

# 3D VIDEO BROADCASTING: LESSONS LEARNED AND FUTURE CHALLENGES

**Marco Grangetto**  
marco.grangetto@unito.it



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## Outline

- Introduction
- Current standardization efforts
  - @DVB
  - @MPEG/VCEG
- Future research trends and challenges
- Conclusions



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# INTRODUCTION

## A bit of history



1986:  
Vancouver Expo



2009:  
Avatar,  
MVC, Blu-  
ray 3D



2010: 3DTV mass  
market,  
broadcasting  
trials



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## 3DTV broadcasting

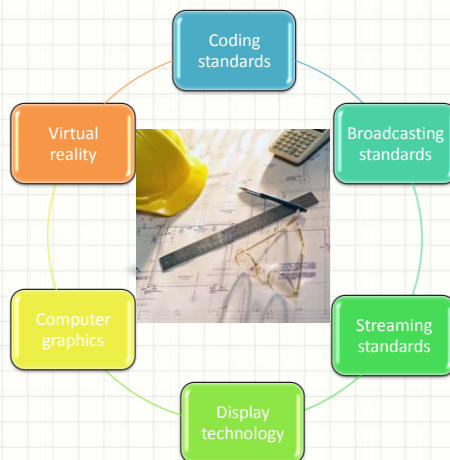
L. Onural, 3D Video Technologies: An Overview of Research Trends, SPIE press, 2011:

**“Widespread opinion indicates that the success of 3DTV is initially based on its delivery in a backward compatible manner to conventional 2DTV”**



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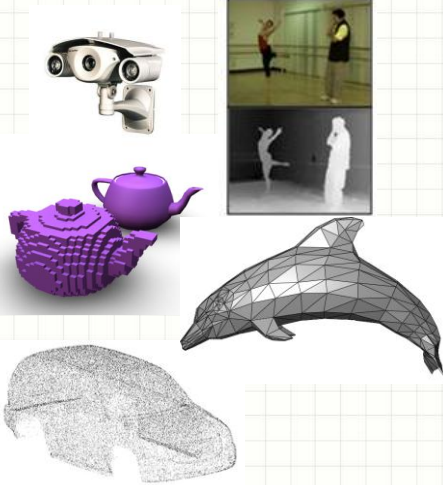
## 3D video: an interdisciplinary challenge



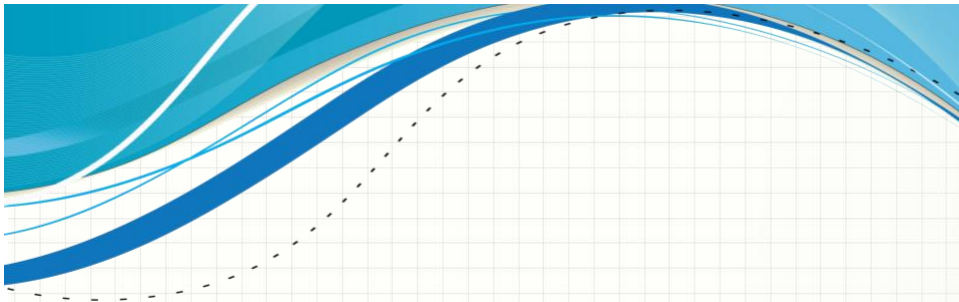
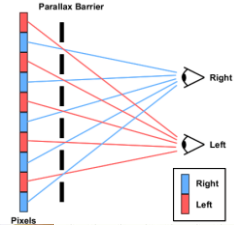
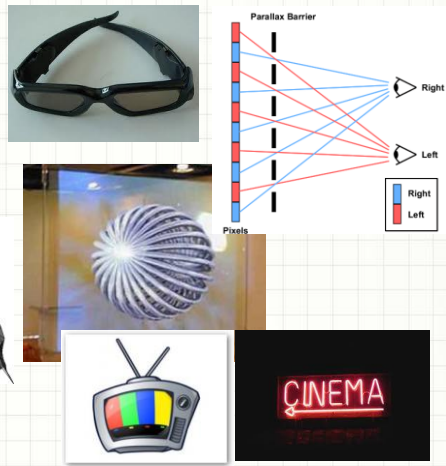
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# 3D compression? Still an ill-posed problem ...

