The Broadcast Experience Beyond The UHDTV Horizon

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IEEE

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The future will be a combination of…

- Developments and extensions of what exists today
- Ideas seeming to come out of nowhere that no one has yet thought of
- The result of lateral thinking
- **We need them all**!

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The tendency is towards...

- Image and sound systems that provide an ever greater sense of reality
- An ever greater choice of content
- Communication systems that are ever more convenient to use

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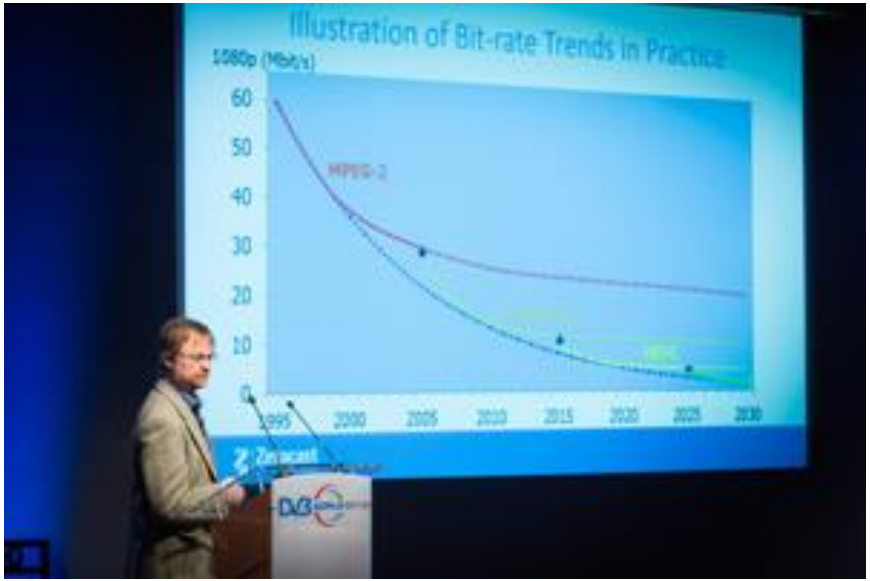
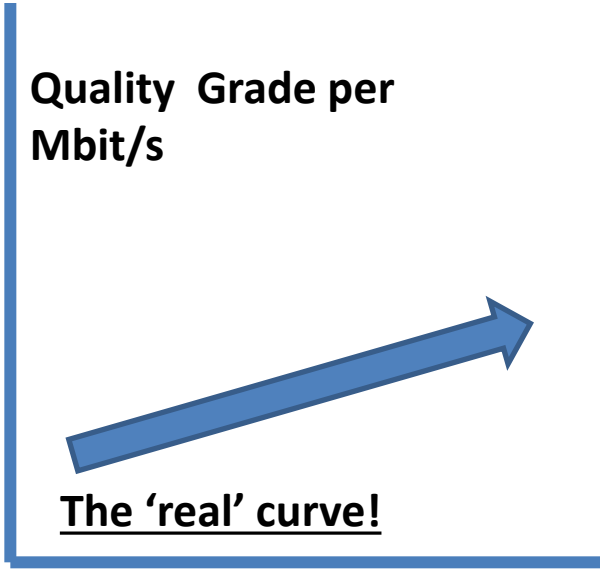
The compression efficiency enigma?



The McCann Curve – eventually we will need zero bit rate?



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The complications...

- Overlapping ideas, development and implementation ‘cycles’
- The regulatory, economic and national industry environments influence what happens
- Manufacturers need for new products
- **The future will be determined by more than just R and D**

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Why does some great technlogy fail?

- PAL plus
- DVB-H
- MAC
- DRS
- STV

- Weak business case?
- Lack of compelling content?
- Insufficient quality improvement?
- Lack of externalities?

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Common standards

- Common standards help to bring larger markets, more competition, and more informed purchasers
- The world's research and development capacity continues to grow with the world's population
- **Common standards are becoming more difficult to achieve as more and more companies are involved**

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Examples of the standards' dilemmas

- Complexity and cost of the consumer equipment versus gain in image quality and convenience
- Compatibility with existing systems versus Image Quality of new systems
- **Should we adopt a short term solution or wait for a longer term solution?**

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Some examples of challenges...

The **near term**

- Which dynamic range characteristics should be allowed for UHDTV?

The **far term**

- Universal communications?
- Are there other senses we can exploit?
- 3DTV – Can a wave-front be recorded?

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UHDTV issues of today include...

