Applying Mobile Communication Technologies in Interactive Media Projects

Case study: *entre-abierto* (*half-open*) interactive installation

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ABSTRACT

Using free software tools for design and art practice is increasingly common in our time. The approach to creative activities has changed significantly because of the increasing affordability of technologies for processing contents in digital format and the free distribution and development of such tools. Added to this, the massive use of mobile phones and its potential for generation and distribution of content, let any person to share digital information through mass media or in more private contexts.

The proposal presented in this article is an interactive installation entitled *entre-abierto* (*half-open)*, which aims to create an audiovisual composition with the participation of the spectators. The visual content comes from the people who get close to the installation and choose to share pictures they have in their cell phone. These contents are manipulated by rules or algorithms of the digital medium. Besides the possibility to send pictures from the cell phone via Bluetooth [2], the viewer has some control over what they see and hear, with his presence and movement transforms the visual outcome.

In this article it will be a description of the installation and how various technologies have been applied in the creative process and some of its possibilities in other applications.

Keywords

Mobile communication, Bluetooth, interaction, audiovisual, digital, computer vision

1. INTRODUCTION

The development of the interactive installation *entre-abierto* arises from the opportunity to implement some ideas raised in the the research project *Collective interaction in public space through mobile devices,* developed in the Department of Design at the Icesi University by Enrique Franco and Javier Aguirre. The development of this installation in 2009, was under the artist in residence program for Latin American Artists in Mexico, coordinated by Fondo Nacional para la Cultura y las Artes (FONCA) and the Agencia Española de Cooperación Internacional para el Desarrollo (AECID).

One objective of this work is to promote the creative use of cell phones in audiovisual proposals involving public participation, sharing content stored in the memory of the phones. To achieve this, we proposed the use of Bluetooth technology to transmit data from the cell phones to a computer. This decision follows two important reasons: the first is that nowadays many phones incorporate this technology and the second is that there is no charge for using it. Many of these phones have a built-in camera which also allows people to generate their own content. These contents will be part of the visual component of the installation.

2. DESCRIPTION

In this piece I want to emphasize the idea of public and private in relation to new communication technologies. The viewer observes and is observed. The amount of information flowing through cell phone networks and ease of being published and shared (Internet, SMS, MMS, Bluetooth), and control mechanisms associated with these consumption and the ability to generate and store content in mobile devices (video, image, sound, text), produce new forms of behavior and communication that somehow are reflected in the final proposal for the installation.

The publication of images and various digital contents is increasingly common practice in our time and people are often not aware of the implications of openly exposing them to the eyes and ears of anyone. In this piece, the decision to "show" or share private or intimate information is evident by the physical presence of other spectators at the time of the transmission of images from cell phones to the installation, and by keeping them on the screen within the exhibition space.

These contents are manipulated by rules or algorithms of the digital medium. The machine can "read" and display the visual and auditory information in their own way (eg positional parameters can be connected to sound and image parameters). Besides the possibility to send pictures from the cell phone, the viewer has some control over what he sees and hears through his presence; his movements transform the audiovisual result.

The piece is not complete without audience participation; this allows a collective elaboration of the piece's sense. It is a space that encourages sharing and monitoring of own and others contents in times that may be simultaneous with the viewer's

presence, or deferred, thereby generating a record of interventions from the spectators along the exhibition.

The title for the piece is entre-abierto (half-open), it resembles half-open blinds where you can see some of what is behind them. As the viewer moves, is as if his eyes focus through one slit created by the blind and so can see more clearly what is behind. It creates a sort of voyeur-exhibitionist relationship. What the viewer sees is what he has decided to publish, but can also look at what others have posted.

During the process it was decided to incorporate the viewer's image as part of the visual composition (Figure 1). For this part the viewer's image is captured by a video camera connected to the computer, which is also used in the application of computer vision for motion tracking. The idea is to make more evident the viewer's presence and its impact on what is seen and heard, with their corresponding transformations. In this way the image of live video and those sent from mobile phones are mixed to produce textures that depend on the movements of the viewer. Figure 1 shows a sequence of images projected on the screen and the viewer's presence.

Figure 1. Sequence of images from the *entre-abierto* installation

The sound consists of soundscapes of Mexico City. In the sound recording are also relationships between public and private, at times it become "zooms" or details of certain places, music, traffic and conversations between people passing by. The sound is clearer and more intense as the viewer moves and the image behind the blinds is revealed.

