# Rememberer: A Tool for Capturing Museum Visits

Margaret Fleck, Marcos Frid, Tim Kindberg, Eamonn O'Brien-Strain,
Rakhi Rajani, Mirjana Spasojevic
Mobile Systems and Services Laboratory
HP Laboratories Palo Alto
HPL-2002-187
July 8th , 2002*

E-mail: {fleck, mfrid, timothy, eob, mirjana} @hpl.hp.com, rakhi@dircon.co.uk

We report on our experiences implementing and testing Rememberer, a tool for recording visits to museums. We describe field trials at the Exploratorium, an interactive science museum in San Francisco. This challenging environment enabled us to verify that Rememberer interferes little with the social, hands-on nature of Exploratorium visits and has promise as a vehicle for post-visit reflection and communication.

* Internal Accession Date Only Approved for External Publication
To be published in UbiComp 2002, 29 September – 1 October 2002, Goteborg, Sweden

# Rememberer: A Tool for Capturing Museum Visits

Margaret Fleck, Marcos Frid, Tim Kindberg, Eamonn O'Brien-Strain,
Rakhi Rajani and Mirjana Spasojevic

Hewlett Packard Labs
1501 Page Mill Rd
Palo Alto, CA 94304
{fleck, mfrid, timothy, eob, mirjana}@hpl.hp.com; rakhi@dircon.co.uk

**Abstract** We report on our experiences implementing and testing Rememberer, a tool for recording visits to museums. We describe field trials at the Exploratorium, an interactive science museum in San Francisco. This challenging environment enabled us to verify that Rememberer interferes little with the social, hands-on nature of Exploratorium visits and has promise as a vehicle for post-visit reflection and communication.

## 1 Introduction

This paper presents our experiences designing, implementing and evaluating *Rememberer*, a tool for capturing personal experience during a museum visit. We conducted this work in collaboration with the Exploratorium science museum in San Francisco [3]. It is also part of the Cooltown project [5], which carries out research into infrastructure and applications for "nomadic computing systems" – ubiquitous systems in which mobile ("nomadic") humans use portable devices to access services and applications that are integrated with the physical world.

Science museums, unlike historic houses or art galleries, provide a boisterous, hands-on setting geared towards exploration of scientific phenomena. The Exploratorium consists of a large, open-plan space populated with several hundred exhibits. Users of all ages and levels of scientific knowledge roam from exhibit to exhibit, manipulating them and reading information from labels. The environment provides a rich sensory experience and emphasizes learning by doing.

The focus of our research in this environment has been on designing and evaluating applications to increase visitors' engagement while preserving the interactive exhibit experience. Portable devices have been used in several other projects to provide museum augmentation or navigation [1][7]. Similarly, we started with a prototype "electronic guidebook", focused on real-time information delivered via a wireless PDA [3][4].

However, our studies of museum visitors with and without the guidebook led us to change focus to a simpler "Rememberer" tool. Our first users expressed a strong interest in a "bookmarking" facility, both to create a record for their own use and as a means of interacting with others about their visit. Rememberer helps users build a record of their experiences, which they can consult during or after their visit. The


**Fig. 1.** A 'reminder' fridge magnet (top left) and 'remember-this' technologies: an RFID card and 'wristwatch', and a PDA in a case that receives and invokes beaconed URLs.

record consists of Web pages about the visited exhibits, including real-time photographs and typed notes. It is intended to provide a starting point for later exploration, discussion and reflection on the observed phenomena. It is aimed particularly at those visitors whom we found to be overwhelmed by the vast amount of information presented in the museum.

In this paper, we describe preliminary evidence that suggests that Remember has value as a recording tool for the users' purposes, although there are implementation issues to overcome. We confirmed that the photographs are very important because of their strong appeal as records of experience.

