
The Coffee Lab: Developing a Public Usability Space

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Abstract

Introducing the Coffee Lab: a novel concept for conducting usability studies in a public space where anyone can experience and evaluate research novel interactive systems. The Coffee Lab serves as a model for the public usability lab, which extends the methods common to laboratory-based usability experiments by adapting prototypes, usability methods, and task interactions to suit different scenarios. Details on the design and implementation of public evaluation methods are discussed, along with a description of the Coffee Lab, and two ongoing public usability tests.

Keywords

Public usability, ethnography, evaluation, methodology

ACM Classification Keywords

H.5.2 Information Interfaces and Presentation: User interfaces, Evaluation methodology

General Terms

Experimentation, Human Factors

Introduction

Usability is a critical factor in the adoption of new interactive systems by prospective users.

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However, since most laboratory-based usability studies are aimed at desktop computing interactions, they are not always appropriate for evaluating mobile, tactile, or perceptual devices. Unexpected user behaviour, system performance errors, and interaction contexts also play a role in determining how well the technology is received by the end user, but these factors cannot always be accounted for in a lab [19].

There is a growing need to develop novel approaches to evaluating interactive systems in the context of everyday lifestyles, to enable people to experience new technologies, and to support the exploration of these new technologies in a natural setting [3]. Some usability information is difficult to obtain in a laboratory setting. For example, evaluating how well a system works across different contexts, how easy it is to learn or to configure, or what the long-term usage prospects are. Because laboratories do not typically allow participants to freely explore and use a system at their own pace, over several sessions, and without supervision, it can be challenging to obtain subjective, affective, or emotional responses. One approach to obtaining this type of information is to expand the laboratory out into the public domain, where interactive systems may be tested and explored by anyone.

The Coffee Lab is a new public usability space situated in a Toronto coffee shop. This is a pilot project aimed at supporting usability studies in a mixed-use space, where a variety of software applications, hardware systems and other interactive technologies are put to the public for evaluation. The public usability test (PUT) represents a novel approach to usability studies that can be applied to most interactive systems, even those not intended specifically for public interactions.

At the Coffee Lab, anyone can explore, use, and experience interactive systems at their leisure. Here, developers and researchers can gain insights into unexpected environmental influences and usability problems revealed when multiple users freely experience a system in situ using different PUTs.

Background and related work

Public spaces offer a unique environment from which to present and evaluate cutting edge technologies, while at the same time, offering researchers and developers valuable insights into user interaction experiences. People can experience and evaluate new technologies without many of the constraints inherent in a laboratory setting, while providing an alternative means of obtaining usability information from a wide range of potential users. To date, usability tests conducted in the public domain have mainly focused on systems or devices designed for use in public spaces. These include kiosks [17] and interactive art exhibits [20]. Many of the techniques common to a laboratory-based usability study can be applied to conducting public usability tests (PUTs), drawing on qualitative and quantitative data collection methods. These include real time observations [1], video recordings [8], interviews [14], questionnaires [2], and tracking devices [4], which are effective in revealing insights into how well a system supports learning, user engagement, or social exchange [5]. Field studies and case studies are additional techniques common to public usability, enabling researchers to access target users in their own habitat or environment. They provide an excellent opportunity to develop creative and unique ways of assessing new technologies or of obtaining design requirements from targeted user groups.

Some of these techniques include cultural probes [9], diary studies [6], Wizard of Oz protocols [16], or simulated interaction scenarios for obtaining user experience data [12,13]. Most methods for accessing public usability data are based on ethnographic methodologies, and can be effectively used in PUTs.

Quantitative data can be more challenging to obtain from a public location due to the lack of control that can be exercised over an interaction scenario. However, most laboratory experiments can effectively be altered to create a hybrid version of the empirical approach that is better suited to public evaluations [10]. Most public usability evaluations are situated within a space that is contextually relevant to the specific application under consideration, like a museum, gallery, or train station. As a novel approach, I present the Coffee Lab: an example of a public usability space where interactive systems, software, hardware, and scenarios can be evaluated in the public domain

The Coffee Lab

The Coffee Lab is a pilot project aimed at developing a permanent usability facility in a coffee shop, where different interactive systems are presented, evaluated, and experienced by anyone who enters the shop. One advantage to this approach is to facilitate the collection of usability data from a large and diverse population of potential users.

