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Convergence of collaborative web approaches and interactive TV program formats

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Abstract

Purpose – TV changes in several disciplines concurrently: from analogue to digital, from scheduled broadcasts to on-demand TV on the internet, from a lean-back (passive) to a lean-forward (active) media, from straight watching to the consumption of content connected to additional services, from the sole TV viewer to the viewer being part in social networks and communities regarding to the TV content, etc. The purpose of this paper is to demonstrate the adaptation of design and realization of TV program formats to the changes that happen to television. In addition, the paper would like find out how to support the design of interactions, dynamic narrations and content types as well as the role of the internet within these processes and this application area.

Design/methodology/approach – Currently, there exist many approaches towards the development of social, collaborative, and interactive TV program formats and systems. Within the scope of this paper, the authors present latest case studies and example program formats for each case. The paper examines them concerning their interaction possibilities and architecture as well as the influence and utilization of the web. Finally, the paper provides a simple categorization according to the narration character, content, and interactivity types of the listed TV program formats.

Findings – Caused by the collaborative and interactive characteristic of the web, a big influence of the web concerning the hardware- and content-sided development of TV is discovered. Nevertheless, the web's potential is absolutely not exploited in this area, neither to give more dynamic to the narration, nor to appreciate the content type or the interactivity. Finally, the paper identifies a high effort, occurrence and development in the interactivity, in contrary to the narration characteristic and content types.

Research limitations/implications – Only one representative, example TV program format enabling interactions by the viewer for each case in the paper, has been chosen. The authors make no claim to be complete, in covering all genres, possibilities of interaction or TV program formats existing for the field of interactive/social/collaborative TV.

Originality/value – This paper presents an extension of a previous paper presented at the MoMM2009.

Keywords Internet, Television

Paper type General review

1. Introduction

Media transformation from one form to another happened to the field of interactive TV (iTV). The digital switchover of analogue television was hyping around the millennium, and much scientific and applied research aimed at developing the killer application for iTV. Nowadays, we see the emergence of new opportunities in the field of iTV. Two of these trends are social and collaborative iTV in convergence with the internet as information/communication/collaboration media.

TV was a social media from the very beginning, where people gathered to enjoy a football match together, were watching the first steps of mankind on the moon or relaxed in front of an exciting movie. The actual "collaboration" took place outside the media, e.g. in follow-up face-to-face conversations. To enable advanced digital environments for increasing and integrating the social experience, we need to evaluate services from the following three perspectives: the technical point of view, respectively, the system architectures, additional platforms, content types, and social behavior.

In this paper, we see TV as an instance of broadcast multimedia, which "is the common denominator for networked multimedia platforms that involve the use of a unidirectional broadcast channel to convey high-speed audio-visual services to consumers" (Lugmayr *et al.*, 2004). Traditionally, this environment is the typical home TV station, consisting of TV set, set-top-box (STB), and the remote control.

With the development of more advanced media formats on the web, interactivity emerged. The TV environment as such is therefore a changing environment, which more and more adapts ideas of media services as known from the web, or using the web parallel as information/communication/collaboration media.

Within the scope of this paper, we focus on the classification of new interactive social and collaborative TV content, rather than focusing on existing broadcast only platforms and extensions to existing passive TV content. We think, it is necessary to first pay attention to what the viewer already consumes instead of the specific technologies and systems that could be used additionally (e.g. the great application "collaboraTV" done by Nathan *et al.* (2008) where viewer can annotate the watched movie with text, events or gestures). The experience of many existing research work has shown that (most) human-beings are creatures of habit. People accept and consume the existing television as it is – simply as a lean back media with content to view passively. But, as we discuss within this paper, also the curiosity and openness compared with something completely different.

Paper outline

The next section describes the way from broadcasting to interaction, followed by Section 3 which gives detailed information about TV program formats and describes the (social and collaborative) iTV content which is classified in the context of this paper. Furthermore, it presents case studies of existing program formats including a description of their technical architectures. Section 4 then describes the criteria used for the classification as well as the results itself. We summarize our findings and give an outlook on future work in this project in Section 5.

2. From broadcasting to interaction

Television was and still is a predominantly passive entertainment and information media, that is to say, TV viewers are watching content, broadcasted by several

channels, without having influence what content and at which time this content is broadcasted. By the technological advance of the TV standards and hardware itself, but also by other platforms which can further to bring activity into a passive media, the field of iTV came into existence.

iTV can be described by the possibility of merging conventional television and new interactive information and communication technologies. Therefore, it enables active participation/interaction with the media by using the TV environment, requiring special interactive elements added to existing content or considered and built in during the production. Depending on the offered physical interaction possibilities, three categories are established:

(1) *iTV*. This offers physical interaction with the media in form of choices and decisions (Lugmayr *et al.*, 2004).

(2) *Social TV*. This goes one step further, and integrates all sorts of interactive and communication entities. Thereby, it supports "communication and interaction in the context of watching TV, or related to TV content including the study of TV related social behavior"[1]. Existing tools for enabling communication are, e.g. instant messengers, interactive audio or video channels, chats, ambient assisted living services, or user contributed content.

(3) *Collaborative TV*. This more or less combines iTV and social TV with collaborative services. Bachmayer *et al.* (2009), collaboration in the field of television may happen in all stages of the TV production chain (pre-production, production, content offering, distribution, and consumption). In our context, we limit collaboration to the "consumption phase," in that case that the viewer/participant collaborate by consuming the content for solving a common task and/or reaching a common goal.

All approaches require adding special interactive elements to existing content or to produce and build completely new program formats suited for this type of TV. For the interaction itself, special devices and user interfaces are needed – for example, interaction by using the arrow keys of a traditional remote control, or with a mobile phone.

