

UNIVERSITÉ DE GENÈVE

Communication Multimédia

SES 4406 CR

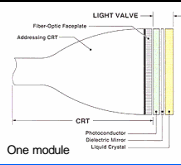
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MSc Kate Wac

UNIVERSITÉ DE GENÈVE

Multimedia Technologies (cont.)


Information systems for MM technologies

Information systems for multimedia applications Light Valve and Image Light Amplifier



- **Light Valve**
 - proprietary technology of Ampro
 - light came from projection lamp and is split into RGB and directed to three light valves modules (CRTs)
 - each CRTs is of a very high resolution and it is connected to optic fibre layer
 - After CRT, layer of liquid crystals (LCD) reflects the light and create mirror images on reflection surfaces of each light valve
 - images are obtained by increase of the light until three light valves are combined and directed to one exit lens

Information systems for multimedia applications Light Valve and Image Light Amplifier




- **Image Light Amplifier (ILA)**
 - proprietary technology of Hughes-JVC
 - signal decomposition in RGB
 - Each component is transmitted individually to high-resolution CRT (for Direct Drive-ILA, it passes reflective screen LCD)
 - each image is converted via photo electronics and lighted by light beam generated by lamp of the high luminosity
 - Each beam touches ILA, image is reflected at the back


Information systems for multimedia applications Light Valve and Image Light Amplifier

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- High-quality projectors and high luminosity based on technologies for the light amplification
- **Advantages**
 - High luminosity (up to 12.000 ANSI Lumen (ILA-12K projector))
 - No pixelization
 - No problem with corners
- **Disadvantages**
 - expensive (30.000 to 300.000 CHF)
 - models with high luminosity need installation of air-conditioning systems



Information systems for multimedia applications Laser projectors
















Information systems for multimedia applications Laser projectors



Technology <http://www.lptcorp.com>

- Light Source – the type of laser determines the color of the show (wavelength) and the brightness (watts)
 - ⚡ Eg. 40-Watt 532nm laser will produce an emerald-green beam that is visible from one end of a large city to the other
- Projector - tiny moving mirrors - single beam of laser light is moved so fast the human eye no longer sees the individual beam **VIDEO**
 - ⚡ Specialized optics can create sheets of light by splitting one beam into hundreds of individual shafts of light
- Whole show - lasers are often combined with other media, such as live or recorded music, dancers, fireworks and video



Information systems for multimedia applications Laser projectors



Example applications

- Construction
- Kitting Guide
- Marine Construction
- Positioning
- Paint Template Guide



VIDEO

Information systems for multimedia applications Laser projectors

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Applications in industry

- 3D laser projection
 - ⚡ single beam of laser light is aimed at a specific location in 3D space and manipulated to 'project' a very accurate pattern within a predetermined space
 - ⚡ E.g. RayTracer software - highly accurate beam-spot locations in X, Y and Z coordinates.



VIDEO

Information systems for multimedia applications Plasma projector / screen



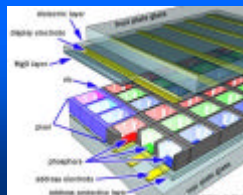
- Gas + free particles (atoms)
 - no electricity = no charging
- Plasma
 - Gas with free particles (atoms) is charged positively (ions) and negatively (electrons)
 - When treating the gas with tension, opposite charged particles are colliding – it gives ultra-violets photons, i.e. non-visible light



Information systems for multimedia applications Plasma screen / projector



- Each pixel is formed from 3 "containers", each having the phosphor of different colour (R,G, B)
- when phosphor is hit by ultra-violets photons, the light visible to our eye is produced of the colour of phosphor
- Depending on luminosity of phosphor at particular colour, there is more/less importance of this colour in formation of pixel
- This way one can generate all the spectrum colour



Information systems for multimedia applications Plasma screen / projector

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Advantages

- Can produce large screens, thin and light
- Each pixel is uniquely addressed, we obtain very bright image and visible from almost all angles

Disadvantages

- collisions in the gas produce heat – cooling / air-conditioning system is necessary

Information systems for multimedia applications Projectors / screens for virtual reality

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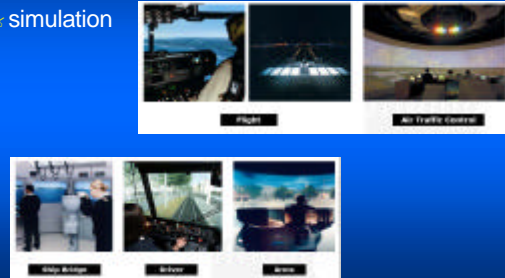
- Give an impression of being internal the virtual scene and allow to interact with elements composing the scene
- For this, computer needs to be occupied by calculation of scenes along the interaction between the user- scene



