The Virtual TV Couch

Enabling shared viewing experiences of television for micro-social networks

Digital Media Master's Project Design Document

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Table of Contents

Abstract

Watching television is not only an entertainment or aesthetic experience; it is also a social experience that is capable of triggering conversation and discussion, and of creating special communities around its programming. Currently, the television industry has not been able to offer an adequate product to facilitates the interaction of viewers that are watching the same programming, but are not in the same physical space. In fact, currently available interactive television applications focus on programming guides, video-on-demand, and voting features, but not on communication tools. Some people have solved this problem by using other kind of communication devices. The goal of this project is to develop novel interactive television (ITV) applications using a Digital Video Recorder (DVR) platform that enables enhanced communications, impulsive interactions, sharing experiences and active discussions of small viewing groups, such us family, friends, and classmates.

Introduction

The goal of this project is to develop ITV applications for families and other small groups of television viewers to help them communicate with each other as if they were physically and temporally together, recreating the "TV couch experience".

For decades, the television set was the central appliance in a home. The family used to sit in front of the screen to watch their favorite programs together. They commented, discussed and laughed from the same couch. This shared experience reveals a very important social aspect of the medium, which has been challenged by the fact that television sets are no longer exclusive to the living room and that every member of the family may watch it individually in their bedrooms or away from home. However, this assumption might not be entirely true since viewers have continued searching for other ways to keep sharing their experiences.

These experiences reveal important intimate and social aspects of the medium, which has been challenged with the fact that television sets are no longer exclusive to the living room and that every member of the family might watch it individually in their bedrooms or away from home. Moreover, the growing usage of DVRs, such as TiVo, is challenging even more the synchronized experience of television viewing. However, DVRs could be used to re-create that sharing experience and even, enhance it. Previous work in the field has addressed some of the features needed to construct such experiences, but many have overlooked the potential behind Internet connected DVRs, the power of simple and impulsive user interactions, and the importance of intimate communication inside small groups.

Although several interactive television (ITV) technologies have been developed in the past to support some aspects of this kind of communications, their results have not been enough to fulfill the user's needs. Today's scenario looks much more promising: The advent of digital and high definition television, the connection of television devices to the public Internet, the growing incorporation of devices such as DVRs, and the development of ad-hoc technical standards might offer novel ways to share the social experience of television.

For years, the television industry has tried to create successful ITV solutions. However, the incipient technology available, the lack of standards, and several other constraints resulted in the failure of many ITV experiments. Today, there seems to be a better soil for the development of attractive and useful television applications. A very important catalyst for this new opportunity for ITV has been the development of network and computational technologies, specially the Internet. Shelly Palmer [34] in his book Television Disrupted presents the transition of the industry from a network (broadcast) to a networked television, explaining how Internet is changing the way television is produced, distributed, and consumed. Traditionally, the television has been a "gardened wall" where the networks and cable/satellite operators decided what we can or cannot watch. With the introduction of Internet broadband connections and high quality video on the web, the walls of traditional broadcasting cracked. Palmer also examines the

enormous opportunities of the networked era for television. Personally, I consider the connection between television and Internet as an important tipping point for the entertainment industry and I want to explore the benefits for one of the most important stakeholders in the equation: the viewer.

Although the opposite has been said, the living/family room has not disappeared at all. Furthermore, a good number of people are buying big HDTV screens and home theater audio systems, placing them on those common areas [36]. Recent figures show that between the first and second quarter of 2006, sales of HDTV screens increased 30 percent worldwide with more affordable prices. Although it is probable that the family TV sets are not used as intensively as used to be, they are commonly used to watch important programs for families or group of friends. Also, if we think about it, from all the electronic devices that we find at home, the TV set is probably the most shareable of all.

The television industry (e.g., producers, distributors, ISPs, cable, telcos, satellite, and so forth) is also working hard these days to improve our watching experience: More channels, digital and high definition broadcasting, video-on-demand, new ITV applications, and so forth. When the ITV services were first introduced decades ago, most of these applications did not succeed. Today, new generation set-top-boxes and new telecommunications standards suggest a better (but not ideal) scenario for the developing of interactive applications.

The Problem

For decades, researchers have debated if watching television is a social activity or not. Although it is common today that people watch television alone, it is very probable that viewers will share their experience with other people later on. Tove Rasmussen, citing Hall and Silverstone, argues that watching television is a "simultaneous communication process" [36] since each viewer participates on a joint effort of understanding and decoding what they see on the screen.

One of the foundational arguments of mass media is that people share what they consume, and this helps to build our society. If we did not have newspapers, radios or television stations it would be very difficult to know what is happening around us. Even more, a good part of our daily conversations are based on what we see or listen in the media. Classmates and work colleagues that watch the same series on television have the tendency to talk about the shows, for example, in front of the water cooler. This tendency is not new. An article published in 1989 in the Journal of Advertising Research presented the phrase "social grease". This concept "represented the role of television as a lubricant to interpersonal communications". Even more, the authors state that "television programs are one of the most popular topic of conversations for both men and women. [28]"

So important are these issues to the ITV community, that the next European Conference on Interactive Television (EuroITV 2007) is titled "Interactive TV: A Shared Experience". Some seminal research was presented in the 2006 edition of the conference demonstrating that this topic is an open issue that needs to be researched, and this project will be presented on the next edition of the conference, in May 2007.

Creating a shared experience is not easy anymore. For example, late teenagers leave their homes to go to college away from their parents; children have their own TV sets in their rooms; extended family members live in different cities or countries; towns have grown so much that people hardly visit each other, and so forth. However, people have tried to solve their inability to share their experiences by using external communication devices such as computers (connected to the Internet) and telephones. These technologies might solve the direct communication problem, but replicating physicality and transmitting non-verbal is a more complex task.

Two highly watched television shows in the United States are "Lost" and "The Simpsons". Around these series, viewers have created great conversations and virtual communities. For example, the worldwide audience of "Lost" build forums and even a complete wiki-site to share theories about the characters and the story. Others have created maps of Springfield, the Simpson's fictional hometown, as a way to share their expertise of the cartoon series. Although these kind of communities bring together people that probably do not know each other personally, these examples show how people use other mediums to recreate face-to-face conversations. Broader examples of these groups are the growing social networking sites such as MySpace, Flicker and YouTube.

However, this project focuses on smaller groups of friends and families. They frequently use more direct and intimate communications like phone, electronic mail, voice-over-ip, and instant (IM) and text messaging (SMS) to recreate a shared environment. In my personal experience, and because my family lives in Chile, there are numerous times that we have watched the same television program and commented it through the phone or via Skype (a voice-over-ip application). The fact that users utilize one medium to entertain themselves (watch television) and one to share the first experience with others, demonstrates that they do not find in the television the communication services they need.

Recent studies about media and Internet use have shown how people watch television today. A growing tendency in media consumption is multitasking. Over 50 percent of people, particularly youngsters, watch television and talk on the phone or browse the web at the same time. This attitude is not only present in the United States; it is a worldwide tendency [1].

The context explained above demonstrates that the current solutions offered by the television and telecommunications industry have been very limited and do not respond adequately to the viewer's desires. Also, recreating the experience of watching television together, but separated in space, is not an easy task.

Foundations and Background

In a project like this, that involves numerous industries, platforms, and technologies, it is important to take a step backwards to see the big picture. Therefore, in this section I will present the various aspects related to this endeavor of creating a "Virtual TV couch".

First, I will explore background aspects of the project such as how current ITV platforms address social interaction, the technology platform chosen for this project – the DVR -, the role of computer mediated communication in the creation of social interaction, the voice as a suitable communication channel, the game-related interactivity that this project can support, the user as a social interactor in television contexts, and finally previous research projects and products that support some aspects of this project and that inspired me.

Interactive Television and Social Aspects of Television

I believe that the history of the ITV industry has focused too much on the technology and the means of transmission, instead of paying attention to the users and their needs. Set-top boxes, the brain behind the majority of the ITV efforts, offer limited functionalities, poor designs, and complex interfaces.

Until very recently, the television experience (with or without ITV applications) has been disconnected from the public network. The "gardened walls" imposed by cable and satellite companies limit the development of much richer and broader experiences assuming that the Internet was not valuable or interesting to their users (I am aware that I am not including the Web TV products from Microsoft and others). The link to the external world opens enormous possibilities to television, especially for empowering, enhancing, recreating, and sharing the television viewing experience with others. Without the network, there is no real chance to be fully connected to your friends or family.

