

EXERCISE 6 — SOLUTION

1. Visual Representation of Virtual Environments

- (a) Why is stereoscopic vision alone not sufficient to fulfill all visual representation requirements of *Virtual Reality*?

Stereo Parallax + Motion Parallax

User centred projection is required for holographic projection. Tracking is required for this.

Solution

- Stereoscopic vision ⇒ illusion of depth in an image by presenting two offset images separately to the left and right eye
- But: motion parallax is missing ⇒ no realistic feedback during motions of the users' head

- (b) What additional feature has to be included to provide a “holographic” perception?

Solution

- User centered projection ⇒ Perspective has to be adapted to the users position and orientation

User centred projection

- (c) What kind of hardware is required for that?

Solution

A tracking system

2. Stereo

Discuss the advantages and disadvantages of the stereo techniques

- Anaglyph,
- Polarization,
- Shutter, and
- INFITEC

with regard to the following criteria:

- Image Quality,
- Synchronization needs,
- Costs, and
- Screen material.

Solution

	Anaglyph	Polarization	Shutter	Infitech
Image Quality	Strong ghosting, bad colors	Ghosting may occur, good colors	No ghosting, good colors	(Nearly) no ghosting, mediocre colors
Synchronization needs	None	Buffer swap	Buffer swap, glasses, projectors	Buffer swap
Costs	very cheap (only glasses)	mediocre (relatively cheap glasses, one standard projector + filter per eye, special screen material needed)	expensive (expensive glasses, one projector per eye, projector and graphics card must support the technology)	mediocre (expensive glasses and filters, one standard projector per eye)
Need for batteries	no	no	yes	no
Screen material	arbitrary	must maintain polarization	arbitrary	arbitrary

3. Displays

Discuss the advantages and disadvantages of *head-mounted displays* in comparison to *room-mounted displays* with regard to the following criteria:

- Field of view,
- Field of regard,
- Resolution and screen-door effect,
- Motion sickness, and
- Navigation volume.

Solution

	Head-Mounted Displays	Room-Mounted Displays
FOV	usually way smaller than FOV of human eye	up to the full FOV of the human eye; may depend on distance to projection surface
FOR Hugely depends on the resolution for both	360° if proper tracking is available	depends on arrangement of projection surfaces; 360° only in fully-surrounding projections
Resolution and screen door effect	fixed resolution per eye; screen door effect depends on ratio of FOV/resolution	fixed resolution for projection surfaces; screen door effect dependent on distance to projection surface
Motion Sickness In HMD, limited res, limited nav volume, trans and rot latency	Often strong or easily occurring due to limited resolution, translational and rotational latency, etc.	Usually less than with HMDs, because of higher resolution and the lack of rotational latency
Navigation Volume in HMD, depends on the tracking system and area Can vary from small head movements to about 1000 sq m.	Varies very strongly; can reach from only small head movements to more than 1000 m ² ; not dependent on the display, but instead on the tracking system and area	Usually dependent on the display size, since only the area in front of the projection screens is tracked; in CAVE-like systems, usually exactly matches the interior

In CAVE, volume of the cave. Depends on the size of display as only area in front tracked