New Trends in the Media Broadcast and Streaming Industries: Personalized and immersive media experience

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Factors Driving the New Industrial Trends

- Consumers Interests
  - Engaging Medium (The experience)
  - Interesting Content, which utilizes the medium's potentials (The creative)
  - Suitable Quality of Service (Technical)

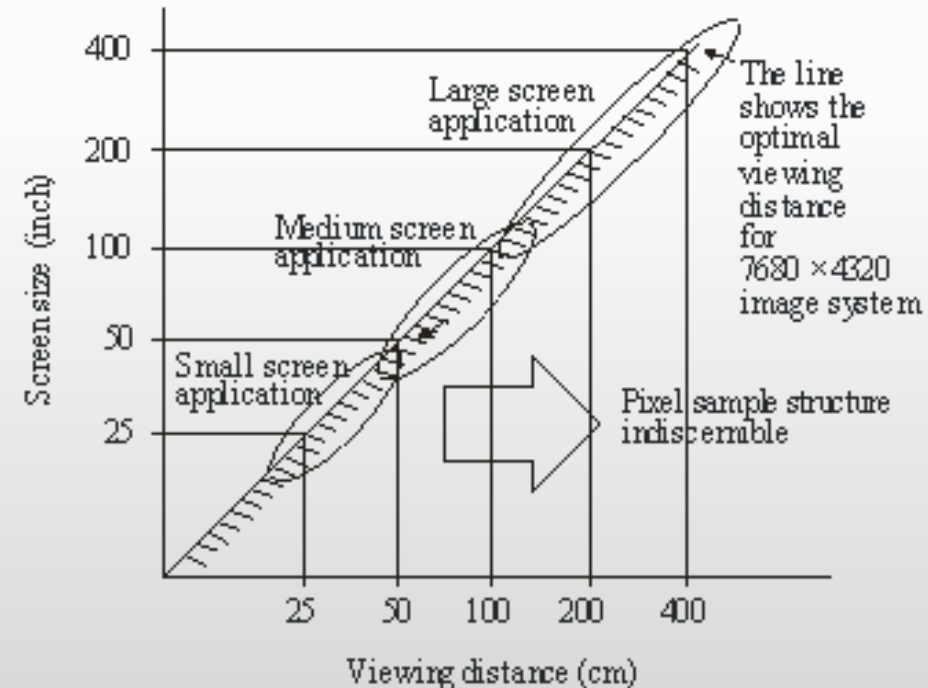- Monetization for Industries involved from production to consumption

What Makes the Media Experience Interesting

- Quality:
  - Higher Resolution: HD, UHD, 8K

  - Higher Dynamic Range: SDR (10 stop) to HDR (16+ stop)

  - Higher Color Gamut: 709 -> P3 -> 2020

  - Higher Frame Rate: (50, 60) -> (100, 120) -> 300

Immersive Media: Near Term

- High Resolution (HVS Sensitivity is 1pixel/arcmin)
  - Larger Field of View (FoV)

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High Dynamic Range: The Concept

- Preserving details, at the dark and the bright areas of the picture

- Measuring the dynamic range by logarithm of the ratio of the brightest to darkest visible details (in base 2 → Stop)
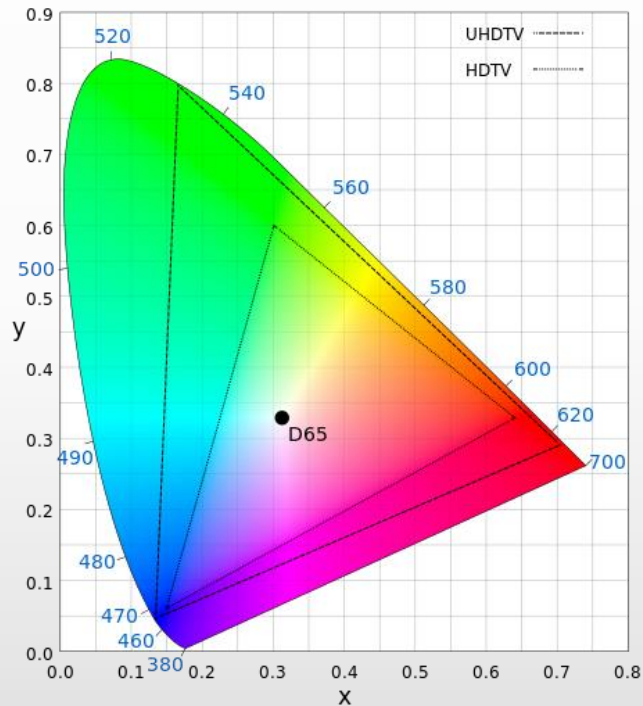- SDR: 8-10 stops
- HDR: 17+ stops

