

HbbTV based Augmented Information Television with Segment-linked Related Content on TV and 2nd Screen

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ABSTRACT

In this paper, new options are presented for seamless connection and synchronization between linear – passive / lean back - Television broadcasts and interactive – lean forward - online multimedia content as well as 2nd Screen applications. Based on two project examples it will be shown and solutions discussed concerning scene- & segment-based synchronization between the content of information/news/documentary or children TV broadcasts and related additionally 'stretched' online content as well as interactive applications – both on TV and/or on 2nd Screen. The projects and examples are based on the emerging interactive TV standard HbbTV – Hybrid Broadcast Broadband TV. A mixed passive / interactive consumption approach is an important issue here.

The first example is a very well-suited solution for the TV program categories 'news', 'information' or 'documentary' and thus for *informal learning scenarios* involving mixed TV/Internet solutions. This is a joint project with Germany's public broadcaster ZDF for the daily 30-minute news magazine 'heute-journal'. The aim was here to provide viewers with access to synchronized complementary information, simplifying broadcasting techniques and facilitating an intuitive way and non-disruptive form of interactivity and presentation. Other related content and Apps are to be used as flexibly as possible, either on the TV screen, a connected second screen device, or in a parallel manner on both devices. The technical basis for this is HbbTV.

The second example is an actual technical concept study implemented for interwoven TV and 2nd Screen content and application. Firstly, the TV-based HbbTV application triggers the 2nd Screen app to change the presentation, content and functionality of the app. We call this effect 'Application Triggering'. Secondly, there are different content and application types focusing either on television or mobile devices that mutually complement each other – we call this approach 'Splitting Content & Splitting Application'.

This second example will demonstrate the extensive interactivity vis-a-vis creative visual tasks. The 'viewer' should A) directly address a specific topic and B) promote their creative work for the viewer community. The application also allows simultaneous / collaborative work on a mutual creative 'project' and the joint presentation of the results to the public.

The aim of such new technical, interactive, cross-media/-channel and cross-device solutions is to promote '*Augmented Informal Learning with Television-based Media*'.

Author Keywords

Interactive Television, Smart-TV, Hybrid TV, Cross-Device, Second Screen, HbbTV, Connected-TV, Content-Enrichment, Synchronized Content, Informal Learning

ACM Classification Keywords

H.1.2 User/Machine Systems, H.5 Information interfaces and presentation, H2. Database Management

INTRODUCTION

We are presently observing certain important developments in media devices infrastructure in terms of the form of media distribution, TV content presentation form, TV formats, and media usage patterns:

- Exponential increase in the usage of WebTV, Internet-Video and IPTV – both live and on demand. [1]
- Growing number of Internet-connected Smart-TV/Hybrid-TV (HbbTV) devices.[4]
- Growing number of complementary multichannel TV-based and TV-related content[1],[5]
- Wide range of daily information/documentary/popular science programs being broadcast.[5]
- Exponential increase in number of mobile devices in particular tablets and 'smartlets'.
- Increased usage of mobile devices used to view television broadcasts – the emerging 2nd Screen phenomena.[1]
- Growing social exchange while, or associated with viewing a certain TV event or broadcast.[1]

Such developments not only prompt new consumption patterns and needs by the viewers of Television and Television-based media, they also give TV media producers and broadcasters/providers new opportunities in terms of new program formats and possibilities.

The Television sector already has access to novel new forms of interactivity and complementary content solutions. Content can be now appropriately distributed among the various media presentation formats, media channels and media devices, which ensures the most effective media impact and creating stronger bonds between the viewer/user 'viewer' and a specific certain media program/channel/.

Within the scope of 'Cross-Media' and 'Connected TV' approach there are also new opportunities to enrich content and to more closely engage viewers with the provided information. Particularly the interplay between large TV Screens and mobile second screens on Tablets or Smartphones is creating an 'Augmented Television' effect. It means the consumption possibility of complementary, additionally content to the running/playing broadcast – whether live or on demand.

How WebTV and IPTV impact traditional TV consumption

There is no doubt for the still exponential growing Internet based Video and Television content and its usage almost of each Internet user worldwide.[5]

The increasing use of 'Online-Video' also impacts cross-media usage patterns and behavior[7]. Online users are used to instantly and directly accessing their desired video/TV. Linear TV consumption is decreasing significantly among younger viewers in favor of active, time-shifted and on-demand TV content.[5] The interactive and non-linear approach to consuming media or any online content is often based on the ability to setting 'bookmarks', 'marking' or to recording certain IPTV content for subsequent viewing.