## Raw video format



## Display technology



**PRESENT  
STANDARDIZATION  
EFFORTS**

## 3DTV standardization

- **DVB** and **CableLabs** have already (independently) defined a first version of their standards
  - Based on **frame packing** technologies – SbS and TaB
  - DVB phase one specification includes the optional usage of cropping rectangle for 2D compatibility
- DVB is willing to develop a 2<sup>nd</sup> phase
  - Viewing disparity adaptation
  - Go beyond the limitation of frame packing
  - Other coding tools such as MVC are being considered
- **ATSC** (Advanced Television Systems Committee) is starting now



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## 3D frame compatible formats



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# 3D technology trial

- Testing of a new frame packing arrangement
  - a couple of 720p frames in a single 1080p frame
  - one of the 720p frames is cut into slices

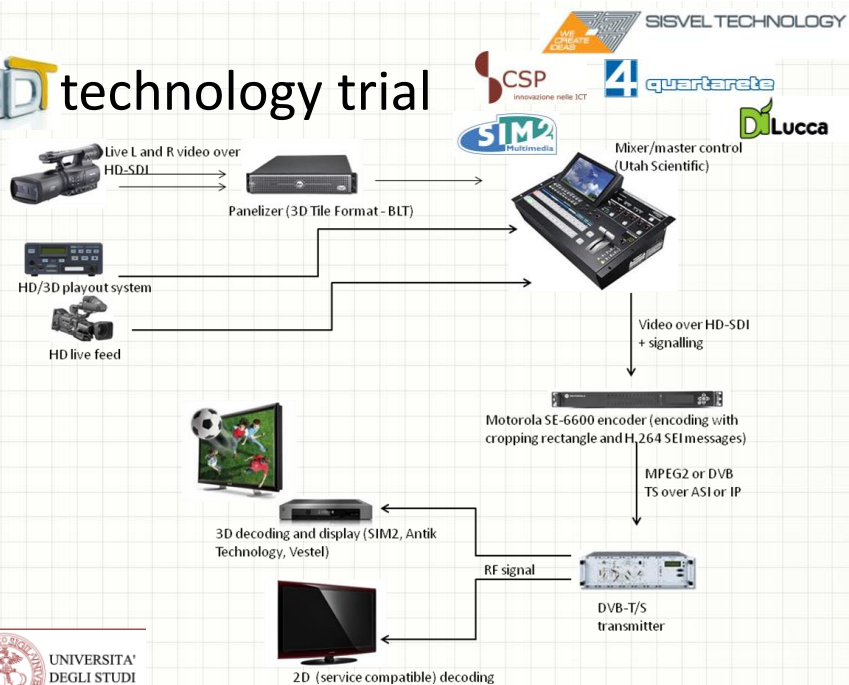


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# 3D technology trial



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## ISO/ITU 3D video: the present

- MPEG 2- MultiView Profile ('96)
- MPEG-C part 3 ('07) (Video + depth agnostic of coding format)
- AVC/H.264 Multi View Coding – MVC ('09)
  - adopted by Blu-ray 3D



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## MVC performance

QP	Simulcast [Mbps]	MVC [Mbps]	Rate saving
Beer Garden 1080p			
36	6.1	5.2	14%
31	11.0	9.8	11%
Beer Garden with virtual background			
36	5.1	3.4	33%
31	9.4	6.5	31%

### MVC coding gain

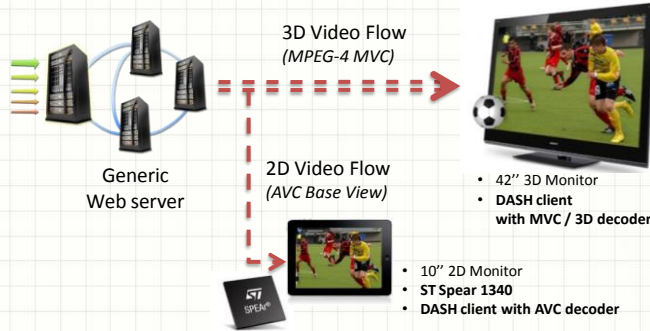
- Highly dependent on the video content
  - Real shooting/ virtual views
- Highly sensitive to capturing settings
  - Camera distance
  - Color correction
  - Image registration
- Limited coding gain in presence of several views



# MPEG-DASH MVC streaming



**Fraunhofer**  
Heinrich Hertz Institute



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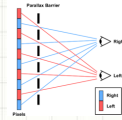
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## OPEN CHALLENGES

## MPEG 3D Video Coding CfP

- Issued on April 2011, coding test due Sept. 2011
- Target:
  - Go beyond existing standards
  - Support for both **stereoscopic** and **auto-stereoscopic** displays (coding 2 and 3 views, rendering of intermediate ones for auto-stereo)
- Goals:
  - Proposal of **compression techniques**
  - Proposal of **novel 3D video formats**



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## MPEG 3D Video Coding CfP

- AVC/HEVC backward compatibility not strictly required
- Input data are 2/3 view plus depth (**depth** signal **can be discarded** if better representation is proposed)
- Proposals will be **subjectively evaluated**



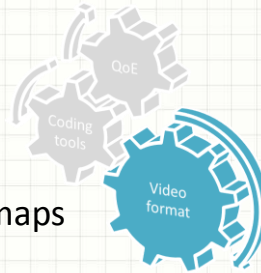
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## Open challenge: raw video format

- Definition of production/compression/display friendly 3d video format
  - Video only
  - Video + Dense depth
  - Layered depth video
  - Sparse depth and saliency maps
  - 3D meshes, point clouds,...



