Vorlesung
Mensch-Maschine-Interaktion

Input devices & technologies

Ludwig-Maximilians-Universität München
LFE Medieninformatik
Heinrich Hußmann & Albrecht Schmidt
WS2003/2004
http://www.medien.informatik.uni-muenchen.de/

Table of Content

Force Feedback Mouse

- Pointing devices with *force feedback*:
  - Feeling a resistance that is controllable
  - Active force of the device
  - Common in game controllers (often very simple vibration motors)

- Examples in desktop use
  - Menu slots that snap in
  - feel icons
  - Feel different surfaces
  - Can be used to increase accessibility for visually impaired
- Logitech iFeel Mouse
  http://www.dansdata.com/ifeel.htm

Game Controllers

Phantom – Haptic Device

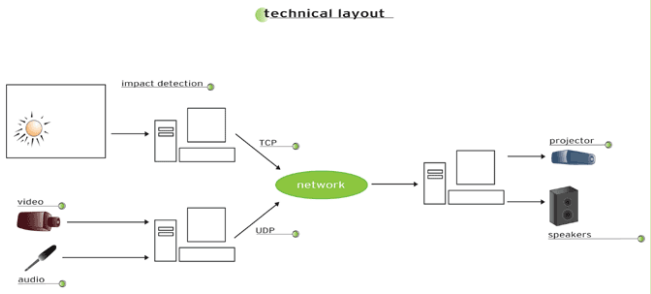
- high-fidelity 3D force-feedback input device with 6DOF
- GHOST SDK to program it

www.sensable.com

Exertion Interfaces

http://www.exertioninterfaces.com/technical_details/index.htm

Exertion Interfaces



http://www.exertioninterfaces.com/technical_details/index.htm

TFT LCD Screens

- Typical color resolution 640x480 to 1920x1200
- ~ 85 pixel/inch
- viewing angle to 170°
- pivot function (90° rotation)

- More on technology
  http://www.pctechguide.com/07panels.htm

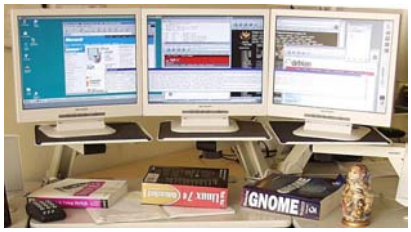
TFT Display

- Screen arrangements
  - Single display
  - Dual screen
  - Triple display
  - Quad screen
- Resolution
  - Typical color resolution 1024x768 to 1920x1200
  - Grayscale for medical applications up to 2048x2560
  - Hi-resolution displays with 3840x2400

Multiple Screens

- Increased screen real estate
- Connected to one computer (one keyboard and one mouse)

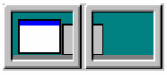
- Screen arrangements with standard hard- and software
  - Dual display
  - Triple display
  - Quad display

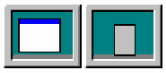


- Application areas
  - CAD
  - Software development
  - Media production
  - Financial software
  - Comparison tasks
  - Customer info & adverts
  - Time tables

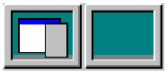
Multi-screen problems & solutions

- Dialog box appears on the boarder between the screens
  - Position in new screen
  - Position in application screen
  - Position at the cursor

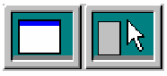




- What is the meaning of maximizing a window
  - Within the current screen
  - overall

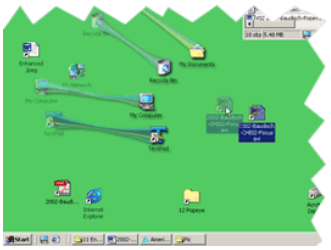


- Losing the cursor
  - High density cursor http://www.darmstadt.gmd.de/~baudisch/projects/highdensitycursor/demo/index.html



Multi-screen problems & solutions drag and drop over screen borders

- Scenario:
  - Multiple touch screens (e.g. smart boards) are connected to become “one” display
  - Drag-and-drop does not work over borders



- Suggested solution – move possible targets to the object that is dragged
- Drag-and-Pop
  http://www.darmstadt.gmd.de/~baudisch/projects/dragandpop/demo/index.html