Currently, most of the ITV applications have centered on the interaction between all the viewers and the broadcaster. The audience votes or bets as members of a big community watching the same show. However, not many applications have focused on the interaction between small groups such as family and friends. [7] In order to produce a real change and make the ITV a real option for the future of television, I believe this focus must change.

All these needs and challenges open interesting spaces for research, which have grown in the last couple of years in several research and corporate environments. Although their work has created some innovative solutions and seminal work, their outcome is still in early stages. The objective of this project is to take the research already started and to take a step forward.

The Platform: Digital Video Recorder

Digital Video Recorders have affected the way many people watch television these days. Its capability to support "time-shifted" viewing has liberated people from having to watch the programs when they are broadcasted. This has aggravated the fact that people do not share the same time-space and programming-space with others. The approach of this project is to explore the potential of DVRs in solving the problem that they produced: re-syncing the un-synced experience.

The moment that DVRs (and set-top boxes and media-centers in general) are connected to the Internet they open network dendrites that can connect not only devices, but people. Shelly Palmer (2006) classifies this as a transition from a network to networked television, which is the most disruptive milestone in the history of television.

An interesting article by Wood and Skrebowski [45] tries to explain why the launch of TiVo failed in the United Kingdom some years ago. The author argues that the marketing campaign was not successful to explain the differences and benefits when compared to a Video Cassette Recorder (VCR). Although a DVR shares many of the characteristics of a VCR, there are some "social affordances" that the old tape machine has and the TiVo does not. "Undoubtedly TiVo affords some useful and compelling features that are unavailable with a VCR. However, the [social] affordances unique to the VCR are all very important (renting, sharing, and collecting recordings)" [45]. Moreover, these social characteristics of "taking a recording and watch it elsewhere and give/lend a recording to others" [45] demonstrates the importance of sharing the experience.

Computer Mediated Sociability and Communication

One of the goals of this project is to recreate the experience of watching a television program together, as if all were sitting on the same couch. In a situation where people are physically together they tend to have high levels of interaction between them, where these relations can be verbal and non-verbal. However, for a physically-separated group these interactions are only possible using some kind of communication technology.

The literature has explored the role of computer mediated communications in different contexts and the first one I will explore is gaming. Massively Multiplayer Online Playing Games (MMORPGs) are videogames that people play on their own computers or game consoles but instead of competing against the computer, they play with or against other players that are connected through the Internet. Numerous games have features that enable players to talk with each other using a voice channel, such as first person shooter games. Moreover, Microsoft's Xbox 360 Live bundle includes an audio headset with a microphone as a way to incentivate the use of voice communication. For example, this kind of interaction allows players to coordinate their moves inside the virtual worlds, as if they were using real two-way radios inside the game. Other games and platforms use text-based chats, but most literature tend to say that "speaking is a more natural way for people to communicate [...] It is faster than typing, and doesn't interfere with use of a keyboard or a game controller" [44].

Several studies have also done ethnographic research to see how and why people use voice-communication in a videogame context. One of the most common problems is the lack of other visual cues, so the players have difficulty recognizing who is talking over the headphones [24]. Moreover, most people do not use the audio channel because of this. "The loss of ambient cues has the effect of making voices of the same sex sound similar to gamers, especially where there are no distinctive accents. Even if a gamer knows someone from outside the gaming context, they can still fin the voice difficult to recognize in-game" [24]. This problem creates an important interface design challenge. In the Wadley study the researchers apply the concept of "Social Translucence" that "emphasizes the importance of making socially significant information visible to participants in digital environments" [44]. The difficulties of not knowing who is talking is a "lack of social translucence in the voice channel negatively impacted on player interaction in these games" [44].

Other studies also explored the use of audio channels in collaborative supported cooperative work (CSCW), where the same kind of issues arose. However, in some contexts it is not that important to know who is talking, even in the physical world.

The research I presented on the previous paragraphs can be applied perfectly to the context of ITV. In a recent paper presented at NordiCHI, the authors state that "one of the strongest ways for enhancing ITV is to support the social uses of television" [18]. This study compared a text-based chat and a voice-based chat over a television broadcast, such as the context for my project. One of the concerns of the researcher was the capability of the users to do "multi-tasking": watching the program and talking at the same time. The results of the ethnographic study showed that using an audio channel "was described as being easier to do while watching television" [18]. Moreover, people tend to lose less from the broadcast if they speak instead of using a keyboard to write messages. Only youngsters were more capable of multi-tasking with text and voice at similar levels.

I believe that the conversation can be more meaningful and be helpful to enhance the watching experience when conversations are connected to the program narrative. If this connection is made, it can help the users understand and experience the program in a much deeper way. Moreover, watching television can be an intense activity that needs a good level of concentration that can get to similar levels compared to a videogame. Therefore, a citation from the first study can support why voice can be much suitable also in the television context: "voice can improve communication and team coordination in a fast-paced action game" [44].

Watching and Playing

The lack of physical presence on the "Virtual TV Couch" means that the computer mediated communication technologies are the only channels that can foster the social interaction of the people watching a television program in different spaces. We have seen that an audio channel is a good choice for verbal communication between the patrons, but what about non-verbal communication? Some portion of the non-verbal

communication can be fostered by applying some videogame ideas into ITV. Craig A. Lindley created some taxonomies of gaming that I believe can useful when we are talking about ITV. Without going too far in the discussion between "ludology" and "narratology", which is not the objective of this document, I believe that since the social interaction is vital on the joint effort of understanding and decoding what people see on the television screen [36], playing on top of the broadcast programs can create a new layer of understanding that can enhance the watching experience. Lindley says "To experience the game as a narrative also requires the creation of a narrative gestalt unifying the game experiences into a coherent narrative structure" [29]. Since most of the interactions will be related to what is happening on the main narrative (the broadcast) the game might acquire some of its characteristics and allow the user to play-the-story. Moreover, playing the story can enhance the understanding of the main narrative. The discussion on this issue can be the foundation of a whole new research project. However, I will apply these basic ideas to the "Virtual TV Couch" project only assuming the viewpoint proposed here.

Studying the user and its context

Several researchers in Europe and in the United States have analyzed why and how people like to watch television together. An early work made to study the behavior of groups of people watching television made at Xerox's Palo Alto Research Center (PARC) showed that the viewers find attractive to share their viewing experiences. Even though this attitude was confirmed to be true in general terms, the researchers also established that some programming are better suited to share, such us "Animation, Sport Events, Documentaries, Action-Adventure, and Reality Television" [33].

Another study made in 2003 by researchers of the Helsinki University of Technology in Finland presented the results from a qualitative user study about ITV applications. The results of their interviews showed that the participants consider watching TV as a "social activity to be shared with other members of the family in the living room." [15]

The same year, a paper made by TV Cabo from Portugal, discussed the potential of communication services in ITV. The author argues that this type of applications can create virtual communities and can become the "true killer application" for television. [35]

Karyn Lu, a recent graduate student from Georgia Tech, wrote a thesis on the interaction principles for ITV. One of those principles was titled "Convening an audience", which was related to this project. However, it does not make a distinction between the broad and micro communities created around television. As I have mentioned before, the most relevant type of community for social television.

Relevant previous research and projects

Beyond the general context described around ITV, there are numerous research works and commercial products that have tried to address many aspects of the problems described on the previous section. Following, I present some of related work examples that helped me think of a second generation of solutions for sharing television experiences. Other works, that are not explained here, but that were part of my literature review, can be found on the reference list [2, 8, 9, 13, 16, 19, 20, 21, 22, 23, 25, 26, 27, 30, 32, 37, 38, 39, 41, 42, 43].

VISION TELEVISION, ICOM, REFLEXION, BREAKOUT FOR TWO

The MIT Media Lab has numerous works related to ITV, but the ones led by Stegan Agamanolis [4,5,6] are the most interesting. He led the European venture of the lab and his work on the Human Connectedness group presented me with interesting insights.

