The Netherlands Institute for Sound and Vision is an advanced and trendsetting audiovisual archive that has successfully made its way into the digital realm. It collects, preserves and provides access to the Dutch audiovisual heritage for as many users as possible: media professionals, education, science and the general public. The collection contains more than a million hours of television, radio, music, film and other media from the beginning in 1898 until today. In addition, the institute develops and disseminates knowledge in the area of audiovisual archiving, digitization and media history.

Research and Development

Sound and Vision has a strong Research and Development department. The multi-annual research agenda includes themes such as:

- building search interfaces to meet expectations of various user groups;
- new annotation approaches: (semi)automatic and using crowdsourcing;
- semantic interoperability;
- dynamic contextualization of the collections (also leveraging archived web pages);
- innovative interaction models, including second screen applications
- digital preservation for long-term access.

Sound and Vision is a highly valued partner in a wide range of research projects. It has been active in the European research arena for over a decade.

Contact

General: http://beeldengeluid.nl/en
Twitter: @beeldengeluid

R&D: http://labs.beeldengeluid.nl/
Twitter: @benglabs
6 WELCOME & PRACTICAL INFORMATION

8 FLOOR PLAN
Find your way around the venue

9 PROGRAM
The whole conference at a glance

12 WORKSHOPS
An overview of workshops that take place on Wednesday

17 DOCTORAL CONSORTIUM
Examples of ongoing work by the next generation of researchers in the field of interactive TV and online video
KEYNOTES
Two intriguing and thought-provoking talks

PAPER SESSIONS
An overview of academic and industry papers at this year’s conference

DEMOS
Join us for two demo sessions, on Thursday at 4pm and on Friday at 1:30pm

WORK-IN-PROGRESS
Authors will be presenting their work during the two WiP sessions, on Thursday at 4pm and on Friday at 1:30pm
Dear conference participant,

It is our great pleasure to welcome you to the fourth ACM International Conference on Interactive Experiences for Television and Online Video (ACM TVX2017) at The Netherlands Institute for Sound and Vision (NISV) in Hilversum, The Netherlands. We hope you already had a pleasant trip before arriving here and that you are ready to enjoy the exciting conference program which has been put together in the past months by the conference chairs, authors and reviewers.

You are now holding the conference program booklet in your hands, which is your guide to make the most out of the conference. You’ll find the titles and abstracts of the many contributions, the various locations where you’ll need to go, as well as practical information to make your conference visit a comfortable one. If you’re attending a workshop or the doctoral consortium on Wednesday, June 14, you will find the registration desk at the entrance of the NISV venue. There, you can pick up your badge and conference bag, as well as locate the rooms where your event will take place. All coffee breaks and the lunch will take place in the Atrium, so there’s no need to go elsewhere, unless of course you want some fresh air (there is a wonderful terrace at NISV!).

During the main conference, on Thursday June 15 and Friday June 16, all activities will take place on the ground floor. Since we have a single-track conference this year, there are no tough choices to make, and you can attend all presentations without worrying where you will go for the next session. The keynotes, paper presentations and Demo/Work in Progress madness session will be held in the Theater I room, while the Demos and Work in Progress posters will be shown in the Atrium. The coffee breaks and lunch will also be served in the Atrium.

We are very happy to invite you to also attend our social events, to make new friends or catch up with old ones. On Wednesday, June 14th we will have a welcome reception starting at 5:30pm, with drinks, Dutch snacks, and the unique opportunity to visit the exhibition ‘Let’s YouTube’, curated by NISV and exploring the new ways of online television. For the conference dinner, on Thursday, June 15th, you will get to visit Amsterdam. The dinner will take place at PLLEK, a beautiful restaurant (with its own beach!) located on the north bank of the river IJ, in Amsterdam. After welcome drinks starting at 6:30pm, dinner will be served in a private space after 7:30pm. No worries if you don’t know how to reach it: we will provide plenty of instructions during the conference and we provide assistance to get there as a group.

As you will see from this program booklet, we will offer high quality content and activities to keep you engaged and to enjoy this event as much as possible. We wish you to have a great conference experience and a lot of inspiration for doing research on interactive experiences for television and online video, which perhaps you will share at TVX2018!

Judith Redi, Omar Niamut and Dick Bulterman
General Chairs ACM TVX2017
REGISTRATION
Registration is possible on-site on the following dates and locations:

June 14: 08:30 - 17:00 - Atrium
June 15: 08:30 - 17:00 - Atrium
June 16: 09:00 - 12:00 - Atrium

INTERNET
Wireless internet connectivity is available throughout the venue. Use the following information to connect, no password is needed.

SSID: Beeld en Geluid

OPENING DRINKS
The opening drinks will take place at The Netherlands Institute of Sound and Vision in the ‘Let’s YouTube’ exhibition on Wednesday, June 14, 2017, starting at 5:30pm. You can enjoy your drink and bite while walking through the

CONFERENCE DINNER
The conference dinner will take place at PLLEK on Thursday, June 15, 2017. PLLEK is located on the north bank of IJ in Amsterdam and has a beach. After welcome drinks starting at 6:30pm, dinner will be served in a private space after 7:30pm. From the conference, guides will bring you to the restaurant via train and ferry leaving at 5:30pm from the conference location.
GROUND FLOOR
- Entrance
- Registration
- Atrium: WiP and poster area
- BENG Labs (-1)
- Elevator
- Studio BENG 02 (-1)
- Atrium: Demo area
- To outside terrace

FIRST FLOOR
- Elevator
- Studio BENG 01
- Theater 01
- Keynotes and paper sessions

SECOND FLOOR
- Elevator
- Exhibition ‘Let’s YouTube’
- Theater 01
- Theater 02
WEDNESDAY, JUNE 14

Coffee will be served from 10:30-11:00 and from 15:30-16:00. Lunch will be served from 12:30-14:00. Both coffee breaks and lunch are served in the Atrium.

<table>
<thead>
<tr>
<th>Time</th>
<th>Workshops</th>
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<tr>
<td>9:00</td>
<td>Converging User-Generated Material with Professional Video User Experiences</td>
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<td>Emerging TV Experiences</td>
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<td>In-Programme personalisation for broadcast</td>
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<td>A Brand New Game of Online Digital Marketing</td>
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<td>12:30</td>
<td>BENG LAB 01</td>
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<td>STUDIO BENG 01</td>
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<td>STUDIO BENG 02</td>
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<tr>
<td>14:00</td>
<td>Workshop on Interactive Digital Storytelling in Broadcasting</td>
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<td>BENG LAB 01</td>
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<td>17:30</td>
<td>Doctoral Consortium</td>
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<td>THEATER 02</td>
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<td>17:30</td>
<td>Opening Drinks</td>
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<tr>
<td>9:00</td>
<td>Welcome and Opening</td>
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<td>9:30</td>
<td>Opening Keynote</td>
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<td>10:30</td>
<td>Coffee break</td>
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<tr>
<td>11:00</td>
<td>Session 01: User Consumption Patterns</td>
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<td>12:30</td>
<td>Lunch Break</td>
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<td>13:50</td>
<td>Session 02: The Role of the Audience</td>
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<td>15:00</td>
<td>Demo and WiP madness</td>
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<td>15:30</td>
<td>Coffee break</td>
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<tr>
<td>16:00</td>
<td>Demos and Work-in-Progress</td>
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<tr>
<td>19:30</td>
<td>Conference Dinner</td>
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</table>
ACM TVX2017 offers a set of workshops designed to appeal to our audience of researchers and practitioners in the TV and Online Video field. Workshops will take place on Wednesday, June 14, 2017, the day prior to the main ACM TVX2017 conference program.