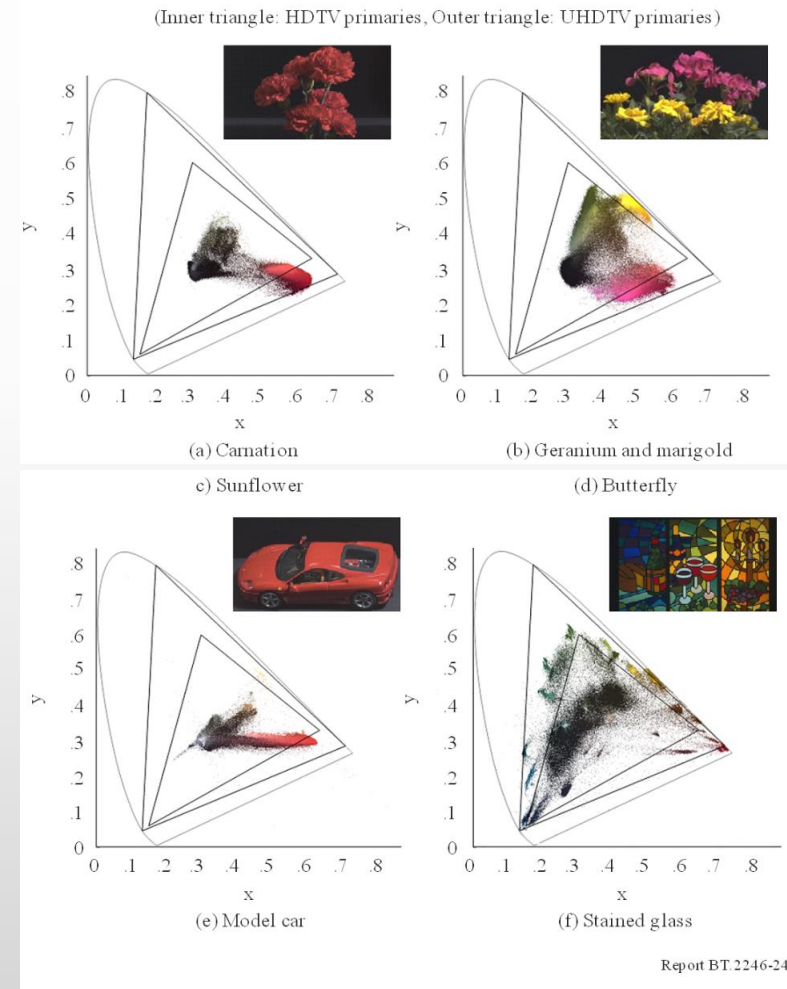# What Makes the Media Experience Interesting

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Wide Color Gamut: The Concept

- Containers for representing color

- Colors in nature exist beyond the HDTV (ITU-R BT.709) color space

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What Makes the Media Experience Interesting

- Immersion:
  - VR: 3DoF (360 view), 3DoF+, 6DoF
- Personalization:
  - Engage with Media whenever and wherever they choose (Multi-Screen)
  - Tailor content suggestion and targeted advertisement based on user's taste (AI & ML)
- Interactivity:
  - AR
  - Multi story tracks
  - Social Media

Enabling Technologies: Increased Quality

- Increased QoE means Increased bandwidth
- Challenge: To deliver higher quality with the same network capacity
- Solution: Compress media more efficiently
  - Increasing the coding efficiency of video compression schemes:
    - HEVC v1 (2013): ~2x more efficient compared to AVC
    - VVC (2020): With the goal to be 2x more efficient relative to HEVC v1
    - On the horizon: Use of AI as (normative) compression tool
  - More efficient video coding decision (non-normative R-D optimization):
    - Better coding mode selection (including use of AI and ML)
    - Smarter rate control (including use of AI and ML)

Enabling Technologies: Personalization

- Personalized Viewing Experience: Multi-screen, personalized UI, personalized and smart recommendation, targeted ad insertion

- Broadcast and OTT service providers are competing to take over other services at the costumer's premises

  - Home Security

  - Energy Management

  - Health, fitness, elderly care

- Media providers are getting into IoT businesses:

  - Example of service providers :MSO gateways, AppleTV/homepod, Google Home/Alexa/, Amazon Echo, Samsung/SmartThings, etc.