However, much more possibilities are enabled by the convergence of television considering the possibilities of the internet which can act as a pure information, communication and/or collaboration media as the following (Behrendt and Zeppenfeld, 2008) (Figure 1).

Information media

The internet acts as pure information media, offering additional and non interactive information to actual TV content. For example, numerous web pages exist for the TV series *Numb3rs* offering additional information to episodes, actors, news, dates of broadcast, user contributed content during live-shows, and so on (for example on www.cbs.com/primetime/numb3rs/). The application of web concepts as follows is supposable:

· *RSS*. For receiving news about content.

· *Streaming*. Getting more and additional audio and video content for a show, live or not, if desired.
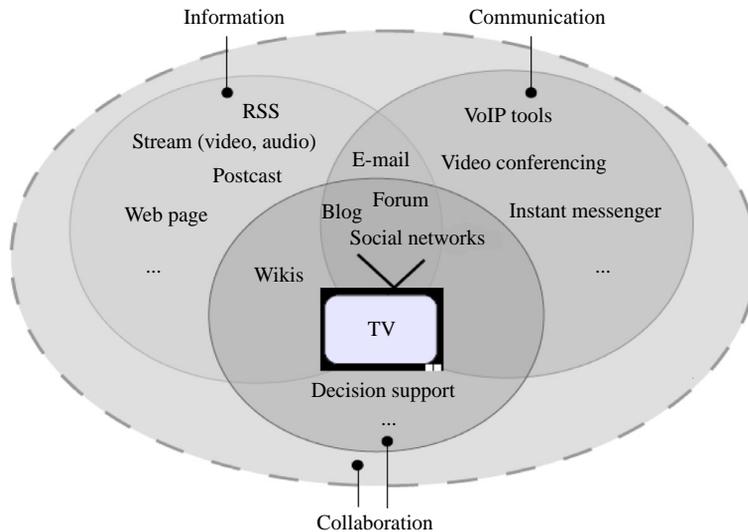
Note: Interactive social/collaborative TV
Sources: Based on Behrendt and Zeppenfeld (2008); O'Reilly (2005); O'Reilly and
Battelle (2009)

- *Podcasts.* Subscribe for additional material (audio, and video) provided to certain TV content.
- *WikiWeb.* A specialized Wiki to a TV series, giving all information about actors, methodologies used in the series, episodes, behind the scenes, and so on.
- *E-mail.* For broadcasting special events or raffles to the subscribed user.
- *Blog.* Similar application scenarios are possible for blogs, forums, and social networks.

Communication media
In this case, the internet acts as a synchronous or asynchronous communication platform to a given TV content. A quite comprehensive example offers the CBS homepage for their TV show (www.cbs.com). It provides Facebook, Twitter, a common Forum and Polls as communication platforms for their TV series as shown for the popular TV series *CSI* on the web site: www.cbs.com/primetime/csi/community/ In the following, the most common web concepts are listed:

- *Social Networks.* Connecting TV viewer with similar taste, preferences to genres and specific content.
- *E-mail.* Offering mailing lists for interested people to subscribe and get in touch with others, actors and producers.
- *Forum and blog.* To enable managed (or not) discussions on the content.
- *VoIP, video conference, and instant messengers.* For discussions amongst the fans, by building special interest groups within VoIP and video conferencing networks as well as within instant messengers.

Collaboration media

Caused by technical limitations, the "TV" itself, as it is used by the middlebrow, offers very limited possibilities for actions amongst displaying content, electronic program guide (EPG), and Teletext or in general simple/limited applications. Therefore, the internet very often acts as collaboration media for TV content by using Web 2.0 technologies for offering collaboration possibilities to the viewer – similar than using the internet as communication media. This was realized for CBS' *Big Brother*, who offered voting possibilities on their homepage: www.cbs.com/primetime/big_brother/. The combination of different web tools enables empowering and connecting the mass of user and establishes a bunch of possibilities like for example, influencing the narration flow of a soap opera as done with *The Truth about Marika* (www.conspirare.se/):

- *Decision support.* Build more complex voting scenarios than on TV only.
- *WikiWeb.* Allows the fans to build up their Wiki about favorite content, connecting Wikis about several TV series which have a common point (mixed episode of TV dramas from the same record).
- *Social networks.* Enable collaborative actions/tools for connected viewer.
- *Forum.* Collecting ideas for prosecution, veto, collective opinions about the content.

Providers and authors of such additional services to TV content may offer those of course, in the ambition to make advertisement and to offer goodies for the fans. Nevertheless, one should not forget that they are able to use this additional occurred content for market research, checking the audience, their ambitions and opinions up to their personal data and preferences.

Note. As you may notice, in some cases, it is not possible to do a strict disjunction of information, communication and collaboration because it just depends on the application of the corresponding concepts.

However, we should not neglect the questions often asked while discussing new television services:

- Why do we need to interact (social/collaborative or not) with content presented on TV when people seem to enjoy the media as passive viewer?
- Which are the most promising services, service domains, content formats for the consumer?
- Which system architectures need to be developed or exist to enable social/collaborative TV extending the current TV technology? And especially, how can other platforms are utilized in realizing services?
- Which possibilities offer (new) web concepts and technologies for social/collaborative TV?
- How do people accept new content formats which were especially produced for social interaction or collaboration?

Especially, the last two questions seem to be exciting and describe the problem circle around social/collaborative iTV the best.

Therefore, our goal is the development of a new collaborative iTV system on top of the television infrastructure. We see the TV infrastructure as extended home

infrastructure, which also includes web-based services rather than pure TV environments. We especially emphasize, the importance of a converged environment, where content formats are the key-driver for successfully deploying advanced social and collaborative iTV services.