Information systems for multimedia applications Projectors / screens for virtual reality

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simulation



Information systems for multimedia applications Projectors / screens for virtual reality

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- Example simulation from
- www.cae.com



VIDEO

Information systems for multimedia applications Projectors / screens for virtual reality

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Engineering and design

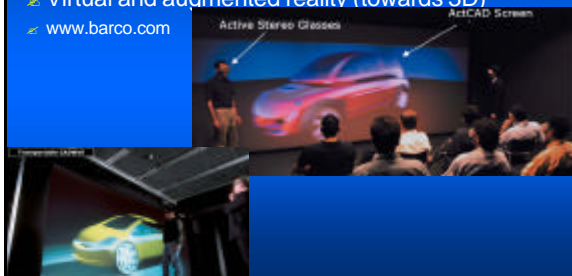
- Dual screen, L-shaped projection table
- Screen 1,8m x 1,35m
- Angle 90 or 100 degrees
- Active stereo
- User movements' tracking possible
- Special software needed



Information systems for multimedia applications Projectors / screens for virtual reality

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- Virtual and augmented reality (towards 3D)
- www.barco.com

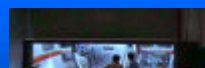


Information systems for multimedia applications Projectors / screens for virtual reality

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Virtual and augmented reality (towards 3D)

- Projectors are at the back of the wall
- For 3D – minimum 2 projectors per screen/wall



Information systems for multimedia applications Projectors / screens for virtual reality

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Virtual and augmented reality (towards 3D)



Information systems for multimedia applications Projectors / screens for virtual reality

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Virtual and augmented reality (towards 3D) 25mx7m giant screen

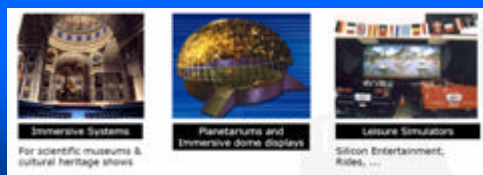


Information systems for multimedia applications Projectors / screens for virtual reality

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Edutainment & entertainment

www.barco.com



Information systems for multimedia applications Projectors / screens for virtual reality

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Main challenges for virtual reality – we need to ...

- Increase display resolution
 - ? Local/global
 - ? Multi-channel approach - depends on screen technology + color matching
 - ? Develop geometry distortion (e.g. rounded display) that will maintain display resolution
- Establish color management
 - ? Critical for design applications (automotive!)
 - ? Difficult due to differences in technologies
 - Design robust optical system + develop electronic color correction tools

Information systems for multimedia applications Projectors / screens for virtual reality

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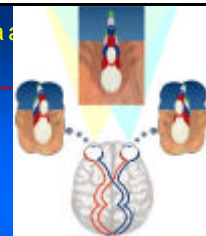
Main challenges for virtual reality – we need to ...

- Improve interaction & collaboration
 - ? Stereo viewing is perspective –dependent
 - ? Adequate head/eyes/body movements tracking required
 - ? How to ensure multi-user view?
 - ? Intuitive practical interface required
- Improve ergonomics
 - ? High-quality 3D without heavy glasses/ heavy complicated equipment for movements tracking
 - ? Good audio + video stereo quality
- Research on real-like 3D virtual reality is ongoing !

Information systems for multimedia applications Recall - 3D vision

- <http://www.vision3d.com/stereo.html>
- <http://www.neotek.com/3dtheory.htm>
- <http://www.3d-web.com/>

artificial creation of 3D vision –
projecting different
images to each eye



Example - How to make images 3D


- Project separately to each eye (head mounted devices).
- Polarized glasses and double projection of polarized images



Information systems for multimedia applications 3D vision – Polarized glasses

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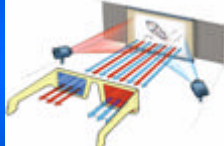
- <http://stereoscopy.com/reel3d/polarizing-glasses.html>
- old technology (1981)
- polarizing filters have a molecular structure that is like an invisible picket fence, with all of the pickets going in one direction
- If separate right & left images are projected through two polarizers, each at 90° to each other, onto a non-depolarizing screen, and then viewed through 3D glasses which match the projection filters, each eye sees the image intended for it, while the image for the other eye is dark
- Your brain does the rest, and converts the separate images into a combined 3-D one



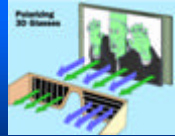
Information systems for multimedia applications 3D vision – Polarized glasses

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- First attempt – red/blue “filters”






