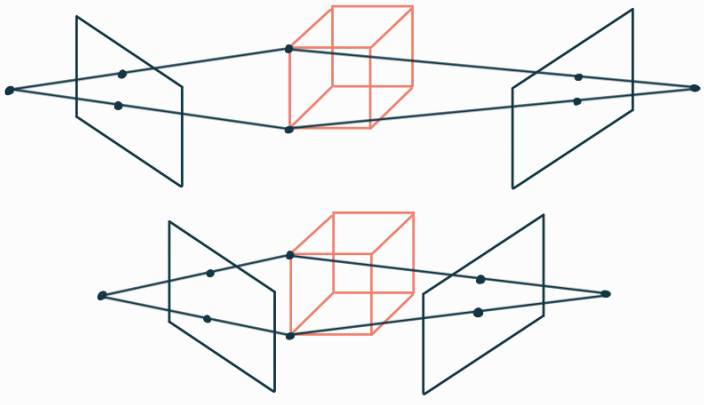
Reconstruction ambiguity

Camera calibration is the process of determining the intrinsic and extrinsic parameters of the camera, such as focal length, principal point and lens distortion which are essential for accurate geometric reconstruction.
When cameras are uncalibrated, the reconstruction process becomes ambiguous because the precise relationship between the 3D world and the 2D image is not known. Without proper calibration, the geometric properties of the camera are uncertain.

With calibrated cameras, reconstruction is defined up to an affine transformation.
An affine transformation does not change the angles between rays.



With uncalibrated cameras, reconstruction is defined up to a projective transformation.
A projective transformation does not change the measured points, although the angle between rays is altered. The epipoles are also unchanged:

$$x \longleftrightarrow x' \quad \text{equal to} \quad Hx \longleftrightarrow Hx'$$