Evaluating the CoolTown User Experience

Mirjana Spasojevic and Tim Kindberg

Internet and Mobile Systems Laboratory
Hewlett-Packard Laboratories
1501 Page Mill Road
Palo Alto, CA 94304, USA
mirjana@hpl.hp.com
timothy@hpl.hp.com

1 Introduction

Evaluation of ubiquitous computing environments, such as the one developed by the CoolTown program at HP Labs [2,3], requires studying users during regular activities and evaluating dependencies between the user's experience and the technologies used, including their modes of use and deployment. The complex nature of such systems and dynamic modes of use need to be reflected in the evaluation methodology – the most significant factor being that these systems 'bridge the physical and online worlds' and require seamless navigation between the two, without imposing significant cognitive load on the user.

In CoolTown, all physical entities (people, places and things) have 'web presence' (web pages). Nomadic users navigate from the physical to the virtual world by picking up links to web resources using a variety of sensing technologies such as infrared receivers and barcode readers. Those readers are integrated with their handheld device, which is typically wirelessly networked. Users access electronic services by using their sensors to pick up URLs from barcodes or infrared 'beacons' attached on or near the objects of interest. Those services are provided using ubiquitous web technology: web browsers on the handheld device and web servers in the environment. The services can be adapted for users based on their context, e.g. their identity, location, device capabilities, personal interests and preferences

As a part of the effort to evaluate CoolTown concepts in practice, we have chosen to develop and deploy an electronic guidebook for visitors of the Exploratorium science museum [1]. On the exhibit floor, visitors carrying wirelessly connected devices are given opportunities for exploration, sharing, explanations, context, background, analytical tools, and suggestions for related experiences. In addition, conventional desktops and browser technologies extend the visit to home or classroom: in advance, through activities that orient visitors, and afterward, through opportunities to review captured experience and explore related ideas. We provide more technical details on the system we built in [4].

The goal of our study is to understand how different aspects of the technologies, and the content delivered through them, affects engagement with the exhibits and other educational materials, and, ultimately, how it affects learning activities. We believe that our approach can be applied to a wide range of ubiquitous computing scenarios, even though here we present examples that are particular to our chosen domain.

2 Models and Methodology

We are developing a model of the phenomena associated with a CoolTown-enhanced activity, to help parameters associated with effective design. We have chosen to separate our model into several levels of description:

1. **Basic affordances** – a model of the handheld devices, the wireless network and the identification technologies as they impinge upon the activities and effects that the system is designed to support. Examples of these affordances are the handheld devices' physical tractability (or lack of it), screen properties and input modes; the tendency of wireless connectivity to break up in certain areas; the 1-2 meter distance from which a user can receive a URL from a beacon, versus the 1-10 cm range from which the user scans a barcode.

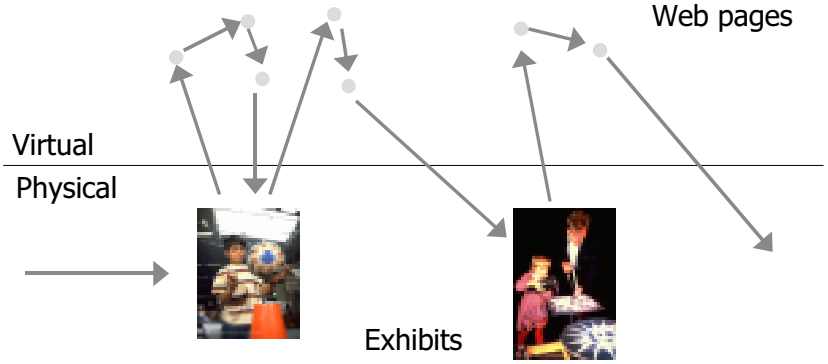

Fig. 1. Physical and virtual navigation interleaved.

2. **Attention to artifacts** – a model of the quality and quantity of the attention that a given user pays to a particular exhibit or web page. We are interested in such questions as: did the user look at a particular page? If so, did they glance at it or read some text on it, for example? Did the user pay attention to the exhibit or were they mostly preoccupied with their device? If they were preoccupied with the device, were they preoccupied with content on the device or with some issue (perhaps a difficulty) to do with the device itself?
3. **Paths through physical and virtual space** – here we are concerned with the sequence of points in physical space (exhibits) and virtual space (web pages) through which the user passes as they visit the museum. We are interested in events that signify a particular activity such as following a virtual link to get more information on a topic, making a decision to walk over to another exhibit, shifting attention back and forth between the physical and virtual at a single exhibit, patterns of use that signify preferences for physical versus virtual content, etc.
4. **Higher order effects** – models of higher order effects that are particular to the specific domain, in this case of a science museum, informal learning and related phenomena such as exploration and reflection that transcend a single exhibit.

Figure 1 shows a path taken by a user while they visit two exhibits. The user shifts their attention back and forth between the first exhibit and some web pages, then they decide to move to another exhibit, where they pick up a link but then quickly decide to move elsewhere. Construing what happened here requires detailed information on such factors as when and where some attention to an artifact took place, what type of interaction took place, for how long, at what level of scrutiny, under what circumstances of system responsiveness, lighting conditions, user skills, etc.

2.1 Methodology

We have developed a system for automatically logging basic events such as accesses to web pages, in particular to web pages obtained from a beacon or a barcode. Thus we have detailed information on virtual locations but only some information about physical location.

We also personally observe users to capture higher-level information such as whether the user was having trouble with the device or whether the user appeared to pay attention to a particular web page or ignored it. As well as performing measurements, we obtain qualitative and more subjective data through pre- and post-visit questionnaires and/or interviews. These are designed to help us find out what the users felt to be the quality of the information provided (including its presentation).

Currently we ask users simply to browse however they are inclined to do so. We are considering asking users to perform specific tasks, such as visiting a particular page from a particular exhibit and meeting a challenge such as answering a question about a collection of exhibits, in order to understand phenomena that occur too variably or not at all under simple browsing.

3 Conclusion and acknowledgements

Our belief is that studying the shifting of the user's attention between such factors as the exhibits, the content about the exhibits, the user's companion, and the technologies themselves as the user navigates between the physical and the virtual will lead towards design implications for electronic guidebooks, as well as ubiquitous computing systems in general. We have collected preliminary data from 25 users (teachers, kids, staff, system developers) ranging in age from 10 to over 50 and with different levels of computer sophistication. We expect to complete studying of basic affordances and attention to artifacts (the first two levels or our model) in time to report on it at the workshop.

We would like to acknowledge the extensive team of researchers from the Exploratorium and HP Labs who have contributed to the initial design and installation of the system.

References

[1] Electronic Guidebook Project. http://www.exploratorium.edu/guidebook/

[2] J. Barton, T. Kindberg. "The CoolTown User Experience". HP Labs Technical Report HPL-2001-22. Available as http://www.hpl.hp.com/techreports/2001/HPL-2001-22.html

[3] T. Kindberg, J. Barton, J. Morgan, G. Becker, D. Caswell, P. Debaty, G. Gopal, M. Frid, V. Krishnan, H. Morris, J. Schettino, B. Serra, and M. Spasojevic. "People, Places, Things: Web Presence for the Real World". Proc. 3rd Annual Wireless and Mobile Computer Systems and Applications, Monterey CA, USA, Dec. 2000. p 19. Available as http://www.cooltown.hp.com/papers/webpres/webpresence.htm.

[4] M. Spasojevic, T. Kindberg. "A Study of An Augmented Museum Experience". HP Labs Technical Report HPL-2001-178. Available as http://www.hpl.hp.com/techreports/2001/HPL-2001-178.html