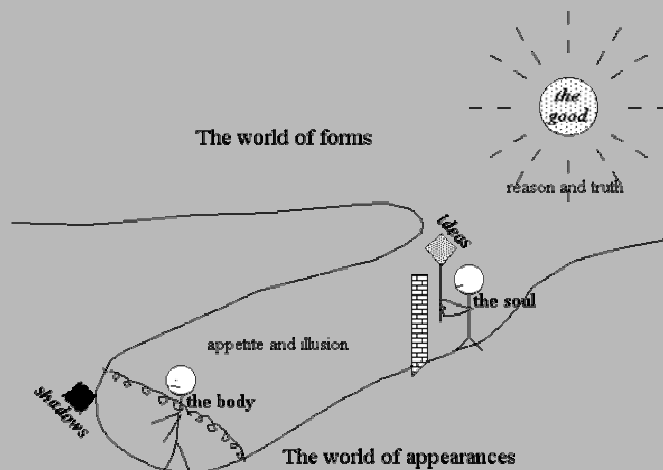
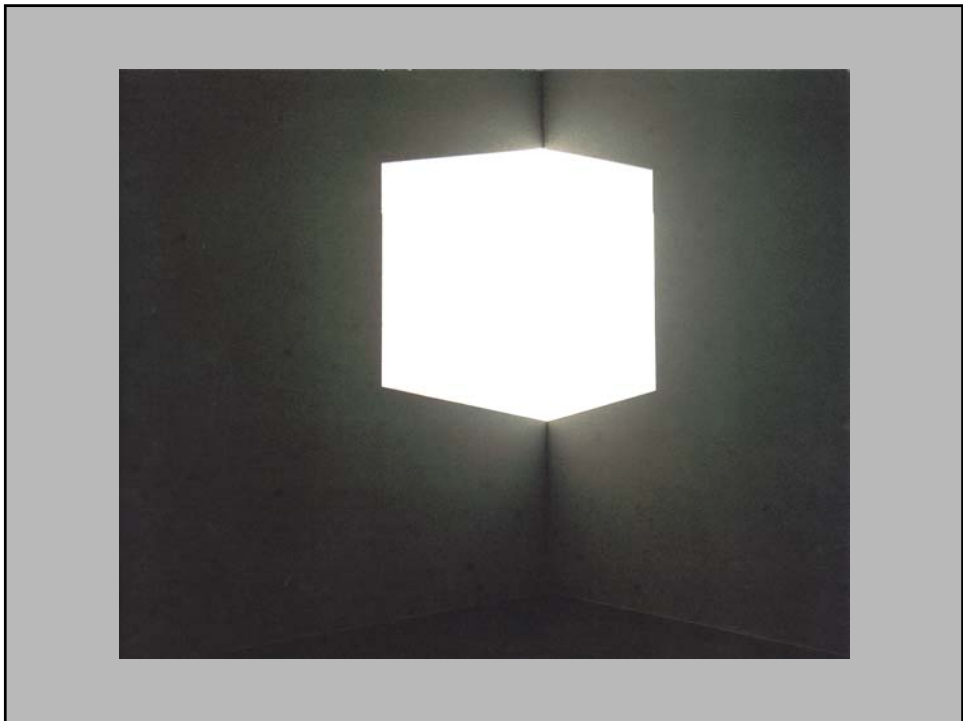
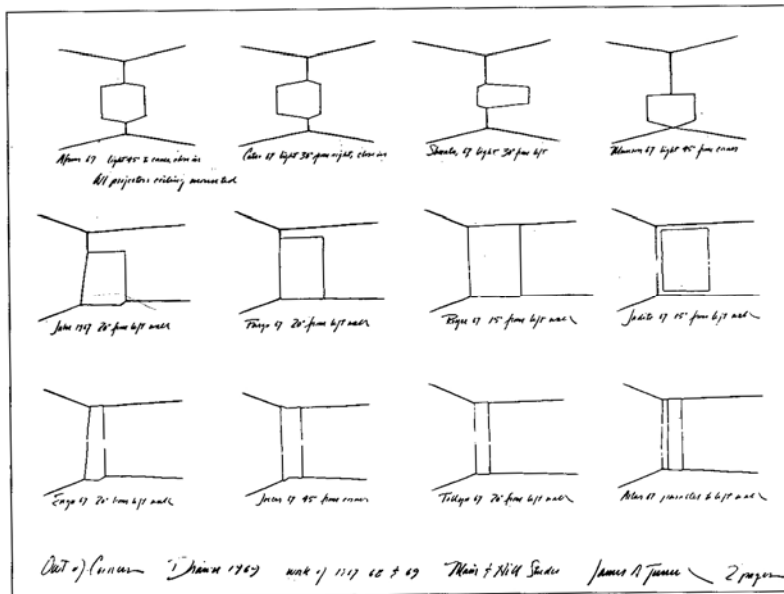


