Digitale Holographie

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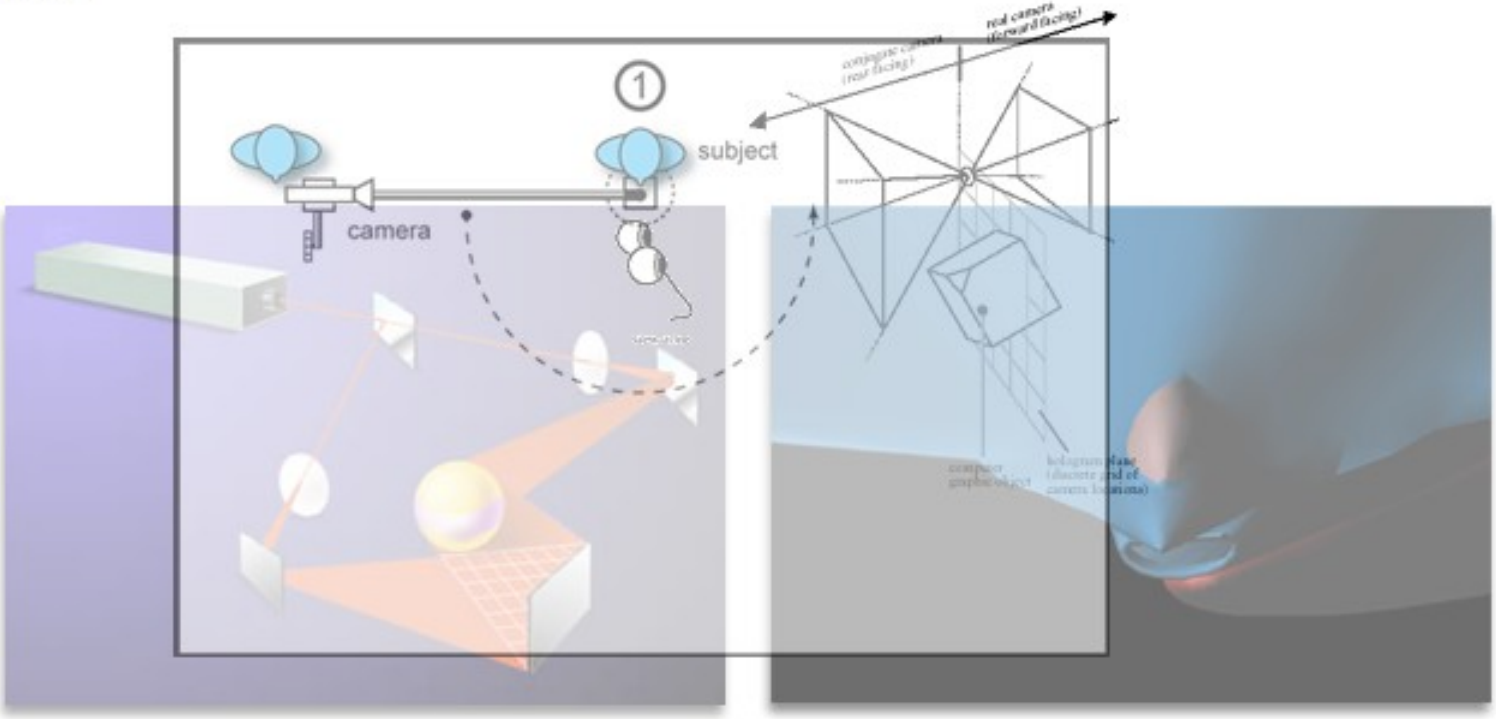