3. METHODOLOGY

The *entre-abierto* installation was developed between August and December 2009 in Mexico City as artist in residence project, to be presented at the Second Ibero-American Art Show in Mexico. The project was conceptually advised by the video artist Ivan Edeza and the technical part by members of the Multimedia Center of National Arts Center in Mexico [4].

The technology component was developed mainly in the Pure Data programming environment [8] for image processing, audio and computer vision. We used an Imac computer with MAC OSX 10.5.8 operating system and 2.8 GHz Intel Core 2 Duo processor.

3.1 Sound

For the sound component we made recordings of soundscapes in various public places and transportation in Mexico City, which were cut and edited in a sound editing program. The recording was done with a digital recorder Marantz PMD 660 [7]. For sound processing we used bandpass filters, delays and reverberations generated and controlled with Pure Data.

3.2 Image

For the visual component we developed an application to receive and process images sent from mobile phones. The application was developed with the GEM library for Pure Data. To achieve the effect of the blinds, the pix_lumaoffset object was used (pd-extended 0.41.4), which separates the pixels of the images according to their luminance and the rate of separation depends on the viewer's position in front of the video camera.

3.3 Communication and interaction

In order to send and receive images, Bluetooth devices and protocols built into cell phones and computer were used. In addition, we used the file management software Hazel [6] and some functions were programmed in Unix and Automator [1] for Mac OSX. For the transformation of sound and image an application of computer vision [10] was developed, using the GEM library for Pure Data, which detects changes in the position of the spectators.

4. SETUP AND TECHNOLOGY

The conditions of the piece require a closed dark space, not less than 4 mts x 4 mts and an overhead light that falls on the viewer. To guide the viewer on how to send pictures, we designed a poster with instructions.

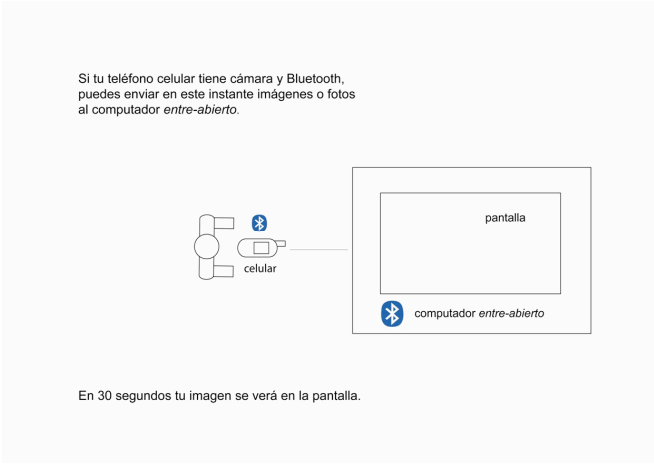

Figure 2. Instructions for the installation *entre-abierto*

The general outline of the piece consists of sending image files from a cell phone to the computer via Bluetooth, which then are projected on a screen. This will create a local network between

cell phones and computer. Several protocols were used for receiving and managing files such as Hazel, Automator [1] and scripts for Unix, developed in collaboration with people from the Multimedia Center of Mexico. The image and sound processing is done in an application programmed in Pure Data, which incorporates effects with varying parameters, which respond to changes captured by a video camera connected to the computer. Figure 1 shows the setup's scheme.

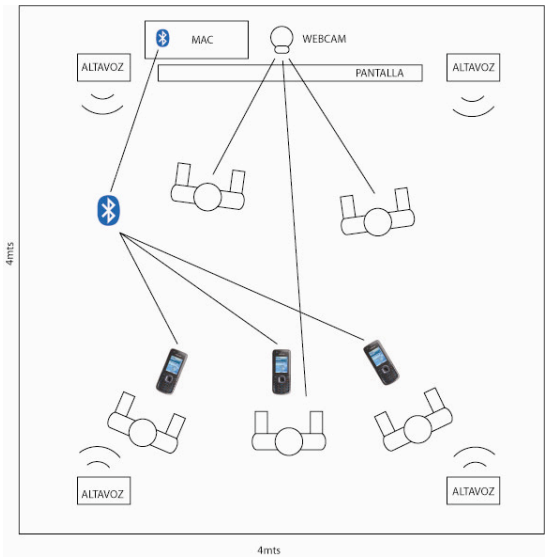

Figure 3. Setup´s scheme

4.1 Technical requirements

- Imac Computer
  - Operating system: MAC OSX 10.5.8
  - Processor: 2.8 Ghz Intel Core 2 Duo
  - RAM memory: 4 GB
  - Graphics: GeForce 8600M GT, 512 Mb
  - Bluetooth
  - Firewire port
- Software:
  - Pure Data: version pd-extended 0.41.4 for MAC OSX
  - Hazel
  - Automator: 2.0.4
- MiniDV camera with Firewire connection
- 42" LCD flat screen
- 40 watts halogen lamp
- Stereo sound system

5. RESULTS

The installation was first exhibited at the Second Ibero-American Art Exhibition at the National Arts Centre in Mexico City from November 29 to December 6, 2009. It was exhibited again at the International Image Festival in Manizales 13-17 April 2010. It is possible to observe a descriptive video in [5].