The coffee shop represents a natural space from which to conduct public usability studies due to volume of people passing through, and the nature of the time they pass while in the space: many patrons spend hours at the shop drinking coffee, having a snack, reading a book, socializing, or using their laptops.

Many customers live nearby and enjoy hanging out and experiencing novel interactive systems during their visit.

Currently @ The Coffee Lab

Since July, 2009, the Coffee Lab has presented several novel interactive systems, including the Emoti-Chair [15] (a tactile music display), and the iGesture system [16] (a computer-vision enabled gesture input system). Other systems including a music visualization application, software for adding audio descriptions to video, an application for creating enhanced closed captions [18], and a sign-language versions of web links [7] are being prepared for PUTs at the Coffee Lab.

Because the space is small, there are limitations to the number and types of systems that can be tested at one time. At the front of the shop is a stage where the Emoti-Chair is on display, which provides a convenient space for working with participants. At the coffee counter, the iGesture system is running, providing staff and customers with gestures for controlling the music player, slide shows, and other presentations that are displayed on a monitor. New devices and systems will be added as interest in this type of study grows, but for now, there are a sufficient number of interactive systems to evaluate towards further developing the public usability lab concept.

Infrastructure

Several basic requirements were met in order to create an infrastructure that supports PUTs. These include wired and wireless network connections, a touch screen, multiple computers to run systems, and web cameras for visual input, communications, or monitoring interactions.

The space currently uses four computers: the main system resides at the coffee counter as control central for all other systems, and runs the iGesture software. The main monitor is mounted with a moveable arm to enable viewing from both sides of the counter. The second computer runs the Emoti-Chair and the surveys for evaluating the system. A third computer is in the adjoining theatre space, where events, shows, classes, and people can be monitored from the lab, with a fourth one in the theatre space for the persistent Skype connection that links customers, staff, and visitors between the two spaces. Additional computers are added to support the display and evaluation of additional systems as required.

Participants

The Coffee Lab is part of an existing coffee shop (Sideshow Café [21]) that is connected to a circus theatre and training space (Centre of Gravity [20]), which contributes an existing population of potential users consisting of staff, performers, students, and spectators. This is in addition to the local customers who frequent the coffee shop, many of whom stay for long periods of time working or relaxing. The staff serves as excellent participants for PUTs, many of which have had little exposure or knowledge of computer technologies, and tend to be long-term participants.

The customers also represent a very diverse group of users who can potentially evaluate the systems on display. Many drop in for daily coffee and conversation, and others come specifically to spend time in the Emoti-Chair. Most of the regular customers have tried one or more of the systems on display, and while many do not provide extensive feedback, others have taken a

keen interest in participating in one or more PUTs. Those who come in for a quick coffee have also proven to be valuable user groups, providing first impression reports on topics like ease of use and general usability. Overall, most of the visitors to the shop have expressed very positive responses to all of the systems on display. Some customers never even notice the interactive systems at the lab until it is pointed out to them. However, by leveraging the broad range of people who visit the space every day, valuable insights can be gained.

Five Evaluation Stages

Based on initial exploration of the public usability lab, there are five distinct stages of the PUT that are applicable to the Coffee Lab. The first stage (*exposure*) is based on the first contact a user has with the technology. This is an excellent way to test the general usability of a system with novice users who may not even know what the system is supposed to do. The first stage also serves as an indicator of the clarity of the interface with respect to its intended purpose and functionality, and offers rich insight into the users' initial impressions.

The second stage (*experience*) is based on a researcher's interactions with the user while they are gaining experience with the system. This stage draws on ethnographic methods that allow the researcher to conduct interviews, observe users, answer questions, and provide guidance to the user about the system.