**EMERGING TV EXPERIENCES: HOW VR, VOICE, AND EMERGING AUDIENCES HAVE CHANGED THE TV LANDSCAPE**

Wednesday, June 14, from 9:00-17:30  
BENG LAB 02

**Organizing team:**  
Isha Dandavate, User Experience Researcher, YouTube  
Kerwell Liao, User Experience Designer, YouTube  
Lettie Malan, User Experience Producer, YouTube

**Summary:** in the past few years, innovations in the television and video industry have brought about changes in TV watching behaviors. This one-day, interactive workshop will bring together academics and professionals in structured brainstorming exercises and discussions in order to collaboratively form a framework for understanding design challenges and opportunities that have arisen from developments in three areas: VR/360 video, voice interactions, and engagement of younger audiences and developing markets.

Website: sites.google.com/view/emergingtvux
CONVERGING USER-GENERATED MATERIAL WITH PROFESSIONAL VIDEO USER EXPERIENCES

Wednesday, June 14, from 9:00-12:30  BENG LAB 01

Organizing team:
Michael Evans, BBC R&D
George Margetis, Foundation of Research and Technology, Hellas (FORTH) Institute of Computer Science
Stavroula Ntoa, Foundation of Research and Technology, Hellas (FORTH) Institute of Computer Science
Rajitha Weerakkody, BBC R&D

Summary: this multidisciplinary workshop will contribute to a user experience (UX) research agenda for the effective combination of video from professional and non-professional contributors. Trends in developing technology and in user behavior, the workshop will investigate a specific range of themes create the opportunity for higher quality integration of the creative efforts of non-professional contributors with those of professionals. Workshop submission themes include, but are not limited to; novel quality of experience (QoE) metrics, computational enhancement of QoE, reward, motivation and development for contributors, relevant creative and personal data ethics, and research methods in this space. The overall aim is to help equip professional producers with the means to support and develop their contributors to be successful in providing video material, and, therefore, optimise viewers’ quality of experience when watching content that is composed of footage from both origins.

WORKSHOP ON INTERACTIVE DIGITAL STORYTELLING IN BROADCASTING (IDB 2017)

Wednesday, June 14, June from 14:00-17:30

BENG LAB 01

Organizing team:
Sebastian Arndt, Norwegian University of Science and Technology
Veli-Pekka Räty, Norwegian University of Science and Technology
Wendy Ann Mansilla, Norwegian University of Science and Technology
Francisco Ibáñez, Brainstorm Multimedia
Scott Davies, Never.no
Andrew Perkis, Norwegian University of Science and Technology

Summary: traditional broadcasters are losing their younger audiences. New ways of user interaction that are catering to the attention of a distracted audience need to be identified. One of the challenging aspects is the growing user requirements for real-time mobile information and stories anytime and anywhere. This has exerted significant pressure on the importance of new forms of storytelling and information delivery on every target audiences. The goal of this workshop is to discuss new ways of information generation and delivery in the traditional broadcasting sense and in the public use. This workshop shall stimulate and facilitate professionals, academics, designers, and digital artists to put forward discussions on multidisciplinary approaches to enhance audience experience and expectations towards information generation and delivery in a new media landscape.

Website: www.iet-multimedialabs.org/current-research/idb-workshop/
IN-PROGRAMME PERSONALISATION FOR BROADCAST (IPP4B)

Wednesday, June 14, from 9:00-17:30

Organizing team:
Jeremy Foss, Birmingham City University
Ben Shirley, University of Salford
Benedita Malheiro, Instituto Superior de Engenharia do Porto
Sara Kepplinger, Fraunhofer Institute for Digital Media Technology (IDMT)
Alexandre Ulisses, MOG Technologies
Mike Armstrong, BBC Research & Development
Nicolas Monnoyer, Big Bad Wolf

Summary: the IPP4B workshop focusses on the automatic personalization of the streamed content. In-Programme Personalisation is a radical innovation for broadcast media, where network content can be personalised according to the viewer profiles. However, there are many challenges to face. The aim of the workshop is to explore both the technical issues of In-Programme Personalisation for Broadcast, also the market and production of content. A community of interest needs to be realized in order that best practice, concerted development and standardization are appropriately addressed in the industry. The likely technology to support these features is object-based media where audio, video and other elements may be placed into existing media and be rendered for consumption by the end viewer platform. The IPP4B workshop will comprise papers, demonstrations and focus groups to specifically address personalisation technologies, personalisation services, use cases and content production.

Website: http://dmtlab.bcu.ac.uk/tvx2017/
A BRAND NEW GAME OF ONLINE DIGITAL MARKETING IN ASIA

Wednesday, June 14, from 9:00-17:30

STUDIO BENG 02

Organizing team:
Hokyoung Ryu, Department of Arts & Technology, Hanyang University
Jieun Kim, Department of Technology Management, Hanyang University
Donghum Chung, School in Communications, Kwangwun Univeristy
Shuichi Aoki, NHK

Summary: digital online advertising today is struggling to find the right way to reach consumers on new digital platforms. Advertisers like social-media platforms because they gather all sorts of data on each user’s age, consumption patterns, interests and so on. This means ads can be aimed at them with an accuracy that is unthinkable with analogue media. However, social networks, and TV advertisers interested in switching to them, have yet to work out what is the optimal format for video ads. This workshop is aimed at dealing with these issues of how Asian markets would approach.

Website: http://imagine.hanyang.ac.kr/acm-tvx2017-asia-forum
The ACM TVX Doctoral Consortium (DC) serves as a forum for PhD students to share ideas about the development, use, and evaluation of interactive television and online video, compare approaches, discuss research problems and receive feedback from the international Interactive Television community.