Hybrid-TV is the foundation for successful Interactive TV

There number of commercially available Smart and Hybrid TV devices is growing rapidly, increasingly with direct internet connectivity features.[4] However, there is a subtle fine difference between the conventional Smart TV usage based on installed TV Apps on the TV device, and the genuine 'hybrid functionality' of Smart TV as provided by the interactive Television standard HbbTV (ETSI TS 102 796).

Traditionally Smart TV Apps will be used asynchronous to the current running or on-demand TV broadcast/content. Typical applications here include video-on-demand portals, 7 days catch up Television, news, weather or multimedia magazines from diverse publishers.

The 'real hybrid' TV approach means a synchronous connection between the on-screen, on-demand or live TV image and an appropriate TV App or related content. Today we can already cross-link an exact scene or segment on the TV screen with additional online content or/and Apps. From the perspective our research group, this time and content based synchronization between the TV broadcast and related additional content or applications is a very important prerequisite in terms of ensuring the effective functionality of interaction between the passive and active TV related content.

Parallel viewing of TV & Internet with 2nd Screen

There are indications that the parallel use of Internet content and services during the consumption of TV has been increasing over the past few years.[7] Parallel use of Tablets and Smartphones as so called 2nd Screen devices during the TV consumption and in particular Tablets (and 'phablets' or 'smartlets' as small Tablets) has increased over the last two years and is increasingly playing a key role due to the enhanced usability and multimedia potentials these devices provide vis-a-vis conventional smartphones.[1]

Inasmuch as the 2nd Screen trend remains a relatively new phenomenon there are many different definitions and categorizations of the applications. The '2nd Screen Society' distinguishes between three major categories of 2nd Screen applications involving slightly different impacts on media experiences: A) Companion Apps (that complete the viewing experiences – e.g. Tweets to the TV event), B) Converged or Enhanced Viewing Apps (for the 'Momentum' Experience – e.g. current statistics during a live sport event) and C) Viewing Apps (for the Viewing Experience – e.g. Video Library of a broadcaster).[1] Increasingly, these three App categories tend to merge. Our projects are positioned between the Companion and the Converged categories.

The question then arises as to age group differences: which is the 1st or the 2nd Screen of choice? Statistics generally show that young people (14 – 29 years old) are still watching TV content, but usually not on conventional TV screens; this group prefers Laptop/PC, Smartphone or Tablet as their 1st Screen devices.[5]

The next important aspect regarding 2nd Screen usage is the issue of WHAT do 'viewers' consume on their mobile devices while watching TV? An important survey conducted in Germany in 2013 shows that the most popular activities (multiple answers were possible) were checking and writing e-mails (65% by Smartphone/74% by Tablet) surfing on the web (48%/58%), visiting social networks (43%/46%) and more importantly for our project - (26%/42%!) are searching for additional content related to the currently viewed TV broadcast, 41% of Tablet users are searching for information about products offered in TV Ads, and 26% are using TV-related social networks.[10]

With more than 41% of the 2nd Screen activity related to searching information either about on-screen TV broadcast content or Ad content, it can be claimed that a significant number 'viewers' are interested in obtaining synchronous information related to their current on-screen TV content

Information, Popular Science and Infotainment on TV

Statistics regarding the consumption of and offered TV in both Germany and in several other countries reveal a broad range of information-related broadcasts. In terms of genre, information-related broadcasts hold first place in Germany itself (the German language also extends to Austria and parts of Switzerland). In terms of consumption, this genre holds 2nd place, only 3% behind the popular fiction genre. The information genre also appears to interest young people, as it holds 2nd place after fiction and ahead of entertainment, translating to nearly 25% of the entire TV genre range.[3]

'News' is the most demanded information format and TV remains one of the main information sources among different media options. Approximately 80% of younger people, i.e. 'Digital Natives'¹ (average age approx. 25 years) visit at least one news option every day, with 90% of the 'Digital Immigrants' and more than 70% of 'Millennium Teenagers' also interested in daily news services. In Germany, the primetime news show 'Tagesschau' presented on the first public broadcast channel ARD attracts nine million viewers each day, and approximately 4 million viewers for the 30-minute news magazine 'heute-journal' presented by the second public broadcast channel ZDF. Television is still the chief information source and medium for news for the 'younger' audience (up to age 44) with approximately 31-35% using TV and 40% using Internet; for the 'over-44' audience the ratio of TV/Internet is 50% / 20%. [3][5]