Vision Television is a project created on the Object-Based Media Group that "detects the faces of its viewers and can transmit them to other locations or incorporate them in the image, creating a community of viewers. [6]"

Vision Television, MIT

ICom was a revisited version of a Xerox's PARC research on the 1980s "which connected several offices and common areas in multiple geographic settings via continuous audio and video links. [4]"

Reflexion "is an interpersonal video communication system that operates like a 'magic mirror' in which you see a reflection of yourself together with the reflections of other people in remote locations. [4]"

Breakout for Two is an "interactive installation for playing sports over distance. [4]" Here the users had a remote social and physical interaction enhanced by video and audio.
http://web.media.mit.edu/~stefan

TRYST (2004)

Although this is not an ITV application, it has some elements that clearly connect it to my project. Tryst is a solution created by an undergraduate student from the University of Southern California that "can make your movies available on the network for everyone to watch together" [40]. The author's objective was to offer a simple way to publish streaming videos and then be able to watch them together remotely.
http://www.trystx.com/index.html

SOCIAL TV (2004-2006)

Xerox's PARC researchers worked on the design for a distributed, social television viewing solution. Although they did not implement a final product, they deeply studied

the behavior of a group of viewers while watching television and communicating with another group using an audio communications channel. Based on the results, the researchers proposed some guidelines and features that could help for future "social television" prototypes.

The main feature of the prototype that they built to do their research was a shared audio communications system. They realized that the audio software must act as a "clearing house" that minimizes disruptions, isolates side conversations, and allows smooth in and out transition of the audience comments. The audio must feel natural as if the remote parties sat beside you, processing the signal to eliminate echo and other disruptions. The PARC team sees just in this area enormous room for future work.

Another interesting guideline is the need to have an intelligent agent that analyzes if "the audience keeps conversing close to the end of a break (...) [and] slow down and eventually pause the show if the conversation appears to continue after the show has resumed. [33]"

"Catch Me up" is a button that any viewer can press to call a "one-minute visual synopsis of the show, displaying screens and moments from the TV program that caused the biggest reactions from the participants. [33]"

In addition, the researchers presented different questions without solving them completely, such as how to implement asynchronous functions into a social TV application. Although neither of the guidelines proposed were developed by the team at PARC, their ideas were very helpful for this project.
http://www.parc.xerox.com/research/publications/details.php?id=5392

AMIGOTV (2004-2006)

The Residential Networked Applications Research Group at Alcatel (Belgium) worked the last two years in a prototype called "AmigoTV" (friend TV). Just a few months ago the solution was launched as part of the Triple-Play IPTV product of the telecommunication company. The main goal of the researchers was to transform a "passive lonesome TV consumption into a compelling social experience" [11]. To do so, they identified three basic components: personal content, rich communication and community support.

Amigo TV, Alcatel

An important finding that they presented is that "speech is the most natural way of communicating [...] [and is offered] as the primal way of interaction with their buddies [11]". The launched application included the following elements: group voice chat, text chat, webcam support, Buddy Mosaic (list of channels that friends are watching), personalized avatars and emoticons for expressing viewer emotions.

One of the disadvantages of this product is its screen and UI design. All the communications are presented as an overlay on the TV screen, that usually occluded the main content: The broadcast itself.
http://www.alcatel.com/tripleplay/tp_portfolio.jhtml

MY OWN TV (2004-2006)

Also part of Alcatel's Triple-Play IPTV solution, My Own TV "provides a way to upload multimedia content (movies and photos) to the operator's network (via the PC) and to then share it with a dedicated group of people (the community or affinity group). Viewers can access the content via the Electronic Programming Guide (EPG) on the television. [12]"

My Own TV, Alcatel

This product allows viewers to share personal content with others through the television. An attractive feature is the creation of a 'virtual' television channel with personal content so that other members of the community may watch asynchronously.

A disadvantage of a product like this is one is the proprietary way to make content available to others. Instead of incorporating more ubiquitous social networking websites such as Flicker or You Tube, Alcatel preferred a "walled garden" approach.
http://www.alcatel.com/tripleplay/tp_portfolio.jhtml

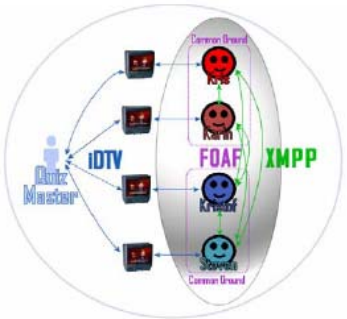
PLASTICBAG.ORG SOCIAL SOFTWARE FOR SET-TOP-BOXES (2005)

Although this is not a formal paper, this blog's posting presents a theoretical social TV application from scratch. The interesting part, and the reason why I was interest in this work, was the numerous comments that the author got on his posting. The person behind these ideas works in social media and software in Yahoo! [10].

This was the only work that mentioned anything about watching PVR content (instead of live/synchronous television) simultaneously. Although the author does not solve how to do it, I found the approach more than applicable.
http://www.plasticbag.org/archives/2005/03/social_software_for_settop_boxes

TELEBUDDIES (2006)

Also in Belgium, researchers from the Expertise Centre for Digital Media (IBBT) of the Hasselt University presented a paper in the last version of the CHI conference in Canada. Their goal was to report their work on "laid-back social interactions using television as a primary interaction medium [31]" in two levels: direct and indirect communication.



Telebuddies and FOAF
Expertise Centre for Digital Media

Utilizing broadcaster driven interaction scripts, the viewers interact with their set-to-box answering questions and voting about topics related to the show. Although this seems like

traditional ITV, they added an important differentiator. The interaction is coordinated and structured in micro-communities that share a common ground. To accomplish this, the researchers used and XML-type protocol called Friend-Of-A-Friend (FOAF) which "contains information about the social relations of the user next to traditional information that identifies the user. [31]"
http://research.edm.luc.ac.be/kris/research/projects/telebuddies/

COMMUNICATIONS SERVICES ON TV (COSE) (2006)

Siemens presented in the last CeBIT conference in Hannover a new set-top-box application that "allows TV viewers to chat with friends or make phone calls while watching a TV broadcast." [3] This is the second product deployed of this list, but as the one from Alcatel, it is only available in Europe.
http://www.siemens.com/index.jsp?sdc_p=i1360563lmno1362536pCBITcfsu4z3&sdc_bcpath=1329408.s_0%2C&sdc_sid=19374200992&

GOOGLE'S REAL-TIME AMBIENT-AUDIO IDENTIFICATION (2006)

This paper presented two interesting ideas, both related to an innovative audio-identifying system able to recognize broadcastings from television just by utilizing the microphone of a computer.

The first one is the creation of an ad-hoc peer community that "includes viewers watching the same show on TV. We [Google] create a community from the sets of viewers whose audio statistics matched the same content in our audio database [17]". This transforms the living room into a 'commenting medium'.

The second one is video bookmarks that helps the user to easily tag portions of the broadcast just by pressing a button.

LYCOS CINEMA (2006)

Lycos created a virtual cinema where people can watch a movie together and text-chat about what they are watching. The host has control of the video (play, pause, seek) and the same video is streamed synchronously to the people joining the room. The content available is not blockbusters, but old and B-class movies. Also, the quality and size of the stream are not the best.
http://cinema.lycos.com/

Example of Lycos Cinema

JOOST (2007)

From the creators of Skype, Joost is a free internet-based television service. Joost broadcasts numerous channels from around the world in full screen quality. It also has community modules that allow the users to chat and rate what they watch. Currently it is a closed beta application. In the future it will allow users to create plugins.
http://www.joost.com/


Example of Joost community modules

YOU TUBE STREAMS AND STICKCAM (2006-2007)

You Tube, the biggest video-sharing service online, added a new application in which people can create rooms, define playlist of videos, and allow the people that join that room to chat about the videos available there. Stickcam.com launched a similar application in 2006.

http://www.youtube.com/streams_main

http://www.stickcam.com /

Example of a You Tube Stream

Proposed Solution: Designing the ITV Application

General characteristics

The greatest challenge for this project is not the technology, since most part of the platform needed is readily available today. The focus of my work will be in enhancing the remote television viewing experience of families and friends and making it as natural as possible.

The real potential behind ITV is to give the audience tools to fulfill their expectations. We have seen that our more individualistic society still needs to be connected, and this applies also to micro-societies such as relatives and friends. Television was one of the devices that concentrated the collective attention, but today, having shared experiences is harder than it used to be. However, the convergence of Internet networking and DVR technology can bring that experience back.