Therefore, our goal is to develop a collaborative iTV system that is merged with a special kind of (collaborative) iTV content. To answer these questions, we define the consumer demands, the shortcomings, and the advances of such a system and its potential content formats.

3. Overview of social and collaborative TV program formats

First, we have to understand the concept of program formats in TV. In our context, we use the term "TV program" as a specific content instance produced for TV (e.g. game show). It is a concept of preparing some kind of content for broadcast to the people's home TV station. Thereby, the preparation of the content is essential and contributes to the success of the program. Depending on the composition and content of the program, TV as art form has well-defined genres for its content. For the following part of the chapter, the genres drama/narration, game show and sports program are appreciable and described shortly as follows:

- *Drama/narration.* A drama/narration is scripted and (normally) fictional TV content. An example for drama TV content is the German production *Gute Zeiten Schlechte Zeiten* (http://gzsz.rtl.de/).

- *Game show.* Game shows invite the viewer, playing a role in this special TV program by playing a game (sometimes part of a team) involving answering questions of solving problems usually for money or other prizes. Depending on the construction of the show, the participant resides at home playing interactive or directly in the studio of the TV show. In addition, in some shows, the participants compete against each other or another team, while in other shows the participant is playing alone for a good outcome. To cheer people for participation, game shows often reward players with money, trips or other profitable giveaways in case of winning the game. A popular example is the game show *Who Wants to be a Millionaire*.

- *Sports.* Programs presents newsworthy, national or international sport events.

In contrary to conventional TV program formats, a social or collaborative iTV program format is designed to support advanced forms of television.

Take a narration as example:

- In passive TV, the narration is broadcasted episode by episode. The viewer has no influence on which content and in which order this content is broadcasted.

- Within an interactive framework, passive content is made (social/collaborative) interactive. For this, e.g. interactive elements overlie the passive content, or additional tools are offered on other platforms – typically on the web.

- The design of a narration (content) for interaction in contrary, "desires" interaction with the viewer. For example, solving tasks by the participants influences the process of the narration (e.g. *The Truth about Marika* (www.thecompanyp.com/)). Nevertheless, the narration and interaction flows can happen on different platforms too.

The following subsection presents, a variety of existing social/collaborative designed TV program formats and their architectures behind. To classify the different program formats, we require certain taxonomy for classification. We took the narration cube (Lugmayr *et al.*, 2004) taxonomy for our purposes. The narration cube relates interaction models, content forms, and narration in a 3D cube. Interactivity can be weak with simple interaction devices (e.g. remote control); hybrid across-platforms and devices (e.g. internet and home entertainment system); collaborative (e.g. communication between consumers); or strong (e.g. smart devices or emotional feedback systems). Content can be monolithic with no branching possibilities (e.g. passive TV show); deterministic, enabling a limited set of content alterations (e.g. via narration branching points); ambient by embedding media objects into the natural environment (e.g. TV content follows the viewer into another room). For detailed information on the narration cube, see Section 4.

We emphasize the characteristic features of each program format on practical case-studies.

3.1 Case studies of TV program formats

We decided to do the categorization by the way people can interact with the TV program, not by the genre. Although patterns can be found this supposes some kind of preference between genre and way of interaction – at least for presence (Table I).

In the following paragraphs, the summarized case studies are described and analyzed in detail.

3.1.1 Tele-voting. Voting procedures might be the best known iTV program formats until now, or let us say they are the first generation of those. Their functionality and architecture is quite simple in the way that viewer can vote for/against a person (as it

Case	Description
Tele-voting	Classical example for monolithic content with asynchronous interactivity, where the narration is either linear or with limited possibilities of branching. The branch is decided by a majority vote
Narration TV	Program formats emphasizing consumer interactions to alter the narration flow of the presented content
Gaming	Program formats emphasizing consumers to play by interaction apart/with/against each other, rather than creating content
Mixed story worlds	Program formats emphasizing the mix of story worlds by embedding narration elements into the natural or any other environment. Consumers experience a mix of fiction and reality as part of a program format
Consumers as content collaborators	Program formats emphasizing the content contributing consumer (either implicit or explicit) as part of the value chain
Collaborative formats for social aspects	Program formats emphasizing the collaboration and interaction between consumers, rather than direct collaboration with content

Table I.
Cases of TV program formats

happens amongst others in *Big Brother*, *Idols*, and the *Eurovision Song Contest* or for a special "matter," out of a predefined number of persons/items per phone call, SMS, MMS or internet. The latter one was realized with the *Kabel Eins Magazine* in the Germans and Austrians TV. With this show, viewer could influence the building of a lighthouse by voting for the floor plan, frontage, roof, interior, etc. out of several choices (www.presseportal.de/pdf.htx?nr=699568).

Another different area of tele-voting happens in music television. TV formats like TRL, sent on the music television channel MTV animate their viewer to vote for their favorite songs every week.

An interesting point is that lots of TV channels have to lure their public into voting with special benefits on one hand, on the other hand they make quite a lot of money with this voting procedures by settling up to €3,00 per vote.

This kind of voting became very popular, therefore TV channels started to produce special TV shows based on voting. (Riecke *et al.*, 2008). Meanwhile, the internet became a quite important media for TV content with voting scenarios. It acts comparably as an information and collaboration media. In its function as information media, it offers, amongst others, detailed descriptions, portraits, properties, news, etc. of the persons/items to vote for/against. The collaboration media "internet" enables the act of voting per mouse click via web page (in the simplest case). This combination offers a more complex voting process over a longer period. Voting procedures that happen exclusively via telephone, have limited possibilities and duration since eligible items/persons as well as the phone numbers for the vote must be repeated several times in TV – also beyond the broadcasting time of the corresponding content. One popular example is *Big Brother* which offers the voting per telephone and internet on their web page: www.cbs.com/primetime/big_brother/interact/americas_vote/ including portraits, pictures, videos and so on about the persons/items to vote.