INFORMAL LEARNING VIA INTERACTIVE HYBRID-TV

Television possesses enormous potential in terms of visualization and story-telling (drama), indeed an approach that can present information in a very dedicated manner. In recent years, a noticeable change in the visual form and presentation quality of information-related TV productions has been observed. In addition to new optical techniques such as tracking and flying camera shots at difficult locations such caves or water falls, there are mixed animated 3D imaging and FX techniques video shots able to visualize hidden structures in underground constructions or bridges for instance, particularly in the documentary sector.

For so called 'fictional documentaries' – Docufiction – theatrical and dramaturgical elements are increasingly

used and mixed with 'real' documentary film to better illustrate the circumstances, topics and content in a more motivated and appealing form.



Fig. 1: Screenshot from the documentary 'Underground City: London' that integrates 3D visualization elements

These new ways of presenting visual and dramaturgical content on TV can help viewers to better understand complex or hidden systems and promote interest in certain topics. Conventional linear Television remains a time based 'fluid medium' nevertheless. The advent of numerous recording or on-demand techniques makes it possible to pause, repeat and search for further additional related information pertaining to the real-time broadcast.

As stated above, based on the broad range of offered content and significant interest in the information genre, it is evident that the demand for 'informal learning' with TV based content will continue to grow.

More effective and more stable information acquisition and thereby improvements in the informal learning process will occur if 'viewers' are not only watching, playing and stopping 'mono-medial' TV content, but are also able to access information via different medial formats and from different content sources, actively involving them across the entire spectrum of the knowledge acquisition process. Such 'effectiveness' aspects associated with the successful knowledge acquisition and construction are well documented in the spheres of e-learning and multimedia didactics. [7]

At this point provides Hybrid-TV in particular with the HbbTV technique the possibility for the audience to interact 'directly' with the viewing content to a) get additional information in variety presentation mode or from different sources or/and b) to use interactive application for deeper elaboration of the content and the presented problem/issue.

From a media-didactics perspective, however, it is well known that neither deep interactivity nor professionally prepared complementary multimedia content 'alone' are adequate in terms of ensuring effective information acquisition and knowledge construction, nor for an effective learning process. Particularly when 'informal learning' is applied to understand a wide range of different new topics in the TV 'information world' the audience

¹ Classifying audiences as 'Digital Natives', 'Digital Immigrants' or 'Millennium Children' is not uncontroversial, but is appropriate for the purpose of this paper.

needs to be provided with an overview of the specific issue. In the otherwise chiefly self-regulated constructivistic learning environments, the 'cognitive apprenticeship' approach is a major instructional & learning methods. The principle here is initially introduce, demonstrate, explain, help and guide learners to internalize problem-solving methodologies, and then to encourage them to act independently of the instructor in a step-wise fashion. Self-guided information and knowledge acquisition is particularly suited for learners familiar with the issue at hand or those requiring additional information. [2]

Other constructivistic well-known approaches include 'Anchored Instruction' and 'Problem based learning', which focuses on promoting an interesting issue at the start of the learning process in order to achieve deeper interest and motivation among the audience for the presented issue. Here, Television is very well suited as an 'anchoring and motivating engine' with its enormous imagery and dramaturgic potential.

Television broadcasts can be perceived according to the above mentioned approaches and aspects such as 'Motivation, Identification and Overview Streams' or 'Guided Tours' (spoken in 'old fashioned' Hypermedia language) with respect to a topic, an issue or a problem. With the technical options currently offered by Hybrid-TV systems like HbbTV and especially through the segment/topic related synchronized additional content or/and 2nd Screen application pertaining to the on-screen broadcast, 'viewers' can immediately access additional information or become interactive participants via Apps, whether on the TV or on the 2nd Screen. Armed with these technologies, a wide range of effective informal learning methods such as those mentioned above can be offered in a meaningful mix of passive (e.g. introduction, overview, problematization) and active (e.g. additional multimedia content, involving apps) phases and artifacts of the converged TV and Online media environment.