Doctoral Consortium chairs: Ben Shirley, University of Salford, UK, and Satu Jumisko-Pyykkö, Technische Universiteit Eindhoven, The Netherlands; Tampere University of Technology, Finland

External jury members: Jonna Häkkilä, University of Lapland, Finland; Thomas Olsson, Tampere University of Technology, Finland; Katri Salminen, University of Tampere, Finland; Jeremy Foss, Birmingham City University, UK

Effects of Camera Position on Perception of Self In 360 Degree Video and Virtual Environments
Adam Philpot – School of Science and Technology, Middlesex University, London, United Kingdom

Decoding Kashgar: Participatory Digital Heritage Making via Digital Online Interaction and Gamification
Serdar Aydin – School of Architecture, Victoria University of Wellington, Wellington, New Zealand

Recommending Personalized Informative Contents on iTV
David Campelo – Department of Communication and Arts, University of Aveiro, Aveiro, Aveiro, Portugal

Integration of Touch and Taste with Interactive Media
Damien Ablart – SCHI Lab, School of Engineering and Informatics, University of Sussex, Brighton, United Kingdom

Enhancing Over-the-Top Video Streaming Quality with DASH Assisting Network Elements
Jan Willem Kleinrouweler – Centrum Wiskunde & Informatica, Amsterdam, Noord-Holland, Netherlands

TV Consumption Practices of Brazilian Young People
Fernanda Chocron Miranda – School of Library Science and Communication/Graduate Program on Communication and Information, Federal University of Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil

Towards Behavior-oriented Quality of Experience Assessment for Online Video Services
Werner Robitza – Telekom Innovation Laboratories, Deutsche Telekom AG, Berlin, Germany

Streaming and Presentation Architectures for Extended Video Streams
Emmanouil Potetsianakis – TSI, Telecom ParisTech, Paris, France
Prof.dr. Wijnand IJsselsteijn has a background in artificial intelligence (AI) and cognitive neuropsychology. Since 2012, he is full professor of Cognition and Affect in Human-Technology Interaction at Eindhoven University of Technology (TU/e). He has an active research program on the impact of media technology on human psychology, and the use of psychology to improve technology design. He is a member of the Jheronimus Academy of Data Science in Den Bosch, and is scientific director of the interdisciplinary Center for Humans and Technology at TU/e, which explicitly focuses on people- and value-centred perspectives of technology understanding and design. He has published over 200 peer-reviewed academic papers in journals and conferences, and has (co-)edited 10 volumes.

‘Here’s Looking At You, Kid’ - Interactive Entertainment In The Age of Machine-Readable Humans

Today, while you’re watching television, your television is watching you too. With the introduction of cameras, microphones, and other sensors integrated with our networked, smart TV sets and mobile devices, opportunities arise that go well beyond video communication, gesture-based interaction, or consumer segmentation. Machines are learning to recognise human identity, contexts, activities, and emotions, and your TV is no exception. In this keynote talk, Wijnand will highlight some of the progress in machine understanding of human behavior and emotions, its potential in interactive and personalised entertainment, as well as some legitimate concerns in terms of human values and human psychology as we enter the Age of Machine-Readable Humans.
Arthur van Hoff is Founder and CTO of Jaunt. Jaunt’s technology provides an end-to-end solution for creating cinematic VR experiences. Arthur is serial entrepreneur and was most recently CTO at Flipboard. He started his career in Silicon Valley at Sun Microsystems where he was an early developer of the Java programming language. Since then he has started several successful companies including Marimba (IPO 1999), Strangeberry (acquired by TiVo), ZING (acquired by Dell), and Ellerdale (acquired by Flipboard). Arthur has expertise in machine learning, big data, mobile applications, 3D printing, and computational photography. He is originally from the Netherlands and has a master’s degree in Computer Science from Strathclyde University in Glasgow.

Virtual Reality and the Future of Immersive Entertainment
Jaunt has been creating Cinematic Virtual Reality experiences since 2013. With Cinematic VR the user is transported to a place of wonder where storytelling has completely new dimensions. In this keynote, Arthur will discuss how Jaunt leverages this new technology and overcome challenges in storytelling, production and distribution. Cinematic VR allows storytellers and brands to create an emotional connection with the viewer, using tools and techniques familiar to the industry.
MEDIA MULTITASKING AT HOME: A VIDEO OBSERVATION STUDY OF CONCURRENT TV AND MOBILE DEVICE USAGE

Jacob Rigby — UCL Interaction Centre, University College London, London, United Kingdom
Duncan Brumby — UCL Interaction Centre, University College London, London, United Kingdom
Sandy Gould — School of Computer Science, University of Birmingham, Birmingham, United Kingdom
Anna Cox — UCL Interaction Centre, University College London, London, United Kingdom

Abstract: Increasingly people interact with their mobile devices while watching television. We evolve an understanding of this kind of everyday media multitasking behaviour through an analysis of video data. In our study, four households were recorded watching television over three evenings. We analysed 55 hours of footage in which participants were watching the TV. We found that mobile device habits were highly variable between participants during this time, ranging from 0% to 23% of the time that the TV was on. To help us understand this variability, participants completed the Media Multitasking Index (MMI) questionnaire. Results showed that participants with a higher MMI score used their mobile device more while watching TV at home. We also saw evidence that the TV was being used as a hub in the home: multiple people were often present when the time the TV was on, providing a background for other household activities. We argue that video analysis can give valuable insights into media multitasking in the home.
HOW PEOPLE MULTITASK WHILE WATCHING TV

Auriana Shokrpour — Samsung Research America, Samsung, Mountain View, California, United States

Michael Darnell — Samsung Research America, Samsung, Mountain View, California, United States

Abstract: We often think of TV watching as the activity where people are fully engaged and immersed in the TV program. However, research has shown that there is a continuum of levels of attention while watching TV. We set out to understand multitasking behaviors as well as users’ motivation and intention behind simultaneous tasks performed in front of the television. We conducted an in-home qualitative research methods study inside ten households across the San Francisco Bay Area and used a quantitative method for analysis of the large amount of behavioral data we gathered. We recorded participants’ television watching behaviors using cameras that were placed in their homes and used retrospective interviews to gather purpose behind events that were observed in the video recordings. We defined eye gaze elsewhere than on the TV as accounting for a multitasking event. It was found that multitasking occurred almost 40% of the time when people were seated in front of the television. Most multitasking occurred during TV programs – not during the interval between TV programs. Of the time people spent multitasking, 36% was spent on a device, mostly a smartphone. However, only 10% of device-related multitasking was related to the content being played on the TV. With our study, we contribute to the greater body of foundational knowledge around common multitasking behaviors that are conducted in front of the television.

COUNTERING CONTEXTUAL BIAS IN TV WATCHING BEHAVIOR: INTRODUCING SOCIAL TREND AS EXTERNAL CONTEXTUAL FACTOR IN TV RECOMMENDERS

Felix Lorenz — Technische Universität Berlin, Berlin, Germany

Jing Yuan — DAI-Labor, Fakultät IV für Elektrotechnik und Informatik, Technische Universität Berlin, Berlin, Germany

Andreas Lommatzsch — DAI-Labor, Fakultät IV für Elektrotechnik und Informatik, Technische Universität Berlin, Berlin, Germany

Mu Mu — The University of Northampton, Northampton, United Kingdom

Nicholas Race — School of Computing & Communications, Lancaster University, Lancaster, Lancashire, United Kingdom

Frank Hopfgartner — University of Glasgow, Glasgow, United Kingdom

Sahin Albayrak — DAI-Labor, Technische Universität Berlin, Berlin, Germany
**Abstract:** Context-awareness has become a critical factor in improving the predictions of user interest in modern online TV recommendation systems. In addition to individual user preferences, existing context-aware approaches such as tensor factorization incorporate system-level contextual bias to increase predicting accuracy. We analyzed a user interaction dataset from a WebTV platform, and identified that such contextual bias creates a skewed selection of recommended programs which ultimately locks users in a filter bubble. To address this issue, we introduce the Twitter social stream as a source of external context to extend the choice with items related to social media events. We apply two trend indicators, Trend Momentum and SigniScore, to the Twitter histories of relevant programs. The evaluation reveals that Trend Momentum outperforms SigniScore and signalizes 96% of all peaks ahead of time regarding the selected candidate program titles.