- The features of the exhibition spaces have some important differences that are mentioned below: The exhibition at the Second Ibero-American Art Exhibition took place in a clearly artistic context, with a space designed especially for the installation. It was projected on a 42" screen hanging on a wall at eye level of the spectators. The PC was hidden from the spectators. We used a sound amplification system and the lighting conditions were controlled.
- The exhibition at the Image Festival was done in a space at the entrance of an auditorium, on a 21" built-in screen in the computer located on a table and with no external sound amplification. The light conditions were those of the place.

5.1 Interaction and participation

The space differences probably influenced the number of participants, which was higher in Mexico City. The sound is definitely another factor of attraction for any piece that is not directly visible from the areas of traffic. Added to this, in the two experiences the use of Bluetooth technology is limited by individuals, either through lack of knowledge of it or lack of such technology in some mobile devices.

Figure 4. Installation and participants at the Centro Nacional de las Artes in México.

About the proposal of interaction and transformation of sound and visual projection, this can be framed within what the Italian designer Alessandro Valli [9] proposed as a natural interaction. This refers to the use of communication forms naturally associated with humans such as speech, gesture and glance. This approach to the use of computer applications eliminates the manipulation of controls and external elements to the people. In *entre-abierto* sound and image processing depend on the location and movements of spectators in the space of the installation. Thus, the viewer must explore the positions from which becomes more or less obvious what you hear and see. This way the installation is always active and constantly changing. Thus there are two levels of participation:

- The transformation of the audiovisual content with the presence and movement of all spectators.
- Sending images from a cell phone by some spectators.

5.2 Image

The following is a quantitative analysis of images sent by viewers in Mexico City and Manizales.

Mexico City: A total of 269 images were sent during 8 days. 78% of the images were clearly taken with cell phones cameras and can be generally categorized as follows:

- 105 people and self-portraits (39%)
- 94 spaces, landscapes and inanimate objects (35%)
- 11 animals or pets (4%)
- 59 of logos, advertising, models or celebrities (22%). These images were not taken with the camera phone.

Manizales: A total of 56 images were sent during 4 days. 77% of the images were clearly taken with cell phones cameras and can be generally categorized as follows:

- 15 people and self-portraits (27%)
- 25 spaces, landscapes and inanimate objects (45%)
- 3 animals or pets (5%)
- 13 logos, advertising, models or celebrities (23%). These images were not taken with camera phones.

5.3 Sound

As mentioned earlier the sound component of the installation consists of soundscapes of Mexico City, which have been previously recorded and edited. To incorporate interaction with the sound, this was divided into segments loaded in Pure Data, which are processed with filters and reverbs whose parameters change with the movement of spectators in front of the projection. To generate the changes in the parameters we used the video camera as sensor. Being less obvious interaction with sound, the sense of control may be reduced.

6. CONCLUSIONS

Communication through mobile devices is becoming increasingly common among people around the world. These devices are becoming more sophisticated and include various functionalities that allow the generation and transmission of audiovisual content. Although several of these features are overlooked by a number of mobile phone users, the use of built-in photo and video cameras is quite common and every phone turns into a storage medium for such images. It is worth noting that the experiences described in this article shows that over 50% of images sent are generated by the users themselves, i.e. that the photos were taken with camera phones. Bluetooth technology incorporated in many cell phones allows images to be sent directly to a computer in a range of 10 meters, which encourages the participation of the spectators.

People's participation in this proposal is not completely confined to the possession of a cell phone with camera and Bluetooth, it also allows the modification of the audiovisual presentation with their presence and movement through the computer vision algorithm. That leads to a greater participation and more natural interaction for viewers in the exhibition space.

In the interactive installation *entre-abierto* was no censorship in terms of content sent by viewers, as seen in 5.2, over 25% of images sent are personal. In this installation it is clear that whatever will be published is observed by others. It then creates a sort of relationship voyeur-exhibitionist. This somehow reflects what happens in social networks such as Facebook, where users post personal information even knowing that in many cases any unknown person can access it. The current ease of transmission and publication of digital content (Internet, mobile devices), makes people ignore things like privacy and intimacy, everything tend to become public.

