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MUSCADE Focus

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Special points of interest:

- The position statement is on Stereo 3D for Broadcasters - Quality control as a guarantee to the future 3D Technologies
- HHI launches 3D Innovation Center

Inside this issue:

Stereo 3D for Broadcasters – Quality control as a guarantee to the future 3D Technologies?

Position Statement submitted by Yvonne Thomas of European Broadcasting Union

2011 is one of the most successful years in the history of Stereo 3D. Thanks to the advancement of technology, the digital approach to implement 3D could be a long-term success. Nearly one fifth of the worldwide 3D cinema screens are refitted with the 3D technology and the number of sold 3DTV sets has increased by approximately 450% during the year 2011. 3D found its niche in special (live) events and movies as a unique viewing experience. But it will never replace the "traditional" 2DTV, although 24/7 3D channels exist, especially in the US.

For a broadcaster, it is currently difficult to produce and transmit 3D content due to the constraints in budget, resource or expertise. To use the current 2D high definition (HD) infrastructure for the transmission, DVB standardized the "Frame compatible format" (FC) in February 2011. Two HD pictures (left/right) are squeezed into one single HD frame in, for instance, a Side-by-Side or Top-Bottom format (mostly 50i or 60i). This also gives the MUSCADE project, which envisages offering more realistic 3D experience than that would never be realised with the stereoscopic technologies, only little possibilities for an innovative workflow. Even though the abovementioned FC technology loses half of the resolution, the next standard will be a "Service compatible format" (SC) and "Frame compatible, compatible format" (FCC) that provide two full HD pictures, nearly the same quality is currently only available via 3D Blu-Ray (MVC 24p). The disadvantage is that it won`t be possible to use the existing Set-Top-Boxes and low bandwidth anymore. As a result, the broadcasters have to struggle between quality and bandwidth (i.e., less number of channels for the same bandwidth).

While the demand for more comfortable 3D content is becoming more intensive, another 3D technology, namely Autostereoscopic/ Multiview, starts to become popular. To reap the full advantage these display technologies that offer more comfortable 3D viewing experience, the 2 or 4 view multiview plus disparity (identified as MVD2/4) format was developed by the MUSCADE project. By collecting broadcasters` requirements, a new infrastructure for delivering

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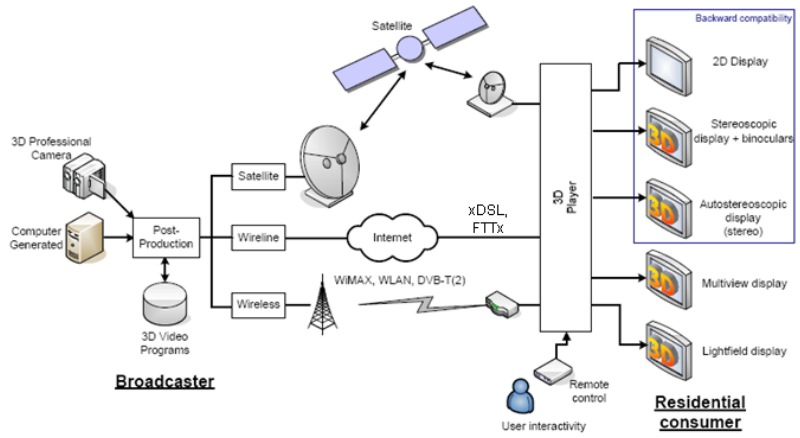

Figure 1. Infrastructure for delivering MVD2/4 multiview and disparity

MVD2/4 multiview and disparity was created (see Figure 1).

It is envisaged that multiview displays will become more popular as an increasing number of consumers are no longer willing to wear 3D glasses. For mobile devices and in shop window based advertising boards, autostereoscopic/multiview screens are already deployed successfully. The disadvantage of the present generation of the multiview displays is that more the number of views offered by the display lesser the resolution of each view would be. For example, a full HD resolution will be divided by five for five view display. Mathematically, one view would only provide a horizontal resolution of 384 pixels, in this case.

In order to offer a good and comfortable 3D multiview experience, a lot of work still needs to be done:

- increase resolution of the display panels and content (4K or higher)
- increase the number of views/sweet spots
- guarantee 2D backwards compatibility
- make the price affordable for consumers
- adapt 3D content production (as of MUSCADE)

In addition to the 3D production and transmission issues, it is urgently required to encourage the standardization work. For instance, there is no methodology for subjective evaluation of 3D content (like ITU-R BT 500 for 2D) and 3D reference displays are yet to be defined. Moreover, what is the status of synchronization, workflow automation, compression (MPEG-2, H.264/AVC) as well as the knowledge in the 3D production? We need to resolve these issues to ensure successful market penetration of the 3D audio-visual services. And especially for multiview content creation, resolving those issues is not very easy. This is one of the challenges the MUSCADE project is facing.