3.1.2 Narration TV. Interactive narration, that is, the ability to interact with stories and influence them by the interaction. This interaction, happens whilst the narrations are being told, represents one clear development path for interactive television. Ursu *et al.* (2008a) define three approaches of interaction combined with narrations in Ursu *et al.* (2008b).

Interactivity enabling simple narration branches. The first one is the choice of linear narrations. It was done in 2004 with the TV crime series *Law & Order* (Ursu *et al.*, 2008b).

It is a similar concept as we described with the tele-voting. The viewer can chose one installment out of several prepared ones by voting for his/her favorite. The voting happens normally via telephone or internet. Its counterpart is linear narrations, where the viewer has no influence on the progression.

Collaboration with content utilizing cul-de-sac[2] application. The second one is about services offered parallel with linear narrations. They can be offered via broadcast to the television set, such as in "enhanced TV" (Jensen, 2005) or via the internet as it was realized with NBC's *Heroes* (www.nbc.com/Heroes/) or for Channel 4's *City of Vice* (www.channel4.com/programmes/city-of-vice/) TV miniseries. In the former case, free broadcast capacity is used to transmit additional content which can be synchronized with the program stream and used interactively. This offers the possibility to access data during the program, at different points in the program or independently. Additional content to the program stream might be for example,

statistics in sports program, additional information about actors and athletes or cross-references to other movies. Examples of enhanced TV give *Big Brother*, where viewer can link directly from the show to enhancements (Jensen, 2005). In case of *Heroes*, the viewer can access additional services via the web like an RSS feed or the *Heroes iStory* (being the main character of an interactive story, shaping the rest of the *Heroes* story and so on) (www.nbc.com/Heroes/iStory/).

Mixed story world. In mixed story worlds, the plot of the narration takes place in different spaces, typically in the physical world and/or internet as well as on the media television. The television content acts as carrier of the story line and action in the web or real-world activities of consumers contribute to the narration flow of the presented content. A special feature of mixed story worlds is their cross-platform character. This type of program format enables cross-platform delivery and cross-media interaction. Cross-platform delivery can be seen as extension to parallel services as mentioned above. The interactive resources are produced as related and specifically spaces, within that viewer can interact by making suggestions or playing a game depending on the TV program. An example for this is Sweden's Swedish Television Channel (SVT) participation drama *The Truth about Marika*. The drama is about a young woman who invites the viewer to help searching for her lost friend. The search took place all over Sweden and happened online. The hub of the search was the web site: www.cons pirare.se for a massive maze of clues, discussions, poetry, art, video, and audio produced in collaboration between participants, the Company P (www.thecompanyp. com/site/?page_id=7) and SVT whereas the internet acts as an all-round media for information, communication and collaboration. For this, several systems operated together, like the TV, smart codes, Java programs, GPS, chat rooms, forums, and so on, just to name some. In a nutshell, they combined the TV, internet, and reality to an interactive narration.

Another example for mixed story worlds is the BBC's *Spooks Interactive* (www.bbc. co.uk/spooks/) (over web) where people interact with the story world through observation tests, puzzles, etc. which influences the way the story unfolds. *Sofia's Diary* (by UK Fiver TV) is a bit different from the listed examples because it was designed to deliver and act with it over the web. Sofia is a teenager constantly faced with dilemmas that viewer can comment on and help to resolve, and their exchanges can inspire and be incorporated into the very short webisodes as they are produced. This kind of show (already been adapted for the USA, Germany, Brazil, Chile, Turkey, and Vietnam) is addressed especially to teenagers, and has a strong bias towards social exchange and development, rather than immersive dramatic narrations. *Akvaario*, broadcasted by the Finnish TV channel YLE, is an example of an interactive production with a more complex organization of the narration: it is automatically edited in real time from a large database of clips (approximately 5,000), according to viewer interaction provided via phone. By keying a number, viewer can influence the mood of the protagonists who "react" to the aggregated input, meaning that appropriate clips are automatically chosen for delivery. However, there is no narration, no spoken dialogue. Scripting was not focused on creating a story, but on generating a conversational space (Sagas, 2007; Ursu *et al.*, 2008a, b).

More similar build up examples can be found in Cesar and Chorianopoulos (2008).

Architecture. Since a lot of examples for interactive narrations exist, we present in a nutshell a general possibility for a cross-platform delivery architecture which was

firstly presented in Ursu *et al.* (2008a). An important thing seems to be the separation of the interactive space from the linear (non-interactive) narration space (Figure 2). Normally, different and unconnected platforms are used for their realization. For example, the web for interaction and the TV broadcast for narration, as used for realization of the above given examples. These technically unconnected platforms are only linked by the viewer's experiences and memories at the delivery end and by the authors at the development end. Nevertheless, the creation of the interactive spaces happens parallel with the narrations. The interactive spaces should be created as places in which viewer can enhance their experience of consuming the linear narrations, by raising issues, expressing opinions and, discussion matters relating to the topic of the corresponding narration. The interactive spaces can be enhanced by the content creators during its broadcast.

