

Steps Towards Interactive Television

Kim Halskov Madsen⁺, Rune Nielsen⁺ and Svend Erik Søfeldt^{*}

⁺ : CAVI
University of Aarhus
Aabogade 34
DK 8200 Århus N, Denmark
halskov@CAVI.dk, rune@kollision.dk

^{*} :
Aarhus School of Architecture
Nørreport 20
DK-8000 Århus C, Denmark
Svend.Erik.Soefelt@a-aarhus.dk

Abstract

Interactive television may be defined as a particular form of television in which the viewer can make programming choices and produce user input. The predominant picture as we know interactive television today is that of fairly basic kinds of interaction with the programme content. From the perspective of the use of virtual studio technology, we have been exploring a platform for making new kinds of interactive television in which we take advantage of the fact that when the scenography is digital the viewers may affect what is being broadcast in a significant way and becoming active co-creators. The core of this article consists of the presentation and discussion of five of the experimental steps we have conducted pursuing new forms of interactive television. Our experiences are predominantly positive but some serious issues are also raised concerning the feasibility of mass media interaction.

Key Words

Virtual studio, interactive television, 3D, entertainment

1. Introduction

According to Jensen & Toscan (1999: 15), many media researchers maintain that watching television is always an active and interactive process. Viewers choose what to watch and interpret and make sense of what they see, but this kind of interactivity is no doubt different from the use of the term 'interactivity' among computer professionals and researchers. There seems to have developed a common agreement that interactive Television (ITV) is a particular form of television where viewers have the opportunity to directly influence what they see on their television set in ways which go beyond changing the channel, adjusting the colour, tuning channels and so on. Jensen & Toscan (1999: 17) distinguish between the programme content and the hardware aspect of what constitutes ITV. Concerning the programme content, viewer input is directly included in the programme or affects the course of the programme as experienced by the viewer. The hardware aspect concerns the technology that makes this kind of two-way

communication possible. In short, "we may define interactive television as 'two way TV' in which the viewer can make programming choices and produce user input" (Jensen & Toscan 1999: 17).

The idea of providing viewers with an opportunity to influence a TV programme is probably as old as television itself. Primitive forms include offering viewers the opportunity to write letters pertaining to competitions, political issues and so forth that would then form part of the programme content for the next show, or telephone programmes, which are numerous in respect to all sorts of topics, from posing questions to a political figure to participating in competitions.

Communication using the numerical keyboard of the telephone has been used as an interaction technology, enabling viewers to remotely control a device (a car, a bow and arrow, a gun) or a co-player. A related variant of this is using the phone as a polling device by pressing the numerical keys to vote for various options. Danish television has used this, for instance, to give the viewers the opportunity to vote among five possible movies for a particular evening.

Other creative forms of communication from the viewers have been used. For instance, in the seventies, before the energy crisis, a popular German TV show used the output readings from city power plants as a polling tool: viewers were given a number of choices that appeared on the screen for a specified period of time; during this period viewers then turned on as many lamps and other electrical appliances in their homes as possible, and the technician in the power plant relayed the increase in consumption back to the studio by phone. The choice that acquired the highest increase in power consumption was the winner. In fact, pretty much every conceivable device that lets the expression of a large group of people become visible has been brought to use: in one Danish show, people would vote by throwing pillows out of their windows.

Typical examples of ITV as we know it today include the following:

- The possibility for viewers to choose among several camera views during the broadcast of a sports event
- Other kinds of multi-stream that, for instance, allow a viewer to choose to see a remix of last week's shows or to see the show of day
- Voting polls using the phone system
- SMS messages that appear, for instance, at the bottom of the screen
- Online horse race betting, one of the big successes according to Michael Gass (Interactive Television, France)
- ITV shopping programmes, which allow the viewers to place their order directly while watching the TV shopping programme
- Video on demand
- Interactive games

The predominant picture is that of fairly basic kinds of interaction with the programme content. More sophisticated kinds of interactive TV exist in the research lab – for instance, steerable interactive Television as described by Ronald Pose (2001), which applies virtual reality display technology to transform the role of the producer and the viewer. Conventionally, the producer and the camera men decide the camera angle; according to Pose, the basic idea is to provide each viewer with the possibility to individually select his or her own viewing point, made possible by broadcasting a 360-degree view from which the viewer can choose his individual view. Pose then mentions, without elaborating on the actual implementation, various ideas about how the steerable interactive TV concept could be developed into an augmented reality system that broadcasts a live video signal along with details of a virtual world.

Researchers from Sony Electronics Distributed Systems Lab have been exploring the next generation of interactive Television, see (Marinn, Kent, J & Broadwell 2001), focusing on content scenarios, a web-oriented markup language, and prototype architecture. The basic idea is to postpone the composition process: "Rather than merging all video and graphics elements together in the post-production suite, elements that will respond dynamically to viewer interaction are distributed in parallel, as their own separate asset" (ibid:8). One of their content scenarios concerns weather forecasts in which each viewer is able to inspect areas of a digital globe of his or her own interest.

