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Production and delivery in Ultra HD and 4K

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Abstract: Questions and answers session of the workshop “Production and delivery in Ultra HD and 4K”, Drexel University, Cinema and Television Department, July, 26th 2016.

The workshop objective is to address the new content production and distribution standards in ultra-high definition (Ultra HD) and the technological bases that support them.

The new standard is already being used at its full potential, although international organizations for standardization are still working on its development. The first stage has materialized in 4K image resolution, but we still do not know where this path will lead film, television and video industries.

Are we faced with a paradigm shift or is it simply a smooth evolution? Is technology ready for this change? Is there really a demand for it?

Keywords: Ultra HD, UHD, 4K, HDR, Ultra High definition, digital cinema, television

What technical factors are involved in the new standard?

Migration to Ultra HD television and 4K digital cinema does not only involve increasing spatial resolution. It must also provide wider color space, increased dynamic range (HDR) and High Frame Rate (HFR). That is, more pixels, but also better pixels. All these breakthroughs must be aimed at increasing perceived quality and enhancing the artistic component of films and TV programs.

How does Ultra HD affects cinema production and exhibition in movie theaters?

DCI is the standard for Digital cinema, 2K and 4K, and the color space is called DCI-P3. From the technical point of view, DCI-P3 is not sufficient; it has a color gamut slightly higher than HD Television's BT-709 but still below photochemical cinema. In that sense, the move from film to digital has been a setback. A new technological development with wider color gamut and higher contrast ratio is needed in order to surpass positive film projection. There is already talk of making a new standard DCI 2.0. The current 1.0 has severe limitations in aspect ratio and frequency rates. For example, format 4:3 is not considered, nor is the projection at 16 frames per second. Film archives have a lot of such material and the standard does not take it into account. These additions to the standard should be considered together with the questions of dynamic range and color space.

Which difficulties are found in the sphere of television broadcasting?

- Ultra HD broadcast uses more bandwidth and is more expensive.

- The codec HEVC (H.265) is very efficient but it is still very difficult to transport 4K signals.
- BT-2020, the new color space for television is an important breakthrough. But 4K displays which are currently marketed have not yet implemented it.
- We are still waiting for the standardization of High Dynamic Range (HDR).

Why is it necessary to increase frame rate?

Higher frame rates mean sharper images as well as smoother movements. This is particularly important if we consider that higher spatial resolution allows for larger screens and reduced viewing distances.

Does 4K necessarily imply larger screens?

A recent BBC study on television viewing conditions in the United Kingdom analyses perceived quality as regards the size of the screen and viewing distance. At a distance of 2 or 3 meters with a 40 or 50-inch TV sets, the difference between HD and Ultra HD is not very perceptible due to visual acuity, which is a physiological factor. 4K will be very noticeable in larger displays, when the viewer is very near, as for example in a 100-inch screen, at 2 meters' distance. But this is not a common situation today in households!

It is not only a question of size and resolution. We also need a new generation of brighter displays with more contrast and colors.

When does migration to Ultra HD will start?

Its implementation is steadily on:

- With regard to production, progress is significant: cameras, digital recorders and postproduction systems can work with these new quality standards.
- HEVC standard is working properly for broadcast and internet
- The first generation of 4K TV sets for homes is already being marketed.

The displays issue is the most critical at the moment. The industry has to offer a clear added value if it wants users to invest in a new set. Ultra HD in 4:2:0, at 8 bits and with BT-709 color space does not seem to meet this requirement. Marketing strategies of display manufacturers will establish the rate of implementation of the new technical features.

The migration process can take a few years' time. The experience from earlier transitions shows it: for example, the definition of digital television standards occurred in the early 90's, but the switchover from analog to digital was not completed in Europe until 2012, that is, 20 years later. In that case the migration process benefited from considerable mediation from the States, which needed to complete the move in order to free up broadcast spectrum. Now, with Ultra HD, there will not be such incentives.

Is there already content in Ultra HD?

All content is produced in BT-709 or DCI-P3 color spaces. When BT-2020 starts and High Dynamic Range values are defined, content will not be ready. It will be necessary to make conversions from original films on photochemical support to comply with the new standard. These conversions will require heavy investments from content providers as well as time.

Is the audience demanding this product?

Audiovisual creation has always been bound to technological development, from the first steps of photography and cinema to nowadays. Professionals tend to use new tools and new formats for their creations within a logic of permanent innovation set out by the industry and by the marketing of works. It is part of the job and is implicit in audiovisual professions. It has always been so: when sound and color were incorporated into films, when the different movie formats were created and when electronic and digital image emerged. Each and every one of these changes has been a challenge for artists, who have exploited the new possibilities offered by technology. The question is to take advantage of these innovations for artistic creation in order to make new and better films and TV programs.