Ursu *et al.* assume that this strict separation of interactive and non-interactive space is due to the technical limitations, although a combination of them would be certainly a more natural and maybe more successful approach. However, as we can mention from the above-presented examples, the interactive narration spaces developed so far are quite simple. Most of them use voter choices between couples of possible outcomes to a dilemma. This is miserable but again, might be caused by the lack of effective software to support authoring and delivery as well as user interface problems, limited capacity of back channels and hardware reasons (just to name some).

3.1.3 Gaming. Interactive games are already more often in use. The most common ones are SMS games in which a mobile phone is used as input device for game moves done by sending an SMS, while the TV acts as display for the game states (Reßin and Haffner, 2007). SMS games usually use coordinates that must be chosen by the participants in order to fill a special task, like for example, throwing a snowball towards the host or kick a football to a moving goal. Moves are issued by SMS, while TV sets serve as display device for the game states. Essentially, iTV-SMS-games are pay-per-play games with SMS serving both as method for player input and billing. Although the scope for those game mechanisms is limited, it is exciting for the viewer to become a participant with one's mobile phone in a live show. The mobile-TV game *Horse Derby* goes one step further and turns the TV into a game console. With the
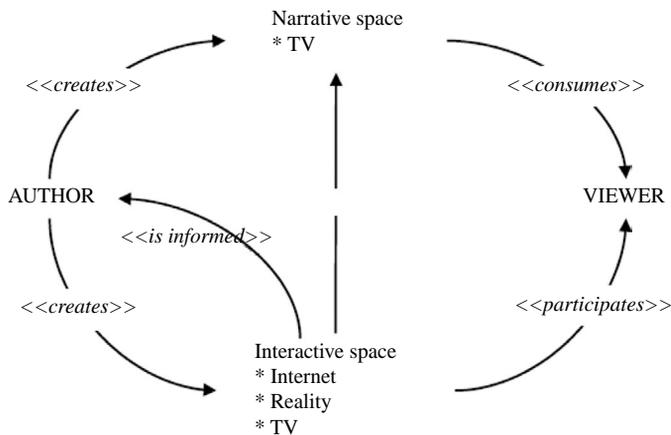
Source: Ursu *et al.* (2008a, b)

phone as game pad, the participant can make his horse faster by pressing the buttons "one" and "three" constantly. Another kind of iTV games like this are the well-known quiz programs as sent on "9Live" in Austria and Germany for example. These quizzes started soon after the first mobile TV games launched. Different kinds of these quizzes exists, most of them are based on luck for the viewer to get through to participations. The questions are mostly ridiculous and easy like finding a female first name with exactly three "A" in it. In these games, one try/message/game move costs several Euros. The prizes are different and ranges from honor for your nickname to some amount of money (Tuomi, 2008).

Even dedicated TV channels only broadcasting these kind of program (like the channel "9Live" in Austria and Germany) were founded earning millions of dollars with voting.

Architecture. We take the SMS game chest hunter as an example for presenting the architecture behind such a game. The game is presented by Reßin and Haffner (2007). In chest hunter, player should reveal yet unrevealed fields on a 9×7 playing field. Depending on the item which was hidden on the corresponding field, the player gets or looses points. For example, an uncovered treasure square is worth 100 points and so on. Its architecture is similar to the voting procedures. The participants send an SMS including the action to be done (speed up a horse, throw something in a certain direction, coordinates, etc.) written in a certain format, containing predefined keywords to a given number. The SMS format for chest hunter is "ki (column) (row)", "ki" constitutes the game code ("chest hunter" = "kistenjäger" in German).

For identification during the game, the subjects were designated by a unique screen name. However, along with the players, several computer players with different screen names would make moves, revealing yet unrevealed fields at random (Reßin and Haffner, 2007). The match of message to screen name happens by using the phone number.

3.1.4 Consumers as content collaborators. Examples in previous sections mostly describe content overlays, where the actual television content is overlaid by additional user interface components to enable interactivity or other platforms are used additionally. A fully different way of program formats enables the consumer being active content contributor. Most existing television systems allow a passive consumer experience and allow limited interactivity. We decided to mention three representative examples of those systems in our paper, or further investigation to illustrate about the differences in producing collaborative content instead of simple content overlays. Since a big amount of those systems exist, we decided to differ between systems for content contribution "Consumer contributed content" and those just supporting collaboration for entertainment. We took one representative example for each category.

Consumer-contributed content. Two iTV systems are presented in this paragraph, namely the EU-IST project LIVE (www.ist-live.org/) since it was tested within a field trial in Austria and the HiTV system presented by Lee *et al.* (2007).

LIVE. The project was done within an Austrian field trial during the Olympic Summer Games 2006. The idea was to build a system that assists the director in producing a digital bouquet of several output streams out of a few hundreds of live streams and archive materials, covering a single event in real time. In behind, the viewer can rate the sent content. Depending on these rates, the producer changes the broadcasted content (Mac Williams and Wages, 2008).

In general, the main architecture of the LIVE system (Figure 3) consists of the following components: metadata extraction and annotation tools, an intelligent media framework (IMF), a recommender and feedback system.

The metadata extraction and human annotation tools annotate, the incoming multi-stream audio-video content from the event.

The recommender system collects and analyses information about the TV consumers, and provides content recommendations.

The IMF manages the access to information across the system in that way to handle information about particular media items and adds semantic information to them.

The goal of the LIVE feedback system is to enable the production team the observation of the viewer behavior and preferences in real-time. The mood of the viewer is collected by their answers on simple questions. The results of this analysis are provided as feedback for the director, showing him the acceptance of the content by the viewer. The director can react immediately, depending on the satisfaction of the viewer.