We also found Rememberer to be largely successful in meeting an important constraint based on early visitor observations: it should not interfere with the hands-on and social nature of the visitor experience. We wanted to avoid the interference that we found with our guidebook, which requires users to manipulate the device (as well as the exhibit) and to shift attention between the virtual world of content and the physical world of the exhibit, the user's companions, and the surrounding environment. Our intent with Rememberer is for users to maintain their attention on the physical world while visiting exhibits – except when recording phenomena – and postpone virtual interactions to after the visit, at home or at an in-museum kiosk.

The rest of this paper provides an overview of Rememberer and its implementation (section 2), outlines research questions and describes field trials with visitors (section 3) and findings from those trials (section 4). Section 5 concludes with key lessons and outlines directions for further research.

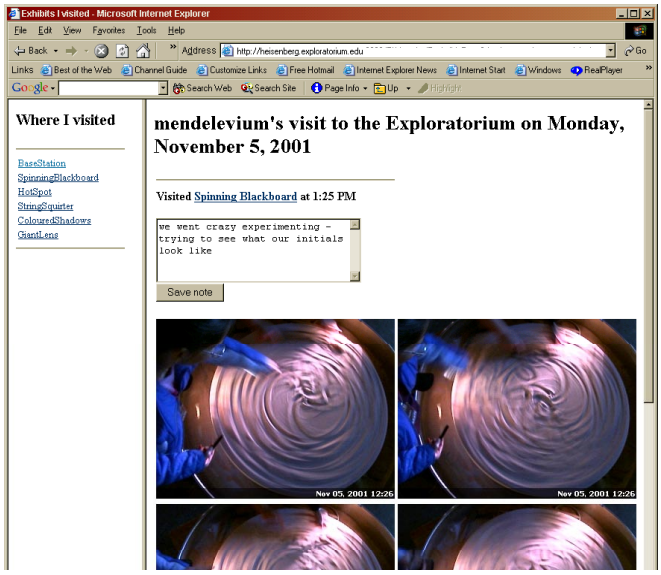



**Fig. 2.** A Rememberer page showing a user's visit to the "Spinning Blackboard" exhibit.

## 2 Overview of the system

Rememberer consists of:

- a "remember-this" technology with which the user registers (selects) exhibits during their visit;
- the visit record, consisting of a set of web pages;
- a physical artifact that reminds the user of the visit and contains a pointer (URL) to the visit record -- an example is the fridge magnet in Figure 1.

In the visit record, in addition to exhibit names listed in the order visited, we included links to content for each exhibit with a stock photograph and a field for users to record comments. Moreover, to make the record more specific to the users personal experiences of the exhibits, we equipped some exhibits with cameras: registering an exhibit caused its camera to take a sequence of photographs. Using Rememberer differs from regular photograph-taking since users do not have to carry a camera to record their experience. Also, the system is different from previous systems that automatically track and capture users' activities [6] – our tool is activated only when users make intentional gestures to record their experience.

Figure 2 shows a page created at the "Spinning Blackboard" exhibit. When the user registered the exhibit with their remember-this device, four photographs were taken at 1-second intervals. The cameras were positioned to take a picture of users at the exhibit or a phenomenon that the user had created on the exhibit. The pictures were

not displayed at the exhibit (the museum wanted to avoid screens immediately next to the exhibits); users saw them only later when inspecting their visit records.

Because the remember-this technology performs a simple task, its handheld unit can be kept correspondingly simple and small. For our initial tests, we used RFID tags (some credit-card shaped and some mounted in watches, see Figure 1). Bringing the tag within about 10 cm of the exhibit's corresponding reader registers the exhibit and causes an LED to light up briefly on the reader.

We also used an HP Jornada 567 connected to a wireless 802.11 network as a remember-this device (Figure 1). We enclosed it in a case for protection and to avoid the distraction of the screen. Pointing the device at a Cooltown infrared beacon [2] mounted on the exhibit caused the registration of the exhibit.