MODEL SCENARIO

The model scenario is that a group of people would be able to watch the same programming synchronously through a television set and a connected device such as a DVR. This group may be a small array of friends or family members that cannot meet physically and they need a computer-mediated system to re-create the television watching experience. These members used to gather together to watch specific programming, such as sports or contests. Also, the individuals in the group tend to talk over what they are watching to interact with the other members, trigger conversations, and some casual-and-quick games. Later in this section, I will present the set of functionality features that could help fulfill this model scenario.

TECHNOLOGICAL PLATFORM

“The Virtual TV Couch” is a platform agnostic set of ITV applications that can be can be potentially inserted as a module on a DVR, a set-top-box, a media center computer, or a game console. I think that the latter probably presents the most flexibility. Furthermore, the game industry is aggressively pushing game consoles as the future media hub for the family. The ability to provide every party with some kind of controller makes the potential of this project to go further. Although I will present TiVo as the model platform for the prototype, it is only presented as a good example of the DVRs that exist in the market.

Recent developments of the computational and television industry have presented new alternatives to choose from. For example, Apple has launched a networked video appliance called Apple TV; Intel is pushing its new digital media ViiV technology and Microsoft launched the new version of its Media Center on the new Vista operating system. Moreover, all the technologies used in the project are currently available, but they do not exist together, and one of the values of this project is to put all the pieces under one logic.

TELEVISION GENERES

The most traditional genres used for ITV applications are game shows and contests. I was surprised that none of the related projects took any of these genres as their platforms of interaction. Other types of programming such as sports and documentaries were mentioned on previous works.

For this project, I selected three types of television programming to work with:

- Contests (e.g., The Oscars, Emmys, MTV Music Awards, American Idol)
- Series (e.g., soap operas, telenovelas, sitcoms)
- Sports

Even though these might seem like superficial programs, they can trigger very meaningful and deep conversations, discussions, and competition inside a group than other genres. For example, *telenovelas* are fiction *melodramas* that present real life conflicts that can create deep value and moral conversations.

The Proposed Designed Application

The goal of this project is to present novel ITV applications for small communities physically separated and that want to watch television together. These are the characteristics I propose:

COMMUNICATION CHANNELS

I agree with previous works that audio is the most efficient and natural way to communicate between the remote parties. It is a vital communication channel that will allow the patrons to interact as if they sat together.

However, and as we have seen this before, one of the more vital problems when an audio channel is used to communicate people that are not together, is the difficulty to recognize who is talking at a particular moment. Because of this, I see that the audio from the conversations and the audio from the broadcast should not be emitted from the same speakers. Actually, from where the sound is emitted is vital to maintain the illusion of the virtual couch. Probably, a surround sound system will be able to create a much natural environment where the broadcast sound is heard from the TV set and the conversations are emitted from speakers near the couch and in different positions as each person had a different position in the room.

A group presence configuration and screen display will also be needed. Each patron can use the DVR to list the other users that are online and their current status. Moreover, while the users are inside a “Shared Play Event” environment (see more about this later), each user will appear as an icon on the screen that will glow when that person is talking. With this visual aid the

User in silence

User talking

other users will be able to recognize who is talking just by identifying the icon that is glowing.

IMPULSIVE INTERACTIONS

Audio transmissions are not capable of recreating all the kinds of communication that exist in the physical world. For example, body language and face expressions are very important elements of the human communication, but a simple audio channel will not support anything more than sound. Beyond the speech communication, this project offers numerous ways to facilitate internal discussions, games, contests, and polls. With the help of the remote or game control, each viewer will be able to trigger 'interactive events' while the rest of the party can vote or act by pressing buttons.

Traditional ITV has given the control of the majority of the interaction events to the broadcaster, not the user, and their applications and games needs massive and costly pre-production from the broadcaster. I think that this approach is adequate in many contexts since the producers have more information about what is shown on the screen and they can create interesting events. However, I believe that event creation should not exclude the users. This solution supports that viewers can create simple interactive events on-the-fly while watching.

One of the most common applications of ITV is answering trivia questions and polls. The majority of these solutions are open to all the viewers that are watching the same program, for me, too a generic invitation. Compare, for example, the television and web advertising. The first ones aim at broad audiences, but the second ones can reach a more precise objective. The same is possible with networked enabled ITV systems. For example, an important characteristic of social-networking in Internet is that the members of communities online tend to share similar profiles, age, work, and so on. However, broad television audiences may share looser characteristics.

My approach is that most people that traditionally do not find ITV applications attractive might change their mind if the interaction offered is directly connected to their desires and needs. I believe that a solution that invites the user to interact, communicate, and share known experiences such as watching television together, is attractive enough even for the most skeptical person.

TiVo's Thumbs Down and Thumbs Up buttons

For example, some people might want to bet about something appearing on the show. Massive interactive television applications have supported this for years, but not for small closed groups as the ones described here. Commonly, this kind of betting games will not be planned, but are very spontaneous. Therefore, this project supports an easy and quick way to perform these types of games. TiVo, for example, has two buttons that work adequately here: the "Thumbs Up" and "Thumbs Down" buttons that are used to rate the programs. If someone is involved in a "Shared Play Event" (see next item), the DVR will recognize the usage of these buttons as voting mechanisms and it will share the results with the rest of the members' DVRs as graphic

elements on the screen. The event would be triggered after a simple cue sent via the audio channel by one of the participants.
Finally, it is important to remember that watching television is a social experience, but is also a very intimate practice. A vital requirement to make this micro-communities work is to make users feel comfortable so that they can act as natural as possible.

As a technical side note; a big problem in ITV is how to integrate meta-data into the broadcasting and applications, which can help to have more assets and content to create interactive applications. The good news is that the upcoming standards of digital television include data transmission pipelines and protocols. This will provide an easier interchange of information from the broadcasters into the ITV applications that can be used by the broadcaster and also the user. [30]

On a lighter side, additional actions includes throwing virtual artifacts to the screen (e.g., pillows, tomatoes, water) as a way to communicate your emotions or intervening the image (e.g., changing its colors, fast forwarding). This kind of interaction can be enhanced with the use of remote controls with the same characteristics of the Wii-mote from Nintendo. These devices support the easy pointing of elements on the screen, so that a user may point to an area on the screen as part of their social interaction.

Another interesting application is around advertising. Since traditional television commercials are in crisis, new ways to make them interesting might be offered as part of this ITV solution. For example, instead of watching the same advertising, you can have a special version of the commercial where you can use your remote/game controller to play a small casual game that will engage the user in new ways with the advertised product.

Also, a broadcasting tagging application that offers a way to bookmark events for later discussion or sharing makes complete sense, especially inside an engaged community.

Finally, I believe that the concept of “Impulsive Interaction” is something that has not been proposed before in the ITV community. The shift from broadcast-driven ITV applications to user-driven created-on-the-fly interactions is a major opportunity.

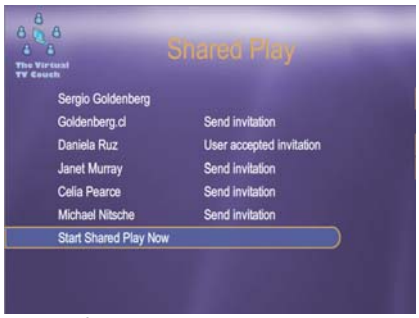
Although many of the applications are very simple, this kind of casual gaming interaction driven by the user makes an intimate connection between the person, the micro-community, and their personal experience of the broadcasted program.

SHARED PLAY EVENT: SYNC WITH THE AUDIENCE, NOT THE BROADCASTER

Most of the projects I presented before, focused on the sharing of live broadcastings, but no one presented an alternative for time-shifted or recorded content. Many say that TiVo changed the way to watch television. Some people today hardly watch live television because they watch what TiVo recorded earlier on the day. Instead of thinking that this might destroy the possibility of watching something together, I believe it presents a great opportunity.

These new television-consuming habits may also be shareable. If all the participants DVRs have recorded the same program, the sharing experience can be possible as if it was a live event. The only addition is that the playback of each DVR will need to be synchronized. Also, watching a DVD could fall into this application. If everyone has access to the same DVD, the system could take care and share the experience, creating a "Shared Play Event".