From the perspective of the use of virtual studio technology, we have been exploring a similar

terrain as a platform for making new kinds of interactive television in which the viewers affect what is being broadcast in a significant way, becoming active co-creators. We have not wanted to be constrained by existing technologies and have therefore used design techniques and design representations such as prototypes, scenarios and virtual video prototypes in addition to pilot productions. According to Floyd (1984), a prototype is the software implementation of an early version that includes selected parts of the desired software. A scenario (see, for instance, Kuuti 1995), is a narrative description of an activity looking at a system from the viewpoint of the user. We use the term virtual video prototype to label the kind of virtual studio production that visualises future usage scenarios of digital technology as an integrated part of the physical environment as we know it in the domain of pervasive computing, see for instance (Bardram, Bossen, Lykke-Olesen, Madsen, & Nielsen 200 or Madsen & Nielsen forthcoming).

In this article we focus on the potentials for viewers' to affect the content of what is being broadcasted as opposed to interface design of televisions set (Petersen, Madsen & Kjær 2002) and ethnographic studies of use in domestic environments (O'Brien, & Rodden 1997) or (Crabtree, Hemmings & Rodden 2002).

To provide the platform for our presentation of the series of small cases we have been working on, we shall briefly introduce virtual studio technology, which is the key technology we have been using. Video from the cases will be made available on www.CAVI.dk no later than early February 2004.

Virtual Studio Technology

The virtual studio is a video technology that makes it possible to combine videos of physical objects, such as people, with video images generated in real time from digital 3D models; see for instance (Moshkovitz 2000 or Lervig & Madsen 2003). This production method results in productions that can be taped live with only a limited amount of editing or broadcast directly allowing for real-time interaction between the TV viewer and the studio in which the filming of the physical objects takes place. This can, for instance, be used in election broadcasts, where election results can immediately be visualized as 3D graphics, and in viewer polls, where the results can generate elements which are part of the digital 3D set. In spite of the delay 0,04 seconds to 0,2 seconds for calculations and synchronizing, the virtual studio is said to operate in real time.

For years, TV broadcasts have utilized blue screen technology. For example, in weather reports the studio host stands in front of a blue or green surface, and this monochrome field is replaced by a weather chart in the final TV picture. The limitation of this classic blue screen construction is that it is impossible to zoom or move the camera. The 3D versions of a virtual studio make it possible to work with a spatial model on the virtual set, where one can put the camera on one's shoulder or on a tripod and move around in the virtual scenography.

In principle, the technology works like this: Physical objects, including people, are filmed in a monochrome, usually blue, studio. A tracking system registers the positions of the cameras and the focus and zoom adjustments. This information is sent to the computer, which handles the virtual scenography in the shape of a 3D model, so that the virtual camera matches the physical camera in the monochrome studio, and from the position of this virtual camera render a picture whose position and focus is identical to the picture that the physical camera is taking at the same time.

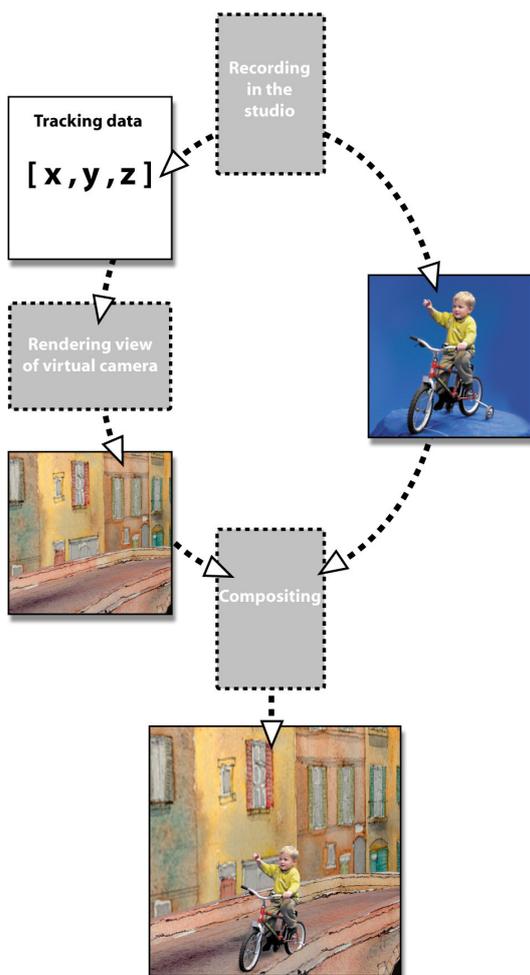


Figure 1 Schematic overview of the process

We now have two pictures in the system: one taken by the real camera in the monochrome studio and one generated by the computer, based on a camera position replicating that of the real camera. These two pictures are composited in the keyer, in a process where the background colour in the picture from the monochrome TV studio is removed and replaced by the computer-generated picture; Figure 1 provides a schematic overview of the process.