The PDA is larger and heavier than the RFID tags. However, PDA's allow us to scale our system to more exhibits, because we could equip exhibits with only a beacon -- instead of an RFID reader and computer. Thus, we were able to study users' reactions to exhibits with different types and degrees of instrumentation. A minimal custom device could be much cheaper and smaller.

## 3 Research questions and field trials

Our evaluation of Rememberer focused on whether the tool provided value to the visitors without interfering with their engagement with exhibits and companions, and on understanding the usability of our implementation choices. Specifically, we were interested in answering the following questions:

- Does either type of remember-this device (RFID tag or PDA) interfere with regular visitor activity and manipulation of the exhibits?
- How do users react to our simple model of invoking picture-taking as a side-effect of registering a visit with the remember-this device?
- How often do visitors use the remember-this device as they tour the exhibits? (They might forget or not be inclined to use it.)
- Does the presence of a camera (as opposed to just a beacon) influence the use of the remember-this device?
- How do people react to the visit record, particularly the pictures?
- Do users find the visit record useful -- as a record or as a vehicle for communication? Are there other ways in which users find it valuable?

We conducted two field trials to answer the above questions. We observed visitors and logged their system accesses. We interviewed them immediately after the visit using questionnaires. We followed up with an email questionnaire.

In the early field trial (described in [4]), we observed 14 adults visiting 6 exhibits. Each exhibit was equipped with an RFID card reader and a camera. These tests suggested that the basic tool was suitable and that RFID cards did not interfere with the visitor experience. However, the tests were limited in scope.

For the second field trial, which we now describe, we switched to using beacons on the exhibits and a PDA as the remember-this device. This allowed us to instrument more exhibits, at the cost of giving users a clumsier handheld device. We felt that the

increased number of exhibits gave users a more realistic option not to register exhibits; it also helped factor out effects due to features of particular exhibits.

The second trial was conducted over two days in a test area containing 35 exhibits. There were about 15 exhibits in a surrounding buffer area, to which our subjects frequently wandered. On each day, 10 exhibits were equipped only with beacons and 5 exhibits had a camera plus beacon. This instrumentation was varied between the two test days: 5 exhibits between a camera (plus beacon) and only a beacon, 5 between a camera and no instrumentation, and 15 between a beacon and no instrumentation.

We observed 17 groups of 1-4 people (a total of 33 people) using the Rememberer system. Each group shared one remember-this device. We also observed 6 control groups (13 people) visiting the same area with no technology. In total, there were 14 male adults, 9 male children, 17 female adults, and 6 female children. 9 groups consisted of a single adult, 5 were a pair of adults, and 9 were family groups. This amounted to a fairly good representation of the general visitor demographics, apart from very young children, but the sample was not large enough or random enough to allow testing for gender or other demographic differences.

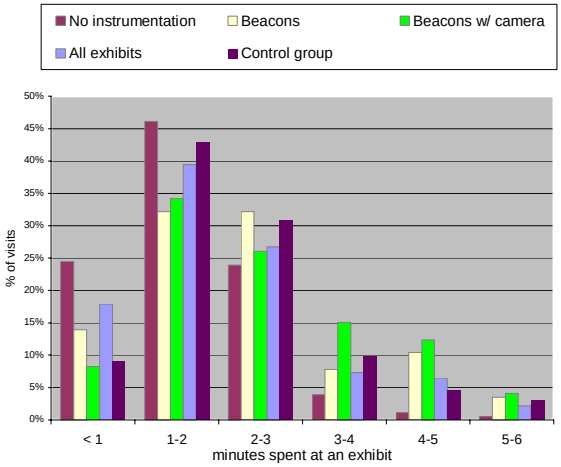
The subjects were solicited through the Exploratorium's membership program and were quite familiar with the environment. A majority reported visiting the museum several times per year and more than half had visited in the previous two months.

