Series (9):

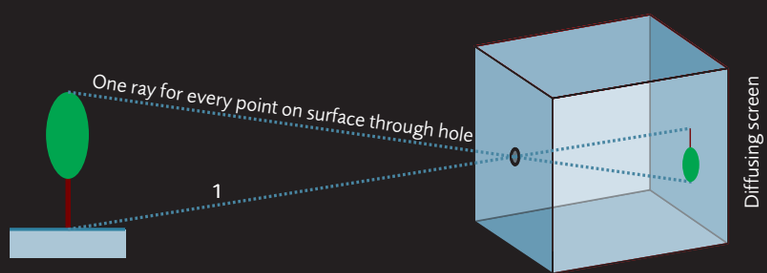
Creating images: Shadows – Photography

All directions = No image

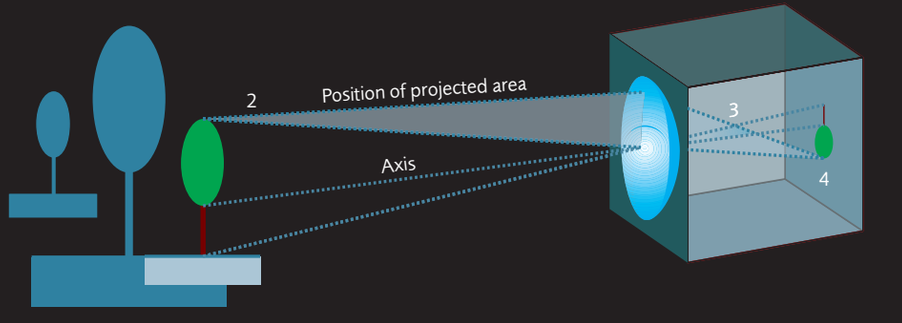
Direction of projection + Object + Projected area = Image

SHADOW
- outline black – white
- no colour
- no details within outline

Composition of focus:
1. Central ray
2. Ray parallel to axis
3. Focal ray
4. Intersection 2 and 3: sharply defined pixel

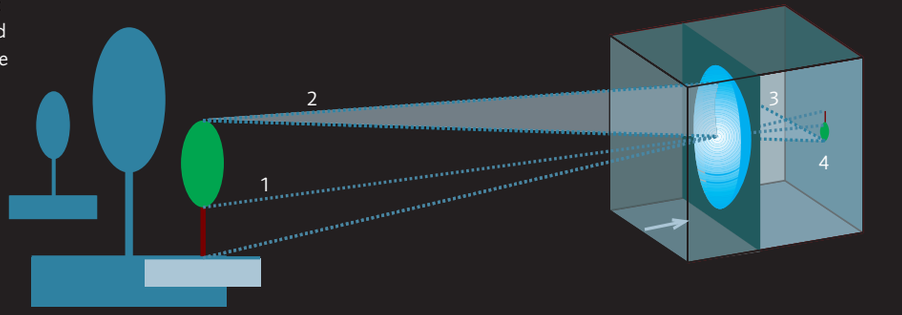


PINHOLE CAMERA
- inverted coloured image
- details also within outline
- only at large distances clearly focussed image
- little light



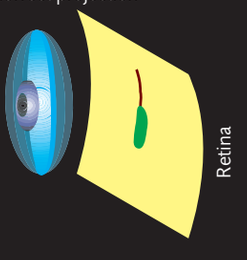
CAMERA
with fixed objective
- larger aperture, more light
- rays focussed
- better focus, but only in limited area

Height: size and distance



CAMERA
with adjustable objective
- flat projected area: contours not clearly defined

EYE
- curved projected area: correct projection



Serie (9): Creating images: Shadow – Photography

Shadow
The object for comparison is a tree with a base, trunk and treetop. Like any illuminated object, it reflects beams of light from all over its surface and in all directions, and can therefore be seen from all standpoints, unless blocked from view by overlap or impossible to see well due to too large distances. An object of this kind offers endless different angles of view, but no image. Two requisites are needed to create an image: the direction of the projection and the projected area. The sun emits practically parallel light onto the earth, and the surface of the earth, i.e. the ground, provides the projected area. Let us take a special case involving horizontal beams and a vertical facade: this gives rise to a view of the tree on a 1:1 scale. The shadow cast by the tree shows us the shape but no colours.

Pinhole camera
If we position a box with a tiny hole in the centre of the side facing the object, and a diffusing screen (diffuse glass or transparent paper) as the rear side in the line of vision of an object, an inverted coloured image of the shape with all details within the general outline is produced on the diffusing screen, and this is visible from outside the box. The further away the object is, the sharper the focus will be. The focus becomes less well defined, the bigger the hole.

Camera
It is possible to take photographs using a pinhole camera, but focus and luminous intensity do have their technical limitations. By enlarging the hole you can obtain the light required (for exposure times without a tripod) and by focussing the rays of light you can obtain a better defined image. The most well known optical component is the lens, in this case a bi-concave lens. This is also referred to as a burning lens. It directs parallel rays to its axis on the opposite side onto a specific point, the focal point. The distance to the sharply defined image can be determined when two rays from specific points on the object intersect: the central ray, and the ray parallel to the axis, the path of which is bent by the lens making it the focal ray. This focus setting is only related to a specific area of distance.

Focussing
The idea of setting the focus is to avoid unnecessary changes in location when photographing. There are two ways of doing this: by displacing the lens or changing its shape. In standard cameras, setting the distance is usually effected by displacing the lens. Some fish and cephalopods (e.g. octopus) focus in this way. Mammals and the human eye focus by changing the shape of the lens. Since using one optical tool gives rise to geometric misrepresentations and colour aberration in the peripheral zone, the photographer requires a whole range of lenses to be able to take perfect pictures.

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