- New system - polarization



Information systems for multimedia applications 3D vision – Polarized glasses

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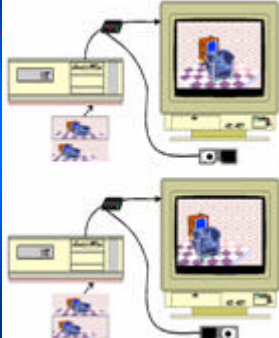
- <http://stereoscopy.com/reel3d/polarizing-glasses.html>
- very old technology
- polarizer for each eye separately
- two images are polarized and projected
- can have multiple spectators (cinema)

Information systems for multimedia applications 3D vision - Shutter Glasses

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- <http://www.frostbit.com/catalyst/syncdouble.html#syncdouble>
- Active glasses with LCD screens that open/close vision for each eye separately
- Need synchronisation with PC
- Technology much acceptable now
- 140 Hz (140 changes / second)

Information systems for multimedia applications 3D vision - IMAX cinema

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- Special: Film + screen size / camera / projector / surrounding sound system

SEE MORE, HEAR MORE, FEEL MORE






Record / Run two separate views of film at once

carefully aligned lenses

Information systems for multimedia applications 3D vision - IMAX cinema

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- IMAX camera
- two different views recorded – for each eye separately
- each image in detail
- Huge! 109 kg (&18kg regular)
- Noisy
- Low number of cameras exists (2 in 2004)

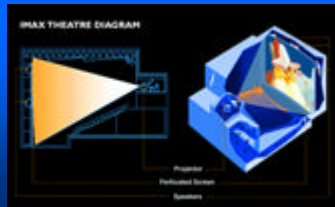



Information systems for multimedia applications 3D vision - IMAX cinema

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Projection rooms of possible types

- IMAX theaters - huge rectangular screen 16x22 meters (&9x20)
- No 3D vision

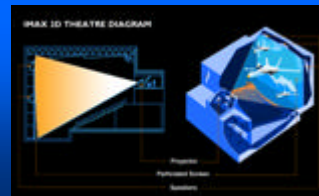


Information systems for multimedia applications 3D vision - IMAX cinema

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Projection rooms of possible types

- IMAX 3D - huge rectangular screen 16x22 meters (&9x20)
- twin-lens projection systems
- polarized glasses or shutter glasses - 3D vision

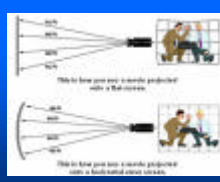


Information systems for multimedia application 3D vision - IMAX cinema



Projection rooms of possible types

- IMAX domes - hemispherical screen (~ 30 meters in diameter)
- twin-lens projection systems
- polarized glasses or shutter glasses - 3D vision



Effect of 3D depth + motion / you are in centre of the action

Information systems for multimedia applications 3D vision - IMAX cinema

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Projection screen characteristics (also for a 'regular' cinema)

- made of heavy white vinyl
- categorized by the amount of light it reflects
 - Matte white:** < 5 percent reflectivity, black is very dark gray too black and the image is not very bright
 - Pearlescent:** 15 percent reflectivity, black is dark gray and image is bright, provides best overall contrast, most used
 - Silver:** 30 percent reflectivity, black is medium gray and image is very bright, dark colors can seem a little dull
 - Glass bead:** 40 percent or more reflectivity, black is light gray and image is usually too bright, normally used only under special circumstances

Information systems for multimedia applications 3D vision - IMAX cinema

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Special projector

- Projects bright, clear, colorful image onto the screen
- two different views projected
- horizontal movements (like in CRT)
- Critical - alignment of lenses
- more intensive light source - e.g. bulb for the projector is a 15,000-watt, water-cooled xenon unit
- weighs ~ 2 tons (~ 2000 kg)

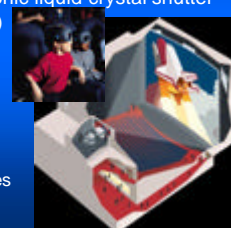


Information systems for multimedia applications 3D vision - IMAX cinema



audience wears glasses of possible types

- polarized glasses
- a headset that includes electronic liquid-crystal shutter (E3D) glasses (see earlier slides)
 - 96 times per second projection of alternate left and right eye images on the screen
 - during the presentation, E3D glasses sense a signal from the projector - open/close vision for left/right eye - each eye sees the appropriate image, ultimately creating the 3D effect



Information systems for multimedia applications 3D vision - auto stereo vision

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- 3D displays
- Ultimate goal
 - The same idea like 3D post cards
 - LCD-based technology
- Advantages
 - No need to wear glasses or other equipment
- Disadvantages
 - Some types - need to observe scene from certain distance and at the certain angle
- <http://www.research.philips.com/technologies/display/3d/>