The users were first shown how to use Rememberer by visiting a special “base station” exhibit equipped with a camera, where they created the start of their visit record. They thus had an opportunity to practice using the remember-this device, and to understand the type of record they were subsequently creating, including the photograph-taking. They then spent 35-45 minutes visiting the exhibits and (if they wanted) a kiosk at which they could view their visit record by using their remember-this device. Each group was shadowed by an observer who recorded the time spent at each exhibit, whether they used the beacon and/or camera at the exhibit, and other free-form observations about their behavior.

Afterwards, all users were shown their final visit record and interviewed about their prior background, memories of specific exhibits, difficulties using the system, and overall reactions to the system. About 10 weeks later, 5 groups who expressed willingness were sent a follow-up questionnaire (on similar topics) by email.

## 4 The findings

In summary, users reacted positively to the system overall. They were especially stimulated by the photographs, although there were problems with the picture-taking implementation. Their comments and visits to the Web pages after the visit suggest that some see value in the record for later reflection and communication, although this requires more study. Users showed a marked tendency to register exhibits, especially when a camera was present. Our evidence so far is that use of the remember-this technologies cause little interference with exhibit visits.




| Instr. level | Minutes at exhibit avg (stdev) |
|---|---|
| No instr. | 1.2 (0.8) |
| Beacons | 1.9 (1.2) |
| Beacons w/ camera | 2.1 (1.3) |
| All exhibits | 1.6 (1.1) |
| Control group | 1.7 (1.1) |

**Fig. 3.** Times spent at exhibits (in minutes) broken down by the level of instrumentation

### 4.1 Characteristics of the exhibit visits

Users in the test group visited between 11 and 31 exhibits in the designated area -- 21 exhibits on average. The average for the control group was 19 exhibits. The most popular exhibits were ones that require the visitors' participation and produce colorful images, which are also good for taking photographs.

Most of the visits to individual exhibits were fairly short: between 1 and 3 minutes (Figure 3). The longest visits lasted about 5 minutes. On average, users equipped with a remember-this device spent the least amount of time at non-instrumented exhibits, followed by exhibits with just a beacon and the most time at those with a camera. This was also true for all individual exhibits whose instrumentation varied.

We found that many of the short visits (lasting less than 1min) were just brief glances at particular exhibits or attempts to see a crowded exhibit which were quickly abandoned. In about 20% of those cases, the users returned to the exhibit later.

The analysis of the observation notes shows that some of the longer times spent at exhibits were due to problems with beacon capture or camera adjustments. In approximately 10% of 170 beacon captures observers noted some problems and in about 25% of 63 instances of camera use there was a need to adjust the camera to capture a person or an interesting phenomenon.

There was no indication that the group size influenced the time spent at exhibits. Moreover, the differences in times spent between the test group and the control group are not significant in absolute terms. We did not observe qualitative differences in social or exhibit interaction between the test and control groups. Overall, the level of interference caused by the remember-this device was reasonably low.

### 4.2 Use of the 'remember-this' device

Our observations showed that users registered exhibits with RFID tags casually but accurately, with no indication that this disturbed their engagement with the exhibit or their companions. The PDA's required more practice and concentration. As expected, their larger size made them harder to carry and more of a hindrance to manipulating the exhibit. In the post-visit interviews, users reported general satisfaction with the ease of use (10 out of 17 said that the device was "very easy" to use). However, users wanted more control over the position and timing of pictures -- they could adjust the camera's orientation but the only feedback was the RFID reader's or PDA's LED which lit about the time of the first photograph in the sequence of four.

The use of the 'remember-this' device was quite high: it was used in 80% of the exhibit visits (151 out of 189). The device itself was used more often when there was a camera present (91% of the time) than when only a beacon was provided (73% of the time). This may be due to differences in visibility between the camera (mounted on a tall stand) and the beacon (mounted by the exhibit label).

We found that 3 (out of 6) single-person groups (adults) used the device very selectively (less than 50% of exhibit-visits). With all other individuals or groups use of the device was at least 75%. In several instances users triggered the camera multiple times at the same exhibit or returned to a particular exhibit to better capture themselves or exhibit phenomena.