**HOW MILLENNIALS AND TEENS CONSUME MOBILE VIDEO**

Jennifer McNally — Verizon, San Jose, California, United States
Beth Harrington — Verizon, Waltham, Massachusetts, United States

**Abstract:** Technology and services available for mobile video have evolved since previous studies were conducted. A majority of teens now have mobile phones and there is an increase in younger users watching video through paid subscriptions. We set out to describe the scenarios in which Millennials and teens view mobile video, their motivations, and how they access video. Twenty-four participants completed diary entries over a five-day period. Nine of these participants also took part in individual interviews that followed. Our findings describe the scenarios and motivations in detail and highlight two main findings. 1) Several mood and emotional states, beyond boredom and killing time, lead to viewing mobile video. 2) When accessing video, choices are made based on desired level of engagement, stimulation, and length. This study provides information that can be used to inform mobile video experiences and proposes opportunities for future research.
The Social Construction of Targeted Television Advertising: The Importance of ‘Social Arrangements’ in the Development of Targeted Television Advertising in Flanders

Iris Jennes — Communication Studies, Vrije Universiteit Brussel, Brussels, Belgium
Wendy Van den Broeck — Communication Studies, Vrije Universiteit Brussel, Brussels, Belgium

Abstract: This paper focuses on the social construction of targeted TV advertising. In 2016, experiments with targeted TV commercials started in Flanders (Belgium). We apply a Social Construction of Technology (SCOT) approach to understand how targeted television advertising is being developed. We underline the importance of social arrangements in the development of this particular technology. Social arrangements can be defined as the relations between relevant social groups that work together to stabilize a technology. The development of targeted TV advertising can be seen as a moment of ‘interpretive flexibility’, implying that different relevant social groups can give a different meaning to targeted advertising as a technological artifact. To steer the development of the technology towards the most beneficial solution to their agenda, different social groups use different strategies. In our paper, we argue that in the case of targeted TV advertising, the audience should be approached as a relevant social group. Our empirical research thus incorporates both television industry and user perspectives on the development of targeted TV advertising in Flanders between 2012 and 2017. Based on expert interviews with industry representatives and focus group interviews with end-users, we provide an analysis of the different strategies, opportunities and challenges that different stakeholders (TV-industry, viewers and policy actors) are faced with. To conclude, we also formulate specific recommendations for a successful implementation of targeted TV advertising in Flanders.
LET’S PLAY MY WAY: INVESTIGATING AUDIENCE INFLUENCE IN USER-GENERATED GAMING LIVE-STREAMS

Pascal Lessel — German Research Center for Artificial Intelligence (DFKI), Saarland Informatics Campus, Saarbrücken, Saarland, Germany
Michael Mauderer — Department of Computing, University of Dundee, Dundee, United Kingdom
Christian Wolff — Saarland University, Saarland Informatics Campus, Saarbrücken, Saarland, Germany
Antonio Krüger — German Research Center for Artificial Intelligence (DFKI), Saarland Informatics Campus, Saarbrücken, Saarland, Germany

Abstract: We investigate how the audience of gaming live-streams can influence the content. We conducted two case studies on streams in which audience influence is central and in which the audience can directly participate: First, we review an existing format of the Rocket Beans TV channel and describe how the audience can influence its course of action. With this, we illustrate current practices for integrating the audience. Second, we report the results of our investigation of a “Twitch Plays Pokémon” (TPP)-like setting in which the audience shares the control of the main character through aggregated chat messages. We explored a wider range of techniques than the original TPP offered and found that this can help the audience to organize itself in more nuanced ways. From both case studies, we synthesize results that are of relevance for streams that want to give the audience more influence.

Session 2 also includes short presentations focussing on the TV industry:

TO BINGE OR NOT TO BINGE – NET NEUTRALITY AND VIDEO DISTRIBUTION IN EUROPE AND THE US

Pieter Nooren - TNO, The Netherlands

Net neutrality regulation is important for media companies, Internet service providers and consumers as it affects the conditions for distribution of streaming music and video. This paper analyzes and visualizes the dependencies between media companies and ISPs in two cases that involve zero-rating of data, an arrangement in which the data for specific services does not count against a data allowance. The cases show that zero-rating brings a substantial change to the distribution segment of the mediaInternet ecosystem. For the many consumers that have subscriptions with a data allowance, the
Internet access is effectively divided in two parts, one where data is metered and counts against their monthly allowance and one where they have unlimited flat fee data – for selected applications. Furthermore, the cases show that net neutrality is an important factor, but also clearly not the only factor affecting competition in the media-Internet ecosystem.

TOWARDS OBJECT BASED BROADCASTING

**Davy Smith** - Digital Creativity Labs, University of York, York, UK  
**Marian Ursu** - Department of Theatre, Film and Television, University of York, York, United Kingdom  
**Chris Northwood** - Research & Development, BBC, Salford, Greater Manchester, United Kingdom  
**Phil Stenton** - BBC Research & Development, BBC, Salford, United Kingdom

Object-based broadcasting (OBB) refers to the delivery of media which has the ability to reconfigure itself based upon the context it is being consumed in. Due to the reconfigurable nature of OBB experiences, both at the presentation and narrative levels, delivery mechanisms and workflows for their production may differ substantially from traditional linear TV broadcasting. Significant research has been undertaken into OBB, although until this point, productions have appeared as bespoke, domain specific, use cases. In this paper, we highlight the relevance for the industry to move towards OBB and express the need for its standardisation in order for it to achieve wide-scale adoption. The findings from prior research into OBB are leveraged in order to propose an end-to-end IP-based architecture which will allow the client controlled reconfiguration of professionally curated OBB experiences. This paper serves to reflect upon our current research, and call upon the rest of the industry for assistance, into the standardisation of OBB as a future facing technology for the production and delivery of real-time context-responsive multi-device broadcast experiences.
Abstract: Panoramic 360 video is a rapidly growing part of interactive TV viewing experience due to the increase of both production by consumers and professionals and the availability of consumer headsets used to view it. Recent years have also seen proposals for the development of home systems that could ultimately approximate CAVE-like experiences. The question arises as to the nature of the user experience of viewing panoramic video in head mounted displays compared to CAVE-like systems. User preference seems hard to predict. Accordingly, this study took a qualitative approach to describing user experience of viewing a panoramic video on both platforms, using a thematic analysis. Sixteen users tried both viewing conditions and equal numbers expressed preferences for each display system. The differences in user experience by viewing condition are discussed in detail via themes emerging from the analysis.
INTEGRATING MID-AIR HAPTICS INTO MOVIE EXPERIENCES

Damien ABLART — SCHI Lab, School of Engineering and Informatics, University of Sussex, Brighton, United Kingdom
Marianna Obrist — SCHI Lab, School of Engineering and Informatics, University of Sussex, Brighton, United Kingdom
Carlos Velasco — Marketing, BI Norwegian Business School, Oslo, Norway

Abstract: “Seeing is believing, but feeling is the truth”. This idiom from the seventieth century English clergyman Thomas Fuller gains new momentum in light of an increased proliferation of haptic technologies that allow people to have various kinds of ‘touch’ and ‘touchless’ interactions. Here, we report on the process of creating and integrating touchless feedback (i.e. mid-air haptic stimuli) into short movie experiences (i.e. one-minute movie format). Based on a systematic evaluation of user’s experiences of those haptically enhanced movies, we show evidence for the positive effect of haptic feedback during the first viewing experience, but also for a repeated viewing after two weeks. This opens up a promising design space for content creators and researchers interested in sensory augmentation of audiovisual content. We discuss our findings and the use of mid-air haptics technologies with respect to its effect on users’ emotions, changes in the viewing experience over time, and the effects of synchronisation.