As for the potential of the auditory component of *entre-abierto*, we must take into account that cell phones are able to record and store audio files, this way sound can go from being a background element with some control parameters, to an active element in generation of content by spectators.

In the current proposal a specific theme was not raised, which would be interesting to test in future exhibitions in order to generate a thread and possibly a more significant visual outcome. It would also be interesting the incorporation of text messages sent from mobile to create a sort of more explicit stories and opinions about a topic. It also could work with video files to generate another kind of audiovisual composition.

7. ACKNOWLEDGMENTS

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Editorial

Hola y Bienvenidos,

Hello and welcome to MexiHC 2010! This is the third Mexican Workshop on Human Computer Interaction and it is celebrated at the campus of the Universidad Politécnica de San Luis Potosí, in San Luis Potosí, México. MexIHC 2010, builds upon previous editions of the workshop, the first in Puebla (2006) and the second in Mexicali (2008). Our workshop is the product of the initiative of a vibrant and strong community of Human-Computer Interaction researchers in Mexico and Central America.

In this edition of the workshop, we have decided to maintain the same spirit, showcase the state-of-the- art research done in Mexico and surrounding areas, but we have decided to change its body. Even though it is still formally a Workshop in title, it is behaving as a Conference.

This year we have accepted eleven papers to be presented as full papers from researchers from all over the area: Mexico, Brazil, USA, Guatemala, Colombia and the UK. We also accepted three short research papers from Portugal, Mexico, Germany and Brazil.

With the support of CONACyT's Thematic Network on Information and Communication Technologies (RedTIC), we are hosting two new activities in MexIHC 2010. Firstly, a student design competition, in the spirit of the ACM CHI Conference, for which eight projects were selected to be presented at the event, and five of them are still in competition to win the contest. Secondly, we are also holding the first doctoral consortium for HCI graduate students researchers, with eight students from all over Mexico. We are also presenting, in Spanish, nine Works in Progress and Case Studies to showcase the research, share experiences and reflections on the current state of the technology and research in Mexico.

The conference has its frosting with three magnificent keynote speakers: Philip Corriveau, from Intel Corporation, Lidia Oshlyansky from Google and Bo Begole from PARC.

MexIHC 2010 could have not happen without the help of all the members of the organizing and program committees. We are very thankful for all their help and endeavors to make MexIHC a valuable venue to present research findings. We would like to extend our gratitude to Intel, Google and PARC for sponsoring Philip, Lidia and Bo to attend and deliver their keynote talks.
Finally, we are very grateful to Universidad Politécnica de San Luis Potosí for all their help in organizing the event, and for lending us their facilities.

MexIHC is held in Cooperation with ACM

Eduardo H. Calvillo Gámez
Program Chair
Universidad Politecnica de San Luis Potosi

Victor M. González y González
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Instituto Tecnologico Autonomo de Mexico

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KEY NOTES

User Experience: A Complete HCI Conversation

Philip Corriveau - Intel Corporation

Biography:

Philip Corriveau is a Principal Engineer at Intel and the Director of the User Experience Research Group. Philip received his Bachelors of Science Honors at Carleton University, Ottawa Canada in 1990. He immediately started his career at the Canadian Government Communications Research Center performing end-user subjective testing in support of the ATSC HD standard for North America. In January 2009 he was awarded a National Academy of Television Arts & Science, Technology & Engineering Emmy® Award for User Experience Research for the Standardization of the ATSC Digital System. Philip moved to Intel in 2001 to seed a research capability called the Media and Acoustics Perception Laboratory designed to address fundamental perceptual aspects of platform and product design. He now directs a team of human factors engineers conducting user experience research across Intel technologies, platforms and product lines. Philip is currently the Chair of Steering Team 5 for 3D@Home addressing Human Factors issues surrounding the development of 3D technologies for end-users. He founded and still participates in the Video Quality Experts Group, aimed a developing, testing and recommending for standardization objective video quality metrics.

Abstract:

When you think of creating a product, what is the first thing that comes to mind? Well, depending on who you are, that framing can be totally different. For an engineer it is all about the technology, for a planner it is all about the roadmap, for marketing it is all about the sale, for validation it is all about reliable functionality, and for the social scientists it is all about whether the product will serve user needs and meet the expectations of the experience.