Formats supporting collaboration. *Explicit collaboration.* Explicit collaboration deals with systems expecting actions by the consumer to manipulate the content or creating additional services to a channel as done by A^{3}TV (de Oliveira *et al.*, 2008). A^{3}TV profits from the new model of the web, where collaborative environments are main concepts. It combines collaborative Web 2.0 and the actual television standards for creating a so-called "CommuTV." A CommuTV results from the combination of a video broadcast with a social network tool, allowing users of an internet community to manage collaborative what is being broadcasted. To achieve this, the system is divided into layers, as shown in Figure 4. On top of this service architecture resides the administration level. It allows creating a CommuTV out of a broadcasted content. The level content feed provides the content for the CommuTV, out of a digital video network or external sources like YouTube. The adaptation layer is responsible for
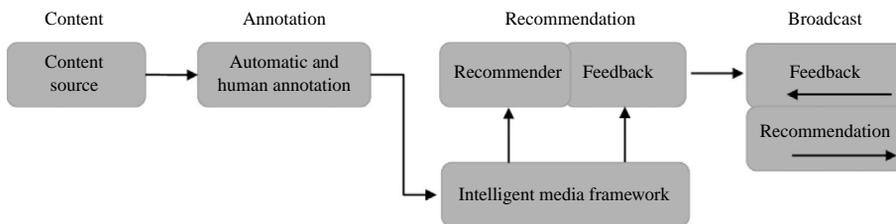

Source: Grünvogel *et al.* (2007)

Source: de Oliveira *et al.* (2008)

recognizing the format and/or the used video codec as well as its metadata. In addition, an adaptation of the video to the service standards happens since provided content is often heterogeneous. Distribution happens via a digital video network, done by the distribution layer. The interaction layer allows the creation of virtual communities attached to a particular TV channel, enabling the interaction between its managing user and other user. The concerning channel can be managed and produced by many user (a community), geographically dispersed, with the possibility of having feedback from the viewer using the same service. Communication is enabled through a forum and a messaging system which allows instant messaging and synchronous conferencing, where the CommuTV hierarchy applies. The presentation layer deals with the services to the user, as system access interfaces, the presentation of visual content through players, systems search, personalization, management, among others, are de Oliveira *et al.* (2008).

Implicit collaboration. Implicit collaboration deals with systems observing the consumer and taking actions in the background. Often, there are smart systems, e.g. recognizing human emotions and triggering actions in the background. An innovative approach is emotional TV, namely the HiTV system. HiTV enables interaction by interpreting the emotions of the viewer. It encourages people reacting more or less spontaneously to the TV content by using a soft sensing ball as input interface. For example, if the viewer does not like the actual TV content, s/he can take the ball and throw it on the TV. As the ball hits the TV, the character inside the TV program will get visually distorted and screaming (Mueller *et al.*, 2003; Lee *et al.*, 2007).

The LIVE system falls in both categories, since the director's feedback consists of implicit (frequency of switching the channel, turn TV on or off) and explicit (ranking for a channel, written feedback and comments to the broadcasted content) user behavior.

3.1.5 Collaborative formats for social aspects and interaction. For the social iTV systems, we want to present shortly AmigoTV (Coppens *et al.*, 2004). AmigoTV is a typical social TV application, which means in the broader sense, that consumers can share their opinions and feeling with friends while watching TV. For that, AmigoTV offers voice communications and multimedia messaging on TV. Of course, AmigoTV also offers the essential function for social TV, namely the community support including (amongst others) a buddy-list, sharing content, inviting-a-friend functionalities, personalization, calendar, emoticons, and avatars (Coppens *et al.*, 2004). Despite of the content delivery which is handled by the internet protocol television (IPTV) platform, the core architecture is build up modularly of the following components (Coppens *et al.*, 2004): the most important components of the AmigoTV services seems to be the messaging middleware providing instant messaging to the viewer and the session management component. It sets up *ad hoc* online communities in which people can interact and update their presence status. The web server storing emoticons and avatars. An real time transport protocol reflector needed for audio conferences and video chat. All non-application-specific services, like administration, profiling and so on are features of the used IPTV platform.

4. Classification
As aforementioned, we plan to compare and classify the presented projects systematically. The paper emphasizes, the importance of the relation between

narration, content, and interactivity modality, related to the narration cube in (Lugmayr *et al.*, 2004) and in its first two sections. But first, we describe the three spaces in detail.

Narration space
The narration can be defined as a place for immersing the viewer into the story flow. Not only explicitly as a kind of co-director, but also by building virtual communities, communication with other interested ones and obtaining natural or narrated multimedia assets. We differ between linear, branched, indeterministic, and evolutionary narrations:

- *Linear narrations (L).* Is a very restricted, top-down story flow without any branches. Its beginning and ending are known ahead. A variety of linear narrations are Cul-de-Sac story flows, with mostly one dead-end branch.

- *Branched narrations (B).* Branches in narrations enable story evolution by offering different alternatives.

- *Undeterministic narrations (U).* This offers more complex narration structures than a simple branch. Undeterministic narrations are realized by creating limitations, places, guidelines, story pieces, and objects where the user can interact. The difficulty here is to find a middle way in openness and non-linearity and direction, e.g. computer game.

- *Evolutionary narrations (E).* This offers the most freedom by letting communities creating their own story flow. Thereby, the end of the story is not predictable.

Content space
We divide the content space into its multimedia assets, which could be metadata definition and multimedia elements (data, audio-visual information, presentation, and animation):

- *Monolithic (M).* That is content, presented to the user with very limited or no interaction or narration possibilities. We can further divide this category into static, synchronized, adapted and real time assets. Static assets belong to simple service types like an EPG. Synchronized ones are content fitted add-ons, adjusted to the current stream like pop-ups. Adapted assets engage to customize assets, running on a specific environment and dynamically. For example, adapting the broadcast to the given bandwidth. One step further goes real time assets which alter the content itself by adding values to it. TV content as we know from a passive, lean-back television environment is completely monolithic.