Overview

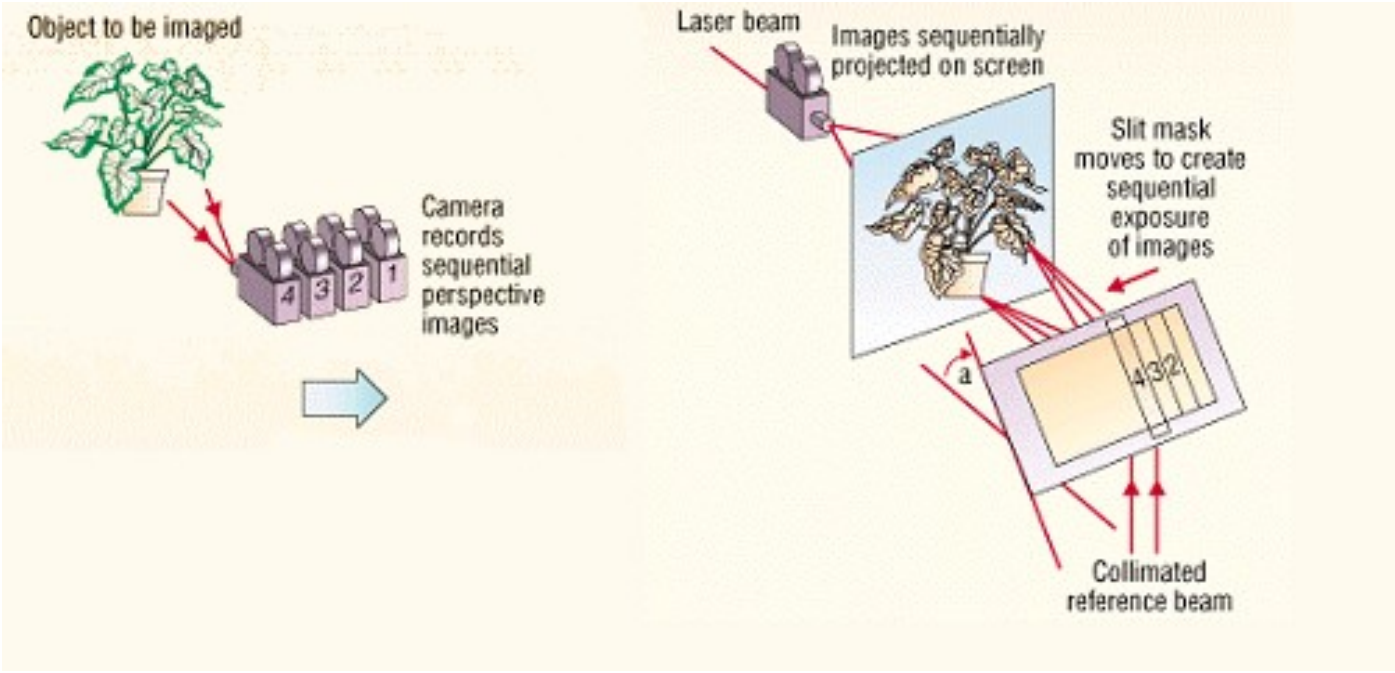
- Introduction
- Holographic printing
- Two-Step-Method
- One-Step-Method
- Rendering
- Amount of data
- Producing our hologram
- Applications

Introduction

- Traditional holograms
- Electro-holography vs digital holography
  - Fringe computation vs rendering
  - Realtime vs realism
  - Flexibility vs accuracy
- HPO or full parallax