In addition to bringing up standards for 3D image formats and modes, it is equally important to generate training opportunities and experience in the 3D area. For multiview content creation, the "3D language" needs to be adapted to make it suitable for more complex systems.

Besides with all the effort focused on adapting and finding new ways for the production, transmission or displaying, the quality should always be maintained at the highest possible level. The key word is quality control to ensure the best viewing experience for the viewer.

There are already some tools to help 3D video production and delivery or work is in progress to

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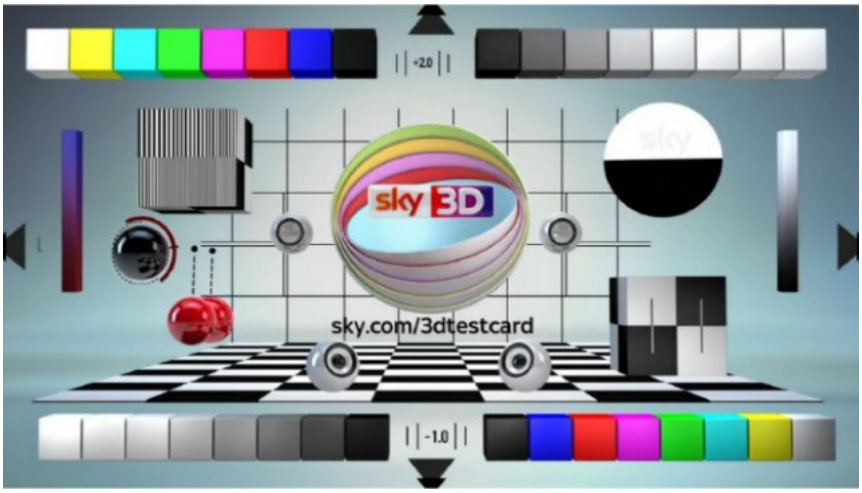

Figure 2. Sky test card

develop new tools. Some of them are described in the following paragraphs:

Sky test card [1]

Stereo content can be sometime uncomfortable, but often it is not the content that is bad. It is rather the inappropriate 3D TV or projection system setup which is responsible for the poor experience. The consumers at home often do not have the knowledge to adjust the environment to the screen or vice versa.

Considering this lack of knowledge, in order to ensure that consumers are able to adjust their 3DTV in the correct manner, Sky launched in December 2011 a 3D Test card which will be transmitted via Sky everyday lunchtime to record it or enable real-time adjustment of the 3DTVs. The video explains more details about the viewing distance, lighting, etc. The 3D Test card itself gives some indication of the correct aspect ratio, colour, sharpness, stereo sound or crosstalk (ghosting).

As soon as a 3DTV is accurately adjusted, the consumer should be able to enjoy 3D in a more comfortable way. It seems that this kind of guidance is very appreciated by consumers and thus filling the lack of knowledge about 3D viewing.

R135 [2]

The EBU 3DTV Project Group has published the Recommendation R 135 'Production & Exchange Formats for 3DTV Programmes' for those EBU Members that need to produce, exchange, archive and distribute 3D programmes using their existing 2D HD production infrastructure and transmission technologies.

The document was issued in August 2011. These kind of recommendations should help to ensure the way to exchange or archive the 3D content in the best possible quality. Several production formats, 720p50, 1080i25, 1080i50 or 1080p50, are included in R 135, as different broadcasters have different requirements in their specific environments. The formats follow the established EBU HD formats as described in Tech 3299 (2010).

Thus the Recommendations give technical aid to broadcasters who intend to use the current or future 2D HDTV infrastructure to produce 3DTV programmes.

To carry the full resolution in 3DTV production, the EBU recommends to use two HD-SDI links (SMPTE ST 292-1) or one single 3G-SDI link (SMPTE ST 424 & 425-1). The camera recording should comply with the EBU R 132 (e.g., min. 2 x 50 Mbit/s 4:2:2 inter-frame coding or min. 2 x 100 Mbit/s 4:2:2 intra-frame coding).