Vision and Light





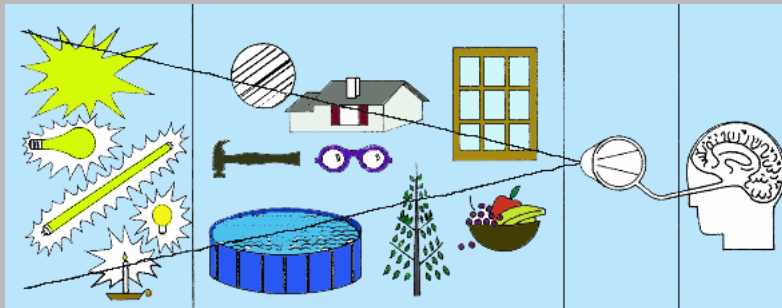


Vision

Generators –
Transmitters
(Light Sources)

Modifiers and
Retransmitters
(Secondary Light
Sources)

Receivers –Decoder –
Encoders Interpreter
(Eyes) (Brain)



Sun, Discharge lamps, fluorescent lamps, Incandescent lamps, Open flames, etc.

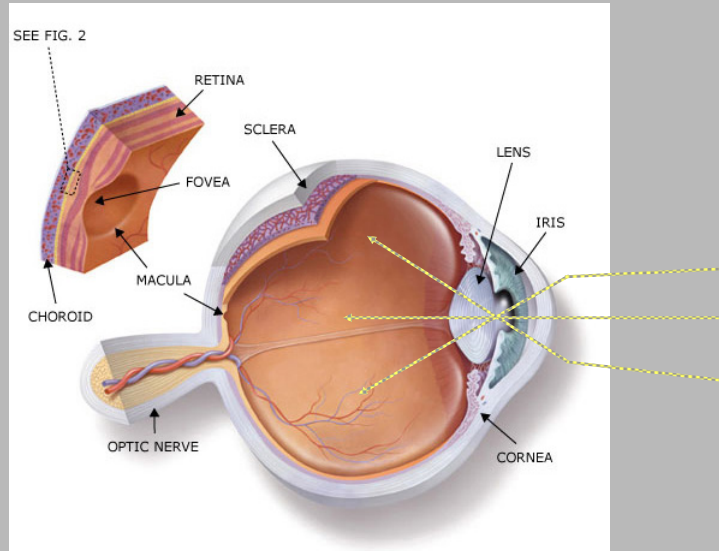
Atmosphere, Air, Water, Planets, Lenses, Windows, Trees – All natural or manufactured objects which modify light waves before they reach the eye.