PROJECT ORPHEUS A RESEARCH STUDY INTO 360° CINEMATIC VR

Mirjam Vosmeer — Amsterdam University of Applied Sciences, Amsterdam, Netherlands
Ben Schouten — Amsterdam University of Applied Sciences, Amsterdam, Netherlands

Abstract: When creating content for virtual reality, filmmakers find that they need to re-evaluate the tools they have traditionally used to tell their stories, and explore the new possibilities that this particular medium has to offer. To determine how storytelling- and filmmaking tools function in VR, the concept of presence is currently being re-evaluated for its possibilities to be used as a measurement of the relative effectiveness of these tools. The research project Project Orpheus is presented as a case study into trans-medial storytelling, exploring how the impact of a traditional television show may be reinforced by an immersive VR experience. The movie was subsequently used to conduct a small qualitative study into the use of 3D sound to guide the viewer’s attention in VR.
Session 3 also includes short presentations of the Best Work-in-Progress and Demo papers:

**SUBTITLES IN 360-DEGREE VIDEO (BEST WIP)**

**Andy Brown** – Research & Development, BBC, Salford, United Kingdom  
**Anastasia Schmitz** – Research & Development, BBC, Salford, United Kingdom  
**Jayson Turner** – BBC Research and Development, BBC, Manchester, United Kingdom  
**Mike Armstrong** – BBC Research and Development, BBC, Manchester, United Kingdom  
**Jake Patterson** – Research & Development, BBC, Salford, United Kingdom  
**Maxine Glancy** – BBC Research & Development, BBC, Manchester, United Kingdom  

See page 38 for the abstract.

**SOCIAL VR PLATFORM: BUILDING 360-DEGREE SHARED VR SPACES (BEST DEMO)**

**Simon Gunkel** – TNO, The Hague, Netherlands  
**Hans Stokking** – TNO, The Hague, Netherlands  
**Martin Prins** – TNO, The Hague, Zuid-Holland, Netherlands  
**Omar Niamut** – TNO, The Hague, Netherlands  

See page 37 for the abstract.
ENHANCING INTERACTION WITH DUAL-SCREEN TELEVISION THROUGH DISPLAY COMMONALITIES

**Timothy Neate** — Department of Computer Science, Swansea University, Swansea, United Kingdom  
**Matt Jones** — Swansea University, Swansea, Wales, United Kingdom  
**Michael Evans** — Research & Development, BBC, Salford, Greater Manchester, United Kingdom

**Abstract:** Second screening – engaging with a mobile device while watching TV – is ubiquitous. Previous research demonstrates that this is hampered by cognitive and physical disjuncts between the simultaneous content streams. To engage effectively with more than one screen, users must manage their attention, for example, by frequently adjusting their gaze or posture. This can lead to cognitive effort, which leads to disengagement, content sacrifice, and ultimately, affects user experience (UX) negatively. In this paper, we look to improve the design of the dual-screen scenario through display commonalities; the mirroring of one content stream (e.g., TV material or second screen content) within the other. We evaluate this design space with professional broadcast practitioners, and then conduct an empirical investigation to determine the impact of the most successful methods towards understanding their impact, and designing towards positive UX with multi-device scenarios.
ON TIME OR NOT ON TIME: A USER STUDY ON DELAYS IN A SYNCHRONISED COMPANION-SCREEN EXPERIENCE

Christoph Ziegler — IRT, Munich, Germany
Christian Keimel — IRT, Munich, Germany
Rajiv Ramdhany — British Broadcasting Corporation, London, Greater London, United Kingdom
Vinoba Vinayagamoorthy — British Broadcasting Corporation, London, Greater London, United Kingdom

Abstract: One major challenge in creation of compelling companion screen experiences, are the time delays between the presentation of content on the TV compared to the presentation of content on the companion screen. Through the use of a synchronised, interactive textbook application, we conducted a user study to evaluate the potential influence of different delays, between the TV and the companion screen, on how users experience watching a Shakespearean play on the TV. Our results indicate that although users do not notice delays of up to 1000 ms, for the kind of experience tested, they feel significantly more distracted by the tablet content for increasingly higher delays. We discuss the implications of our findings with regards to the time delay tolerances users might have when using a synchronised text accompaniment to these kinds of TV programmes.

DON’T LEAVE — COMBINING SENSING TECHNOLOGY AND SECOND SCREENS TO ENHANCE THE USER EXPERIENCE WITH TV CONTENT

Daniela Huber — LMU Munich, Munich, Germany
Daniel Buschek — LMU Munich, Munich, Bavaria, Germany
Florian Alt — LMU Munich, Munich, Germany

Abstract: In this paper we explore how the use of sensing technologies can enhance people’s experience during perceiving TV content. The work is motivated by an increasing number of sensors (such as Kinect) that find their way into living rooms. Such sensors allow the behavior of viewers to be analyzed, hence providing the opportunity to instantly react to this behavior.
The particular idea we explore in our work is how a second screen app triggered by the viewer’s behavior can be designed to make them re-engage with the TV content. At the outset of our work we conducted a survey (N=411) to assess viewers’ activities while watching TV. Based on the findings we implemented a Kinect-based system to detect these activities and connected it with a playful second screen app. We then conducted a field evaluation (N=20) where we compared (a) four hints to direct users’ attention to the second screen app and (b) four types of second screen content requiring different levels of engagement. We conclude with implications for both practitioners and researchers concerned with interactive TV.

UNDERSTANDING SECONDARY CONTENT PRACTICES FOR TELEVISION VIEWING

Frank Bentley — Yahoo, Sunnyvale, California, United States

Abstract: Secondary content experiences related to television viewing have been a frequent topic of study in the TVX community. While many new interfaces have been created and studied in the small scale, we are not aware of any larger quantitative work to study current practices now that many secondary content experiences are publicly available. We conducted a survey with a broad sample of the American population to explore current secondary content use. We report on our findings, including that 80% of these experiences occur before or after viewing the primary content, and not as simultaneous experiences, and that social posting about television content remains quite low, even for one’s favorite show. We conclude with implications for the design new secondary content systems based on our findings.