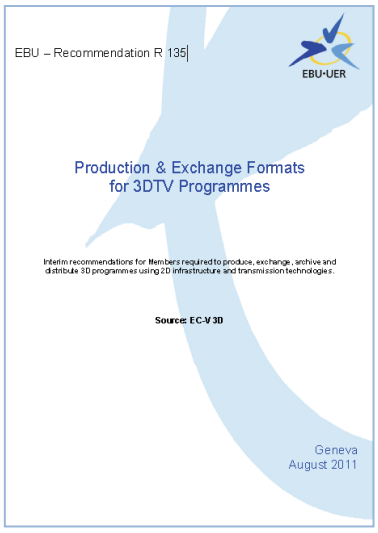

Figure 3. R 135 'Production & Exchange Formats for 3DTV Programmes'

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Stereo 3D for Broadcasters – Quality control as a guarantee to the future 3D Technologies?

continued...

DVB requirements [3]

DVB and the 3D@Home Consortium agreed on a pact to facilitate 3DTV standards in November 2011. In that case, they will also focus on the human perception of stereoscopic content, share and benefit from their knowledge and research results.

Meanwhile DVB is also working on the **Service Compatible (Phase 2a) format**, with two separate Full HD streams, and **Frame-Compatible Compatible (Phase 2b) format**, with is Frame Compatible plus something, to transmit two FullHD (left/right) images to provide the highest possible quality.

The commercial requirements for the Phase 2b are already very stable. As Phase 2a requires different requirements one decided to split the second phase in a and b.

Compared to the first Phase of the 3DTV specification, the Frame compatible format where two FullHD images are squeezed in one FullHD frame, the Phase 2 formats will require a new infrastructure (namely STB`s, wider bandwidth). So, when broadcasters want to transmit a better 3D quality, and this is highly appreciated by the consumers, they have to think about some issues at the same time.

In the future work of the standards bodies as well as projects like MUSCADE, the quality of 3D content needs to be ensured over the entire chain. However, it should keep in mind that any attempt of ensuring quality might cause some other issues, especially when autostereoscopic/multiview become more popular.

REFERENCES

[1] www.sky.com/3dtestcard

[2] http://tech.ebu.ch/docs/r/r135.pdf

[3] www.dvb.org

Fraunhofer HHI launches 3D Innovation Center in Berlin

A 3D Innovation Center (3DIC) is inaugurated by Fraunhofer HHI on 5 September 2011. The Berlin 3D Innovation Center offers the whole cast of actors a platform and a pre-competitive environment where they can exchange views and opinions, build contacts, put their products and systems to the test and present them jointly to a diversity of target audiences.

The ready availability of know-how covering the whole 3D systems chain will generate new synergies – in terms of product development, marketing and sales as well as market positioning and public relations.

The Berlin 3D Innovation Center is

- a showroom for products, prototypes and ideas
- a development platform and testbed for 3D technologies, applications and infrastructures
- an R&D lab for projects, innovations and standards
- a communication platform for providers, users and the general public
- a transfer platform for expertise and professional training
- a marketing instrument for advertising, sales and PR
- a pool of resources for experts, know-how, and marketing and target audience data etc.

The establishment and organization of the 3D Innovation Center is in the hands of the Fraunhofer Heinrich Hertz Institute, The Berlin 3D Innovation Center is planned to operate for an initial period of five years.

During the initial phase the Berlin 3D Innovation Center is supported by the German Federal Ministry of Economics and Technology.

"The Berlin 3D Innovation Center offers the whole cast of actors a platform and a pre-competitive environment"

For details about the center please refer to http://www.hhi.fraunhofer.de/en/3d-innovation-center-berlin/ and http://www.3d-innovationcenter.de

Submitted by: Frederik Zilly, Fraunhofer Institute for Telecommunications, Berlin, Germany

3D Stereo MEDIA conference, Liège, Belgium on 5-9 December 2011

Link:

http://www.3dstereomedia.eu/

Frederik Zilly of Fraunhofer Institute for Telecommunications, Berlin, Germany delivered a talk about MVD4 generation in the context of the MUSCADE project at the 3D Stereo MEDIA conference held in Liège, Belgium on 5-9 December 2011. His talk entitled "Depth-based Content Creation for Auto-Stereoscopic Displays using Multi-Camera Rigs" was delivered during the session "3D range cameras and their applications". In his talk, he detailed the MUSCADE Multi-Camera rig, Multi-Camera-assistance system, MVD4 depth estimation and MVD4 virtual view generation (Depth Image Based Rendering). He extensively used MUSCADE results to support his discussions.