Advanced 3D models are made using an external 3D modelling tool like the ones used for architectural visualization. The 3D models are then imported into the software used in the virtual studio, which is created and optimized for real-time production. Or the 3D model is made directly in the software used in the studio; which means that the tool can be used to create geometric standard primitives and animations that in general do not require much calculation – which is necessary to meet the need for real-time rendering – and at the same time, a large amount of ready-to-use material is available in the shape of functions and attributes not normally seen in a 3D programme but which are practical in a situation where time is of the essence. The demand for simple calculation has been met by simplifying the models for use in the virtual studio and limiting details so that lighting calculations are not particularly necessary.

Into the Blue

Into the Blue is an extension of theatre sport, or improvisational theatre, a genre that has been popular for decades in live theatres. The basic idea in this new variant is the virtual studio's ability to differentiate the stream of video between two groups of people, so that group A receives more (or different) information than group B.

In this concept, the type of interaction in this pilot production is in-house, that is, it occurs within the production facility, between performers in the studio and audience in an adjacent room.

Eg, Liechti, Hedegaard and associates have together with the Danish theatre group Ej Blot til Lyst produced a pilot production for this concept, complete with actors, game master, audience and a real-time motion capture animated digital character. The audience in the audience room writes assignments for the actors (“Batman goes to psychotherapist to be cured of vertigo”), and puts them in the game –master’s hat. These are then drawn at random, and next the actors have to improvise a play based on this. The audience can choose among a wide range of virtual sets that can be put on. The game master together with the producer then chooses whether or when the actors

are allowed to see the set on a projection screen in the studio). He can also introduce animated elements, such as shark fins that suddenly pop out of the waves as two actors are contemplating swimming away from a deserted, tropical island; see Figure 2. The blue box also enables an actor wearing motion capture gear to control the animation of digital characters that suddenly pop into the picture.

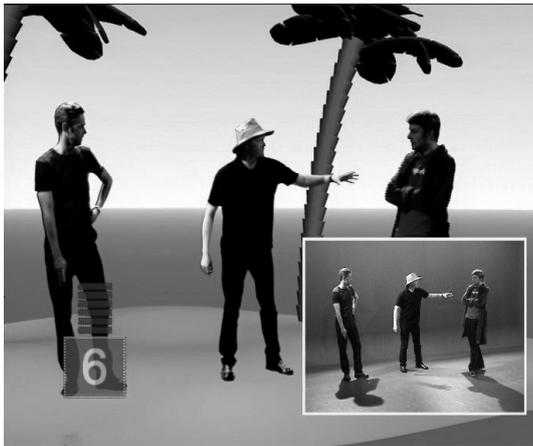


Figure 2 On a deserted island and in the virtual studio

After the experiment, questionnaires were passed out to the audience, and a large percentage replied. The responses showed, in short, that practically everybody had had a very enjoyable evening. As theatre sports programmes have done well on Danish TV, this was to be expected. But would it work with a much larger audience, as stipulated in an interactive broadcast scenario?

A future broadcast version of the programme could be enhanced with input from viewers: on the programme website the viewers could write (hilarious and absurd) assignments for the actors to undertake next; these could be scrolled along the bottom of the screen for other viewers to enjoy and for the game master to select from. The viewers could then vote among a selection of these assignments, and a selection of sets, visible as thumbnails on their computer screen, by clicking with their mouse.

But would the viewer feel confident that his or her brilliant little contribution would have any impact on the programme whatsoever, in particular if the number of participants prohibit all the contributions from being made available for polling?

Cyberhazard

Cyberhazard has as one of its roots a Danish game show in which one team member of a team of two

guides the other team member through an invisible maze.



Figure 3 In the studio

Cyberhazard, developed in co-operation with the Danish production company Zentropa Interaction, takes advantage of the virtual studio's ability to distinguish between the almost invisible world of the studio and the much richer visual world of the composite video stream, which makes it possible to establish a situation where one person knows more than the other, see Figure 3. We have produced a virtual video prototype illustrating the programme concept; however, none of the interactivity has yet been established as a working technology.

The programme addresses children from eight to twelve years of age. The genre is the computer game, and the basic plot is that a child gets sucked into the Internet, see Figure 4, and finds herself present in its virtual world.



Figure 4 The opening scene from the virtual video prototype

According to the scenario we have developed, two school classes have been selected to play the game, and before the game can begin they are introduced to the virtual studio technology. The two competing groups of children are seated in a room adjacent to the studio, and from each team one child is

appointed “pilot”, one is appointed “fighter”, and the rest cheer.