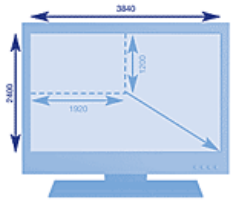
Hi-Resolution Grayscale Displays

- Use for medical imaging, radiology
- Image presentation according to DIN 6868-57
- Calibration software

- E.g. Eizo RadiForce G51
  - 21.3" monochrome LCD
  - 5 mega pixel
  - 2560 × 2048 pixel
  - 154 pixel/inch
  - 10-Bit simultaneous grayscale display

Hi-Resolution Color Displays

- Application examples
  - Medical imaging
  - CAD and construction
  - Digital content creation
  - Geophysical imaging
- E.g. IBM T221 Flat Panel Monitor.
  - 3840x2400 pixel
  - 9.2 million pixel
  - 22.2" TFT LCD
  - 204 pixels/inch
- Resolution close to a photo



Hi-Resolution Displays Potential Problem

- Often standard software is designed for different resolution (e.g. 90 pixel/inch)
  - controls are too small
  - fonts are hardly readable in normal size
- Approach
  - Design for the specific characteristics of the output device

Context & Focus

Baudisch et al.

- Central area is a high resolution display
- Peripheral area is low resolution and provides context

- http://www.darmstadt.gmd.de/~baudisch/projects/focuspluscontextscreens/index.html

Context & Focus

Baudisch et al.

- Central area realized as TFT screen
- Periphery is projected
- Helps with task where context does provide important information

Video Projector

- Key Criteria
  - Resolution
  - Brightness
  - Weight
  - Noise
  - Lens
  - Image correction
  - Projection distance
  - Connections
  - Lamp life time

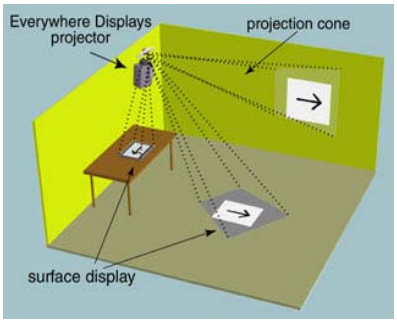
- E.g. Toshiba TLP-T720U
  - Wireless 802.11B

- E.g. WiJET
  - http://www.otcwireless.com/802/wijet.htm

Everywhere Displays Project (IBM)

http://www.research.ibm.com/ed/

- The Everywhere Displays project aims to develop systems that allow the transformation of every surface in a space into a projected "touch screen".
- Basic technology
  - LCD projector
  - pan/tilt mirror
  - Camera
- The projected image is processed to compensate for the perspective distortion
- pan/tilt video camera to detect hand/body activity on the projected area,
- people can interact with the projected image by simply touching the surface.



Everywhere Displays Project (IBM)

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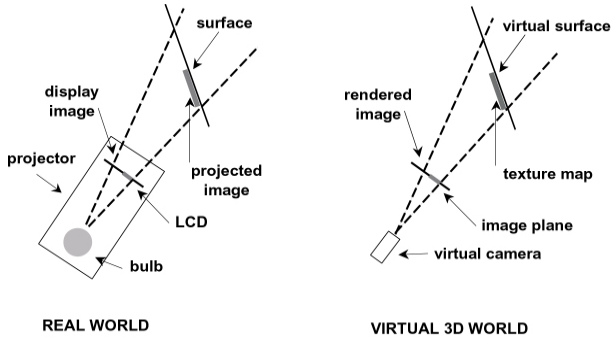
- Correct image distortion



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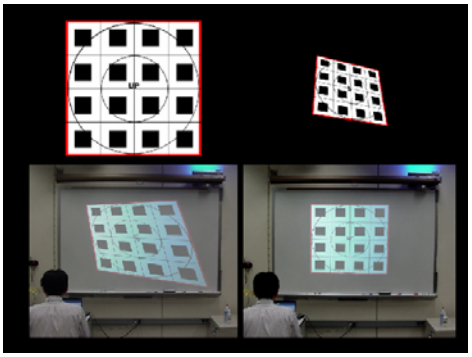