Stage two participants often provide insightful comments and feedback about the system, any problems they experience, or issues that could improve their interactions.

The third stage (*experiment*) is based on laboratory style experiments that are designed to evaluate a specific feature of a system. This requires slight modifications to the experiment design, mainly in shortening the time requirements by limiting sessions to less than 30 minutes to minimize disruptions to the participant. Third stage participants agree to take part in the experiment, and provide minimal demographic information for the data collection. The experiments may consist of a pre-study questionnaire, a training session, one or more blocks of trials, a post-study questionnaire, and an interview. This is very similar to laboratory studies, but is simplified where possible to account for the potential distractions that can occur in a public space. Ethics approval is not required for this specific type of study, since there is no deception, and the PUTs are strictly intended to evaluate the usability of systems, not the performance of the user.

The fourth stage (*extension*) offers an in-depth look at one or more users over time, providing a more detailed perspective of the user's interactions. Fourth stage PUTs use case studies, focus groups, diary studies, or other techniques that will lead to more specialized feedback and information about the user experience with the system. These sessions are extremely useful in allowing the researcher to examine issues and problems that are revealed only after extended periods of usage, or longer-term experience with the system. This is also an opportunity to learn about any unique interactions that a longer-term user may have discovered.

The fifth stage (*exploration*) occurs once the system has been evaluated, or when the research is between stages.

Participants may leave comments and provide feedback, or may even wish to use the system further and provide more insightful comments about their experience. The prototype continues to be useful in eliciting more information about the longevity of the system if people continue to express interest and continued use over time.

Evaluation Techniques

Feedback, comments, and responses gathered after one experiences a system represents one of the primary sources of information from PUTs, however, additional types of data can be obtained through traditional evaluation techniques. Qualitative studies are the most accessible method of acquiring user feedback in the public domain, and can be based on observations, questionnaire responses, interviews, or comments left by the users. Quantitative data can also be obtained through PUTs using traditional laboratory methods such as controlled experiments and tests that provide measured responses to interactions. But to make empirical style evaluations work in a public space, it is necessary to first modify the experimental method. Users may easily be distracted, or become bored with too rigid a study, so long experimental sessions should be shortened to allow more users to try the system, and to maintain user interest in the study.

Tasks can also be designed to make the evaluation more interesting and fun for the participant who is spending time to take part in the evaluation. Participants can be compensated with a coupon for the coffee shop if they are taking part in a more intense experiment, but it is essential to try to maintain the participant's interest and attention over the duration of the evaluation session.

Although quantitative data obtained through a PUT may be less stringent or precise than a laboratory study, these results may be instrumental in serving as pilot tests for empirical studies that are in the planning stage, or for formulating hypotheses. Hybrid versions of experiments incorporate both qualitative and quantitative data acquisition methods, and are well suited for PUTs. Games can be developed as an informal and fun way to get users to try different functions of an interactive system, providing a pseudo-empirical method of evaluating ease of use, performance metrics, or learnability. Different environments must also be considered when developing these evaluation techniques based on where the PUT is set up, who likely candidates will be for participating in the study, and what type of features are being assessed.

System preparation

One of the key factors to consider when conducting PUTs is the durability of the system, both in form and in function. Any system that is available as a stable interactive prototype can be a candidate for PUTs provided it can endure the high volume of usage it can receive. Although the systems at the Coffee Lab are always supervised, either by the staff or researchers, there is always the possibility of a system being damaged or misused. Form factors must be robust enough to withstand reckless usage; peripheral devices should be secured so they don't go missing, and any software or functional components must be reliable enough to handle extensive use by people of different computing skills. Thus, only the features that are stable and ready for public testing should be included in the interface or interaction. There are always problems, but most of these can be avoided through careful planning.

