

European Broadcasting Union

Watching 3D at home

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Projection method

- In the anaglyph method, projected red / cyan split images are separated by glasses

+ **Simple method**

- **Color loss- Synchronization error, ghosting**

Biological requirements:

no red-green weakness (available up until 8%),

no strabismus (5%),

no phorias (up until 40%)

no amblyopia (disorder of visual system)

Projection method

- The shutter method (XPanD) by using active glasses with variable optical access
(Pulfrich effect: dark optical stimulus are perceived with some delay in contrast to a light optical stimulus → cues)
- + **Only 1 projector, optimum head clearance, standard screen+**,
 - 84% loss of light, 22% of the glasses are rated negative

Biological requirements:

good brightness perception, no glare sources produced by the optical media, no flickering agitation in the brain (migraine, epilepsy), no sensitive spots on the ear or nose resulting from the eyeglass weight

Projection method

- Polarization method RealD technology,

- + Only 1 projector with variable R/L circularly polarized filter, glasses with circulating polarizing filters+,

- silver screen, double flash, triple flash, residual light 29%, without head movement, Ghosting- => double contours associated with headache

Biological requirements:

No forced head posture or media opacity such as cataract, corneal scars, vision disturbances after Lasik

Projection method

- Interference method (e.g. Dolby 3D) with narrow-band color filters through a rotating color wheel (expensive) with small and imperceptible change in the RGB color values, synchronized interference glasses to the projector, nur 14 nm wavelength shift,

**+ only 1 projector, silver screen not required,
head freely movable, only 4% poor evaluation of glasses**

- expensive glasses

Biological requirements:

Normal color perception and sensors,
normal fusion energy,

Projection method

- Double projection with linear polarization

- 2 projectors

Biological requirements:

Tolerance of glasses ,
normal visual field due to very large screen,

Error sources in 3D projection and acceptance

- Crosstalk/Ghosting
- Keystone effect
- Ghost busting
- Imaginary window
- Wrong distance
- Large deviation between depth of focus and vergence
- Incorrect camera offset
- Gigantism at smaller base than the 6,5 cm distance between the eyes
- Lilliput effect at larger stereo base
- Depth of 3D projection, max. 20 meters before and behind the screen
- Avoid extremely near objects

Headache and dizziness

A universal problem

- 10 % of the German population is suffering from migraine, including dizziness, eyepain and nausea
- In Europe, 27 billion Euros in damages per year caused by migraine
- 50 % of all people suffer from tension-type headaches
- Only a little myopia may cause Migraine and tension-type headaches
- 3D prove the eye-brain system and the existing biological system

Why do some people react differently to 3D systems?

- Depending on the type of glasses, different sensory, motor or cognitive properties of the eye-to-brain connection are demanded
- Local irritations occur (pressure receptors on ear, nose or head) based on anatomical conditions
- Disturbances in the normal physiology of the eye (color-sensing, phoria, refractive media, retina, contact lens wearer or wearer of glasses?)
- Systematic diseases such as blood pressure instability, diabetes, migraine or epilepsy readiness promote sensitivity and failure of the complex system

Why do some people react differently to 3D systems?

- Contact lens wearer or wearer of glasses get adjusted to 3D glasses more quickly because of the prior learning of acceptance in terms of a potential three-dimensionality by 3D glasses
- Women are more sensitive to 3D, due to the fact that women usually have lower blood pressure than men and suffer twice as often from migraines (shutter → pupillary movement → pressure waves/trigger)
- The sitting posture changes the subjective size of the displayed image on the retina (anisometropia) on the side positions particularly on big screens.
- Are there any studies for the industry to clarify problems associated with 3D?(Children?)

What aspects can cause disturbances of spatial perception?

- Visual defects (hyperopia, myopia, astigmatism, anisometropia)
- Glasses, contact lenses, Lasik, PRK
- Nystagmus (involuntary movement of the eyes)
- Amblyopia (disorder of visual system)
- Strabismus and phoria (muscle imbalance)
- Sicca (dry eyes)

What aspects can cause disturbances of spatial perception?

- Cataract and secondary cataract
- Macular degeneration
- Diabetes mellitus
- Circulatory disturbances (high, low blood pressure)
- Microcirculation disturbances

Future objectives

- Biological (EYE) problems are shown by 3D, A certain number of patients can not be helped
- Utilization of 3D eye examination to improve optical interference and optimizing eye muscle activity
- Reduction of existing disposition for headache by the Cephlas method



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Thank you for your kind attention!

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