Moreover, this feature enables something that is critical if someone wants to share the experience with people in different time zones, as in the United States, where the Pacific and Atlantic coasts are shifted by three hours. Without being able to watch a program on a shared schedule, this would be impossible.



Example of a Shared Event creation, where the user sends an invitation to another party

Also, and because of technical differences, satellite feeds are almost five seconds behind cable broadcasts. A fine-tuning synchronization made by the DVRs would be required to have a natural feeling of sharing exactly the same broadcast, without delays and echoes.

REMOTE DVR CONTROL

In order to have a synchronized experience inside a micro-audience it is vital to synchronize the playback between the different DVRs involved. For example, if one of the parties wants to manually "pause" the program that everyone is watching, they should be able to do it and make all the parties devices synchronize and respond to the "pause" command. Remember that watching television is a common constructed experience, therefore pausing to discuss or talk about what they are watching is an important requirement.

Although today this feature is not available, the second generation TiVo devices have Ethernet jacks to connect to broadband Internet. The moment that all these devices are connected, the remote control of all of them should be an easy task. This is an important advance. Television devices, such as set-top boxes, were disconnected from the world except for the use of phone-modems to download electronic programming guides (EPG) updates. With these devices connected to the public Internet, they could potentially talk to each other, and therefore synchronize themselves. The coordination mechanism should not be complex, since the videos are stored locally and the Internet traffic needed is only for triggering command such as play, pause, stop, rewind, and fast-forward.

DVR DATABASE FOR RECOMENDATIONS

The TiVo system stores, processes, and analyzes the television habits of the users in order to suggest and predict interesting programs. Moreover, the company that runs the TiVo platform also uses the information from all the devices to have an aggregated view of the habits of their clients. Therefore, the data that resides inside the DVR could be

used to advise the micro-group which programs their members watch and help them to create shared events.

SCHEDULING SYSTEMS

Finding the right time to sit down together, but in different physical locations, can be a difficult task. However, as with the programming recommendations, the DVR television-consuming data can help since it knows when each user watches television. Since the devices are connected to the Internet, this information can be sent directly to each person's web calendars, mobile phones, e-mail addresses, and so forth. For example, the DVR could send an automated message to all the parties' cell phones during the day to inform them that a premiere episode of the show that they all like was recorded by all their DVRs and suggests a time to watch it together.

Also, the user can check what other parties on their list are watching at that moment (see privacy issues below). If someone is watching something that is of interest, you can invite or join the broadcast of the other party.

SENDING AN INVITATION

If someone is watching a show and wants to invite their micro-network to watch it together, the DVR would allow a quick way to invite them through the Internet connected device. With a few remote control keystrokes, the system will understand that the user wants to create a shared-watching experience. First, each DVR would contact the other parties' DVRs to see if they are available. The device would then check if the program is being broadcasted to all the members of the group. If all the checks are passed, the video will be paused and returned to the beginning and the host will wait for the response from the other parties.

Example of a Shared an invitation received by another party

WEB AND MOBILE COMPANION

Some tasks could be difficult to perform on a television set and with a remote control, especially if you need to synchronize other aspects of your life. The DVR will only know when you watch television, but not when you have planned a dinner at home. Therefore, a website where each party will have the ability to create future planned events, see shared programs lists, and so forth, would be useful.

Also, and since the television sets are not always turned on as computers or cellphones, we have to offer other ways of triggering communication events. For example, future events can be administered on the web (since it is a better medium for complex tasks), and alerts or invitations could be sent to mobile phones. Also, discussions started while watching television might be continued online, since the computer is a better medium for offline, asynchronous, and extended communication.

MICRO-COMMUNITIES

Viewers will have adequate tools to create their own micro-communities. They will also have the ability to add, invite, and erase members that can join shared television events. In addition, users will be able to have numerous groups depending on their preferences. These distinctions might establish groups for football, movies, or family movies interactions.

Although the enabling technology is similar to the one present on any instant messaging (IM) program, the kind of communities that someone will create with this application differs from the ones they would create on Internet communities. The latter kind is focused on expanding your network of friends, but the first type is focused on creating an exclusive, small and closed group, only for people very close to you.

SIMPLE, TRANSPARENT AND UBIQUITOUS

I believe that an adequate approach to solve the challenges presented here, and also for the ITV field as a whole, is to understand that successful applications must be as simple as changing channels on the remote control. Also, and taking from a more abstract and global perspective, an ITV application must be as ubiquitous and transparent as possible. A remarkable quote by Mark Weiser reads: "Machines that fit the human environment instead of forcing humans to enter theirs will make using a computer as refreshing as walk in the woods [14]". My goal here is to create an interface and an experience so simple that it does not disturb the conversations inside the group. The interactions must be quick, simple and they must not interfere with the broadcast content unless that is the user's desire. Therefore, the interaction of the user must be very efficient and easy to understand. The TiVo interface satisfies those expectations and the ideas presented here must follow the same qualities.

ASPECT RATIO AND RESOLUTION

Neither of the previous works on this area talked about the potential differences between a 4:3 and 16:9 aspect ratios, or between standard definition (SD) and high definition (HD) solutions. I believe that the interface design for these different versions of screen might be completely different. Even more, interfaces based on wide screens may be less occluding and easier to present the extra content.

SHARED ASSETS

This characteristic was mentioned in many of the previous experiments, but they were very limited. Opening the sharing of assets (videos, photos) to the Internet should make it much more appealing to the user. Many users already share they photos and videos on Flicker or YouTube. Since this ITV application is connected to the Internet, future modules should allow viewing those assets and even adding enhanced abilities such as voting.

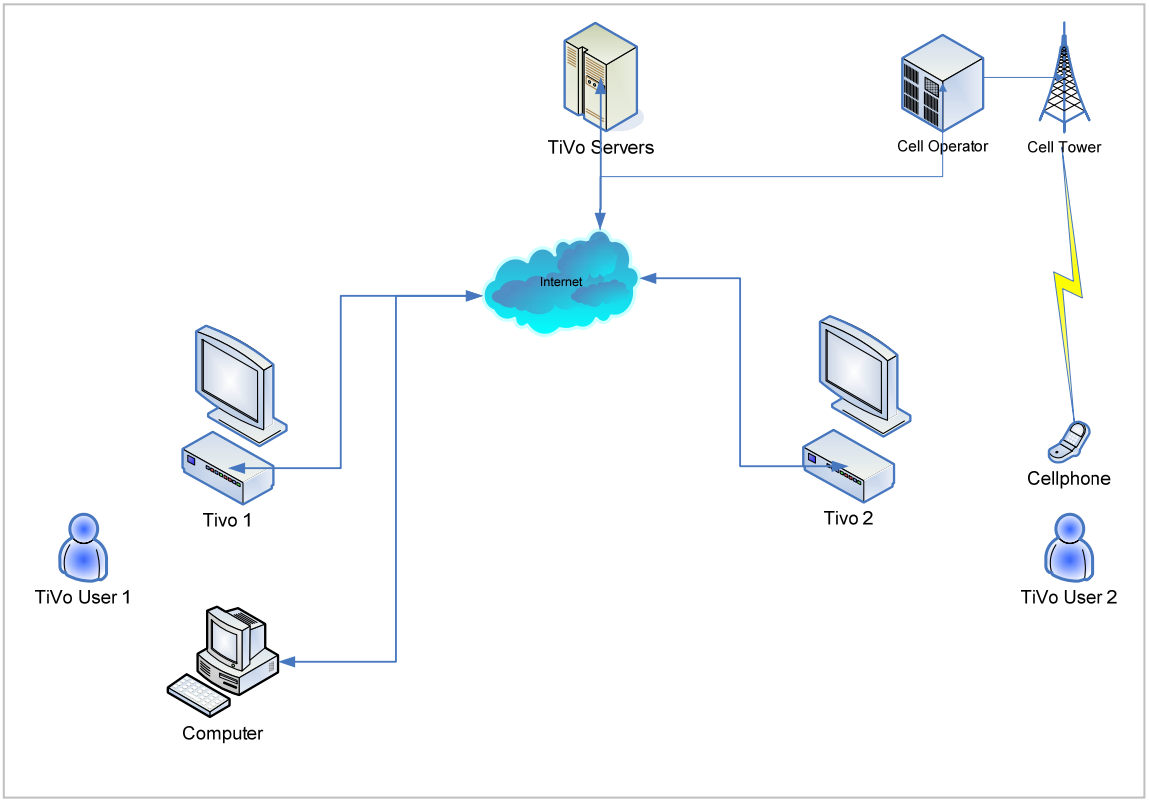
PRIVACY ISSUES

Although I have assumed that these micro-social networks are formed by family members or closed friends, it does not mean that they wish to share everything with the

members of your group. Establishing privacy settings on the DVRs regarding what and with whom the information is shared is a vital feature.