- *Ambient (A).* These assets surround the consumer and are part of the real world. Of course, this assumes the surrounding of the consumer by intelligent, ambient technology (like sensors, interfaces, and similar). For example, forwarding a TV show to another device in the viewer proximity, while the viewer leaves the living room.

- *Mixed (Mi).* The merging of elements from fictive and real world falls into the category of mixed assets.

- *Synthetic (S).* The system creates a temporary "real world" for the user, where he/she gets absorbed, for example, CAVE (3D graphics projected to several walls) systems.
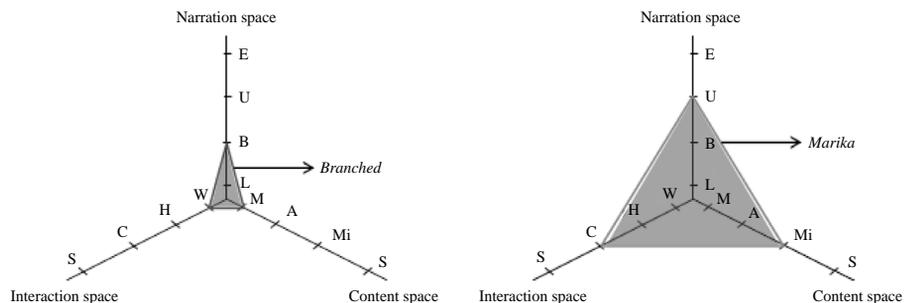
Interaction space
Interaction describes, the possibilities and ability to change the way the content space is presented. Interaction influences the narration space likewise to the content space. We distinguish four levels of interaction, namely:

(1) *Weak interaction (W).* Includes the classical human-computer interaction models. For example, pressing a button on the remote control leads to a predefined (a mostly known) action on the TV set.

(2) *Hybrid interaction (H).* From its basic concept, it includes the same than weak interaction but enables more complex and advanced interaction forms. This is provided by involving any type of interaction device like, e.g. a given broadcast, watched on the TV set, provides additional information to the actual content on any other desired device (like PDA, computer, and mobile phone).

(3) *Collaborative interaction (C).* This consists of inter-human communication, exchanges, awareness, trust, and privacy. Sharing experiences, knowledge and trust as well as performing collaborative actions. The aim might be on one hand to provide from a "collaborative brain" for producing content, additional services, gaming, distribution, etc. On the other hand, such interactivity is used simply for providing social activities to the viewer like exchanging feeling and opinions about the content, building communities and so on.

(4) *Strong interaction (S).* The highest level of interactivity is based on the previous one. It extends interactivity by integrating intelligence into technology, e.g. making complete device functions available to communities or people.

The narration cube supports a quick and easy representation of the opportunities that TV content can provide for participation and integration of the viewer (Figure 5). It visualizes, the focus of the corresponding content (format) and makes the coherency among the three spaces apparent – e.g. a distinctive narration space requires a comprehensive interactive space. By identifying these coherencies, technological advantage can be exploited in combining elements from the narration space to those of the interaction space, offering for example, a library of predefined interactions to certain types of narrations. It also helps in identifying the needs of interaction as well as in creating narration patterns for an ambient content space offering predefined interaction patterns depending on the characteristic of the content space.

Figure 5.
Volume of the spanned pyramid between the spaces gives information about the level of possibilities and their focus

Source: Lugmayr *et al.* (2004)

Predefining patterns and offering a library of interaction to a certain narration space can help to standardize iTV, make it more marketable, easier to produce and easier to use.

In Table II, the aforementioned program formats are listed and classified. The explanations of the features as well as explanatory notes are stated below.

Explanatory notes
In general, the common monolithic content space is noticeable, except *The Truth about Marika* and HiTV. This may be due to the technical complexity of building up an ambient mixed content space. The most complex one is the content space built up for *The Truth about Marika* (Figure 5). It was merged with the real world by hiding smart codes and using GPS as well as the internet as hub for collaboration.

Furthermore, one can notice the simplicity of almost all program formats in mostly all spaces. This result might not be surprising if we think about the reasons. Beginning with technical restrictions of the TV sets and back channels, ending up to the essential simplicity for the consumer, TV should remain a relaxing spare time activity available for all social ranks. In the following, some specific notes are adduced.

Tele-voting. Has a branched narration space. The branches result from peoples voting for their favorite item. We denote this as collaborative.

Narration TV. The simplest form of narration TV "interactivity enabling simple narration branches" often works similar to the tele-voting, whereas it gets the same narration space. The undeterministic narration space of *The Truth about Marika*, BBC's *Spooks Interactive*, *Sofia's Diary* and *Akvaario* can be constituted by the huge amount of possibilities in moving the narration ahead (puzzles, different numeric combinations, etc.).

Gaming. Concerning their narration space, one has to differ between computers or let us say in general more complex games and the TV games we presented in this paper. The SMS games and quizzes can establish different branches, depending on the moves the player does or questions s/he is able to answer. This of course, can influence how the narration of the game unfolds.

Consumer as content collaborator. We can split those kinds of formats into two parts: those which are used for influencing the broadcasted content collaborative – as the LIVE system does with its feedback and recommendation system. And the other which use the concept of collaboration for interaction like creating new content, extend existing content with different add-ons, etc. as A^3 TV and HiTV do. The focus on the latter ones lies on interaction, not on narration, therefore they mostly have a very simple narration space but a complex and collaborative interaction space.