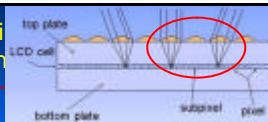


Information systems for multimedia applications 3D vision - auto stereo vision

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- *How does it work— need for a 3D visual effect*
 - perspective - size of 3D objects depends on a distance
 - occlusion - things in front hide what is behind
 - atmospheric effects – distant objects appear blurry
- Some of 2D pictures may appear as 3D
- Real 3D - each eye sees a slightly different picture
- Goal of 3D displays
 - no need for special glasses
 - no need for the fixed position of head + fixed distance
 - multiple users viewing a display at once

Information systems for multimedia applications 3D vision - auto stereo vision



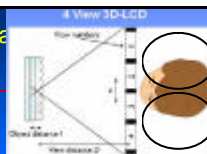
- *How does it work*
 - sheet of cylindrical lenses (lenticulars) is placed on top of LCD
 - LCD image plane is located at the focal plane of the lenses
 - If the LCD underneath each lens is divided into different sub-pixels, then eyes looking at the screen under different angles see different pixels
 - Furthermore, if the correct image information is put on the different pixels, (i.e. a stereo pair of images), then the observer will see 3-D

Information systems for multimedia applications 3D vision - auto stereo vision



- *How does it work*
 - each lenticular works as a small projection lens and images the individual pixels behind it in the space in front of the user
 - the left eye will see the image of one pixel underneath a lens and the right eye will see the image of another pixel
 - the same action is performed by every lens in the lenticular array and overlapping images of the pixels underneath the different lenses are formed in front of the user

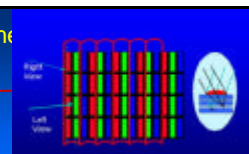
Information systems for multimedia applications 3D vision - auto stereo vision



- Development of 3D displays (Philips)
- 4 View Monochrome 3-D LCD
 - no need for the fixed position of head
- 7 View Color 3-D LCD
 - 11.3?SVGA (800x600) display
- 14.5 inch Color 3-D LCD
- 9 View 3-D LCD Monitors
 - 15?XGA (each eye sees 341x256 pixels)
 - 18?SXGA
 - 20.1?UXGA (533x400) LCD
- 4? Hand held 3-D LCD
 - 4?SVGA



Information systems for multimedia applications 3D vision - auto stereo vision



- 3D displays of Phillips
- LCD
 - Resolution (pixel count) 1600(x3) x 1200
 - Size (diagonal) 20.1"
 - Pixel pitch (μ) 85 x 255
- 3D-LCD
 - number of views 9
 - Resolution / view 533 x 400 x RGB
 - Working distance 30 – 150 cm

Information systems for multimedia applications 3D vision - auto stereo vision

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- 3D vision of Kodak
- Kodak Autostereoscopic Display System
- costs \$10,000/2004
- place head into the viewing area and see your digital photos 3D-like
- data visualization, engineering applications requiring virtual prototyping, medical image analysis etc.



Information systems for multimedia applications 3D vision - auto stereo vision

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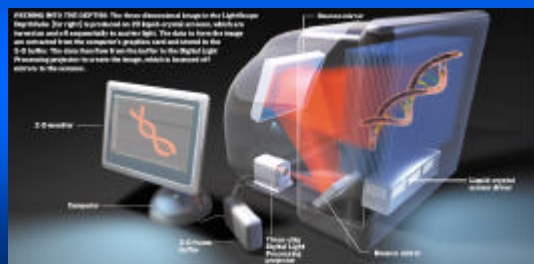
- 3D displays— research
- Swept Away display (Perspecta)
- renders 3D images up to 25 cm in diameter
- graphics card sends the image to a DLP projector, which bounces the projected pixels off relay optics (mirrors!) to the rotating projection screen



Information systems for multimedia applications 3D vision - auto stereo vision

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- 3D displays - research



Information systems for multimedia applications 3D vision - auto stereo vision

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- 3D displays – research
- LightSpace DepthCube
- Expensive - \$50,000 / 2004



Information systems for multimedia applications 3D vision - auto stereo vision



- 3D displays— research
- LightSpace DepthCube
- Inside - 20 different LCD screen slices stacked one in front of the other
- DLP projector shines against the panels from the back – only one panel is active and displaying the image – the rest set to "clear" (the light will pass through)
- DLP projector shines in succession rapidly to illuminate the different panels in succession - 20 full refreshes of all 20 LCD planes / second.
- Slow moving or static object + a true 3D effect
- fast motion images are a problem