Session 4 also includes a short presentation of the Best DC paper:

ENHANCING OVER-THE-TOP VIDEO STREAMING QUALITY WITH DASH ASSISTING NETWORK ELEMENTS (BEST DC)

Jan Willem Kleinrouweler – Centrum Wiskunde & Informatica, Amsterdam, Noord-Holland, Netherlands
SCANNING NEWS VIDEOS WITH AN INTERACTIVE FILMSTRIP

Martin Prins – TNO, The Hague, Zuid-Holland, Netherlands  
Joost de Wit – Media Distillery, Amsterdam, Netherlands

Abstract: Determining whether a (news) video is of-interest and what it is about is a time-consuming process. This is a problem when users quickly want to catch up with the latest news and don’t spend time to see something they already know or saw or is not of interest at all. In this paper, we present a novel method for users to discover what a video is about by means of a summary of the video, presented as an interactive filmstrip. With the interactive filmstrip, users can quickly scan the contents of a video, determine if they want to watch it (and which parts) and playback these parts. The interactive filmstrip is implemented in a response web-based demonstrator application, with mouse-based interaction on PCs and touch/gesture based-interaction on smartphones and tables.

MULTI-USER MOTION MATCHING INTERACTION FOR INTERACTIVE TELEVISION USING SMARTWATCHES

David Verweij – Department of Industrial Design, Eindhoven University of Technology, Eindhoven, Netherlands  
Augusto Esteves – Centre for Interaction Design, Edinburgh Napier University, Edinburgh, United Kingdom

Vassilis-Javed Khan – Industrial Design Department, Eindhoven University of Technology, Eindhoven, Noord Brabant, Netherlands  
Saskia Bakker – Department of Industrial Design, Eindhoven University of Technology, Eindhoven, Netherlands
Abstract: Motion matching input, following continuously moving targets by performing bodily movements, offers new interaction possibilities in multiple domains. Unlike optical motion matching input systems, our technique utilizes a smartwatch to record motion data from the users' wrists, providing robust input regardless of lighting conditions or momentary occlusions. We demonstrate an implementation of motion matching input using smartwatches for interactive television, that allows multi-user input using bodily movements and offers new interaction possibilities by means of a second screen as extension on TV displays.

PRODUCTION AND DELIVERY OF VIDEO FOR MULTI-DEVICE SYNCHRONIZED PLAYOUT

Juan A. Nuñez – i2CAT Foundation, Barcelona, Spain
Szymon Malewski – PSNC, Poznan, Poland
Sergi Fernández – i2CAT Foundation, Barcelona, Spain
Joan Llobera – i2CAT Foundation, Barcelona, Spain

Abstract: In the contemporary living room, the audience’s attention is often divided between TVs, second screens and, increasingly, head mounted displays. To address this reality, ImmersiaTV is a H2020 European project which is redefining the end-to-end broadcast chain: production, distribution and delivery. It is built on two ideas: multi-platform synchronous content playout, and orchestrated videos rendered in the head-mounted display as interactive inserts, which allow introducing basic interactive storytelling techniques (scene selection, forking paths, etc.) as well as classical audio-visual language that is not possible to render with 360 videos (close-ups, slow motion, shot-countershot, etc). We demonstrate our pipeline for offline production, distribution and synchronized playout.

2-IMMERSE – A PLATFORM FOR ORCHESTRATED MULTI-SCREEN ENTERTAINMENT

Ian Kegel – BT Research & Innovation, Martlesham Heath, Ipswich, United Kingdom
James Walker – Cisco, London, United Kingdom
Mark Lomas – BBC Research & Development, Salford, United Kingdom

Jack Jansen – Centrum voor Wiskunde & Informatica, Amsterdam, Netherlands
John Wyver – Illuminations, London, United Kingdom
**Abstract:** This demonstration will showcase a new approach to the production and delivery of multi-screen entertainment enabled by an innovative, standards-based platform developed by the EU-funded project 2-Immerse. Object-based production enables engaging and interactive experiences which make optimal use of the devices available, while maintaining the look and feel of single application. The ‘Theatre at Home’ prototype offers an enhanced social experience for users watching a live or ‘as live’ broadcast of a theatre performance, allowing them to discuss it with others who are watching at the same time, either in a different room or in a different home.

**TELLYBOX: NINE SPECULATIVE PROTOTYPES FOR FUTURE TV**

Libby Miller – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Joanne Moore – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Tim Cowlishaw – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Henry Cooke – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Anthony Onumonu – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Kristian Hentschel – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Thomas Howe – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Chris Needham – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Sacha Sedriks – Internet Research and Future Services, BBC Research and Development, London, United Kingdom

Richard Sewell – Electric Pocket Limited, Pontnewynydd, United Kingdom

**Abstract:** We have developed nine speculative (“half-resolution”) prototypes as part of our project to explore future possibilities for television experiences as widely as possible. The prototypes are physical representations of our research into why people watch television and what they like and dislike about it. Their physicality improves engagement and quality of feedback, at low cost. The ultimate goal is to be able to describe the high-level characteristics of a really good experience of television in the home, and so provide direction for future technology and interface development.
MOVIES IN MID-AIR: ONE-MINUTE MOVIES ENHANCED THROUGH MID-AIR HAPTIC FEEDBACK

Damien Ablart – SCHI Lab, School of Engineering and Informatics, University of Sussex, Brighton, United Kingdom
Marianna Obrist – SCHI Lab, School of Engineering and Informatics, University of Sussex, Brighton, United Kingdom
Carlos Velasco – Marketing, BI Norwegian Business School, Oslo, Oslo, Norway

Abstract: We present a novel movie experience which involves users’ sense of touch. In our demo, we showcase this multisensory experience concept whereby a mid-air haptic technology, which creates tactile sensations in mid-air without direct contact, is integrated into short movies. Specifically, users can experience audiovisual contents (i.e., one-minute movies) enhanced via mid-air haptic feedback. We are convinced that this demo will stimulate interesting discussions around the future of viewing experiences for television, cinema, as well as online video consumption.

EDINBURGH FESTIVAL EXPLORER DEMO

Andrew Gibb – North Lab, BBC Research and Development, Salford, Lancashire, United Kingdom
Sam Nicholson – North Lab, BBC Research and Development, Salford, Lancashire, United Kingdom
Graham Thomas – R&D Dept, BBC, Salford, UK

Abstract: Head-mounted displays and spherical (“360”) video are emerging as an important new medium. Watching a spherical video in a head-mounted display is a compelling experience the first time, but the user soon discovers that they cannot move. The problem of how to move a user’s viewpoint between spherical
videos recorded at different locations remains without a general solution. The Edinburgh Festival Explorer demonstrates a novel approach to this problem. The user is given a better sense of the physical relationship of the video locations by placing windows into video spheres in their geographical positions, and giving the user an overview of the region which they can navigate interactively.