Figure 5 The fighter in the studio

The fighter enters the studio, which, of course, is just a blue box, so all she sees in the beginning is a grid of lighter blue lines on the floor, see Figure 5. The pilot, however, sits in front of a screen showing the composite video stream, see Figure 6. The task of the fighter is then to navigate a hazardous maze solely on the basis of the verbal instructions from his pilot. The pilot can direct her from square to square – for instance: “go one east and two north!! strike left for the dragon“. As an additional element, the pilot has a limited number of tiles he can add for the hero to step on, see Figure 7.



Figure 6 The view of the pilot

As the game progresses the trials become harder, but at the same time more aid is given to the fighter. For instance, short flashes of the composite are shown on a projection screen in the studio, or on VR glasses made available to the fighter, but monsters also appear in the studio (actors in monster suits), which are of course visible to the fighter. When the maze is completed or the fighter is dead the competing team takes over.



Figure 7 Tiles to step on

As an alternative we have created the following scenario, which involves the viewers as active participants. They are randomly selected by the computer among the applicants on the programme’s website, and they play the role of pilot and can direct the fighter in two ways:

1. Through audio commands.
2. Through a “chessboard” on their computer screen, duplicating the light blue grid on the studio floor. Clicking on a given square on the “chessboard” lights a corresponding blue LED on the studio floor, communicating to the fighter where to go next.

The game can be extended to include teams formed between battles – i.e., the weekly programmes – for instance, school classes from geographical areas. The team members play the game on their personal computer by clicking on a particular square on the chessboard (within a set time frame), and the chessboard with the most hits becomes the team’s choice, and the corresponding LED lights up.

The feedback that we’ve received indicates that the aesthetics, the plot, and the game play is well suited to the target group, and that the combination of the sci-fi universe and the gadgetry of the virtual studio holds a strong appeal to the target group in question. However, will the game play hold sufficient fascination to last throughout the intended series of programmes? How long will it be interesting to see a man running around in a blue box, slaying dragons that aren’t there? Granted, the virtual studio allows for spectacular sci-fi scenery, but the basic game could be staged by just putting a blindfold over the man’s eyes.

Blue versus Red

We have explored the potential of experiences of a social nature – of togetherness and of belonging to a peer group – based on the possibility of “hive

thinking”, that is, the uncanny ability of a large group of people to work together as one with only little preparation and limited internal communication, like a stadium full of people landing a flight simulator aircraft in unison, see for instance (Carpenter & Carpenter WWW). This type of concept offers the potential of one’s experience of being an active part of a large team and imparts a feeling of elation comparable to what one feels when watching a major football game when one’s team is in the lead.

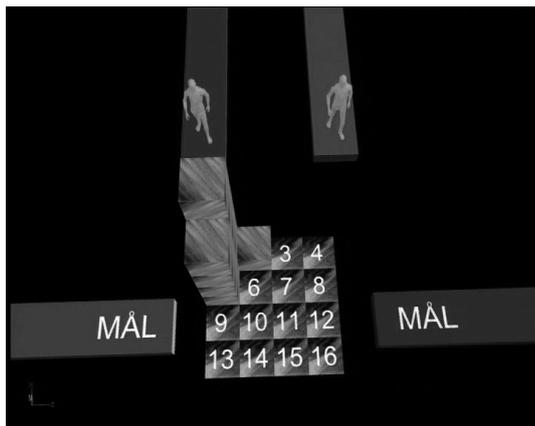


Figure 8 A snapshot from the animation

We have made a short animation illustrating the concept behind Blue Versus Red: two players in the virtual studio are the protagonists for two teams, the red and the blue one, respectively, see Figure 8.

The basic scenario is as follows: On your computer at home, you enter the programme’s home page, select your army, and follow the broadcast on your TV set. In turn, the two armies then have to build virtual bridges across a void for their heroes in the studio, two actors, one male and one female, for instance, in suitably martial costumes. The bridges are made up of building blocks that have to be stacked to a specific height to allow passage. It requires a given number of players (a calculated percentage of the players that have logged on) ticking with their mice in a little frame to build one block. An army has to build the correct number of blocks for one section of the bridge to be passable; too many blocks, and some players will have to un-tick until just the right number of ticks has been achieved. Thus, the army with the players that are best at “feeling” their team –mates’ intentions will be the most successful.

A number of variations of the game play are possible, and experiments must determine the level of complexity that is possible in this type of programme.

Scenario variant number 1: Each team deals in turn with one and just one stack of building blocks at a time within a specified time limit. When a team has reached the correct height of a given stack inside of its allowed time limit, the studio game-master allows it to progress to the next. The player’s interface only allows tick/un-tick. When the time is up, the opposing team starts building.

Scenario variant number 2: The player’s interface shows a grid resembling a chessboard. The players may place a building block on any of the squares of the board. It is possible, then, to entice one’s fellow players to follow a specific strategy, such as whether the team should go left or right around the board. The teams still play one at a time, within given time limits. On this level it is also possible for the game master to act as a coach, who through suggestions and warnings can contain emerging chaos.