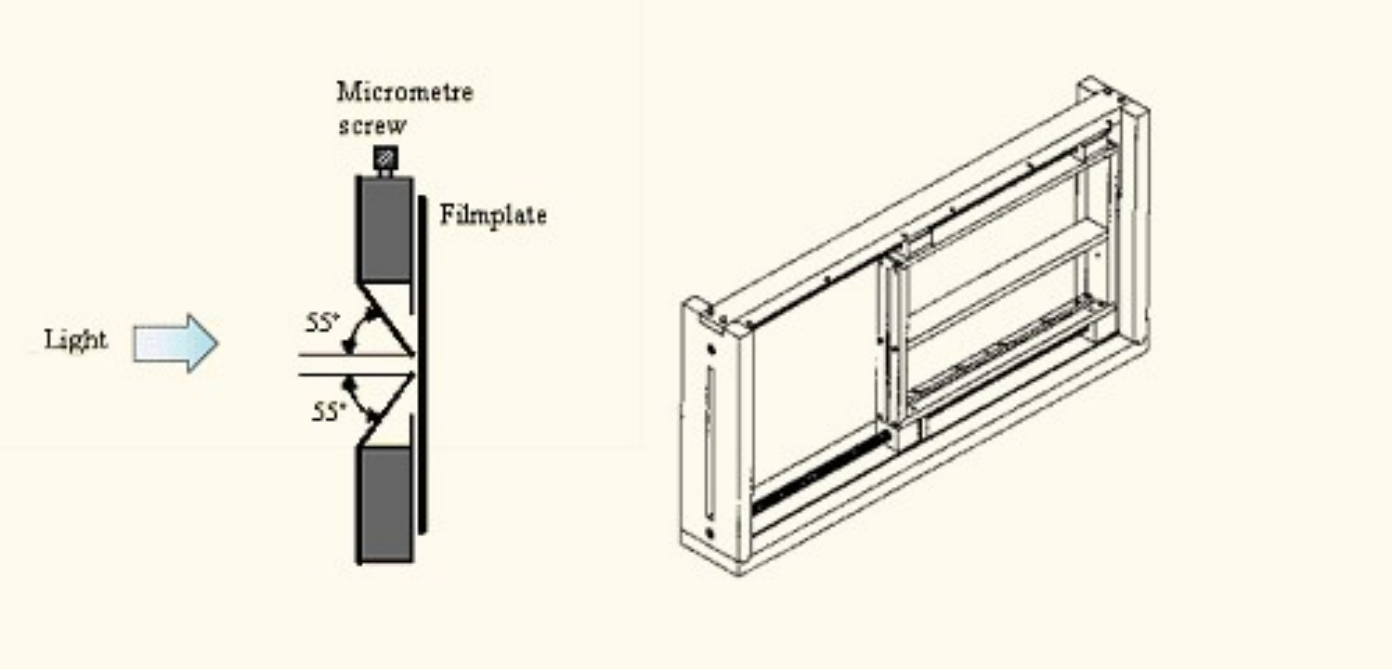
Holographic Printing

- How do we print a hologram?
- Content is shown on a LCD / SLM
- Content is exposed on certain point on filmplate using slits



Holographic Printing

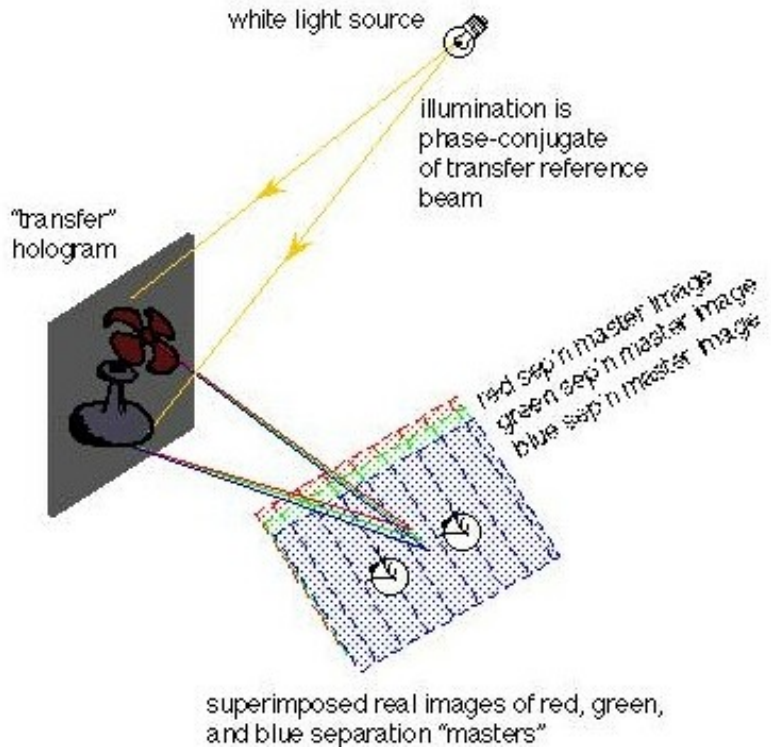
- Film plate moves
- Slit width ~ 1-5 mm adjustable
- Slits constructed to cast no shadows