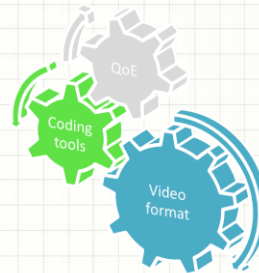
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## Open challenge: coding and view synthesis tools

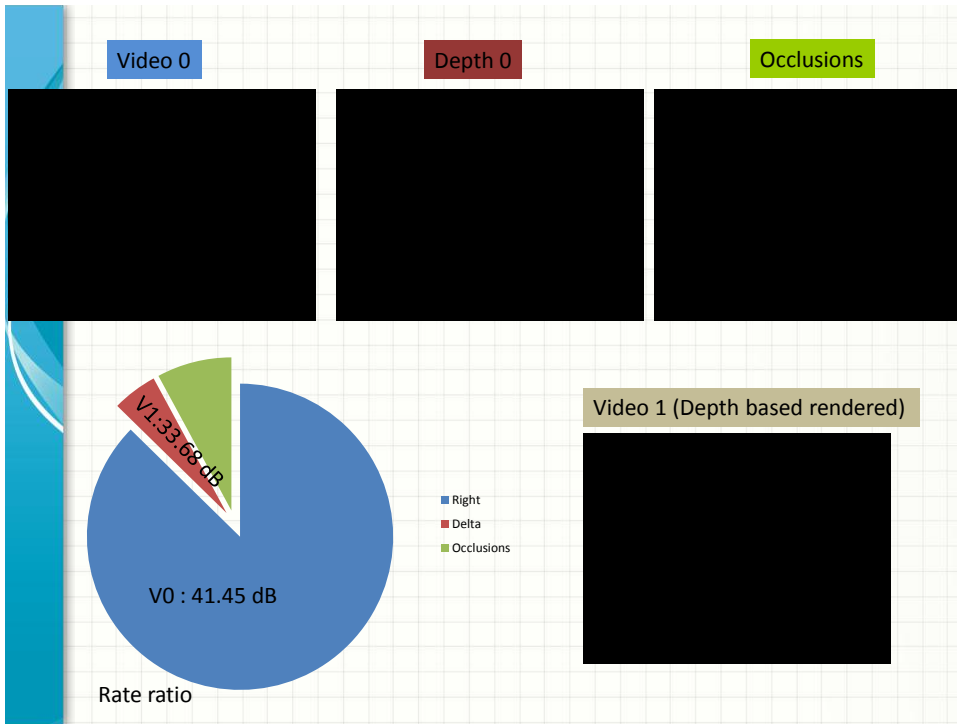
- Predictive and transform coding have dominated the scene of video coding
- Time to seek for innovative and interdisciplinary solutions
  - Image registration
  - Image warping
  - Depth saliency
  - Rendering, 2D to 3D



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## Open challenge: Qo3DE

- Quality of 3D experience
  - Asymmetric coding (lower resolution/lower quality view)
  - Dominant eye issue
  - DVB (phase 1) requirements suggest to guarantee same quality for both views
  - Acceptance (eye-wear, smooth view transition in multi-view auto-stereoscopic, fatigue)



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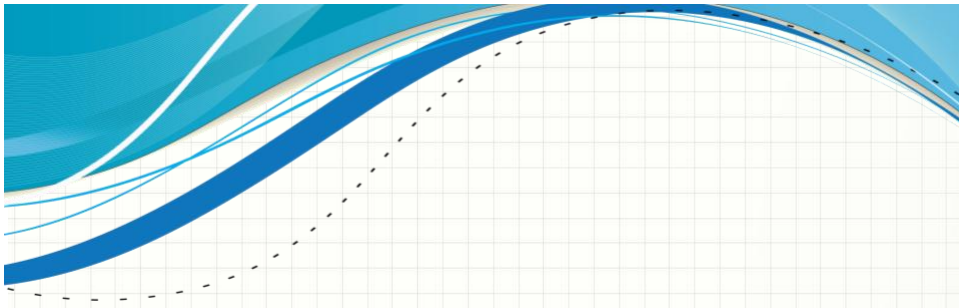
## Future applications...

- Toward a complete convergence of immersive multimedia services within Future Internet
  - Free view-point TV
  - Virtual reality
  - Social interaction
  - Interactivity (Backward compatible 2D on DVB, enhancement and interaction through broadband)



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**THANK YOU!**

[marco.grangetto@unito.it](mailto:marco.grangetto@unito.it)