3D Stereo MEDIA is an international event fully dedicated to "3D" and covering ALL aspects and ALL applications of ALL forms of "3D" (stereoscopic, holographic, integral, range,...). The event is built around the four key components below, designed to fulfill the needs of most people interested in the scientific, technical, artistic, and/or business aspects of 3D. The power of 3D Stereo MEDIA lies in the fact that it focuses on 3D, provides high-quality information, uses 3D visualization extensively, brings together scientists, engineers, artists, businessmen, and deciders, is supported by a major university and the local imaging industry. This year, 3D Stereo MEDIA reinforces its offering by introducing a scientific conference, with appeal to researchers, and a 3D film market, with appeal to artists and investors.

"The power of 3D Stereo MEDIA lies in the fact that it focuses on 3D, provides high-quality information, uses 3D visualization extensively, brings together scientists, engineers, artists, businessmen, and deciders, is supported by a major university"

Submitted by: Frederik Zilly, Fraunhofer Institute for Telecommunications, Berlin, Germany

Figure 4. Multi-Camera rig

INIT Autumn School on 3D Imaging Technologies

Link: http://init.uji.es/school2011/

Péter Tamás Kovács was one of the lecturers at the INIT Autumn School on 3D Imaging Technologies, organized by Institute of New Imaging Technologies (INIT) of the University Jaume I of Castellón, taken place October 3-7, 2011 in Benicàssim, Spain.

The participants of the school were PhD students, postdoc researchers and some lecturers involved in 3D imaging, 3D vision, capturing, processing and rendering. During the week, fruitful discussions with other researchers as well as young researchers were taken place, fuelled by the in-depth lectures, which included a detailed discussion of the work and challenges of the MUSCADE project.

Figure 5. Péter Tamás Kovács's lecture at the INIT 3D School

"fruitful discussions with other researchers as well as young researchers were taken place, fuelled by the in-depth lectures, which included a detailed discussion of the work and challenges of the MUSCADE project. "

Submitted by: Holografika

Astrium represented MUSCADE at the 8th FP7 Networked Media Concertation meeting

Astrium attended the 8th FP7 Networked Media Concertation Meeting in Brussels on 13-14 December 2011. Details of the meeting and presentations can be found on the Commission Website http://ec.europa.eu/information_society/netmedia/events/concertation-meetings-platform/concertation-meeting/8th-cm/index_en.htm. During the meeting of the 3D Immersive Interactive Media cluster, a presentation of MUSCADE was made to share the latest project outcomes with other FP7 projects.

Submitted by: Astrium

"During the meeting of the 3D Immersive Interactive Media cluster, a presentation of MUSCADE was made to share the latest project outcomes "

Publications Corner

Real time depth estimation using line recursive matching

Authors: C. Riechert, F. Zilly, P. Kauff

Affiliation: Fraunhofer Institute for Telecommunications, Berlin, Germany

Publication: The 8th European Conference for Visual Media Production (CVMP2011), 16-17 November 2011, London, UK

Link: http://www.cvmp-conference.org/

Abstract: Depth Image Based Rendering (DIBR) is a key technology needed to create content for auto-stereoscopic displays and to adapt stereoscopic content to different screens sizes. Pixel-dense depth maps for stereoscopic videos are required for this purpose. In this paper we present a new depth estimator which generates HD resolution depth maps suitable for DIBR in a real-time environment.

Semantic Kernels Binarized - A Feature Descriptor for Fast and Robust Matching

Authors: Frederik Zilly, Christian Riechert, Peter Eisert, Peter Kauff

Affiliation: Fraunhofer Institute for Telecommunications, Berlin, Germany

Publication: The 8th European Conference for Visual Media Production (CVMP2011), 16-17 November 2011, London, UK

Link: http://www.cvmp-conference.org/

Abstract: This paper presents a new approach for feature description used in image processing and robust image recognition algorithms such as 3D camera tracking, view reconstruction or 3D scene analysis. State of the art feature detectors distinguish interest point detection and description. The former is commonly performed in scale space, while the latter is used to describe a normalized support region using histograms of gradients or similar derivatives of the grayscale image patch. This approach has proven to be very successful. However, the descriptors are usually of high dimensionality in order to achieve a high descriptiveness. Against this background, we propose a binarized descriptor which has a low memory usage and good matching performance. The descriptor is composed of binarized responses resulting from a set of folding operations applied on the normalized support region. We demonstrate the realtime capabilities of the feature descriptor in a stereo matching environment.

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