Two-step-Method

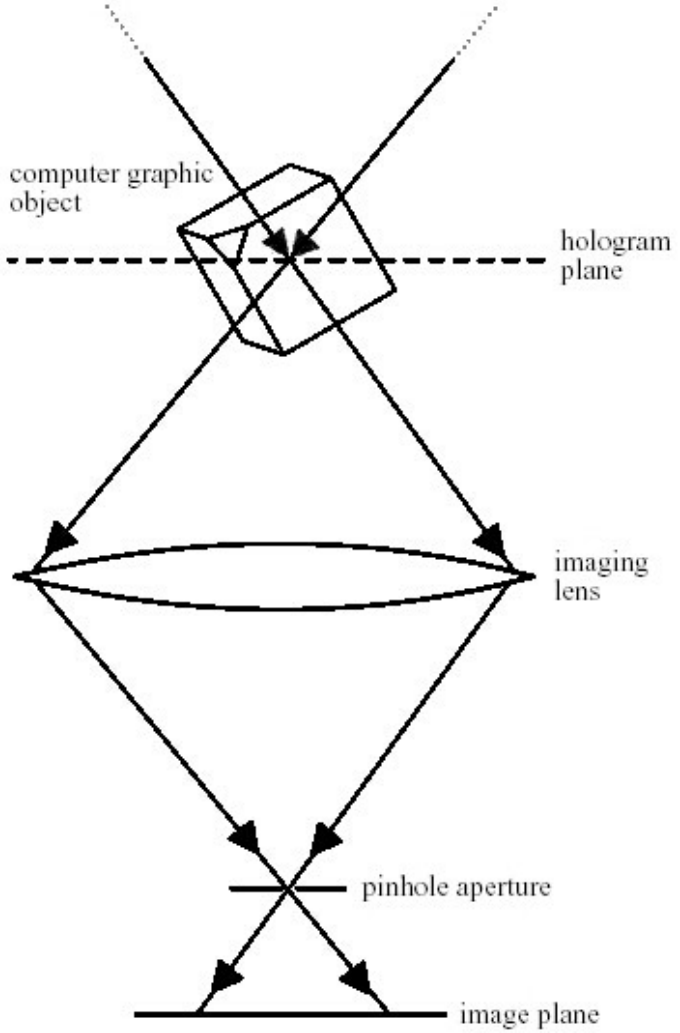
- Create a master using computer-generated or photographed content
- The real image of the master is pseudoscopic
- Master hologram is created by holographic printer.
- Reprint transfer holograms to obtain holograms visible with white light

- Master and transfer hologram
- White-light hologram
- Full color hologram using 3 masters



One step Method

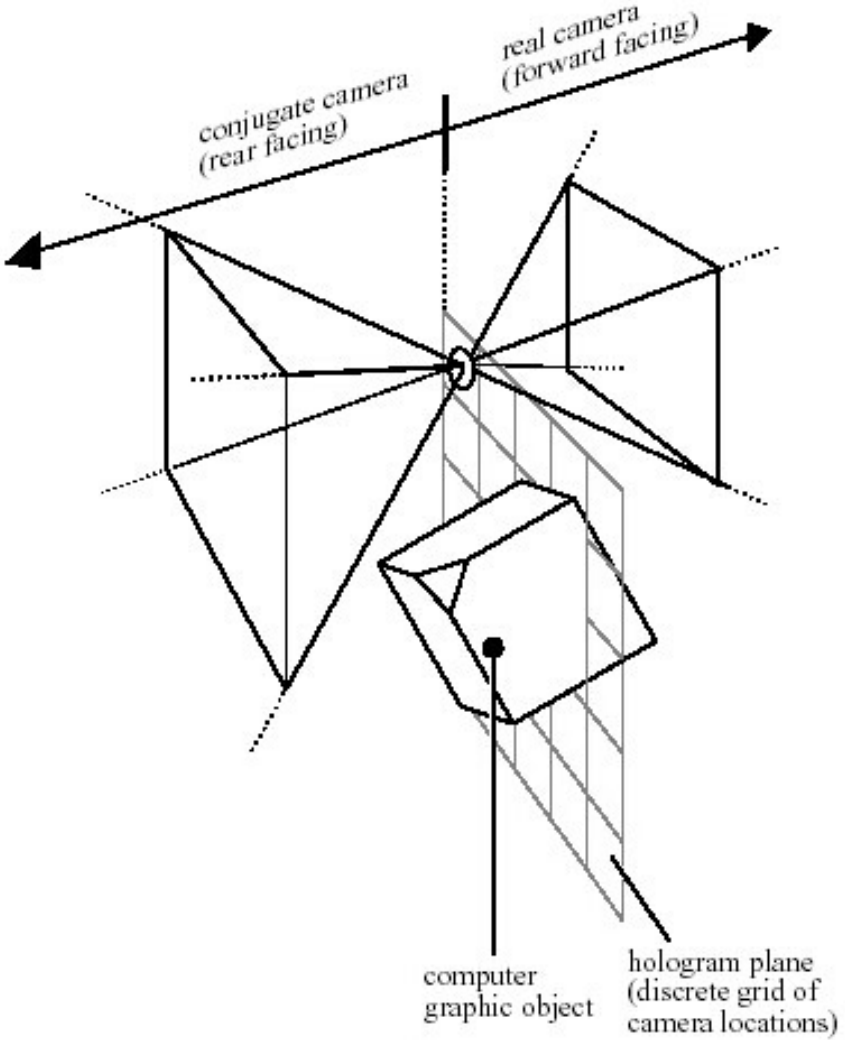
- Tries to avoid creating a master holgram
- Image has to consist out of pseudoscopic (behind) and orthoscopic (in front) parts
- With a normal camera we could achieve this effect by using a large spherical lens or two double crossed cylindrical lenses
- Rendering rebuilds the camera set-up