Scenario variant number 3: The two teams play simultaneously. This will enhance the competitive element but might prove to be too complex: not only do the players have to guess their team mates’ intentions, but they also have to relate to the action of the opposing team, because the teams have the possibility of obstructing their opponent’s progress.

The concept promises unheard-of levels of presence or in electronic media. Today we can cheer our favourite football team with mates in the local pub, but this type of programme allows us to actively participate.

But will it work? Our next step is to establish an experimental set-up to determine the possible level of complexity with a limited number of players (ten to twenty). However, if it works, will it also work with 1000 players? 10,000? It remains to be seen to what extent our experiments can be extended to a larger number of participants. Other questions must be addressed: Will the viewer actually feel that his/her influence is noticeable, and that just clicking with a mouse is a sufficient level of involvement? Will the combined efforts of the players actually progress towards an equilibrium (within an acceptable time frame), or will oscillations in the feedback just increase towards ultimate chaos?

Other components might be considered, such as upstreaming audio from the players to the programme, so that the players can yell and chant in unison like at a real football match, or writing cheery slogans from one’s keyboard onto a large screen above the game area of the virtual studio.

Super3DHome

Super3DHome is the name of a series of experiments carried out in collaboration with Superflex, a Danish art group that works in the field of art, engineering and science; (see, for instance, Steiner 2003). Rather than working with art in a conventional sense, Superflex makes tools for engaging users in social collaboration. Their projects vary from biogas systems implemented in Tanzania to digital communication platforms like the virtual city Karlskrona2 and the web-cast community Superchannel. The underlying philosophy of Superflex's works is that art itself is a tool, not just for contemplation or aesthetic experiments, but for social empowerment. Superflex often collaborates with different experts and uses the art world as a showcase for their works.

In autumn 2001, Superflex was invited to CAVI to do a production on the virtual set. Several meetings and two days of production developed Super3DHome, which grew from the Superflex tools Karlskrona2 and Superchannel and ideas of interactive communication across platforms. The original idea was to have an interactive set design during a live broadcast by giving on-line users represented as avatars the possibility to act in and construct the virtual set. Because the setup controlling the virtual set is a rather closed circuit, not meant to be controlled or affected by external input, it proved to be too big a mouthful to solve the initial idea. Instead, different workarounds and experiments were carried out using Karlskrona2 and Superchannel.