In the two following projects below we have tried to create such mixed and converged interactive and multimedia TV/Online/2nd Screen environments for more effective informal learning.

PROJECT 1: AUGMENTED NEWS MAGAZINE THROUGH SEGMENT-RELATED & SYNCHRONIZED ADDITIONAL CONTENT & 2ND SCREEN

In this project – in association with the second German national public television broadcaster ZDF – we have developed a Connected Hybrid-TV & 2nd Screen real scenario based on the HbbTV standard for the 30-minute late-evening daily news magazine 'heute-journal'. The goal of the project was to give audience the opportunity to access additional more comprehensive, issue-synchronized information on the topic at hand during the live news broadcast (magazine or documentary). The topics generally run between two, and not longer than five minutes. The broadcast stream automatically triggers the

TV and the 2nd Screen device to display additional information – initially as thumbnails or text lines – using 'stream events' techniques, which are integrated into the DVB transport stream.



Fig. 2: Screenshot Project 1 'Connected HbbTV' Application with related content shown on the TV screen

The additional related content appears as a thumbnail tail in the lower area of the screen. A 'short mode' also provided that can display the supplementary incoming information in the non-intrusive form of a text line above the navigation panel (see the next figure).



Fig. 3: Screenshot Project 1 in the 'short mode'

The 'short mode' should take up as little space as possible on the TV screen.

The related additional content will be prepared within an editorial process. ZDF is currently working to automate the content matching process.

In the 2nd Screen App (see figure 4 below) a time line corresponding to the news broadcast time is displayed, which will shifts automatically during the broadcast, as long as the user does not touch the screen. Synchronous to the stream events, fresh information appears at the corresponding time stamp on the running timeline.

In this way viewers still have very easy and intuitive access to the additional information concerning the current presented topic of a broadcast.



Fig. 4: The synchronized functionality of the 1st (above) and the 2nd Screen – on both screens same new content

Initially, the audience is not required to search at any website or media database for the additional information, thereby losing focus on the running broadcast. Both the mobile and TV App present teasers of information related to the current running topic. The viewer can either access the supplemental information immediately via one-finger touch or by selecting the teaser with the RC or by bookmarking this information for time-shifted access to the information after the news broadcast.

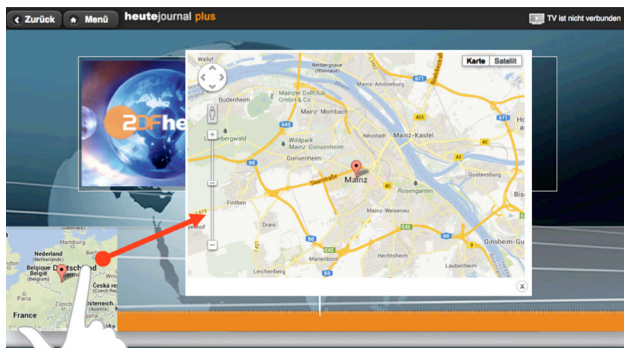


Fig. 5: Screenshot of the 2nd Screen App with the presentation of geographic information for each topic in the news

The viewer can decide to view the additional content on the TV Screen only, on the 2nd screen only, or on both screens. This helps to keep the TV screen as 'clean' as possible, particularly in when more than one viewer is watching the TV screen. The second advantage of the mobile presentation is the intuitive user interface that reacts to touch and swipe gestures to navigate the timeline in order to access the desired topic point.

The connection and the synchronization between the TV and the mobile device will be established through a QR code on the TV screen in the form of session number, which is scanned via the Tablet's camera. The communication then runs via a synchronisation server based on node.JS technology.

This News Application is an example of a 'gentle mix' of the passive and active components of a news magazine, indeed a non-disruptive and very flexible instrument in terms of providing and using supplemental content related to the viewed TV program.

At the present time we are conducting usability tests with the 2nd screen App.

PROJECT 2: SYNCHRONIZED AND CONVERGED 2ND SCREEN APPLICATION FOR INFOTAINMENT GENRE

The second project focuses on HbbTV 'application split' between a TV and a Tablet device to facilitate comprehensive and creative interactivity, especially for children.

The broadcast video shows a graffiti artist and his work; for this purpose we have created a 'gamification' and creativity App for 'graffiti'/painting tasks that functions on tablet devices.