Rendering

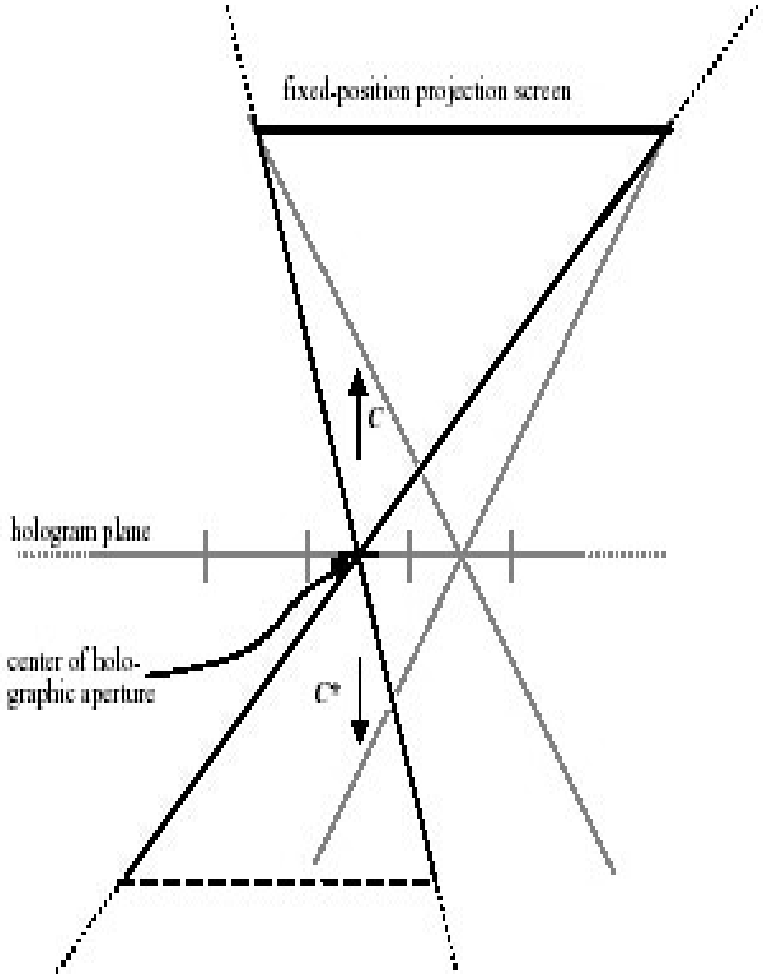
- Double-frustum approach
  - Positioned on the holographic plane
  - Pseudoscopic and orthoscopic

  - Clipping problem with camera model



Rendering

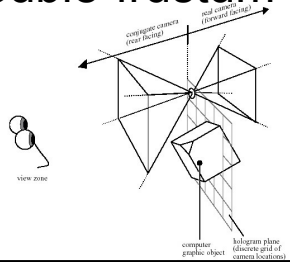
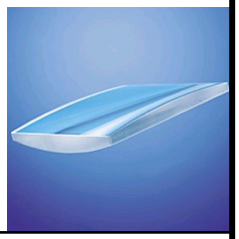
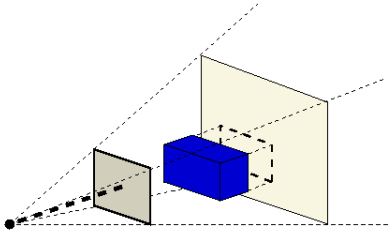
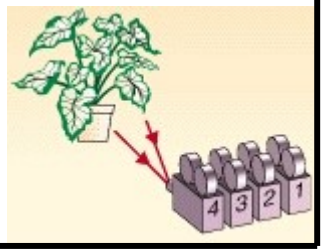
- We have to set up two frustums
- One facing from the hologram plane to the viewer
- The other facing away from the object.
- Combine the images using the depth-buffer.
- Build a image sequence by rendering every view from each point on the holographic plane
- Viewing direction can be orthogonal or off-axis (sheared) → depends on the producing method