Cornea, Iris, Lens, Rods & Cones, Optic Nerves

Analysis, Identification, Association, Perception

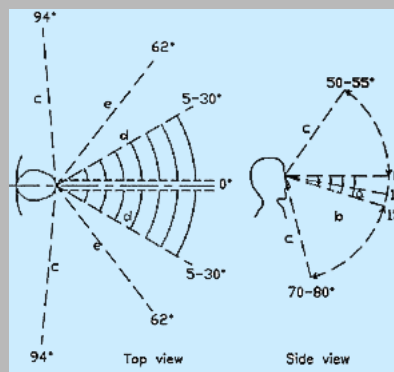
Structure of the Eye

- Cornea
- Iris
- Lens
- Retina
- Fovea

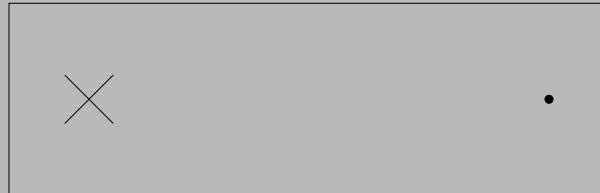


Field of Vision

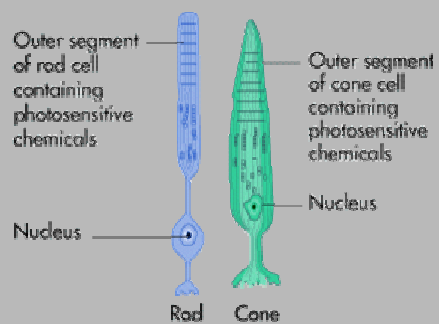
- a. Normal optical axis, standing person
- b. Normal optical axis, sitting person
- c. Limits of field of vision
- d. Normal angle of vision
- e. Maximum angle of vision



Blind Spot



Cones and Rods



Day & Night Vision

Mesopic - Dim Light Vision (Rod and Cone vision)

This occurs when the light levels are low but there still is the ability to see color (between .01 and 1 cd/m² adaptation luminance).

Scotopic – Night Vision (Rods vision)

The rod is responsible for night and peripheral vision.

Photopic – Day Vision (Cones vision)

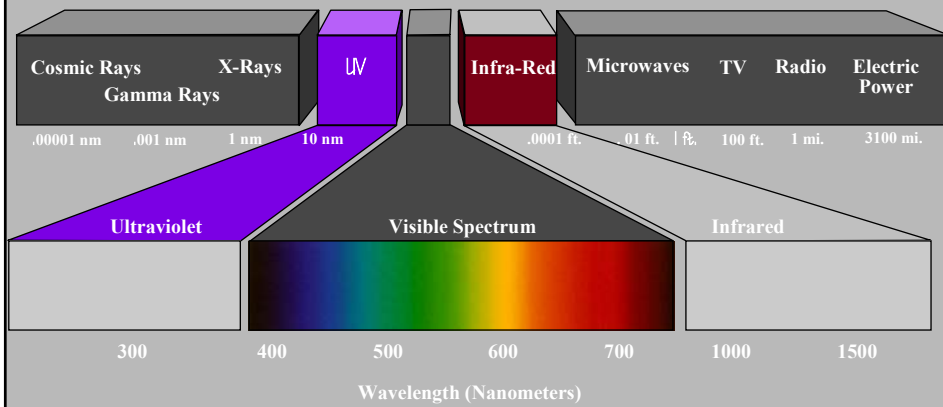
The cones of the eye are of three different types. These are the primary colors (additive) in light, which are red, green, and blue.

Functions Performed by the Eye

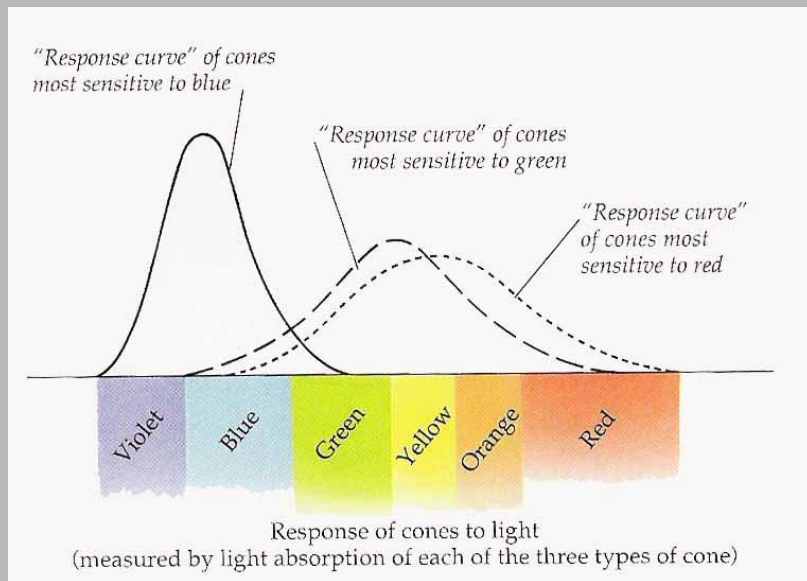
- Adaptation
 - How?
 - 1. the Pupil Size changes,
 - 2. Photochemical - the cones and rods bleach
 - 3. Transient – over time
- Accommodation
 - How?
 - 1. The lens changes shape and focus
- Eye Movement