We also questioned users on specific instances when they had been in a position to use the remember-this device but had chosen not to do so. Their reasons universally pointed towards a problem with the exhibit itself, such as an inability to get it to work or not finding it particularly interesting.

### 4.3 Reaction to the personal records and photos

During the immediate post-visit interviews we showed users their personal Web pages, which contained both simple stock photos of the exhibits and their real-time photos. The users reported liking photos of the exhibits in general, because they contained details that they may have missed during the visit and reminded them of their experience, as well as increased their enjoyment, fun and motivation. They also expressed a preference for the real-time photos, which represented a more personal capture of the experience. The dynamic photographs were of low resolution and were sometimes blurred, dark or poorly framed. However, the users were not always satisfied with the higher-resolution stock photographs, either.

### 4.5 Value of the visit record

During the immediate post-visit interviews we asked users about their perceptions of the value in using the tool. In addition to the previously discussed value of the photos, several users expressed interest in writing annotations on the web pages. They also saw the value in being able to revisit the web site from home, to keep a record of their different visits to the museum and to share the web pages with family, friends or others socially, or as a guide to others who plan to visit the museum.

We gave users the URLs of their Web pages and logged visits to those pages after they left. Most re-visited the pages, some several weeks after the event (10 out of 17 individuals/groups). Several of those saved comments within their pages, referring to the photographs. At least one user emailed his page's URL to relatives. All this suggests that Rememberer could have value for personal and social uses.

## 5 Conclusions

Rememberer is a nomadic tool for capturing a record of a personal experience. In an environment that places conflicting demands on the attention, it helps users by letting them record tokens of an experience and so postpone access to related electronic services to a convenient time. Our experiences in building and testing two simple prototypes demonstrate the promise of such a tool in a science museum.

Our future work centers around the need to improve our implementation and to perform longitudinal studies based on more specific user goals. For example, we could modify our beacon design to produce a remember-this device as unobtrusive as the RFID tags, while enabling us to equip many exhibits only with beacons. We are exploring how to best fit this tool to the complex requirements of social interactions with family and friends and classroom activities, spanning time well beyond the museum visit. We are also interested in evaluating Rememberer in other domains such as shopping or medical settings.

The photograph-taking functionality raises very interesting issues. Users liked the fact that the 'system' took the photos (they did not need a camera of their own; they could appear in the photos without help). However, there is a tension between their desire for more control over the photographs and the simplicity of the remember-this device and corresponding infrastructure components. We are investigating options for infrastructure cameras and also PDA's and phones with integrated cameras. Moreover, some users expressed interest in capturing videos of their experience.

**Acknowledgements**
We would like to thank the rest of the team (both HP and Exploratorium staff) who helped design and implement these experiments and the NSF grant ESI-9901985.

## References

[1] K. Cheverst, et al.,"Experiences of Developing and Deploying a Context-Aware Tourist Guide: The GUIDE Project", MOBICOM 2000, pp. 20-31.
[2] Cooltown beacons. http://cooltown.hp.com/beacon_full.htm
[3] Electronic Guidebook Project. http://www.exploratorium.edu/guidebook/
[4] Fleck et al., "From Informing to Remembering: Ubiquitous Systems in Interactive Museums". IEEE Pervasive Computing, vol 1, no 2, pp. 13-21.
[5] T. Kindberg et al., "People, Places, Things: Web Presence for the Real World". Proc. 3rd Workshop on Mobile Computer Systems and Applications, Dec. 2000, pp. 19-28.
[6] M. Lamming, M. Flynn. "Forget-me-not Intimate Computing in Support of Human Memory". Proc. FRIEND21, 1994.
[7] A. Woodruff et al., "The Conversational Role of Electronic Guidebooks". Proc. of Ubicomp 2001, pp. 187-208.