For many interactive systems, such as software applications, input devices, or novel display systems, PUTs can be run throughout the development lifecycle. If carefully designed, a prototype can serve a long and valuable existence as a usability research tool in the public domain, or as a test environment for evaluating new features and functions as they are developed. Regular system maintenance is essential, and daily checks are required to ensure the displays are functioning at all times. In the next section, I describe two studies that were conducted at the Coffee Lab on two different types of interactive systems.

Current Studies

Two main systems are currently part of the Coffee Lab pilot tests: the Emoti-Chair, and iGesture.

The Emoti-Chair

The first system installed at the Coffee Lab was the Emoti-Chair. This is a tactile audio system (TAS) that presents music and other sounds along the back and seat as tactile vibrations. It uses a sensory substitution method called the Model Human Cochlea (MHC) [15] to translate sound into physical vibrations. The Emoti-Chair was designed to make emotional expression from music accessible as tactile sensations, which is a challenging feature to effectively evaluate, primarily due to the subjective nature of emotion. The prototype is an early system developed for a public concert at the Ontario Science Centre for members of the deaf and hard of hearing community [2]. The prototype was introduced into the Coffee Lab in August 2009, and set up on the stage shown in Figure 1. Music that plays in the shop also plays on the MHC, enabling anyone to sit in and experience music as vibrations. A touch screen located next to the chair displays the control software.

Investigations into the chair and the software-control interface have already been conducted at the Coffee Lab for PUT stages one, two, four, and five. Stage three is currently being run to evaluate the system's ability to communicate emotional content of speech, or prosody to the body.



Figure 1: The Emoti-Chair on the stage at the Coffee Lab.

The software is being evaluated as a separate component of the system, and to date, user feedback has led to many improvements to the interface. Over a four-month period, hundreds of people have tried the chair, providing excellent feedback for the different stages of PUTs conducted.

STAGE ONE: EXPOSURE

Stage one investigation of the MHC explored a user's first impressions of this system. While there have been several previous laboratory studies and public events featuring the Emoti-Chair [2,15], this was the first time anyone could simply use the chair to relax and experience the TAS, which provided general feedback and user perceptions of the system. Everyone expressed excitement and enthusiasm about the chair. Many people who visited the coffee shop were very curious about the chair, while others never noticed it. Those who were interested, either by being informed about the system by staff or other customers, or by the signs in the shop would immediately approach the chair, then notice the music coming from the seat, and either be seated, touch the gold contacts on the seat to verify the sound, or proceeded to ask me, or the staff at the shop more details about the system.

All visitors were encouraged to try the chair and to provide comments about their experience. Stage one results suggest that this is a very exciting interface that could be well received as a new form of musical experience. It is comfortable and relaxing, and the software controls are easy to use and obvious, even to first time users. This was after several users failed to notice that the software was intended to control the chair, which led to several changes that have improved the interface. Finally, everyone who first uses the chair tends to have a similar response, which is to move their eyes as if searching for something, which may reflect the novelty of experiencing many different signals along the skin. This will be further investigated as an empirical experiment in our research lab where biometrics and other psychophysical methods can be applied to learn more about tactile music perception.

STAGE TWO: EXPERIENCE

After stage one, I conducted a series of interviews with over 20 participants who spent longer periods of time in the chair (between 10 and 30 minutes). Some would simply relax, while others wanted to control the different features using the software interface. From this group, I discovered that in order to make people understand the chair, it was essential to first make them aware that each of the eight channels present different information by isolating and presenting each channel one at a time. This serves to clarify the concept of the system to participants, who often didn't comprehend the nature of the multi-channel display system otherwise. Stage two users often requested that the music be changed to reflect their favourite genres, which suggests that users felt they would enjoy the vibrations more if they were feeling music that they liked. This led to the implementation of a set of pre-programmed frequency distributions that are now included in the interface for easy adjustment of sensations for different types of music. Manual settings also enable users to customize frequency splits.