**OBJECT-BASED PRODUCTION: A PERSONALISED INTERACTIVE COOKING APPLICATION**

**Jasmine Cox** – British Broadcasting Corporation, Manchester, United Kingdom  
**Rhianne Jones** – Research & Development, BBC, Salford, Greater Manchester, United Kingdom  
**Chris Northwood** – BBC Research and Development, BBC, Manchester, United Kingdom  
**Jonathan Tutcher** – Research & Development, British Broadcasting Corporation, London, United Kingdom  
**Ben Robinson** – BBC Research & Development, BBC, London, United Kingdom

**Abstract:** We present the Cook-Along Kitchen Experience (CAKE), a novel prototype that illustrates a new type of interactive, personalised audio-visual experience created using Object-Based Media (OBM) concepts and techniques. CAKE is a real-time, interactive cookery programme that dynamically adapts in real-time as you cook with it. It represents a new interactive video format that combines existing technologies in novel ways to create a distinctly new user experience. We demonstrate the novelty of the user experience: users can interact with the application and see a behind the scenes view of the data model and scheduling algorithm visualising how CAKE is responding to user input.

**WEB-BASED PLATFORM FOR SUBTITLES CUSTOMIZATION AND SYNCHRONIZATION IN MULTI-SCREEN SCENARIOS**

**Mario Montagud** – Universitat Politècnica de València, Grau de Gandia, Valencia, Spain  
**Fernando Boronat** – Universitat Politècnica de València, Grau de Gandia, Valencia, Spain  
**Juan González** – Universitat Politècnica de València (UPV), Grao de Gandia, Valencia, Spain  
**Javier Pastor** – Universitat Politècnica de València, Grau de Gandia, Valencia, Spain
**Abstract:** This paper presents a web-based platform that enables the customization and synchronization of subtitles on both single- and multi-screen scenarios. The platform enables the dynamic customization of the subtitles’ format (font family, size, color...) and position according to the users’ preferences and/or needs. Likewise, it allows configuring the number of subtitles lines to be presented, being able to restore the video playout position by clicking on a specific one. It also allows the simultaneous selection of various subtitle languages, and applying a delay offset to the presentation of subtitles. All these functionalities can also be available on (personal) companion devices, allowing the presentation of subtitles in a synchronized manner with the ones on the main screen and their individual customization. With all these functionalities, the platform enables personalized and immersive media consumption experiences, contributing to a better language learning, social integration and an improved Quality of Experience (QoE) in both domestic and multi-culture environments.

**SOCIAL VR PLATFORM: BUILDING 360-DEGREE SHARED VR SPACES**

**Simón Gunkel** – TNO, The Hague, Netherlands  
**Martin Prins** – TNO, The Hague, Zuid-Holland, Netherlands  
**Hans Stokking** – TNO, The Hague, Netherlands  
**Omar Niamut** – TNO, The Hague, Netherlands

**Abstract:** Virtual Reality (VR) and 360-degree video are set to become part of the future social environment, enriching and enhancing the way we share experiences and collaborate remotely. In this demo, we present our ongoing efforts towards social and shared VR; a modular web based VR framework that extends current video conferencing capabilities with new VR functionalities. The framework allows for two people to come together for mediated audio-visual interaction, while engaging in (interactive) content. First results show that a majority of users appreciate the quality and feel highly immersed and present. Thus, with our demo we show that current web technologies can enable a high level of engagement.
SUBTITLES IN 360-DEGREE VIDEO

**Andy Brown** – Research & Development, BBC, Salford, United Kingdom

**Jayson Turner** – BBC Research and Development, BBC, Manchester, United Kingdom

**Jake Patterson** – Research & Development, BBC, Salford, United Kingdom

**Anastasia Schmitz** – Research & Development, BBC, Salford, United Kingdom

**Mike Armstrong** – BBC Research and Development, BBC, Manchester, United Kingdom

**Maxine Glancy** – BBC Research & Development, BBC, Manchester, United Kingdom

**Abstract:** Currently there exists no agreed-upon user experience guidelines regarding subtitling (closed captions) in immersive 360-degree video experiences. It is not clear how subtitles might be acceptably displayed within this context, namely to support the balance between comprehension, freedom to look around the scene, and immersion. This work-in-progress describes four subtitle behaviours that we have designed and implemented in order to perform user-testing. We describe our rationale for each behaviour and discuss our initial hypotheses surrounding a full empirical investigation.
USER RESEARCH AND DESIGN FOR LIVE TV UX IN CHINA

Rui Zhang – UX lab, Samsung Electronic (China) R&D Center, Nanjing, Jiangsu, China
Lei Shi – UX lab, Samsung Electronic (China) R&D Center, Nanjing, Jiangsu, China
Ye Deng – UX Lab, Samsung Electronics (China) R&D Center, Nanjing, Jiangsu, China

Abstract: In current Chinese TV market, Live TV programs are buffeted by internet contents from smart TV/over-the-top (OTT) box and other screens like mobile phone and pad. The user experience of Live TV watching can’t satisfy user needs. We defined Chinese typical TV users: elderly, housewife, then qualitative and quantitative studies are implemented. In the qualitative study, 30 users’ telephone interviews were implemented to understand general behavior of Chinese users when watching live TV. We designed a questionnaire according to telephone interview results, and then conducted a survey with 100 Chinese typical TV users to understand their habits, needs and pain points associated with live TV watching experience. Based on our research, we summarized 3 live TV UX directions: 1. Integrate live show functions with Internet functions. 2. Base smart services on users’ habits and needs. 3. Information visualization. We explored some design hypotheses for future live TV viewing scenarios based on those identified research directions.

HED: A FLEXIBLE HBBTV WYSIWYG VISUAL AUTHORING TOOL

Carlos Navarrete Puentes – Systems and Computer Engineering, Universidad de los Andes, Bogotá, Bogotá, Colombia
Jose Tiberio Hernandez – Systems and Computer Engineering, Universidad de los Andes, Bogotá, Bogotá, Colombia

Abstract: In the last years, no significant progress has been made towards making interactive TV a relevant tool for average household members. There is no big offer in terms of interactive content; hence, most viewers are familiar only with HD broadcasting. Due to its complexity, technical terms, high costs, and the fact that these technologies are usually designed from scratch, it is not commonly used by viewers. This paper is based on the HbbTV specification (Hybrid Broadcast Broadband TV), which has been adopted in various nations around the globe. The official statistic on HbbTV’s website show approximately 300 deployed services, thus, the average, since 2009, has been only around 3.12 services a month across the world. This paper presents HEd (HbbTV Editor) as a flexible
visual authoring tool which aims to reduce the development time, complexity and costs of creating applications. In addition, HEd aims to develop improved interactive applications related to the broadcasted signal. These contents may include culture and education as it will be shown in the present case study. In it, an application about an African-Colombian culture-related children’s TV show is presented, where viewers can actually interact by playing the cultural musical instruments or watching some of the traditional music groups.