Immersive Media

Immersive Media Use Cases

- Event broadcast/multicast

- Cinematic VR

- Learning applications

- Medical/therapy applications

- Commerce and retail

- VR calls

- User generated content
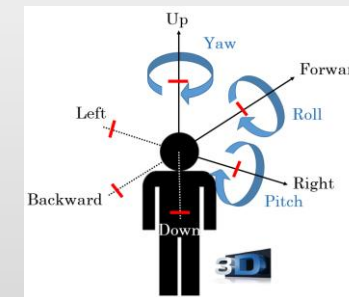
- HMD-based legacy content consumption

Enabling Technologies for Immersive Media

- 3DoF (360 view): Viewing/Head position is fixed = Camera Rig position

- 3DoF+ : Head can move around while

   body is still
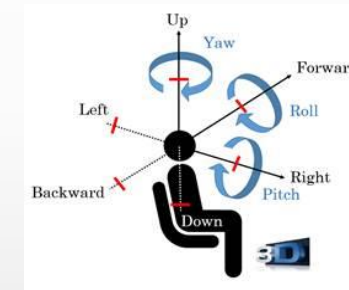
- 6DoF : Viewing position can change
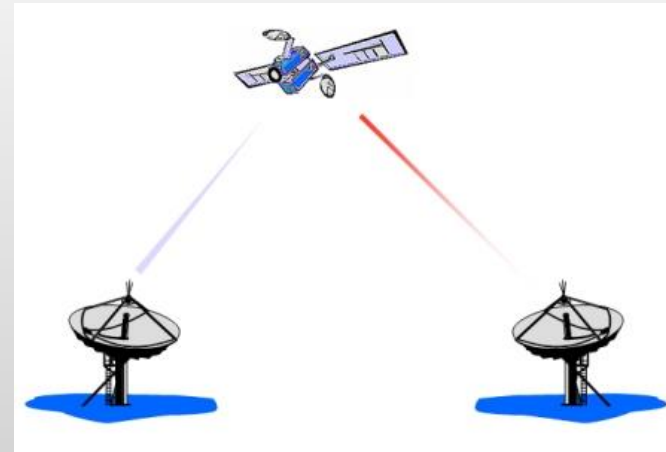
   without restcitions

360° View Ecosystem

| Capture | Format Preparation | Production Workflow | Storage and Distribution | Consumption |

3DoF Technical Challenges

- 360 view is prone to causing sickness in the viewer.
  - Remedies:
    - High Resolution (>21K resolution, in ERP to achieve simple acuity of 1/60 sample per degree)

    - High Frame Rate (>120 fps)

    - Low motion to photon on display delay (<10ms)

- Storage and Distribution Requires High Data Rate (10-50 Mbps for 3DoF and 100-500 Mbps for 6DoF)

5G to rescue: 3GPP Requirements

- SA1 service requirements, documented in the TS 22.261 service requirements for the 5G system.

    - To support VR environments with low motion-to-photon capabilities, the 5G system shall support:
        - motion-to-photon latency in the range of 7-15ms while maintaining the required user data rate of [1Gbps] and
        - motion-to-sound delay of [<20ms].
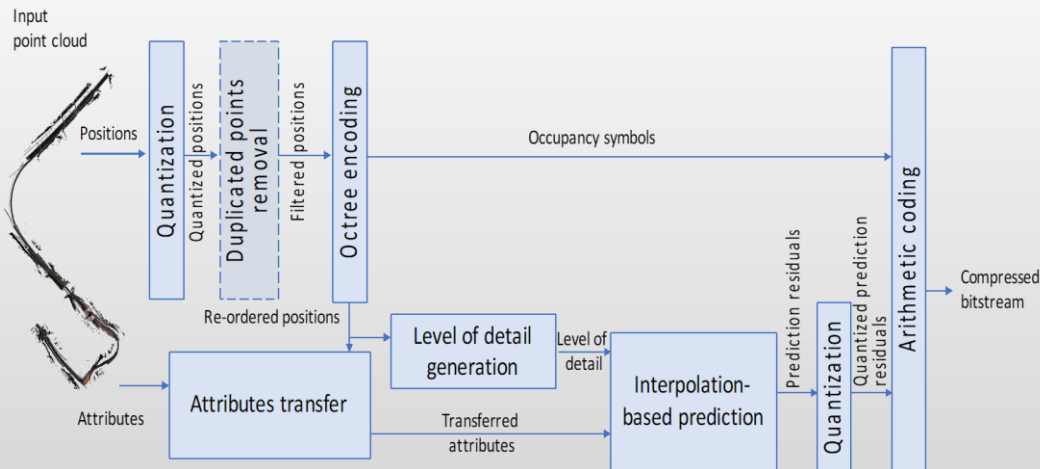
Immersive Technologies: Point Cloud

