figure 5) (Tarasoff, et al. 2009b). Broken up over its intended 6 year life cycle, the costs of Explora seem more manageable. However the manpower costs of the project have not been totally factored in. The estimated work days for the project has been calculated for the initial and future projects, but the cost of paying the workers has not (See Figure 6) (Tarasoff).

| Costs to develop first and subsequent Explora projects | | | |
|---|---------------------------------------|---|---|
| Assumptions: Scale and nature of project is similar to Explora pilot; assumes site will update and add content each year | | | |
| Item | Year 1: Cost for first project | Year 2-6: Costs for sustaining project | Amortized cost per year over 6 years |
| Software license and support | TBD | TBD | TBD |
| First project set up fee | TBD | 0 | TBD |
| 12 PDAs and accessories | 4600 | 4000 | 1433 |
| Equipment (laptop, digital camera, etc.) | 0-3000 | 0 | 0-500 |
| Satellite reradiator | 900 | 0 | 150 |
| Storage rack and charging station | 200 | 0 | 33 |
| Travel for team members | 0-1000 | 0-5000 | 0-1000 |
| Translation | 2500 | 12500 | 2500 |
| Copyright fees | 500 | 2500 | 500 |
| Illustrations, AV | 850 | 4250 | 850 |
| GIS data | 200 | 0 | 34 |
| Promotional material: signage, flyers | 2600 | 1000 | 600 |
| Total | \$12,350-16,350 | \$24,250-29,250 | \$6,100-7,600 |

Figure 5. This shows the projected costs of the Explora project (Tarasoff et al. 2009b).

| Explora Project: Time Required to Develop First and Subsequent Projects | | |
|--|-------------------------------|------------------------------------|
| Assumptions: Scale and nature of project is similar to Explora pilot; excludes time for support from Explora support team | | |
| Function | Days for First Project | Days for Subsequent Project |
| Project Manager | 20-30 | 10-15 |
| Interpreter | 80-100 | 30-50 |
| GIS Specialist | 12 | 4 |
| Subject Matter Experts | 8 | 8 |
| Visitor Services | 8 | 4 |
| CIO | 4 | 4 |
| Operations/Facilities | 8 | 2 |
| Total | 140-170 days | 62-87 days |

Figure 6. This shows the difference between the number of days of work needed to develop the initial Explora project and that of subsequent projects (Tarasoff et al. 2009b).

A Few Notes

Before stating recommendations, I want to clarify some key points about my community partner, Tricia Edgar's work and her intentions for this research. One strategy used by the Lynn Valley Ecology Centre to familiarize groups of kids with the outdoors is to host a clue based outdoor scavenger hunt. This takes place along a walking trail in Lynn Canyon Park, with a partially hidden letterbox at the end of the hunt containing a 'secret' code. By bringing the secret code back to the ecology centre participants can learn the solution to the secret message. Tricia was wondering if there was a way for the letterbox to contain or make use of a QR code to reveal more information. She also mentioned that the centre has an excellent video taken of the creek during a major flooding event. She is interested in incorporating a QR Code into signage near the creek site, so that people could watch the video on their mobile device. This could serve as a visual aid to educate visitors about the creek and allow them to make comparisons between flooding and current conditions.

Due to cost concerns, my recommendations revolve solely around the implementation of QR codes. QR codes are an inexpensive and relatively easy way to add mobile media content to the park. They just require that park staff do regular maintenance checks to ensure that QR codes have not been tampered with.

My Recommendations

My first recommendation is that QR codes be integrated into existing signage in Lynn Canyon Park to enhance visitor experience. I feel that this is an effective, low-cost option. QR codes are easy to implement and they could be easily added to existing trailside signs. They could even be added next to existing signs, on their own, as they were in Long Beach, Washington. These QR codes could point people to further information about the park on its

website (www.lynncanyon.ca). These QR codes could also make use of existing multimedia content such as the video of Lynn Creek during a flooding event.

My second recommendation is that QR codes be used to enhance the scavenger hunt experience. Small signs could be placed along the trails in strategic locations, each providing clues for a smartphone enhanced scavenger hunt. The final clue could lead participants to a special site in the park or back to the Ecology Centre. The reward for completion could be a cool little-known fact about the park or even a small takeaway sticker saying, "I completed the Lynn Canyon scavenger hunt!" Implementing QR codes in this way would allow any visitor with a smartphone to participate in the scavenger hunt experience, not just school groups.

Conclusions

One critique stood out for me in the literature. These mobile technologies can inspire interest and enhance the experiences of visitors, but perhaps they can take people out of context with the environment around them (Barney, 2010; Gudrun, 2005). I think that we must be careful when designing such systems, that they not take away from the natural beauty or awe one feels for the raw experience. However, these devices can serve to inspire interest from people not otherwise disposed to the experience.

A few last personal critiques. QR codes can be a sustainable alternative to printing paper trail booklets and maps. But, I also acknowledge, that smartphones that are needed to access the content they provide are not accessible to everyone. This is mainly due to the high cost of these phones and their data plans, especially in Canada. Therefore, these QR codes cannot completely replace trail signage, but perhaps they can enhance the experience.

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