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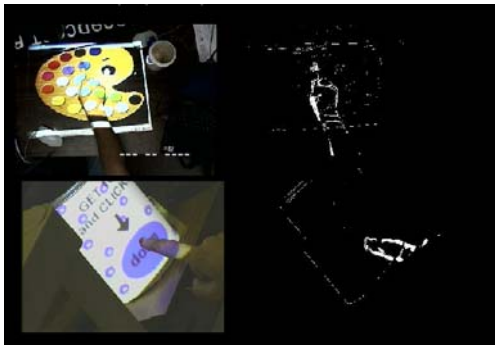
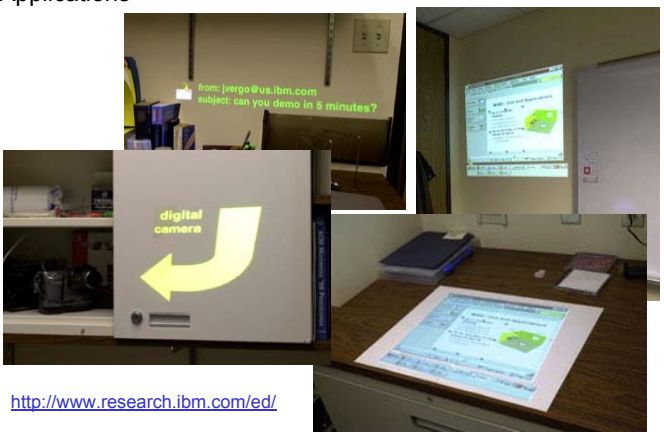
- Detect user interaction



Everywhere Displays Project (IBM)

Applications

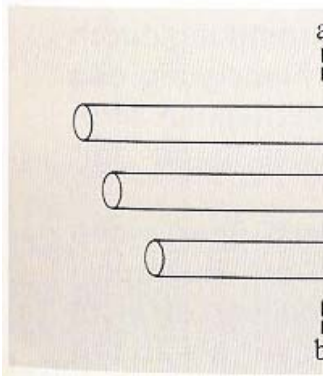


http://www.research.ibm.com/ed/

2D and 3D Views and Displays

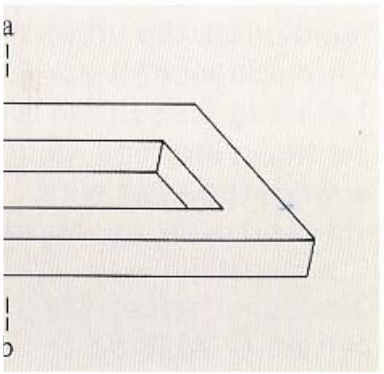
- Everything on a 2D display is 2D!
  - If we see it 3 dimensional we imagine it…
  - Expectations and experience as basis
  - Displaying a projection of a 3D model
- "real" 3D needs requires a image for each eye
  - Happens naturally when looking at 3D objects in physical space
  - Can be simulated by providing a separate image for each eye using technology
- Options to visualize 3D graphics
  - Create a 2D image that the user translates in 3D in his head
  - Provide images (that represent a 3D model from a particular view point) for both eyes
  - Create 3D structures (static or dynamic)

2D drawing: Make it conclusive…



From A. Maelicke, Vom Reiz der Sinne, VCH 1990

2D drawing: Make it conclusive…



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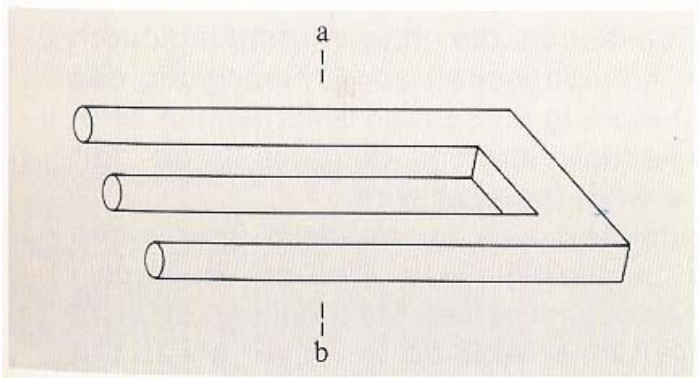