Diagram of the Designed Application

This is a diagram of the overall proposed system



Prototype

While the challenges outlined in the previous sections guided the overall design of my project, the actual prototype that I constructed had to be constrained to something possible to create in one semester. However, my goal is to present a workable product that will show most of the elements of my solution, even if some of their functionalities are not final.

The working prototype was built using Flash 8, Flash Video, Actionscript 2.0, HTML, JavaScript, Flash Remoting, PHP, MySQL, and Skype API. All these technologies were used in order to create a similar experience than the one found on a TiVo platform. The reason why the prototype was not build in top of TiVo is because this platform does not currently allow this kind of extensibility. Also, and to make the prototype fully functional, most of the interactions and content is dynamically generated by the client and they are not hard-coded.

In order to simulate a believable prototype, the prototype needs to be ran in at least two instances, simulating two parties physically separated and connected to the Internet.

Technologies used

FLASH 8, FLASH VIDEO 8, AND ACTIONSCRIPT 2

The client was built in Flash 8 since it is a platform that allows quick implementation, complex coding, and good cross-technologies communication and collaboration. The code was done in ActionScript 2 using classes. The videos where recorded and encoded in Flash 8 video format.

HTML AND JAVASCRIPT

The flash application had to be embedded in an HTML page for two reasons: First, because I am using the Skype API which uses JavaScript as a communication channel. Second, the communication between the Flash object needed Javascript to create a communication bi-directional channel between the Flash file and the external world. To create this communication I used a Flash class called “External Interface”, that allows JavaScript to trigger methods inside Flash (via a listener object), and allows Flash to also trigger methods defined in JavaScript.

FLASH REMOTING AND PHP

Flash applications have limited connectivity with the external world. In order to make Flash gather and post information to an external database engine or a web service, a special connector is needed. The technology is called “Flash Remoting” and it allows Flash to see classes and methods on a PHP script as if they existed inside Flash. Therefore, I can talk to the database as if I was doing so from the PHP script.

MYSQL

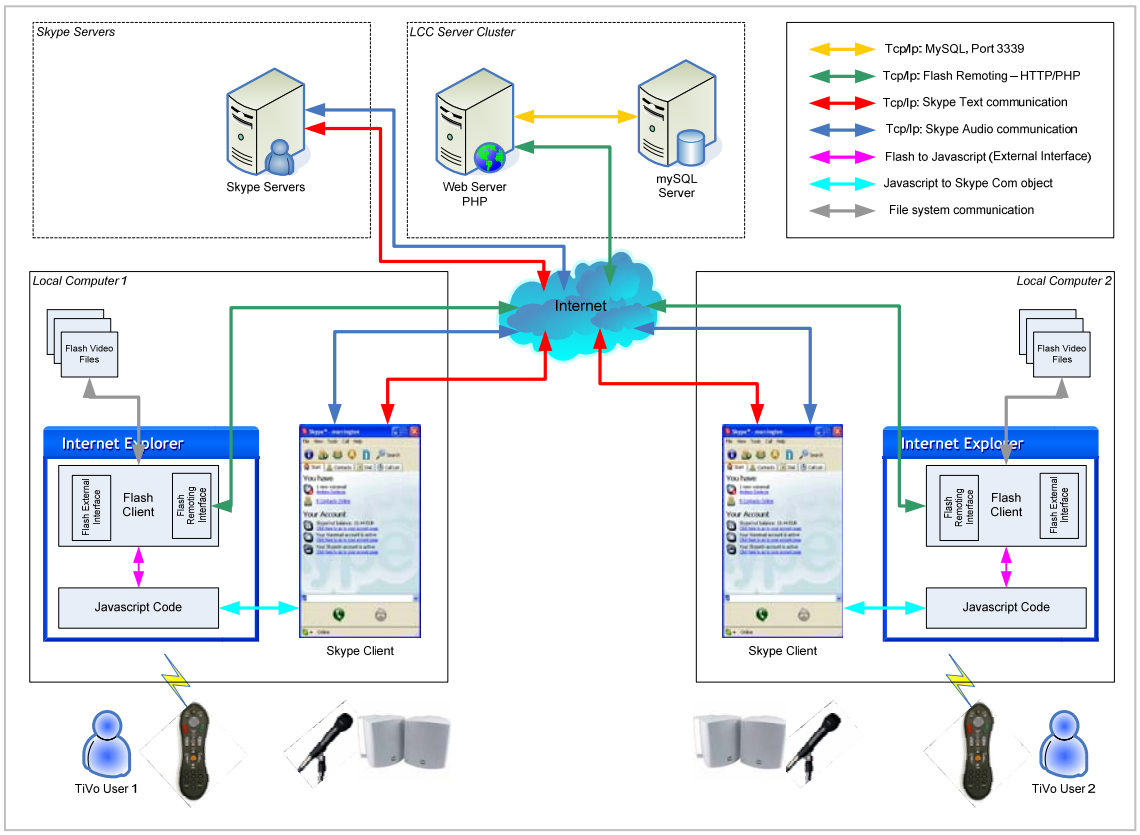
All the information of the users, videos, programs, invitations, shared events, and others are stored in a remote mySQL database, which is connected to the application using "Flash Remoting" technologies based on PHP scripts.

SKYPE API

The Voice-over-IP platform Skype is used in this application for two different goals. The first one is to create the audio channel between the remotely connected users. Skype is a popular desktop application that has a good quality and reliable system of audio and chat communication. The application triggers a Skype-to-Skype call or conference call between the patrons on a "Shared Play Event".

The second application of Skype is the use of its text-chat capabilities. The text messaging is used by the application, and not directly by the user, to send coordination commands back and forth between the connected clients. Commands such as start a play event, or pause a video, or send an invitation, are all sent via Skype. For this purpose I created a Command Protocol that each client understands and processes. These two uses of Skype are supported by the Skype API that allows to control the Skype desktop application from Javascript functions, and therefore, from Flash via the "External Interface".

Diagram of implemented technologies



Features included in the Prototype

The artifact developed for this project includes the following elements from the overall design presented on this document and this is how they were implemented on this prototype:

AUDIO COMMUNICATION CHANNEL

The system automatically starts the audio channel when two or more parties are involved in a "Shared Play Event". By default each patron can speak and hear everyone on the "virtual couch". However, any user can mute their microphone as desired.

Each user will have an icon with their nickname on the "Shared Play Event" screen, so everyone can quickly identify who is online. Also, the icons will glow when a user is talking over the microphone, so that the other parties can recognize their interlocutor.

The audio channel is used for general chatting over the broadcast that everyone is sharing, for triggering conversations, or to cue interactive events.

USER GENERATED INTERACTIONS EVENTS (IMPULSIVE INTERACTION): VOTING

While the users are involved in a "Shared Play Event", anybody may create and start a "voting event" by pressing the "Thumbs Up" or "Thumbs Down" buttons in the remote control. The protocol for this event is the following:

- User X speaks over the audio channel cueing a new "impulsive interaction event": *"Let's vote if Martin Scorsese will win the Oscar this year"*.
- User X starts the "impulsive interaction event" by pressing the "Thumbs Up" or "Thumbs Down" button.
- User X's DVR recognizes that the user is involved in a shared event, and that the pressed button means that he wants to start an "impulsive interaction event".
- User X's DVR changes the screen mode to L-shaped.
- User X's DVR records the vote and sends it to the other parties DVRs.
- User Y's and Z's DVRs receive the command from User X's DVR and recognizes the event. They store the vote and are ready to receive its respective users voting. They also change the screen mode to L-shaped for the duration of the event.
- The voting results will not be displayed on all the screens until the entire party votes.
- User Y and User Z press the voting buttons, and the system sends the vote to the other devices.
- When all the DVRs have the entire party votes, the results are displayed on screen.
- After a few minutes the "event" times-out and disappears and the screen returns to the normal size.