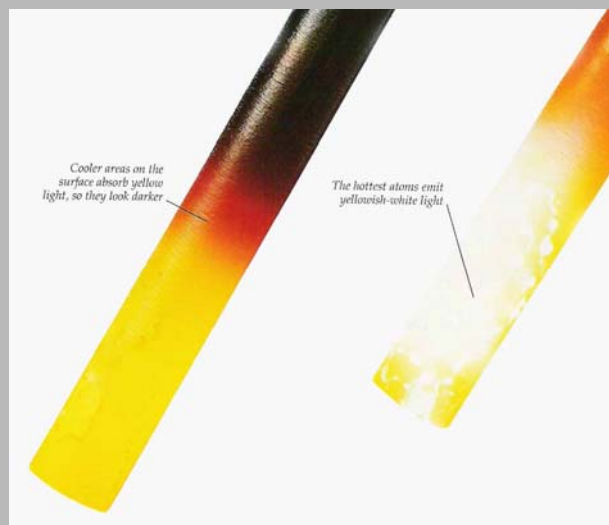
Electromagnetic Spectrum

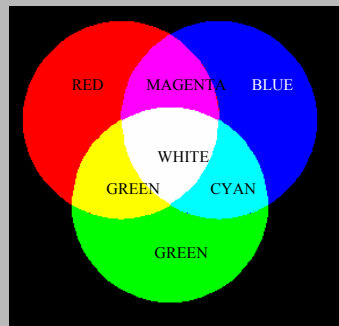


Eye Sensitivity Curve

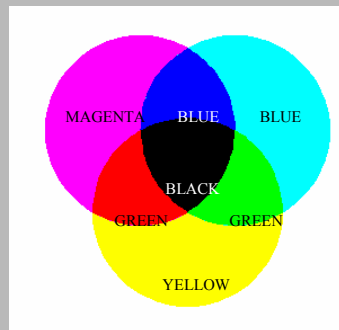


Color



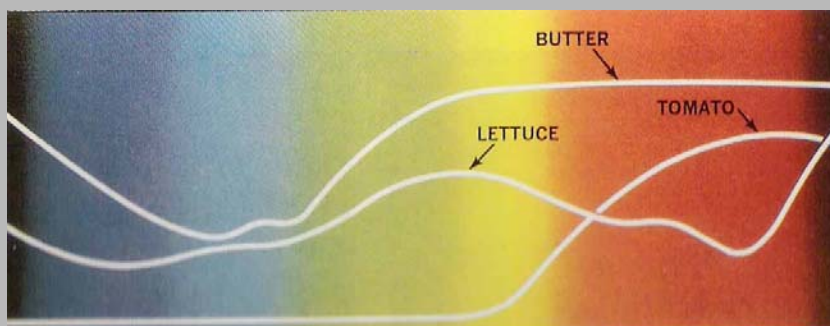


Additive Color Mixing

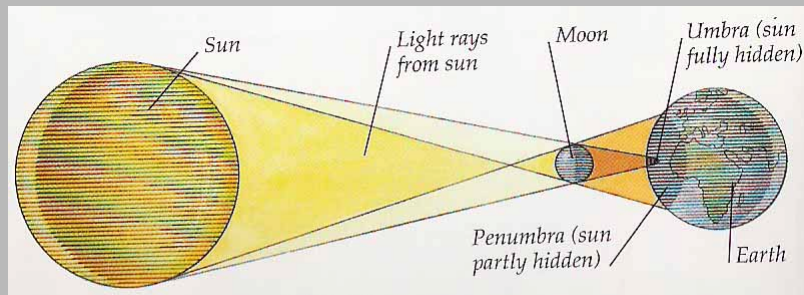


Subtractive Color Mixing

Color



Shadows

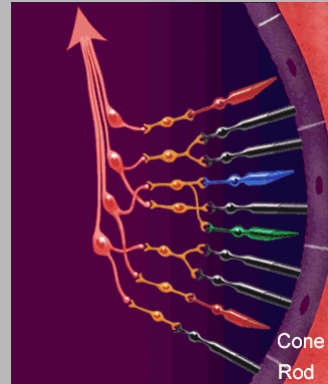


Health and Light

- The role that light plays in human health has two broad categories of interest:
 - ◆ 1) Effect of light on healthy people in normal environments
 - ◆ 2) The therapeutic application of light
 - * SAD (seasonal affective disorder), depression
 - * Sleep disorders
 - * Alertness
- In both key areas, health and welfare appear to be closely linked to the effect that light has upon the circadian rhythm.