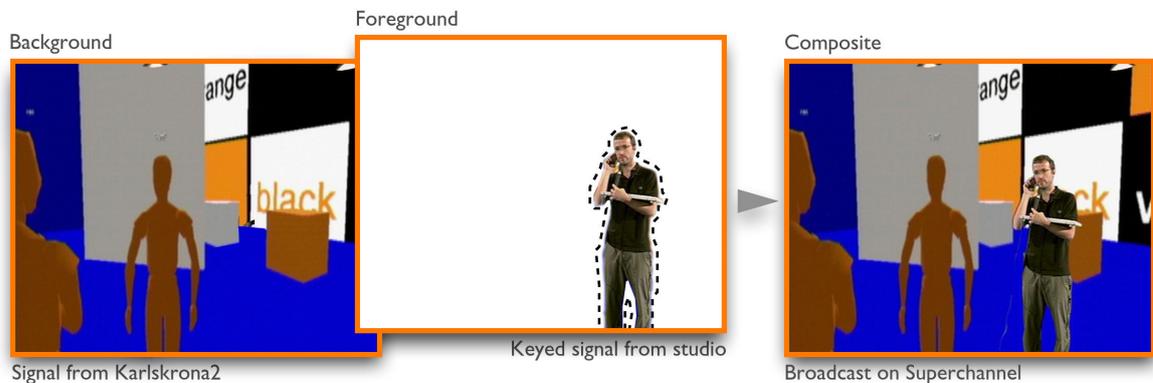


Figure 9 First setup

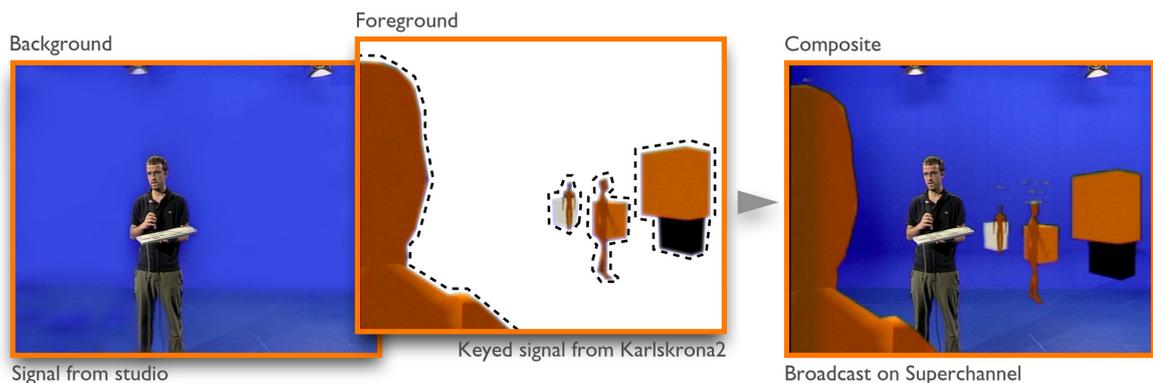


Figure 10 Second setup

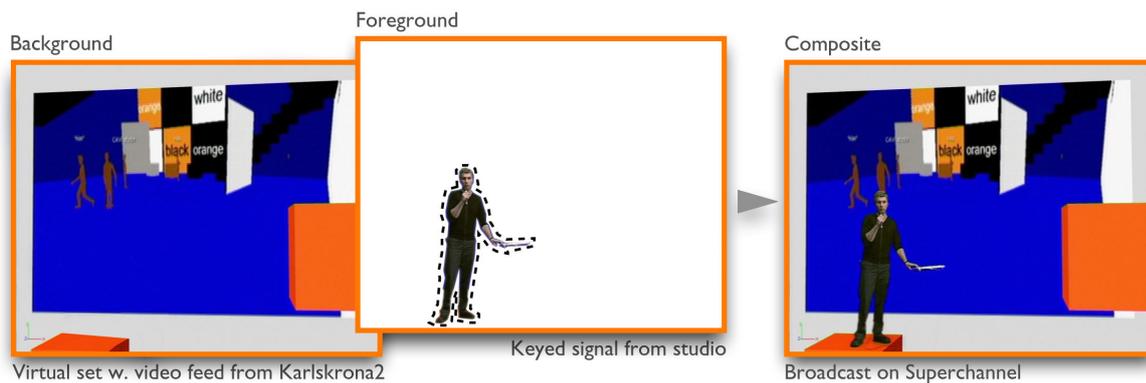


Figure 11 Third setup

Superchannel is a network of local independent web-cast channels that allow users to produce their own Internet TV. The channels represented on Superchannel are all associated with one or more local studios, including ones in the city of Chiangmai, Thailand, and Liverpool, England. From the Internet platform, Superchannel discussions and presentations are live streamed and the users can chat and access archived shows. In general, the shows on Superchannel can be characterized as narrowcast, indicating that the content often targets local communities.

Karlskrona2 is a digital copy of the city of Karlskrona, Sweden, accessible through the Internet. The users are represented as avatars and they are allowed to build with 3D geometries, images and text, and to communicate through chat. The centre of Karlskrona2 is built as a rough copy of the real city, but as a result of the use of the virtual citizens certain aspects have changed: the appearance and functions of the areas adjacent to the city centre have been redefined and reconstructed into experiments concerning new ways of living (Nielsen 2002). Originally, the main square of the city was to have a big screen that would make it possible for people in the physical city to look at the digital version of the city. Here it would be possible for the citizens of Karlskrona to follow the activities of their avatars and consider the differences between the two parallel cities.

Through three different setups combining Karlskrona2, Superchannel and the virtual studio, experiments with interactive communication were carried out. First, a dedicated room, a representation of the virtual studio, was built in a waste area of Karlskrona2. The idea was to let the virtual room and the avatars in Karlskrona2 become part of the virtual scenography in the virtual studio where a host could lead a discussion with the users. The mix

of Karlskrona2 and the host was then broadcast live on Superchannel. The experiments made it possible for the users of Karlskrona2 to visually take part in the show by making live changes to the set design by building and by chatting with each other and the host in the studio. At the same time, the users of Superchannel could chat with each other and the host. During the experiments, most of the users used Karlskrona2 and Superchannel, thereby having access to different perspectives, means of communication, and interactive mixed media.

The first two setups did not make use of the 3D possibilities of the virtual set, but investigated new ways to blend the avatars' world with the world of the host. In the first part of the experiments, Bjørnstjerne of Superflex, who presented the show, was keyed onto the signal from the dedicated room in Karlskrona2, see Figure 9. With a delay of twenty seconds, the users of Superchannel could then see a composite of Bjørnstjerne, who seemed to be in the same room as the avatars, who were building and chatting with him.

The next experiment shifted the foreground and background. The setup took advantage of the fact that the dedicated room in Karlskrona2 was built by blue walls, allowing it to be used as a virtual blue screen studio. By this means the avatars were keyed onto the pure signal of Bjørnstjerne in the blue studio, see Figure 10.

Both the setups consequently superimposed the physical host onto the virtual avatars or the virtual on to the physical without taking into account which part of the worlds perceptively belonged in the back and the front of the other. It was very obvious that the two perspectives seemed to slide on top of each other, and therefore the illusion of doing a reliable blend between the two worlds never really succeeded.