- We **have already** the basic production formats for the two UHDTV quality levels – UHD-1, UHD-2
- We **do not yet have** the specification for the ‘extended image dynamic range’ system (aka EIDRTV or simply HDR) one of the most important features

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Extended Image Dynamic Range(EIDR)

- The EIDR is the range and handling of image information on the screen between the blackest black and the whitest white
- In future, UHDTV sets will have higher peak brightness capability (e.g. 2000 nits and maybe more) than do HDTV sets today (e.g. 200 nits)
- **There are several approaches** with image quality and backwards compatibility among the variables

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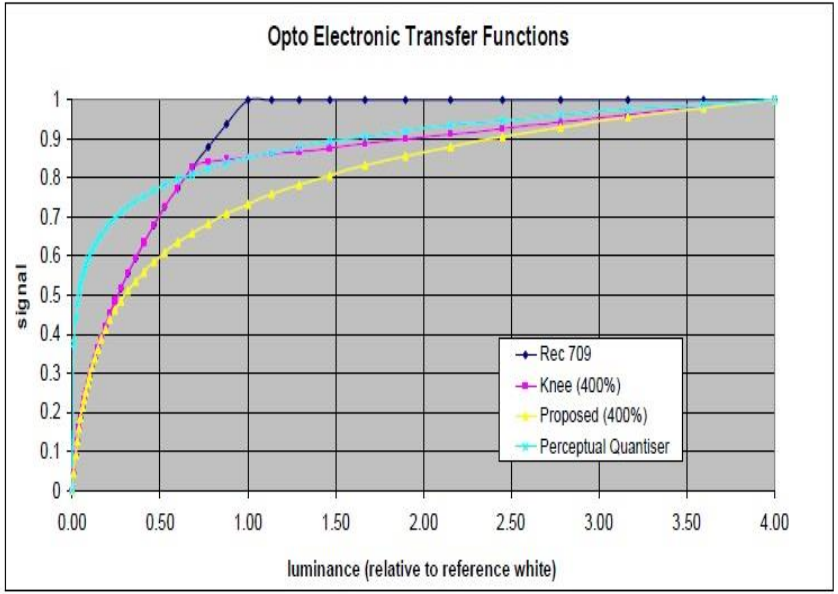
The choices are...

- 1: “Compatibility with good performance” - the ‘log-gamma’ approach
- 2: “Best possible performance with measures to achieve compatibility” - the ‘Barton’ approach
- **Which should be chosen?**



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UHDTV Quality Factors

- Higher Spatial resolution
- Higher Temporal resolution
- Wider Colour gamut
- Sample resolution
- Aspect ratio
- Constant luminance coding
- Advanced sound system
- High Dynamic Range

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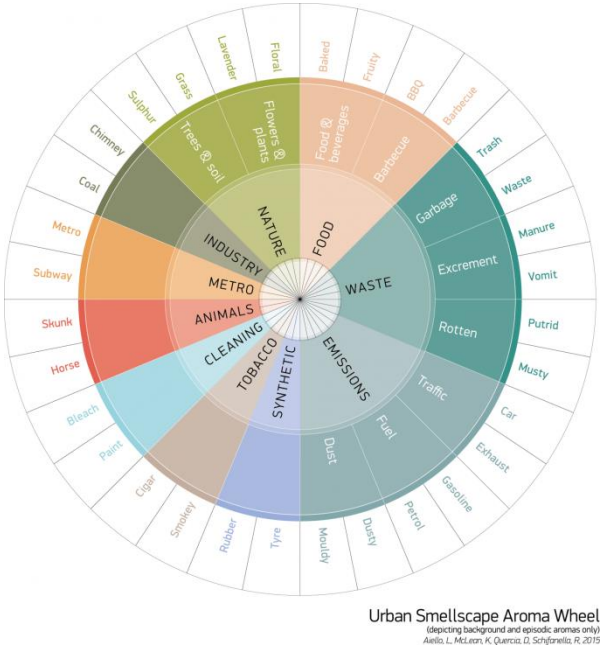
Which Quality Factors should be broadcast?

- Many (but not all) broadcasters believe that for UHDTV to be successful, the quality step needs to be very large
- Many (bit not all) manufacturers believe that for UHDTV to be successful, the cost of UHDTV sets needs to be moderate
- **Who is right?**

And looking much further ahead...

Outside the box?



Urban Smellscape Aroma Wheel
(depicting background and episodic aromas only)
Aiello, L., McLean, K, Quercia, D, Schifanella, R. 2015

- Could stimulating the sense of smell enhance the media experience?
- Are there a limited set of ‘primary smells’?
- Could we provide a combination of transitory primary smells?

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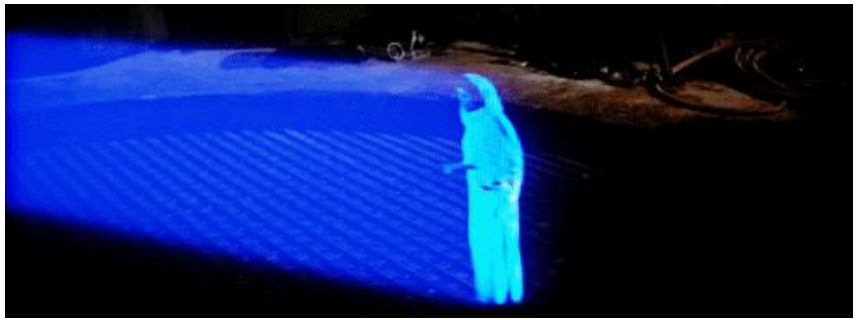
Outside the box?



