creating the living network. together

Use cases & Challenges about Volumetric Video Immersive Experiences
Volumetric content is the future generation of video where the user can experience the sense of depth and sense of parallax.

Volumetric video brings an increased immersion into a content
Outline

Volumetric video for new user experience
Content creation challenges
Challenges related to single user / multi-user experience
Future of Volumetric Displays and AR
Volumetric Video rendering
Perspectives
Experience of parallax

• **VR experiences**
  • Freedom of movement inside the content
    • Not only in front of the content anymore
  • Game engine content showing the direction to go, raising expectations
  • Still weird real
    • Flat content
    • Subject to sickness

➔ VR experience : where volumetric video is mandatory
Experience of parallax

• On any viewing device
  • Experience of parallax makes the user feeling more immersed in the content
  • Dynamic window concept on a 2D screen
    • Showcased at MWC 2019
  • Positive reactions in front of the screen


➔ What type of content would make volumetric video mandatory?
Virtual Camera motion

• **Volumetric Selfie**
  • Creative content from new capture setup
  • Volumetric selfie created from 1 single frame capture
  • Not a scan - you catch the instant emotion


➡ Creating attractiveness for such experiences
Need for volumetric video for all content duration?

- Volumetric video to bring more on key moments
- More than just parallax

Freeze on Volumetric image
AR social experience

- **Volumetric video call**
  - From 3D video call to more immersive content
  - Up to Real Body Telepresence on AR devices

- **AR**
  - From Snapchat like filters to Avatars
  - 1st experiences with volumetric capture characters transported as 3D meshes
AR social experiences

- Volumetric AR challenges
  - Seamless blending
  - Real time streaming & interactions

Volumetric video blending is mandatory for AR experiences
Volumetric video for new video experiences and shared media

Next question is about volumetric video creation challenges
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Capture real video

- **Light Field camera arrays**
  - Trade-off between degree of freedom and rig design
  - Large environment capture challenge
Tools for creatives

- **Virtual camera motion**
  - From stop motion capture to virtual camera motion
  - New perspectives for creatives
Compositing

- **Required tools**
  - For scene compositing to create video with parallax
    - From a non full light field capture setup
  - For large field of view content
  - For VFX compositing
  - 3D compositing tools today not adapted to multi-views content

→ Required editing tools adaptation to ingest light field assets
Game engine plug-in

- From game engine-based content
  - Implementation of a virtual camera rig and a virtual path
  - Creation of multi-views + depth content to feed volumetric format pipeline
  - For lightweight volumetric content experience
  - To expend content repurposing paths
  - To enable fast deployment of volumetric experiences
Volumetric video creation brings additional creative opportunities but limited tools for now.

Next question is about targeted devices to feel volumetric video.
Use cases & Challenges about User Immersive Experiences

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Single user experiences

• **Head mounted displays**
  • “Out of real world” experience
  • Real immersive experience with “no screen” feeling
  • Capture & real time rendering challenges

➡️ Ultimate experience facing technical challenges
Single user experiences

- **Head mounted displays**
  - From limited toward extended DoF experiences
  - Enlarge displacement for the user
  - Some multi-spot experiences proposed
  - Trajectory based step could be an option

- Required tradeoffs between experiences and tools
- Adaptation of DoF to storytelling
Single user experiences

- **Smartphones**
  - Social content
  - AR primary device today
  - Volumetric effect limited by
    - “Screen border” effect
    - Screen size

➡️ Design proper tools for simple but mass market experiences
Challenges related to single user / multi-user experience

Single user experiences

• AR glasses
  • Real world is volumetric
  • Mixed reality experience
  • Primary challenges today are on optics
    • (FoV, VAC, multi focal planes, brightness )
  • Next challenges to come
    • Real time content understanding
    • Volumetric content rendering

-Seamless blending of real world and volumetric content
Challenges related to single user / multi-user experience

Single user experiences

- **New 3D screens**
  - Directional 3D view
    - Eye tracking based
  - Good image quality since only stereo views generated out of 4K/8K display
  - Professional markets

➔ Volumetric video to bring differentiators to new 3D screens
Multi-user experiences

• **Multi-Views Screens**
  - Lenticular / Microlenses arrays on top of standard displays
  - Real time multi-views rendering
  - Today: resolution down sampling to cope with (4K) display

• **Solutions**
  - New look and feel out of standard display experience to avoid «screen border effect»
  - Specific design to enlarge FoV

Early stage prototypes
**Future of Volumetric Displays and AR**

- Volumetric video seen as ultimate user experience
- Light Field Display facing views/resolution trade-offs
- Holographic displays as the holly grail for seamless reality blending

- AR screen today first in industry without depth cues
- Holographic AR head up displays for automotive market

➢ **Today 2D screens able to render volumetric video**
➢ **Early stage Light Field Displays and AR glasses**
➢ **Long term vision is Immersive video for large scale video experiences**
Core technology for volumetric video is about view rendering, adapted to each display device.
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**Volumetric Video rendering**
Perspectives
View Synthesis

- **Real video content**
  - Virtual View Synthesis = the core tool
  - Smooth rendering and Immersive User Experience

➤ End user quality assessment point
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Deep Learning

- Deep Learning for Volumetric content creation and rendering
  - Create or enhance depth information
  - Magnification or intermediate views creation
  - Unlocking some image-based rendering limitations

- State of the art mainly on still images and limited baselines
  - Showing promising opportunities
PERSPECTIVES: WE NEED

New content types where volumetric essence is core
Editing tools to ingest true volumetric content

Deep Learning solutions to scale content creation & unlock rendering technologies

Video formats & distribution solution
Adapted to diverse use cases
Adapted to market timeline
Showing a path to extended immersive experiences

Encoding and Rendering tools for next generation of capture and display devices
Thank you