Further observations suggested that children are best able to understand the system, even before I demonstrated each channel individually. This was apparent in the way children were seated in the chair, stretching out along the seat, trying to feel all of the eight channels. One child in particular, who was roughly 5 years old spent many days in the chair, playing games, having naps, or enjoying the vibrations while waiting for his mother to drink her coffee. He continues to enjoy the chair during each visit to the shop. He was also proficient in using the control software, changing the volume, adjusting frequency settings, and helping other children who wanted to try the chair.

Some of the adults experiencing the chair did not seem to understand the system as well as the kids. Many adults thought initially that the chair was primarily for massage, rather than a communication device for translating music into vibrations. This took some explanation for some, who eventually understood that they would have to pay attention to the different channels in order to feel the different sounds.

STAGE THREE: EXPERIMENT

A study is currently underway, which extends a previous experiment and evaluates speech emotion, rather than musical emotion using only vibrations [15]. Participants are deafened using headphones and white noise to block out sounds from the chair, and the study runs two blocks of trials. Results from this study can be analysed in a similar manner as in the previous experiment using the emotional categorizations assigned to each speech samples.

STAGE FOUR: EXTENSION

Over 10 people have taken part in longer-term studies, and another 10 have participated in focus groups to discuss the chair and its intended applications. These sessions revealed a long list of potential applications including movies, television, live concerts, and a portable version for dancing, as well as a new list of target users that participants' thought would benefit from this system. Studies also revealed that users are able to sit in the chair for hours without experiencing any problems or discomfort. Most found the experience relaxing, and some have fallen asleep in the chair. Further, longer periods in the chair may lead to improved recognition of sounds as vibrations, and an improved ability to process information from multiple channels along the skin, which will also be evaluated.

STAGE FIVE: EXPLORATION

When studies are not taking place at the lab, the chair continues to run and is always available for anyone to use, offer comments on, or provide feedback about their experience in the chair at their leisure. While the stage three experiments are being planned, stage five provides visitors to the lab with the chance to try the MHC, which adds an interesting component to the coffee shop that can attract more customers. Users can try the system, explore different studies on their own, or leave comments for the researcher. This also gives people the chance to become familiar with the system, and for the researcher to learn about the persistence of interest in the system over time.

iGesture

The gesture system is currently used to control the music at the Coffee Lab and is also being explored and evaluated using a stage three approach. One approach employs a set of cards that describe tasks that users can perform with the system. Tasks are initially simple, like changing music or volume levels, and progress to more complex interactions like configuring the interface, training new gestures, or loading and creating new interaction scripts. This study is ongoing, and is proving challenging to run, mainly due to the problems in the vision tracking system. One approach to this problem is to use large, brightly objects, such as pinwheels, to improve tracking and recognition, which also serves to increasing the fun factor.

Gestures can also be used as a midi controller for creating music using different sounds. This proved to be somewhat annoying for staff and customers, so we limited its use to specific times of the day.

Unfortunately, iGesture may remain at stage one until we can improve the recognition process or devise a new interaction zone to reduce the impact of changes in lighting. The iGesture may prove to be a useful tool for supporting distance interactions for controlling simple functions in media players, however, it appears that the main problem with this system is the constant need to re-calibrate tracking to account for lighting changes. This problem may be addressed from different perspectives: the recognition system (implement improved tracking processes), the user interface (automate or simplify the calibration process), and the environment (alter the interaction zone to reduce variation in light). These will be considered in future iterations of the iGesture design cycle.

Conclusions

The Coffee Lab serves as an alternative venue for testing all types of interactive systems on a wide range of users. Almost any type of study can be altered to fit into the PUT model, which offers a unique user perspective based on experiencing a system in a relaxed and natural environment. Future studies will focus on different systems, with the aim of bringing new working prototypes to the public domain where they can be accessed, experienced, and evaluated by potential users. Further public usability tests are being conducted in a deaf community centre, where the Emoti-Chair is permanently installed. We have received valuable feedback from the deaf community on their experience with the tactile audio system, which will directly influence new features and designs of upcoming systems. Additional studies are being designed for the Coffee Lab, and will continue to contribute to the development of public usability methods, approaches, and locations.

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