Health and Light

- As mentioned earlier, light sensitive cells (rods and cones) are responsible for changing light into electrical signals which are relayed to the brain.
- Recent research has suggested the existence of a third type of cell or network of cells: melanopsin containing ganglion cells which are most sensitive to blue light in the 480nm frequency.
- Circadian rhythms – sleep, alertness, hormone levels, and other key physiological processes are closely tied to the natural progression of light changes over the course of the day.
- Interestingly, blind people have been shown to maintain their “internal clock” despite impaired retinal function.



Health and Light

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Health and Light

- Healthy people and their environments
 - ◆ Work place
 - ◆ Play
 - ◆ Commercial
 - ◆ In all three of these conditions, the factors to consider are
 - * Alertness
 - * Task appropriate lighting
 - * Fatigue and source variability
 - ◆ Healthy people also interact in a range of other environments, but current research is largely focused on the above.

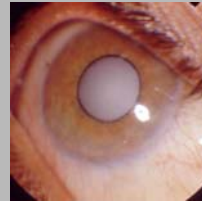
Health and Light



- “treatment” for light associated disorders and normal environmental design factors are convergent. All of the following are desirable, though many still require research and fine tuning:
 - ◆ Variable lighting, both intensity and color, can help to synchronize circadian rhythms.
 - ◆ Full spectrum sources should be used, as the bodies response to exact frequencies over time has not been fully investigated.
 - ◆ Both so called “emotional” and biological factors affect individual response to light and play a role in health
 - ◆ Adequate light levels and contrast should be of paramount concern when designing lighting for architectural spaces.

Effects of Aging

- Yellowing of the lens
- Opacity of the lens
- Less Elastic Lens
- Amount of light reaching the Retina
- Time required for Visual Process
- Visual Acuity and Sensitivity decrease



Effects of Aging

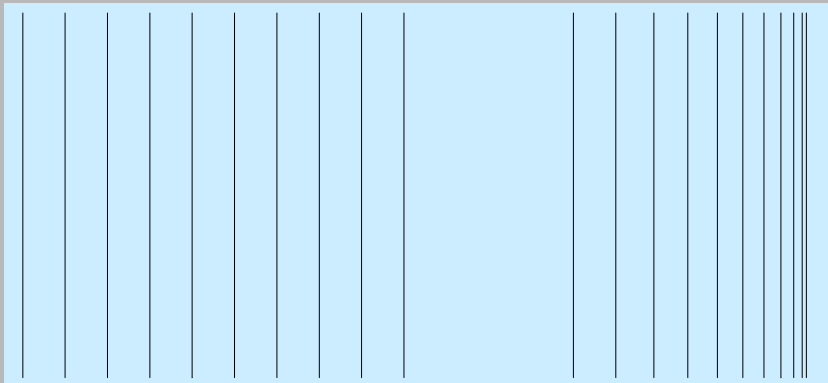
- These physiological changes lead to:
 - ◆ Poor depth perception
 - ◆ Increased glare sensitivity
 - ◆ Reduced speed in adaption
- Which can in turn lead to major lifestyle impediments:
 - ◆ Limited mobility
 - ◆ Fear of falling
 - ◆ Disrupted sleep patterns (see discussion of Circadian Rhythms)
 - ◆ Increased reliance upon caregivers as escorts



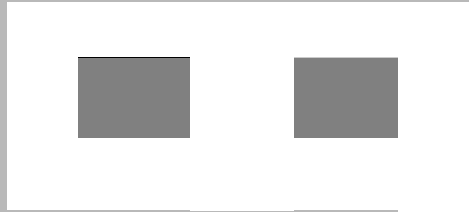
Processing of Visual Information

- Depth Perception
 - Your eye determines distance by 3 methods (size, moving, stereo)
- Motion Detection
- Brightness Perception