Collaboration for social aspects. The linear narration space is caused by their focus to social activity, less on participating to an exciting and complex narration.

Understandably, the internet influenced the interaction space most until now. This is because of its collaborative, communicative and interactive characteristic (concept and evolution). In addition, interaction additionally on the internet might be more accepted by the user than parallel interaction during the show. We suggest this because iTV applications hardly established on the market until now. This is one reason besides technical limitations and the lack of standards. But despite this, platforms on the web additionally to a given content are more popular. It is easier to realize a comprehensive offer by reaching most of the interested people – if we take the

Program formats	Spaces	Narration space				Content space				Interactive space			
		L	B	U	E	M	A	Mi	S	W	H	C	S
Tele-voting Narration TV	Branches		X			X				X	X	X	X
	Cul-de-Sac		X			X				X	X		
Mixed interactive space	Marrika			X		X					X	X	X
	Spooks			X		X					X		
	Sofia's Diary			X		X				X	X	X	
	Akvaario			X				X				X	
Gaming	SMS games	X				X				X	X		
	Quizzes	X				X				X	X		
Consumer as content collaborators	LIVE	X		X		X				X	X	X	
	A3TV	X									X	X	
	HiTV	X					X				X		
Collaboration for social aspects	AmigoTV	X				X						X	

Table II.
Systematic comparison
of program formats

European Union as example, in the first quarter of 2009, 65 percent of private households have access to the internet (EU-27 Member States[3]). Prospective, the internet will in general influence the TV behavior of the user. The supply of TV content in the internet, which is available 24×7, is growing. Therefore, people will decide what they want to see at which time – a fixed broadcasting schedule will take a back seat[4].

Concerning our scenarios, the internet is also offered/used as collaboration media but in very simple application scenarios (voting, collecting something, and building a common Blog/Forum/...). In consideration of the nearly "unlimited" possibilities of the internet, this is hard to comprehend.

Therefore, scientists working in this area might be interested in the neglected spaces about narration and content. The question that rises is what does it mean to integrate the internet into the content and into the narration? In content space for example, single content objects can be made accessible over the web or backwards. Changes on this objects effect the narration flow, or in general properties of the content directly. Another example is the narration space, taking place on TV and/or in the web alternating. Depending on this, the user gets immersed differently.

5. Conclusion and future work
We focused on the classification and systematic comparison of new interactive social and collaborative TV content, rather than focusing on broadcast only platforms. Furthermore, we checked the influence of the platform "internet" to television content.

Before doing the comparison and classification by the narration cube (Lugmayr et al., 2004), we presented the most representative TV program formats categorized by the way people can interact as well as by the role of the consumer.

Tele-voting, narration TV, gaming, mixed story worlds, consumers as content collaborators, and collaborative formats for social aspects. Additionally, we checked and highlighted the influence and usage of the internet if existing.

The narration cube, we adopted for the classification and comparison in Section 4, consists of the 3D:

(1) *narration space* – immersing the viewer into the story flow;

(2) *content space* – consisting of multimedia assets (all kinds of multimedia elements and metadata definition); and

(3) *interaction space* – ability for the viewer changing the way the content is presented.

We could find out that none of the program formats tapped the full potential, especially in narration and content space – except the format *The Truth about Marika*. We attributed this simplicity by the following reasons:

- Limited hardware resources available on TV environments (STB, back channel, and user interface).

- Simplicity claimed by the viewer. During the past years, we could observe absence of consumer acceptance over TV program formats which are too complex in understanding the rules, flow and interaction (if possible).

- Complexity and costs of production. Especially, costs of a production increase with the levels of our cube.

The influence of the web mainly to the interaction space is noticeable which might be caused by the characteristic of the web as interaction and collaboration media. In most cases, the TV is extended by services on the web offering additional interaction. Interesting research questions come up by spotlighting, the other two spaces namely narration and content space and their possibilities including the internet.

The benefit of our work is the classification of existing program formats to identify similarities, differences and gaps between the spaces. Therefore, we figured out the necessity of predefined patterns and libraries for the single spaces as well as the modeling of coherences between the spaces. This will cover one part of our prospective research work.

Additionally, we will check the ability of TV and in general of broadcasting and streaming content for collaboration especially in a technical (transport, compression protocols, codec, signaling, etc.), but also in an artistic (topic, structure, mechanisms to response the viewer, etc.) manner. In addition, we would like to figure out the possibility of connecting the three spaces of the narration cube into one object/program format and evaluating the role and possibilities of the web in single spaces. Broadcasted content as we know best consists of a linear narration, monolithic content and weak/no interaction – it is completely passive. Most systems take this passive content, enhance the content space with special assets for appreciating the interaction space into a higher level. We would like to connect all dimensions from the beginning – enabling collaboration by:

- designing an accordingly narration space;
- providing and developing all necessary assets (multimedia elements, protocols, codec, tagging, etc.) for; and
- enabling a high-interaction space – and providing this for future productions, packaged in form of frameworks and standards.

The success of Emmy winner *The Truth about Marika*, where a first approach of this connection happens, approves the high potential of this concept.

Notes

1. Definition of social television; web reference: http://en.wikipedia.org/wiki/Social_television (accessed January 2010).

2. Dead-end street with only one inlet/outlet (definition cul-de-sac, web reference: http://en.wikipedia.org/wiki/Cul-de-sac (accessed January 2010).

3. Web reference: http://europa.eu/rapid/pressReleasesAction.do?reference=STAT/09/176& format=HTML&aged=0&language=EN&guiLanguage=en (accessed January 2010).

4. Web reference: http://advertising.microsoft.com/deutschland/Europe-Logs-On (accessed January 2010).

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