Even though the perception of the composite was challenging to the users, the communication between the two worked out fine. The live stream on Superchannel made it possible for Bjørnstjerne to communicate with the avatars in Karlskrona2 and the viewers of Superchannel through the live audio and video stream and chat. Different discussions took place about how to furnish the set design, and the online avatars answered by building common constructions, writing texts on signs, and so on. During the show Bjørnstjerne even used a mobile phone to communicate directly with more of the avatars and in this way a new and external way of communicating was integrated into the experiments.

As a result of difficulties encountered with blending Karlskrona2 and the virtual set, a new approach to combining the two worlds was attempted. Instead of blending them, a video feed of Karlskrona2 was displayed on a surface in the virtual scenography, see Figure 11. This divided the two worlds into two separate logics of perception that were easier to understand as if there were a window from the virtual set design in the blue studio looking into Karlskrona2.

As in the previous experiments, this setup formed the basis of discussions with the virtual avatars. Votes were held by using the avatars ability to make gestures; for instance by waving with their hands they could vote for or against suggestions made for change in the virtual set. In similar ways various experiments were conducted concerning how to involve people in set re-design.

The two worlds having been divided into two, the set design had to be copied and reproduced in the blue studio in order to become part of the virtual set. This was made possible by doing real-time modelling that imitated the set from Karlskrona2 during the live show. In this way they recreated the avatars' proposals in the virtual set, making, for instance, a chair for the day's host, and carrying out experiments with texturing with screen dumps taken from inside Karlskrona2.

Super3DHome was a success in terms of its creation of communication across traditionally separated platforms and technical solutions, but because of its experimental character it only vaguely indicated a concrete use for the setup itself. Nevertheless the potential of the experiments may be found in the possibility of having a central host in control of a distributed discussion and a common 3D construction. For example, it has been discussed whether the setup could be used in relation with urban planning, enabling a group of experts to lead

a public debate, or in distributed teaching, which could take advantage of the 3D and streaming possibilities to be more visually communicative. This would question the aesthetics of the set design, which in the experiments described is deliberately primitive in its shape and colour palate, because it would demand a discussion of the tools and rules defining the common space. Public discussions of urban planning, for instance, require more specific tools for constructing and visualising architectural ideas and discussions; see, for instance, Nielsen (2002). The users ability to manipulate the virtual set and thus directly affect the composite broadcast show also raises the question of how to coordinate many users in a shared environment

Dating in the Blue

Dating in The Blue is a concept for an interactive TV programme developed by Rohde, Bundgaard, Hovgaard & Krogh (2003) which has been realized as a video prototype, see (Bardram, Bossen, Lykke-Olesen, Madsen, & Nielsen 2002). The TV concept combines elements from reality shows and the direct communication that takes place on dating chat sites but with the particular difference that the communication is broadcast weekly at a scheduled time.



Figure 12 The viewer's living room

From a technical point of view, the interface in the viewer's living room consists of a large display integrated into the wall and a fingernail-sized input device. The viewer has the opportunity to have several windows open at the same time – for instance, to see several camera angles at the same time or view more than one program at a time in separate windows, see Figure 12. Using the fingernail input device, which emits a spot of light, along with voice control, the viewer is able to interact with the system by, for instance, opening, closing and moving the windows. A camera (the TV home cam) which enables viewers to

communicate with other viewers and with people in the studio is an integrated part of the system.

The interface in the studio consists of a large monitor wall, either virtual or physical, showing video from the homes of the people who are connected to the programme and enabling people in the studio to communicate with people in their homes, see Figure 13.



Figure 13 The guest in the studio

Dating in the Blue is a specific case of a general concept where viewers can sign up to participate in a TV programme and become direct participants in the programme, communicating directly with other viewers as part of the programme or as a separate parallel stream of communication. A number of guests are invited into the studio, and the basic idea is that each of them in turn gets the opportunity to find a person to date among the viewers who have signed up for the programme and who, by using the home cam, appear on a huge monitor wall, see Figure 13. The guest walks around in the cylinder while the floor slowly moves upwards. If the guest wants to get in touch with one of them she points at the specific monitor and the two can communicate. For a period of fifteen minutes the guest has the opportunity to select up to three candidates for a date. The hot/not barometer offers all viewers to affect the events – for instance, if the viewers predominantly vote ‘not’, the connection between the guest and the person to whom she is talking is disconnected. An additional feature is the interaction between viewers who have signed up for the programme, which is made possible by a camera view that viewers can select at home and that browses the monitor wall, enabling a viewer to identify another viewer – each of whom have been assigned a unique ID – that he or she wants to get in touch with. In this way two viewers may be in contact with each other independently of the part of the programme that is being broadcast. When a viewer establishes contact with another viewer a

new window automatically opens. With a wireless TV home cam there is the possibility for viewers to show their home, dog or garden to other viewers.