- Enabling several applications: such as 6 DoF immersive media, VR/AR immersive real-time communication, autonomous driving, cultural heritage and 3D printing

From wg11.sc29.org

Immersive Technologies: Point Cloud Compression
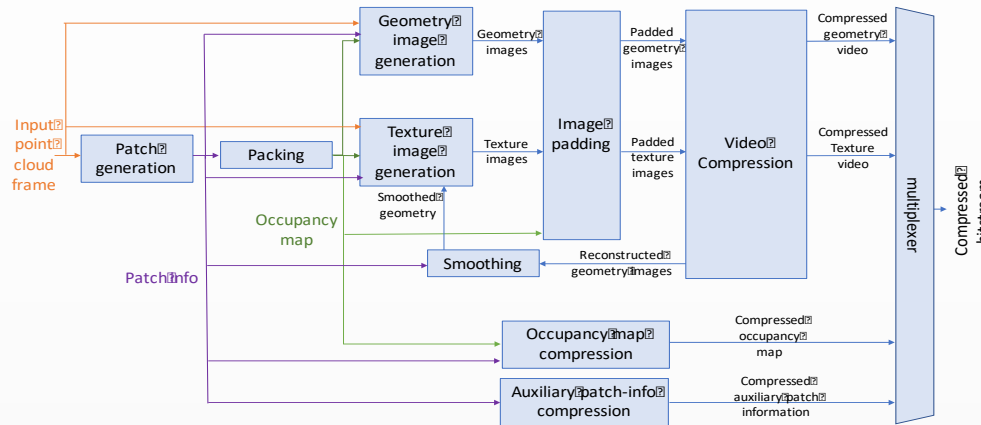
V-PCC Video-based PCC
appropriate for continuous dynamic PC

G-PCC Geometry-based PCC

appropriate for sparse PC

From: Plenary presentation of 3DG Group

Immersive Technologies: Dense Light Field

- Captures light from different angles
- Allows for change of perspective and refocus at rendering

From: http://jpeg.org

Enabling Technologies: Dense Light Fields Compression

- Exploration experiments on **Compression of dense representation of light fields**

  - Find a better way to compress lenslet video with existing standard: lenslet or multiview