The importance of this display hold until the entire party votes is vital to create the tension and anxiety between the members of the group.

SHARED PLAY EVENTS: CREATION AND INVITATIONS

The user can use the DVR menus to select create a "Shared Play Event", invite some or all the members of its micro-group, and trigger the start of a synchronized event. The protocol for this event is the following:

- User X gooes to the desired Program in the DVR menu, and selects "Create Shared Play Event" option.
- User X selects the user that he wants to invite.
- User X's DVR sends an invitation to the other user's DVR (if they are online).
- If the invited user(s) is on "non-disturb" or "menu" mode, the invitation will be stored until the user changes its online status. However, the user can see its pending invitations on the respective menu.
- If the invited user(s) is "online" and watching a program, the invitation will appear first as an alert on the screen. The user can respond quickly to this invitation clicking the "Thumbs Up" or "Thumbs Down" buttons.

When the system stores a "Shared Play Event" it also schedules to record the desired program locally, so it will be ready for watching it later. It is important to note that a "Shared Play Event" can be created as a future event or can be created as quickly as an event to be triggered in seconds.

SHARED PLAY EVENTS: PLAY MODE

Commonly, a "Shared Play Event" will be created beforehand and will be automatically triggered when the desired time comes. In that moment each involved user's DVR will change to "Shared Play Event" mode and will wait until everyone is ready to start, and then will start the synchronized screening. This means that every party will be watching the same program, played from the local DVR hard drive, but synced with the other parties DVRs.

When the event starts, it also starts the Audio Channel between the parties. Also, while on this mode, any user can change to an L-shaped screen mode and see the other users icons or keep in the full screen video mode.

REMOTE DVR CONTROLS

This element is related to the last item. When several users are involved in a "Shared Play Event", they are all granted full control of the video playback. This means that if anyone pauses, fast-forward, rewinds, stops, replays, and so forth, the video, the user's DVR sends a synchronization command to the other users' DVRs to follow the same playback command.

An important characteristic to note is that any party can leave the event at any moment and reclaim individual control of the DVR.

MICRO-COMMUNITY CREATION, ADMINISTRATION AND DISPLAY

From the Main Menu, the user can list the current "Buddy list", see the user's actual status and activity, add, and delete users.

User Interface Design

The prototype was implemented in Flash 8 trying to mimic the visual design and metaphor used on the target platform: TiVo. Its simple menu structure and screen-by-screen navigation similar to the DVR navigation design was a design goal on this project. The user should not be intimidated to use "The Virtual Couch" inside a TiVo since it will be a couple of extra menus in the system that work in exactly the same way as the other menus.

Some ex amples of the User Interface mimicking TiVo's UI

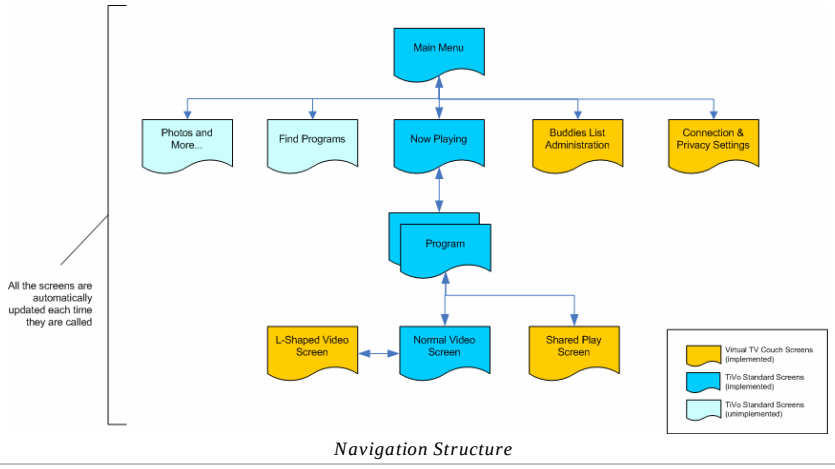
However, in order to add more complex interactivity, such as the ones proposed on this project, I decided to adjust the way that TiVo presents videos on screen. Even when TiVo is using the whole screen with visual elements, it will still present them as overlays over the video playing, which occludes the program behind it. For this reason, this project adds the ability for the user (and the system) to shrink the video screen creating an L-shaped space that can be used for more complex visual elements that need to be displayed on screen. This L-shaped screen is automatically called when a user receives an invitation from a buddy on their list or when the user is involved in a "Shared Play Event" and someone triggers a "voting event".

This screen shows the following visual elements: Voting status, voting results, users connected, name of the video being, and so forth.

Modified TiVo's User Interface to add a L-space for Interaction

NAVIGATION STRUCTURE

Several menus have been added to the traditional TiVo structure. All of them follow the interface design of the other TiVo menus.



Navigation Structure

User Interaction Design

This ITV application is meant to be experienced the same way as people use a TiVo and a television set today. The ITV industry has called this a 10-foot interface because the user interacts with the application from an average distance of 10 feet: from the couch to the television set. Therefore, since this application is designed as an extension of current systems, the overall design is guided by these same systems.

REMOTE CONTROL

The common way of interaction in a 10-foot interface is the remote control, and in this case this is also true. Again, as this project is an extension of the TiVo platform, this prototype is meant to be controlled by the TiVo remote control. The only difference in usage is the implementation of new actions for buttons that already exist for similar features.

TiVo Remote

Future Work

I agree with the notion that exists in the related research presented in this document: that this is a novel and growing area within ITV; therefore there are numerous gaps in the guidelines presented here, even more being a design document and a first generation prototype.

Many technologies and platforms must be opened to collaboration before any of these ideas could be deployed. Although TiVo has an SDK to run applications inside the device, there are no APIs available to connect to the DVR functionality of the system. Also, Internet connectivity is not as open as it is required for a network intensive application like this one.

An interesting next step on this research is to install the functional prototypes in a DVR/PC environment and then evaluate its use by a group of users on a real world environment.

Finally, this project will be presented in the next EuroITV conference that will be held in Amsterdam in May 2007 as a work-in-progress paper and poster.

Conclusions

The goal of this project is to present a novel perspective into the ideas that the industry and academia have explored in the last years. The contribution of this research has been the identification of important characteristics for these shared experiences: A new hidden power behind the DVR, the opportunity of impulsive user-driven interaction events, and the focus on micro-social groups.

DVRs have been overlooked by most previous work, and in particular, they have not seen the potential of its Internet connectivity. When these devices break the "gardened walls", the doors that will be opened will change the television paradigms again.

As I stated before, I believe that the concept of "Impulsive Interaction" is something that has not been proposed before in the ITV community. The shift from broadcast-driven ITV applications to user-driven created-on-the-fly interactions is a major opportunity. Moreover, the fact that DVR devices are now connected to the Internet, the back-channel should not be a limitation as it used to be. Although many of the applications are very simple, this kind of casual gaming interaction driven by the user makes an intimate connection between the person, the micro-community, and their personal experience of the broadcasted program.

The ITV industry has focused for years in the massive interaction of the audience without looking into the needs of the intimate groups of people that want to watch television together. Broadcast-driven interactive applications can be more cost-efficient compared to creating a tailored experience for every person on the audience, but if the power is handed over to the users, they will create more meaningful interactions for them.

Moreover, many of the features and guidelines presented in this research project can be applied to similar realms of video sharing. For example, the latest web products from Lycos, You Tube, and Joost (from the creators of Skype) are applying similar ideas in a video-streaming world, instead of a DVR-local-streaming realm as in this project. I believe that some of the guidelines presented here can enhance those applications or future iterations of them.

The era of sharing has started in the Internet, and now is the time for television. Implementing some of the guidelines presented here can help close the time and space gap of television sharing.