INVESTIGATING THE EFFECT OF RELATIVE TIME DELAY ON COMPANION SCREEN EXPERIENCES

Wei Liang Kenny Chua – UCL Interaction Centre, University College London, London, United Kingdom

Jacob Rigby – UCL Interaction Centre, University College London, London, United Kingdom

Duncan Brumby – UCL Interaction Centre, University College London, London, United Kingdom

Vinoba Vinayagamoorthy – British Broadcasting Corporation, London, United Kingdom

Abstract: Mobile devices are increasingly used while watching television, leading to companion apps that complement programmes being developed. A concern for these applications is the extent to which device and television content need to be temporally aligned. In this study, 18 participants watched a nature programme while being shown companion content on a tablet. Temporal synchronisation of content between the devices was varied. Participants completed questionnaires measuring immersion and affect and were tested on companion content recall. While there were no statistically significant effects on these measures, qualitative interviews with participants after viewing consistently revealed that longer 10s delays in content synchronisation were frustrating. This suggests that poor content synchronisation can produce a negative companion experience for viewers and should be avoided.

A MIDDLEWARE TO ENABLE IMMERSIVE MULTI-DEVICE ONLINE TV EXPERIENCE

Hussein Ajam – Faculty of Arts, Science and Technology, The University of Northampton, Northampton, Northamptonshire, United Kingdom

Rajiv Ramdhany – Research and Development, BBC, London, United Kingdom

Mu Mu – The University of Northampton, Northampton, United Kingdom
**Abstract:** Recent years have witnessed the boom of great technologies of smart devices transforming the entertainment industry, especially the traditional TV viewing experiences. In an effort to improve user engagement, many TV broadcasters are now investigating future generation content production and presentation using emerging technologies. In this paper, we introduce an ongoing work to enable immersive and interactive multi-device online TV experiences. Our project incorporates three essential developments on content authoring, device discovery, and cross-device media orchestration.

**BEYOND THE TIMELINE A DATA-DRIVEN INTERFACE FOR INTERACTIVE DOCUMENTARY**

Mirka Duijn – HKU University of the Arts, Utrecht, Netherlands  
Hartmut Koenitz – HKU University of the Arts, Utrecht, Netherlands

**Abstract:** In this paper, we present work on the data-driven interface for The Industry, an interactive documentary in development about the Dutch illicit drug industry. The motivation for the work was to provide a more complete overview of a highly complex matter using a form of interactive digital narratives (IDN). As it is with many complex issues, news reports on illegal drugs in the Netherlands are mostly fragmented and reactive, which makes it difficult for audiences to gain a good understanding of the topic. The approach starts by obtaining big-data sets from police and media. On this foundation, a narrative interface will be designed. This paper reports on the iterative design approach, and interface metaphors, on the lessons learned and the current state of affairs. Our intent with this paper is to fuel a discussion on narrative representations of complexity.

**EXPLORING ONLINE VIDEO DATABASES BY VISUAL NAVIGATION**

Wolfgang Hürst – Utrecht University, Utrecht, Netherlands  
Bruno dos Santos Carvalhal – Utrecht University, Utrecht, Netherlands

**Abstract:** We present an interface design for interactive exploration of large movie databases based on a concept we entitle visual navigation. Our approach aims at combining the major advantages of existing systems, which are commonly either simple but limited in functionality or powerful but complex and less engaging. To verify the potential of our idea, we performed a pilot study, which indicates the validity of our approach, highlights advantages, and pinpoints areas for improvement and future work.
MOBILE DEVICES AND PROFESSIONAL EQUIPMENT SYNERGIES FOR SPORT SUMMARY PRODUCTION

Sujeet Mate – Nokia Technologies, Tampere, Finland
Igor Curcio – Nokia Technologies, Tampere, Finland
Ranjeeth Shetty – Tampere University of Technology, Tampere, Finland
Francesco Cricri – Nokia Technologies, Tampere, Finland

Abstract: We present a novel approach for sport video summary production that leverages the best aspects of mobile devices and professional equipment. The proposed recording set-up and workflow, consisting of both types of devices has two main advantages compared to conventional techniques. Firstly, it reduces cost of content production by reducing the cost of equipment and crew required for content capture. Secondly, it reduces the time for content production by leveraging automation. Subsequently, a tunable summary production approach is presented for creating a multi-camera representation of a salient event. Incorporating cinematic rules creates aesthetically pleasant viewing experience. Interactive production of the summary enables professional users as well as second screen device (mobile, tablet, etc.) users to create a summary, where inclusion of highly ranked salient events can be done based on the subjective viewing value. Furthermore, automation provides a framework for easy inclusion of crowdsourced content. The proposed hybrid production method is illustrated here by considering basketball as an example.

ENHANCING USE OF SOCIAL MEDIA IN TV BROADCASTING

Sebastian Arndt – NTNU Norwegian University of Science and Technology, Trondheim, Norway
Veli-Pekka Räty – Department of Electronic Systems, NTNU, Norwegian University of Science and Technology, Trondheim, Norway

Christian Keimel – IRT, Munich, Germany
Francisco Ibanez – Brainstorm Multimedia, Valencia, Spain
Andrew Perkis – NTNU Norwegian University of Science and Technologies, Trondheim, Norway
Taco Nieuwenhuis – never.no, Oslo, Norway
Abstract: Traditional linear TV is decreasing in popularity and the broadcast industry has identified the need to change communication with their audience as a way to counteract on this. Especially younger generations are using social media twenty-four-seven and would like to continue doing so while watching TV. The VisualMedia project accepts this challenge by enriching the TV experience with elements and information from social media in real-time during live broadcasts. It enables broadcasters to select and distribute posts and stats from various social media sources in a fast and reliable way. With the help of VisualMedia, posts and stats can be shown within live programs using enhanced graphical representations or on the second screen, with minimal latency. The goal of the project is to deliver a framework that combines all necessary steps from retrieving posts to delivering them into a live TV show. This gives broadcasters the opportunity to react fast on their audiences, and facilitates audiences to interact with their broadcaster.

MULTI-SCREEN DIRECTOR: A NEW ROLE IN THE TV PRODUCTION WORKFLOW?

Britta Meixner – Centrum Wiskunde & Informatica (CWI), Amsterdam, Netherlands
Maxine Glancy – BBC Research & Development, BBC, Manchester, United Kingdom
Matt Rogers – BBC Research & Development, BBC, Manchester, United Kingdom
Caroline Ward – BBC Research & Development, BBC, Manchester, United Kingdom
Thomas Röggla – Distributed Interactive Systems, Centrum Wiskunde & Informatica, Amsterdam, Noord-Holland, Netherlands
Pablo Cesar – Centrum Wiskunde & Informatica, Amsterdam, The Netherlands

Abstract: Multi-screen applications have been a research topic for the last 10 years. Recent technical advances make authoring and broadcasting of interactive multi-platform experiences possible. However, most of the efforts have been dedicated to the delivery and transmission technology (e.g., HbbTV2.0), and not to the production process. The hypothesis of this article is that broadcast television requires radical changes in the production workflow, in order to allow for an efficient production of interactive multi-platform experiences. This paper explores such changes, investigating workflows and roles, and identifying key requirements for supporting these. The final objective is to create a new set of tools, extending current processes, that allow broadcasters to curate new types of experiences. The methodology was to conduct a set of interviews with television producers and directors, that allowed us to identify two major (sub-)workflows, one for pre-recorded and one for live experiences. We could then assign roles to the different stages of the workflows and derive a number of requirements for the next-generation of production tools.
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