- Stereoscopic television (STV) today is the delivery of two point source images (‘left and right eye’) with parallax. Mechanisms are used so that each eye sees one of these images. The visual cortex fuses the images
- Can a light wave-front (object wave) be sampled and recorded?
- **Can we create a single variable that combines the amplitude and phase of the object wave**?

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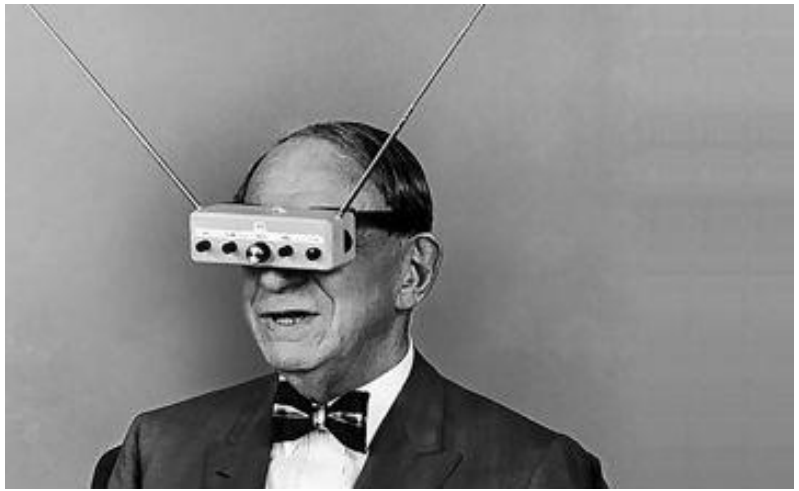
The future of 3D TV?

- Glasses-free displays have been developed but have limitations (convergence/accommodation conflict remains)
- ‘Integral TV’ could provide a large number of fixed viewpoint pairs
- ‘Nature’ in fact provides something different - a ‘wave front’ or ‘object wave’ that has amplitude, frequency, and phase - a kind of ‘superset’ of STV.



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How could it be captured?

- We need to be able to record, in slices, the amplitude and phase of the complete wave front that passes through an aperture, for example a 16:9 landscape rectangle
- Filters can be used to reduce the wavelengths to be recorded to three or four, as a match to the cones of the eye, with ≥100Hz and UHDTV resolution
- The signal will need content adaptive compression for storage and transmission

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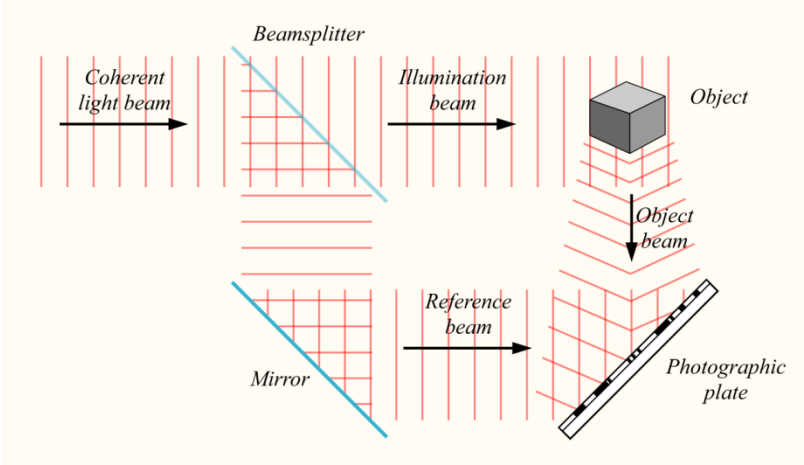
Holography



- Holography is a relatively simple mechanism for converting an object wave into a recordable signal.
- In Holography, a single optical wavelength (laser) is used, so only the variations in amplitude and phase of the wave front need to be recorded, which simplifies the recording process
- In Holography, the amplitude and phase of the object wave are used to amplitude-modulate a reference wave. This creates a single function that records both amplitude and phase variation of the object wave.

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Looking forwards by looking back!

- Essentially, holography is a simple modulation and demodulation system, using **amplitude modulation.**
- Remember that in broadcasting, the first technology (1920) was also analogue **amplitude modulation**.
- Now, 90 years later, there are much more efficient modulation technologies – fm, pm, OFDM, digital forms, etc. . Can more efficient technologies similarly be developed for modulating and compressing a wave front signal?

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Conclusions

- The future of the media is not just determined by R and D. There are **many other influences**
- Standardisation is becoming **more difficult.**
- In the example of UHDTV a **trade off** between compatibility, quality, and complexity is needed. Are there rules that could be applied?
- For the future should we have faith that big problems will be solved in future if we keep trying, or should we go for shorter term solutions?
- We need your creative thinking.

If we can dream,

why can’t our dreams come true?

Thank you for listening!