Timeline

	Week 1 8-Jan-07	Week 2 15-Jan-07	Week 3 22-Jan-07	Week 4 29-Jan-07	Week 5 5-Feb-07	Week 6 12-Feb-07	Week 7 19-Feb-07	Week 8 26-Feb-07	Week 9 5-Mar-07	Week 10 12-Mar-07	Week 11 19-Mar-07	Week 12 26-Mar-07	Week 13 2-Apr-07	Week 14 9-Apr-07	Week 15 16-Apr-07	Week 16 23-Apr-07	Week 17 30-Apr-07
PHASE 1: Research																	
Continue literature review																	
Television genres analysis																	
Definitive list of elements to implement																	
List of assets																	
PHASE 2: Developing																	
Assets																	
Video encoding and editing																	
Image assets editing																	
Documentation																	
Update Research																	
Outline																	
First Draft																	
Second Draft																	
DC Conclusions																	
DC ESL Proofreading																	
Final version																	
UI Design																	
Wireframes (interaction design)																	
Visual design																	
Coding																	
System architecture																	
Pseudo code																	
First Coding																	
Alpha version																	
Debugging Alpha																	
Beta version																	
Debugging Beta																	
RC version																	
Debugging RC1																	
RC2 version																	
Debugging RC2																	
Final version																	
PHASE 3: Testing and Delivery																	
Testing																	
Preliminary tests and evaluations																	
Second round of tests and evaluation																	
Presentation rehearsal																	
Delivery																	
Final version printed and burned to disc																	
Defense of project																	
Project revisions																	

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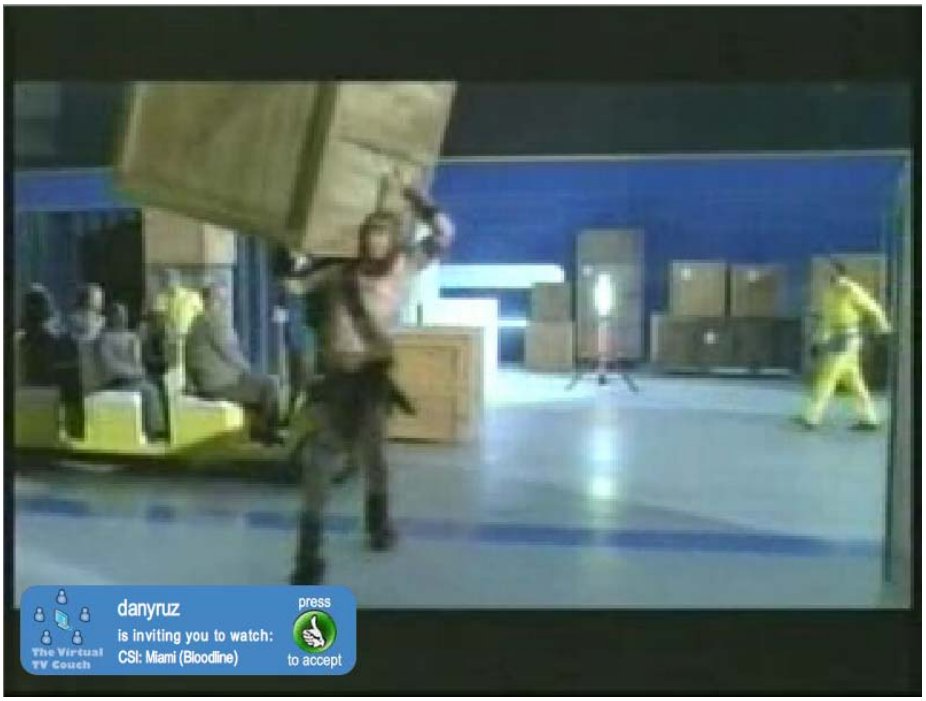
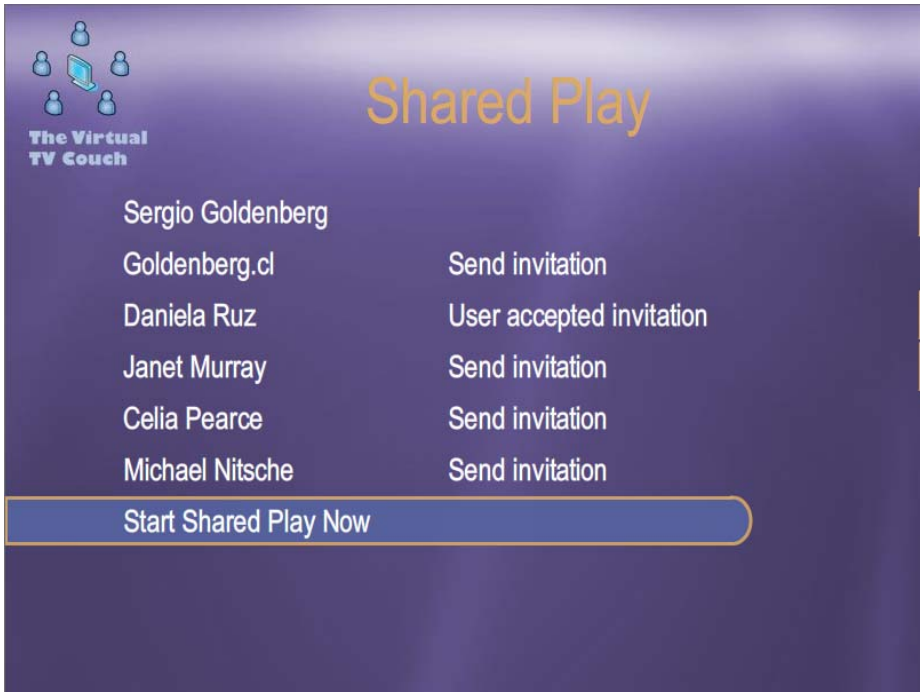
Appendix: Screenshots

WELCOME SCREENS

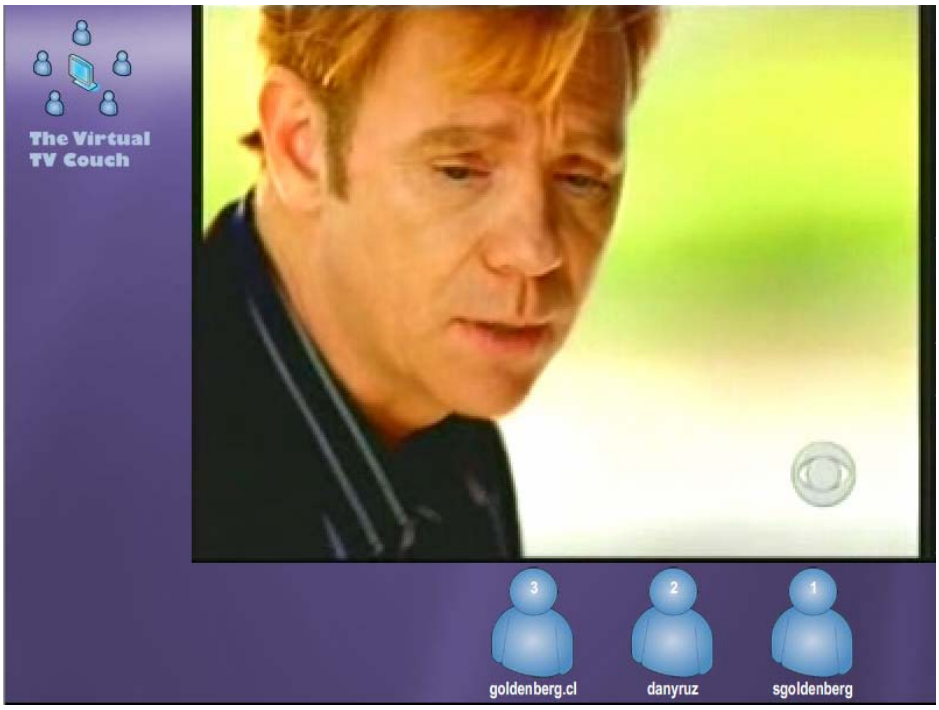
SHARED PLAY SCREENS




The Virtual
TV Couch
Shared Play
Sergio Goldenberg
Goldenberg.cl
Send invitation
Daniela Ruz
Waiting response
Janet Murray
Send invitation
Celia Pearce
Send invitation
Michael Nitsche
Send invitation


The Virtual
TV Couch
Shared Play
Sergio Goldenberg
Goldenberg.cl
Send invitation
Daniela Ruz
User accepted invitation
Janet Murray
Send invitation
Celia Pearce
Send invitation
Michael Nitsche
Send invitation
Start Shared Play Now

SHARED PLAY AUDIO COMMUNICATION SCREENS



IMPULSIVE INTERACTION Screen