The purpose of the application was to actively involve children in the topic of graffiti paintings and to give them the opportunity to create their own electronic graffiti paintings on several objects, for instance on an underground train wagon or a wall.



Fig. 6: Schematic visualization of the functionality of the project 2

Our Application promotes collaborative work, for example two or more children can work on one graffiti painting together and make the results available for all viewers of the application or the broadcast on demand.

The application belongs to both the 'Split' and 'Converged Apps' categories. 'Split' because one part of the application – the choice of painting object/background – is only possible on the TV device. The painting 'canvas' is only possible on the Tablet device. The gallery of user generated graffiti pictures can be run on both devices.

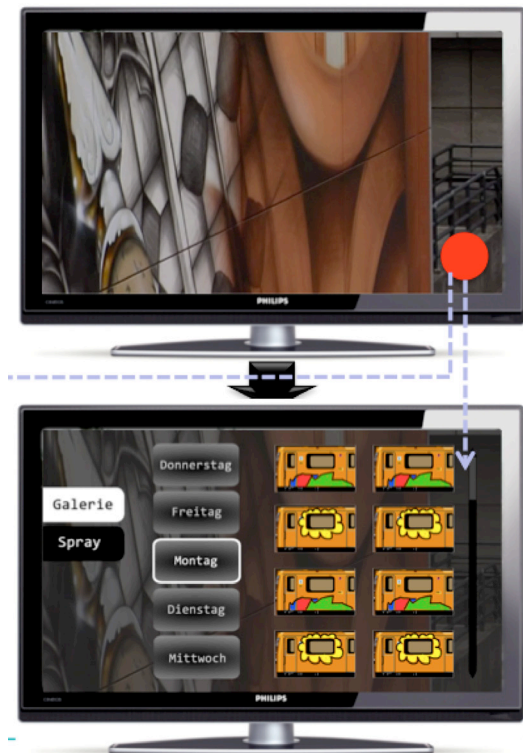


Fig. 7: During the presentation of the 'Graffiti Artist Film' the viewer can start the Graffiti-Application with the Red Button

The application is also 'Converged' due to a seamless connection between the TV and the 2nd Screen components of the application. Moreover, the 2nd Screen App is an extension of the 1st Screen App and is visual completely matched with the 1st Screen App.

In this project we have established a quite new converged technique between the 1st and the 2nd Screen, the so called 'Application Triggering' Effect.

Connected & Social Shared Smart TV Scenario on HbbTV

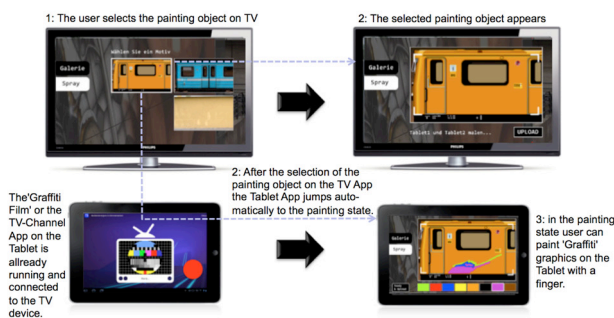


Fig. 8: Schematic illustration of the functionality of the 'Triggering Effect' to change the 2nd Screen App from the 1st

This means that the 2nd Screen App can be triggered either by a certain time point during the broadcast and in the DVB / Transport Stream or through a special interaction/activity inside the 1st Screen part of the converged application. In our case we use the latter solution and trigger the 2nd Screen App to change the state

of the application from the beginning / overview state to the graffiti/painting state, after the user has chosen on the TV screen the painting object. The chosen object appears on the TV screen but only in the presentation mode to show later the creative changes on this object. On the Tablet appears the object in the ready to interact canvas and in painting mode (see the figure above).

The painted object can be published to the joint gallery and made accessible for the application users, whether passive or active. The application has been tested during on two occasions and the children very excited about using this interactive infotainment offer.

CONCLUSION

An increasing number of technical options are available that can serve to promote information and educational content, in addition to novel media and interactivity solutions for modern informal learning TV & Internet based environments. Numerous options exist for the highly targeted synchronizing and linking of presented TV content (segment based) with supplemental information in the form of Apps for both TV and 2nd Screens. TV format developers, broadcasters and producers should therefore consider the great options at their disposal in terms of attracting the attention of 'viewers'!

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