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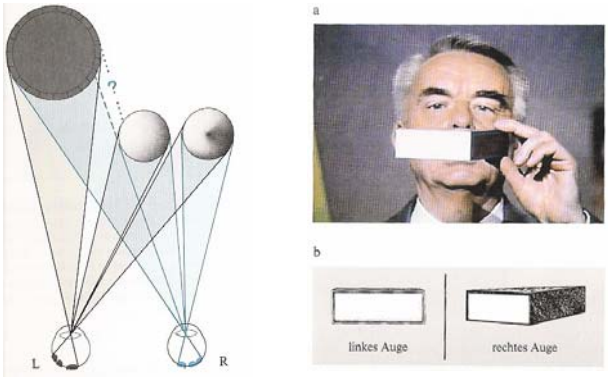
Stereo 3D Vision Basics



From A. Maelicke, Vom Reiz der Sinne, VCH 1990

Stereo 3D Vision Basics

- Image for each object is dependent on the spatial relation between object and observer
  - changing viewpoint changes the images
  - Different people at different view points see different pictures
- Challenges
  - Acquire relation between viewpoint an object
  - Create different images for each eye
  - Deliver different images to each of the eyes
- Approaches
  - Volumetric displays
  - Divided stereo display
  - Autostereoscopic

http://www.3dcgi.com/cooltech/displays/displays.htm
http://fantoma.free.fr/lien3d.htm

Stereo photography
stereo vision is not new…

http://www.stereoblick.de/

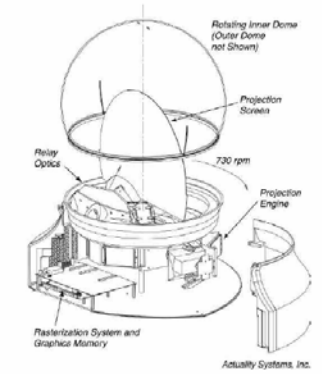
Volumetric
3-D Display

- Creating a volume image – like an objects "Volume-filling imagery "
- Many simultaneous viewers
- Multiple viewpoints,
- Autostereoscopic

- E.g. Perspecta™ 3D
  - Swept-screen multiplanar volumetric display
  - 198 2-D slices
  - 768 x 768 pixel slice resolution
  - 100 million voxels
  - 24 Hz volume refresh
  - 10" diameter spherical image
  - 8 colors at highest resolution
  - Viewing Angle: 360° horizontal, 270° vertical

http://actuality-systems.com/specifications.php3

Theory of operation
high speed projection (5000 fps)



http://www.actuality-systems.com/admin/publications/Actuality_Whitepaper_AeroSense_2002.pdf

Separate displays for each eye

- Stereoscopic 3D computer imaging
- Separate displays
- E.g. i-glasses SVGA
  - Resolution: 800 x 600
  - Pixels: 1.44 Million per Display
  - Field of View: 26 Degrees Color Depth: 24 Bit
  - Refresh Rate: 120hz

Electro optical shutter

- E.g. CrystalEyes
  - electro-optical shutters
  - wireless active eyewear
  - infrared emitter is placed at the monitor and broadcasts synchronization information to the eyewear.
  - The system works seamlessly so the user sees stereoscopic image

http://www.stereographics.com/support/hp-paper.htm

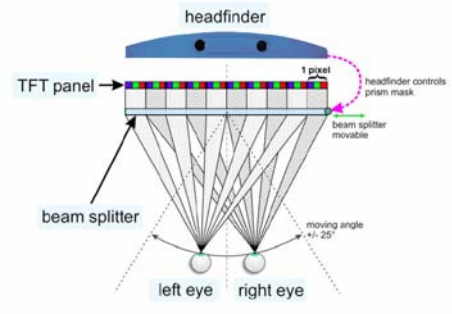
Dresdener 3D Display

- Auto stereoscopic display
- no special glasses
- high resolution
- Full brightness display
- tracking system that allows the user to move naturally while working but without losing the 3D effect.

http://www.seereal.com/_docs/SeeReal_Stereo_Implementation.zip

Dresdener 3D Display basic Technology

- Tracking of users position
- camera or infrared (requires reflector) based
- Moveable prism provided two views
- Alternating columns for left and right eye



2D Printer

- Different technologies, e.g.
  - Laser (B/W and Color)
  - Ink jet
  - Plotter

- Postscript as language
- Not just paper, e.g.
  - Laser cutter
  - Sewing machine