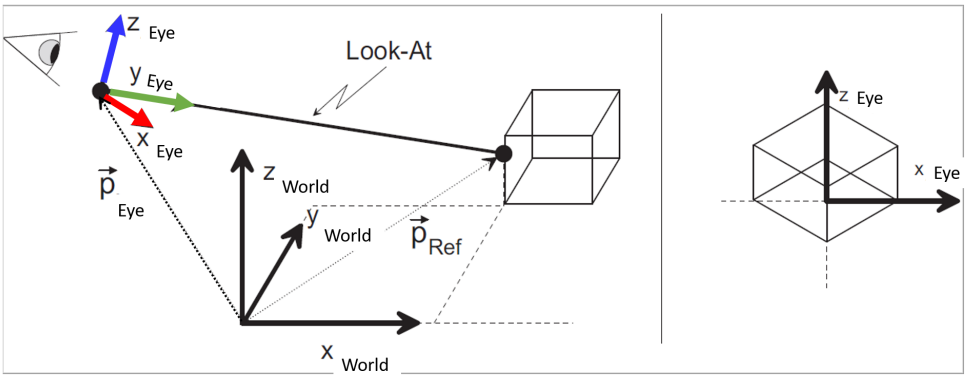
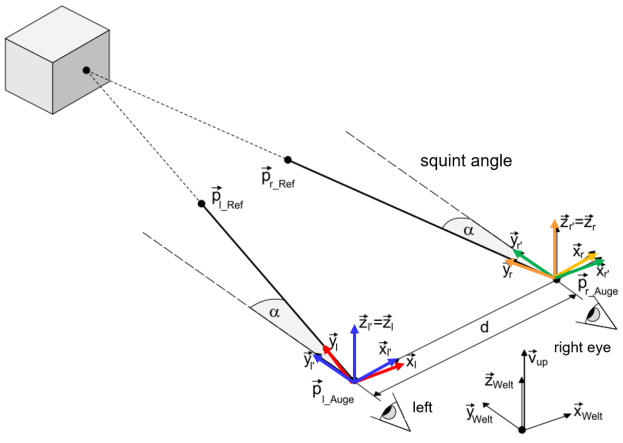
Exercise
Homogeneous Transformation

Look-At Specification In computer graphics, views are typically described according to the "Look-At" specification. Among other things, the specification consists of a location vector $\underline{p}_{eye}$, that determines the eye or camera point from which the scene is viewed. The direction in which the eye looks at the scene is determined by the reference point $\underline{p}_{ref}$. The view is aligned so that the point to which $\underline{p}_{ref}$ is pointing to is in the center of the image plane. If the user does not want to tilt his head, i.e. if the view is not rotated around the axis defined by $\underline{p}_{ref} - \underline{p}_{eye}$, these two statements are sufficient to clearly describe the view of a scene. In order to also take into account the inclination of the head, the "up-vector"' is also inserted. By definition this is directed "up(wards)", i.e. it determines which view is to be displayed for the inclination 0°.



Task 1. Determination of the homogeneous transformation according to the "Look-At" specification
Given are the positions $\underline{p}_{eye}$ and $\underline{p}_{ref}$. Determine a homogeneous transformation ${}^{world}\underline{T}_{eye}$, that represents a view according to the "Look-At" specification. In this coordinate system, the y-axis points in the direction of the view. Also, assume an "up vector" pointing in the direction of the z-axis of the world coordinates.



Task 2. Determination of a homogeneous transformation for stereo views
Given is the homogeneous transformation ${}^{world}\underline{T}_{eye_l}$, describing the position of the left eye in a stereo view. Determine a matching homogeneous transformation ${}^{eye_l}\underline{T}_{eye_r}$, which indicates the position of the right eye in coordinates of the left eye, for a given *balance angle* α and a *eye distance* d.

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