Depth Perception



Brightness Perception



Visibility and Visual Performance

- Contrast
- Size
- Background Luminous
- Viewing Time

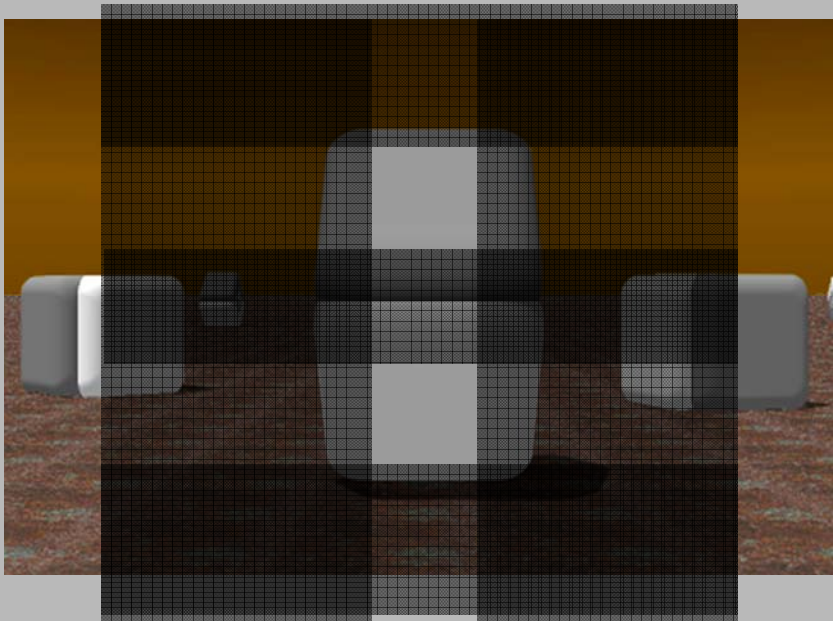
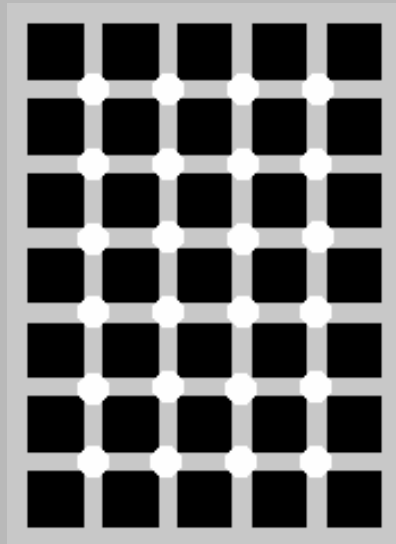
Contrast Gradient

A solid gray rectangle with a thin black border. The text "Contrast Gradient" is positioned in the top-left corner.

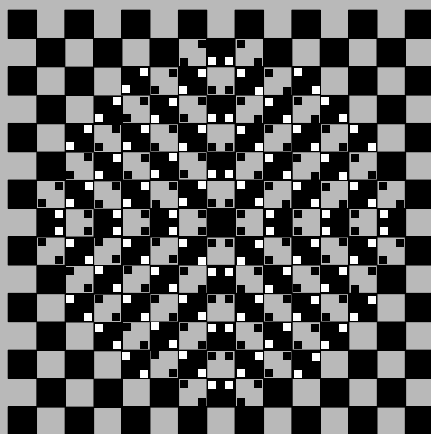
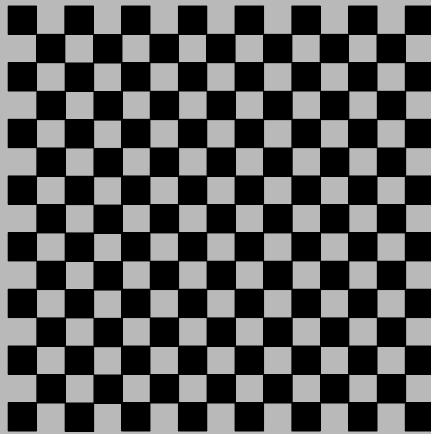
Contrast Gradient