Within the general area of social science, again the framing can be different. Human Computer Interaction is more than designing interfaces based in software. HCI is also the ability to develop and standardize techniques for evaluating and comparing interfaces. It is also the development of predictive models that are built around the theories of interaction. In reality HCI is not one tool but a complex

kit of tools that enables the creation of a fantastic user experience.

Broadening the HCI conversation to include Ethnography and Human Factors allows an even more compelling toolkit to create the user experience. Ethnography allows us to discover the unmet needs for our future products. Human Factors methods apply rigor to the development process to ensure we stay on target for a complete user experience.

When you lift the hood of user experience you find what can be a well oiled machine of social science components that can ultimately discover, define, develop and deploy something that is fascinating. Regardless of whether you are designing for a productive environment like the cockpit of a plane, the control machinery for a factory, or a consumer product like a 3D television, the experience should come first. What does the well-oiled machine look like when all the pillars of social science are included in the HCI conversation?

Combining the skills and results of all of the social science disciplines creates the pillars of a foundation upon which any product can be developed.

Today we look under the hood of user experience at Intel.

Doing, teaching, learning

Lidia Oshlyansky – Google

Biography:

Lidia started her professional career as a Social Worker and then moved into Computer Science, through programming to Human Computer Interaction. Her career in HCI has taken her through various roles and companies. She has worked for dot coms such as Orbitz.com and Cars.com, as a consultant in the financial sector, in an agency environment where clients included WWF.org, Royal Mail and the UK Department of Health. Most recently she has worked as a User Researcher for Nokia and now Google. Lidia completed her PhD in the UK where she has been working and living the last 7 years.

Abstract:

Every few years we think about what we teach our students before they go out into industry to find jobs and every few years we discover that there are gaps in their knowledge. This is not a problem unique to HCI, but we are talking here about our field and our professions. More often then not we hear back from our students saying that they found a wonderful job but there was so much for them to learn on the job, so many skills to acquire and so many concepts to understand. What is it we are teaching, what is it our students are learning and what is it they are doing when they go to jobs in HCI? From methods to tools to concepts where are the gaps between what industry wants and needs from our graduates and what academia teaches them? And most importantly what can or should we do about these gaps?

Ubiquitous Intelligent Media.

Bo Begole – PARC

Biography: Bo Begole is a Principal Scientist at Xerox's Palo Alto Research Center, the famed innovation center credited with inventing and commercializing many core information technologies including laser printing, Ethernet, Graphical User Interfaces, the laptop and more. He currently manages the Ubiquitous Computing Area at PARC, a computer science team that habitually collaborates with social scientists and others to create innovations that help people work together remotely, find information more rapidly with less effort, communicate more efficiently, and generally enhance our ability to engage in life across both physical and digital environments.

Bo holds several patents and has published dozens of papers in peer-reviewed venues. Currently, Bo serves as Technical Program co-Chair for the 2011 ACM conference on Human Factors in Computing Systems (CHI 2011). Prior service includes General co-Chair of the 2008 conference on Computer-Supported Cooperative Work (CSCW 2008), Papers co-Chair (CHI 2007) as well as serving on the program committees of several top-tier conferences.

Bo is a senior member of the ACM. He received a Ph.D. in Computer Science from Virginia Tech in 1998. Prior to his studies, he served in the US Army from 1981-92 as an Arabic language interpreter.

Abstract:

In many ways, Ubiquitous Computing is no longer a dream, but an all too ubiquitous reality where managing and controlling the multitude of information services, devices, and applications is becoming increasingly impossible.

Fortunately, the problems Ubicomp has raised also provide the seeds of solutions. The proliferation of devices, sensors and services provides multiple points of interaction that can be recorded and mined for

patterns to predict current and future user needs. Future services will become even more perceptive as they are fed by additional sources of information such as medical devices, on-body biometric monitors, vehicle telematics, user interaction with devices and services, social network services, etc. All of these information sources can be tapped to identify the relationships between people, objects and information, creating a personal semantic network to retrieve information that is more pertinent and actionable.

In addition, sensors and cameras use increasingly sophisticated techniques of computer vision and perception to detect the state of the physical environment. Media applications can respond to the reactions of people seeing the media. Today's "Responsive Media" systems are simplistic and in need of deeper research in human-to-human conversation to construct systems that respond more naturally.

We are only now beginning to understand the opportunities that a variety of such "intelligent" systems are creating. Human Computer Interaction researchers have the skills and insights needed to identify unaddressed problems that such systems can fill and to design proactive, semi-autonomous applications that act appropriately to the user's situation and preferences.