News
15.2.2023.

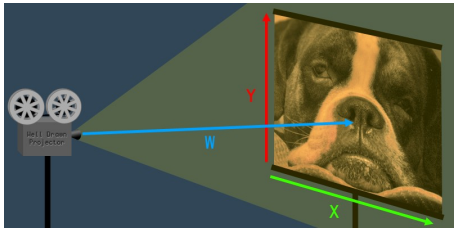
Exam date

- NEW date confirmed: **29.3.2023.** at 16h, Raum 136.1B

Projects

- Deadline: **8.4.2023**, 23:59
- Project points will be announces **after** 8.4.2023 for everyone.

Homogeneous coordinates



- Working in 3D often implies working with Euclidean geometry, coordinates in 3D space (x,y,z).
- However, next to Euclidean geometry, there is also projective geometry which adds extra dimension: (x,y,z,w) – 4D:
  - This four dimensional space is called projective space
  - These coordinates are called homogeneous coordinates and are used for transformations
- To explain homogeneous coordinates, let's consider 2D coordinates to which homogeneous coordinate can also be added
  - (x,y) coordinates define 2D image projected by 2D projector. In this case w coordinate determines scale of image; distance of projector to wall.
- Same as in 2D space, w coordinate in 3D space determines scaling of (x,y,z) coordinate → perspective divide
- Different projective spaces exist: https://en.wikipedia.org/wiki/Homogeneous_coordinates#Other_projective_spaces
- More info:
  - https://en.wikipedia.org/wiki/Projective_geometry
  - https://yasenh.github.io/post/homogeneous-coordinates/
  - https://www.tomdalling.com/blog/modern-opengl/explaining-homogenous-coordinates-and-projective-geometry/

Look-at matrix and generating camera rays

- Camera is placed in world origin O(0,0,0)
  - Calculate point P(x,y,z) - world space pixel coordinate of virtual image plane through which ray passes
- When camera is moved using look-at matrix, the look-at matrix defines camera-to-world matrix
  - In this case, to generate ray, there are two options:
    - Apply camera-to-world matrix to points O and P and calculate ray using transformed points O' and P'
    - Calculate ray using point O and P and then apply camera-to-world to this ray (origin and vector)
- More info:
  - https://www.scratchapixel.com/lessons/3d-basic-rendering/ray-tracing-generating-camera-rays/generating-camera-rays.html
  - https://steveharveynz.wordpress.com/2012/12/20/ray-tracer-part-two-creating-the-camera/
  - https://blenderartists.org/t/camera-from-location-target-and-up-vectors/576132