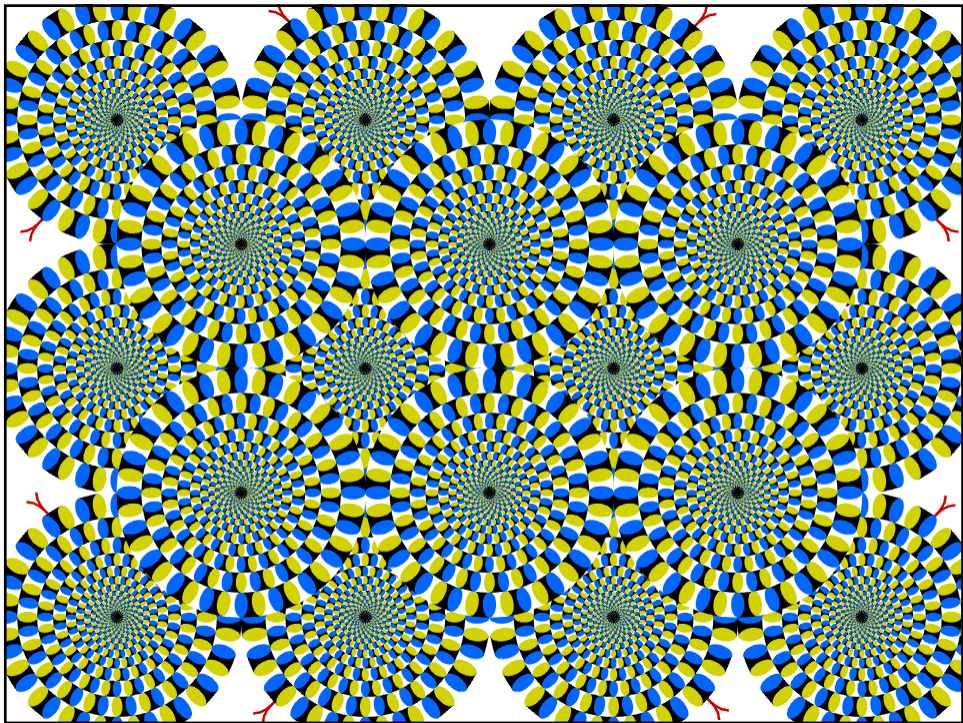
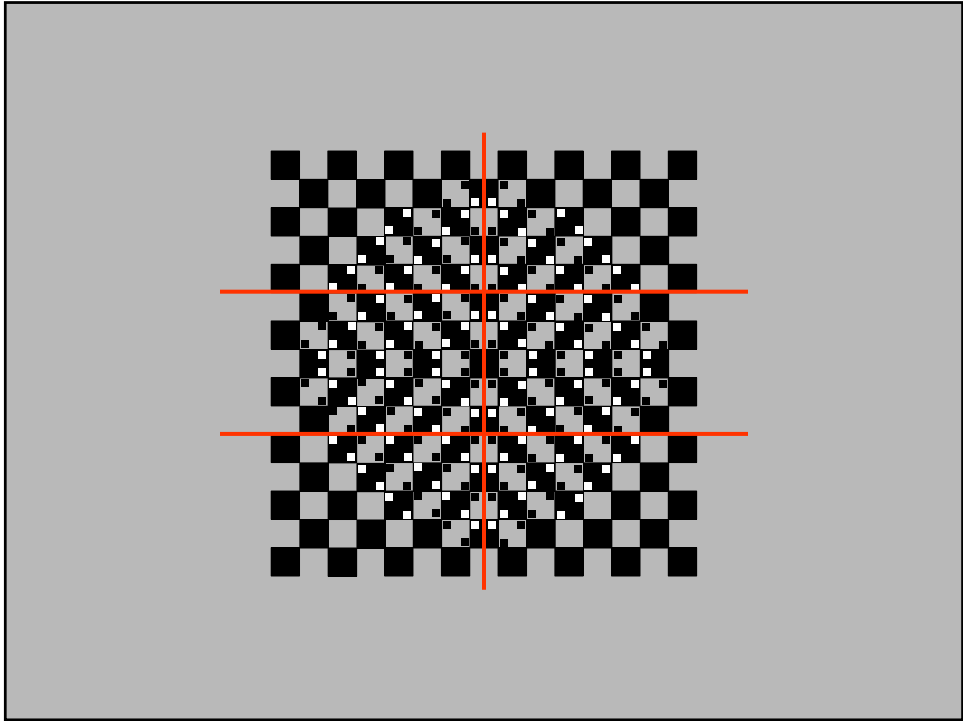
A rectangle with a thin black border, divided into three horizontal bands. The top and bottom bands are gray, and the middle band is white. The text "Contrast Gradient" is positioned in the top-left corner of the gray band.

Optical Illusions



Hering illusion





Stare at the white dot for 20 seconds