Rendering Pseudoscopic

- How can we render pseudoscopic
- Make the Depth-Buffer to prefer images far away and occlude close ones.
- Build up a new lighting system with N=N*, L=L*
- In a normal system the eye-vector E points from the surface to the camera position

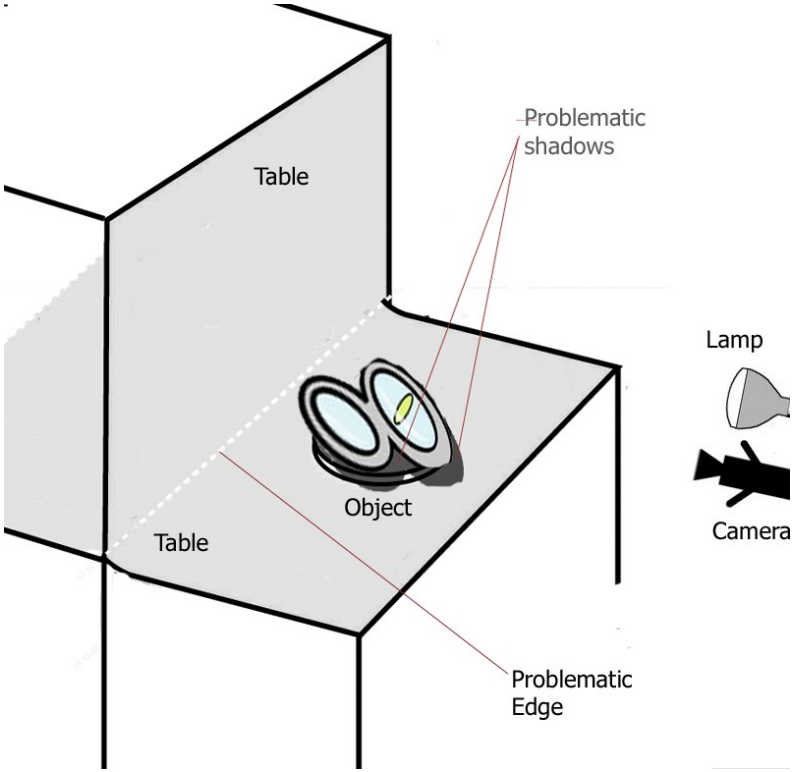
→ In a pseudoscopic image it is opposite.

	Digital content	Real content
One-step	Render with double-frustum 	Using special lenses 
Two-step	Render each perspective 	Photograph each perspective 

Amount of Data

- Computer graphics:
  - Megabyte
- Analog holography:
  - Terabyte
- Digital holography (HPO):
  - 1024 x 768 x 24 Bit x 110 degrees at a half degree resolution ≈ 500 Mbyte (our case)
  - Gigabyte

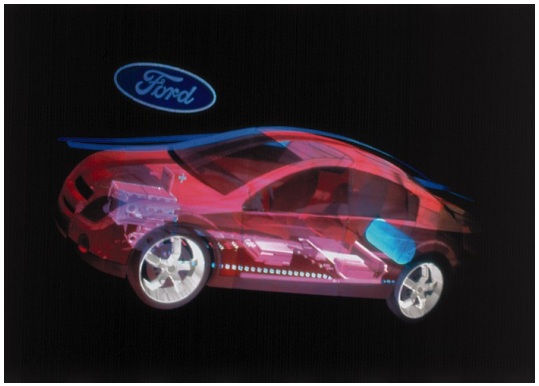
Producing

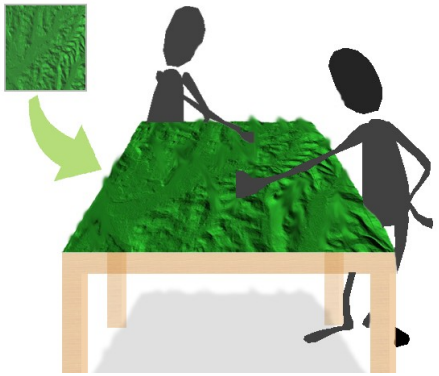


Video

Applications

- Holograms can be used in designing processes, advertising…,
- Full Parallax-holograms provide additional possibilities
- Large and scalable holograms
- In combination with computer graphics





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