From wg11.sc29.org
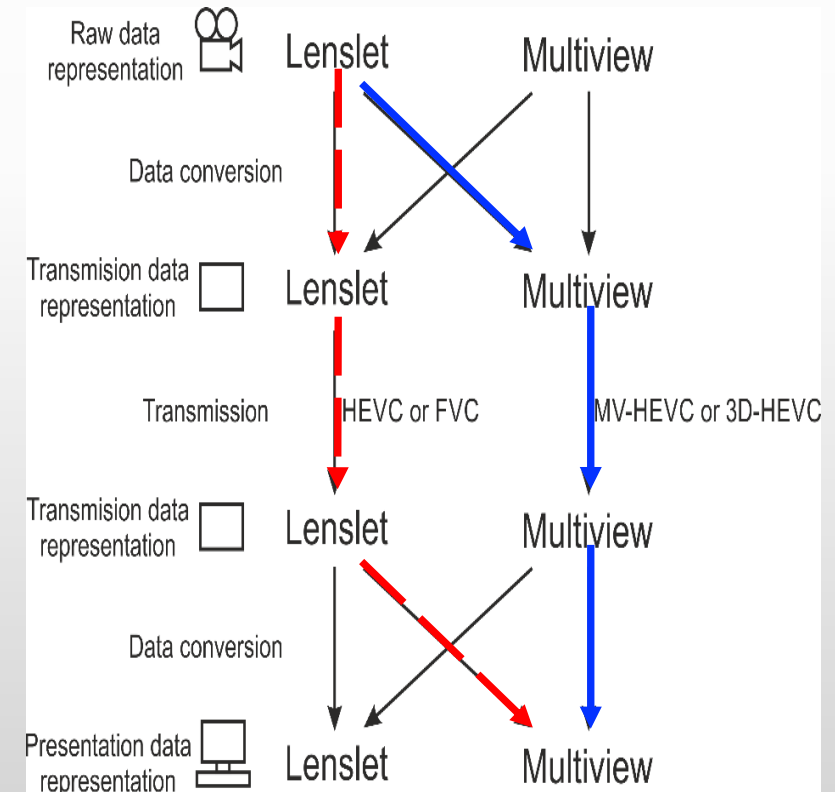
VR Audio Experience

- Audio doesn't add, multiplies the immersive experience

- VR Audio gives a sense of depth and direction

- Positional Audio is More Important in VR
  - Provides strong cues to direct attention to a specific story line
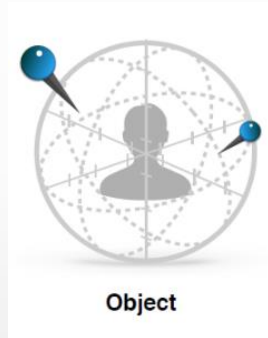 - Without 3D audio the experience is not complete

3D Audio Models

- Ambisonics

- Object based

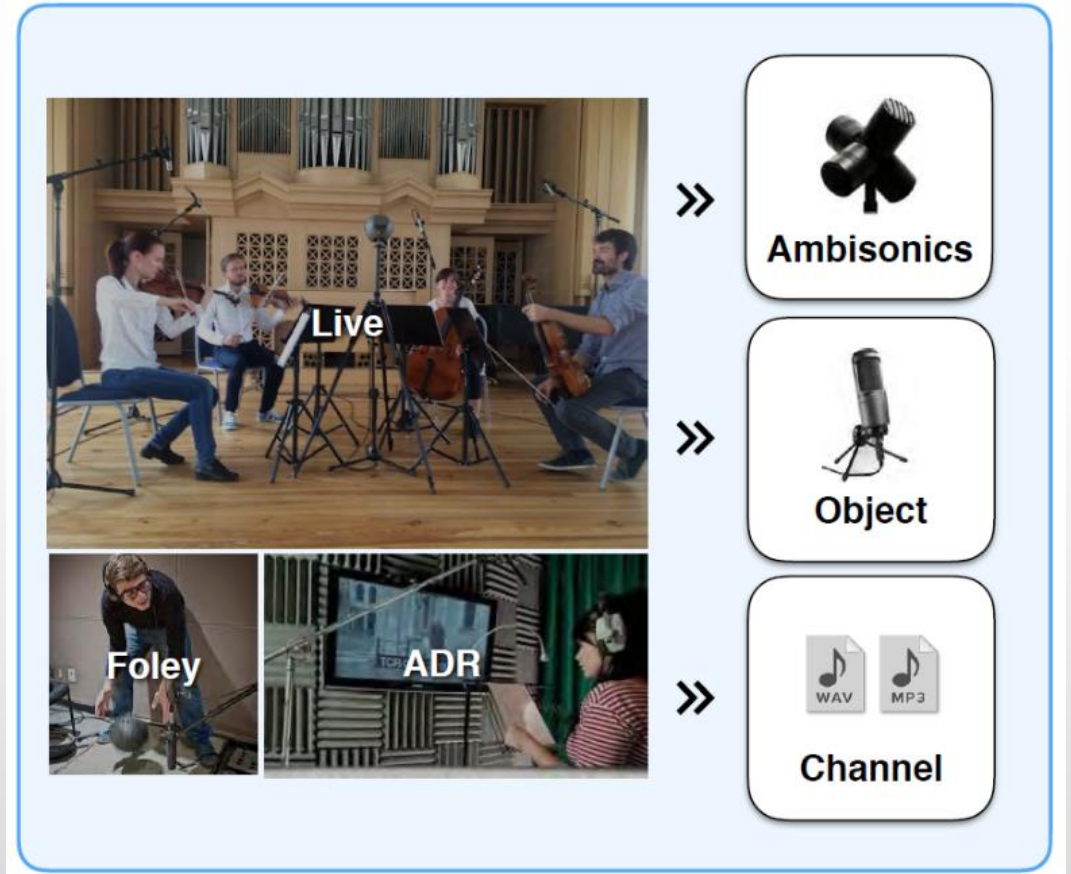- Channels

From wg11.sc29.org

Other Trends in Media Industry

- Network Based Media Processing: Allow mobile devices to benefit from complex resources for
  - Transcoding
  - Viewport rendering
  - Etc.
- Blockchain for:
  - Privacy
  - DRM
- Use of AI for image compression
- Compression of neural networks:
  - CDVA
  - Speech and audio recognition.

Thank You!