But a number of pertinent questions nevertheless spring to mind. We know very little about the nature and functions of the social space created in this type of programme. Dating on the net has become popular, but basically because anonymity is granted, and a slow unveiling of one’s identity possible, progressing as one becomes more confident in the person with whom one is communicating. In this programme concept everything is up front: everyone can see on broadcast TV that you’re looking for a date. What about “saboteurs”, perverts, child molesters? Will a filter, akin to the one used in present-day telephone programmes, be necessary?

As mentioned earlier, Dating in the Blue is an instance of a general programme type, and one could easily imagine other specific concepts – for instance, a discussion programme in which viewers would get an opportunity to directly participate. Or a science-teaching programme where pupils could become direct participants in the programme and show the experiments they have been working on or get in directly in touch with other people.

Discussion

Bordewijk and Kaam (1986) have introduced a typology in order to come to grips with the patterns of communication made possible by new media like interactive television and the Internet. The two main distinctions concern who provides the information and who controls the distribution, which leads to four main patterns of communication:

Transmission: A central provider produces and controls the information. Classical broadcast television is an instance of this category.

Consultation: A central provider produces the information, but the consumer controls the distribution. Video-on-demand falls in this category.

Conversation: The consumers produce and control the information. An example of this is email.

Registration: The consumer produces the information but a central provider controls it – for example, a viewer sends in SMS messages to a TV station and the broadcaster decides which of them to broadcast.

As pointed out by Jensen (1999), transmission is the only kind of one-way communication to the consumer. In the following discussion of the experimental cases presented in the early part of this article, we focus on the kind of communication and interaction where the consumer, specifically the viewer, plays an active role in creating the content – i.e. conversation and registration. In the instance of registration, we distinguish between the interactivity at the production facility and between the viewers and the production facility.

Interactivity at the production facility

Everything in the virtual studio can happen in real time: animations can be started and stopped on cue, single elements and or full sets can appear or disappear, and so forth, which the audience or select members of it can control. In *Into the Blue* we saw how the audience could indirectly change the whole scenography, and the pilot in *Cyberhazard* had a limited number of tiles he could add for the hero to step on. Other parts of the interactivity in are handled by the production team, which in *Cyberhazard* can initiate flying circular saw blades threatening the hero, or cause motion-capture controlled characters to enter the play in real-time, as occurred in *Into the Blue*.

A unique feature of the virtual studio is that what can be seen in the studio is different from the composite video, which makes visible to the audience what is invisible to the actors in *Into the Blue* or to the hero in *Cyberhazard*. This feature paves the way for a different kind of interactivity where the composite image may be revealed to the actors or the hero by glimpses in the studio.

Interactivity between the viewers and the production facility

First of all, it must be noted that real-time broadcast is a pre-condition for the kind of interactivity we have been exploring. The kind of interactivity one experience is different from the conventional human-computer interaction because the broadcast medium establishes a centre of sociality like a city square, an arena, a forum, for the events in the programme, that has far more tangible references to the human experience of “being together” than for instance a chat-room on the internet. Being part of *Dating in the Blue* allows the participant to become a TV star for at least fifteen minutes and to meet her date in a glamorous place.

A fundamental challenge when it comes to interactivity in a broadcast context is to address that many people may participate at the same time and herby create qualitatively new experiences in a broadcast context similar to the feeling of being

present at a big event like a football match and become a co-player oneself. Apparently, there are some new types of social spaces which have only been superficially explored, and *Blue versus Red* indicates one of the directions to pursue in this respect.

In *Super3DHome* we have explored different levels of interaction, ranging calling in on the phone, animating avatars and writing messages, to creating and moving elements of the digital scenography. In this case viewers have the possibility to individually interact with a large range of elements, as opposed to *Blue versus Red*, where the effect of the interaction is the collective result of a large number of viewers that have an influence on some primitive elements. A critical issue in this case is whether the viewers actually feel that his/her influence is noticeable and that it makes sense at all. At the other extreme, *Super 3DHome*, drawing heavily on *Karlskrona2*, offers the possibility for individuals to change elements of the scenography, potentially creating chaos. Probably much can be learned from digital communities on the Internet, where one of the lessons learned is that people form their own communities a set up rules for proper behaviour.

Interactivity among viewers

Dating in the Blue offers viewers the possibility to meet via the programme and in an interactive way initiate communication in a separate thread, independently of the broadcast programme, and even to continue communicating after the programme is finished. Those involved probably feel a sense of belonging to a community, albeit part of the community is public.

A culture can develop in connection with the programme, with interested participants exchanging ideas, advice, plans or strategies. In the case of *Blue versus Red* one could imagine an extension where discussions between players could qualify the strategies employed, making it more interesting.

The quality of view-to-view communication is one of the attributes of *Super3DHome*, but a quality that has been inherited from its integration with *Karlskrona2*.

Interface issue

The technical implementation has only been superficially discussed, including two-channel media, that is, the television system along with some other technology such as the telephone or the Internet. The interface issue at the viewer end is an issue that needs to be addressed as well.

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