Light In Architecture and Psychology of Light

Vision

Lighting and Specialty Design

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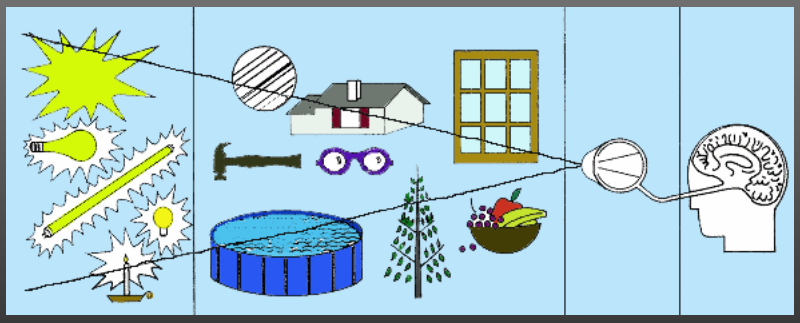
Visual System

Light Sources	Secondary Light Sources	Eyes	Brain
Generators – Transmitters	Modifiers and Re-transmitters	Receivers – Encoders	Decoder – Interpreter



Sun, Discharge lamps, fluorescent lamps. Incandescent lamps, Open flames, etc.	Atmosphere, Air, Water, Planets, Lenses, Windows, Tress – 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

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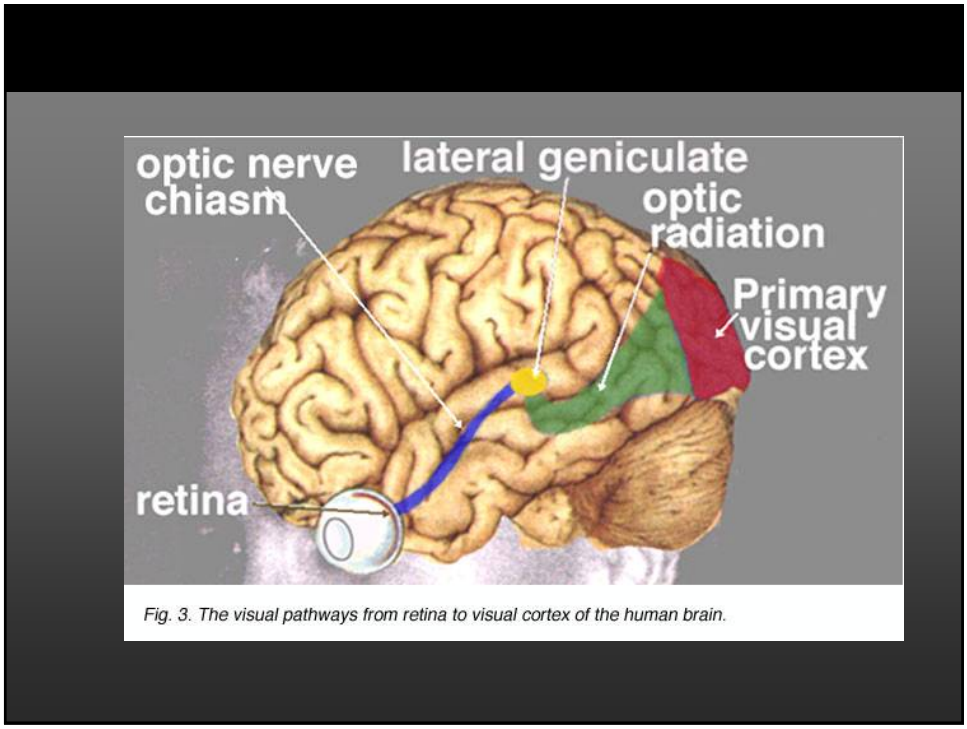
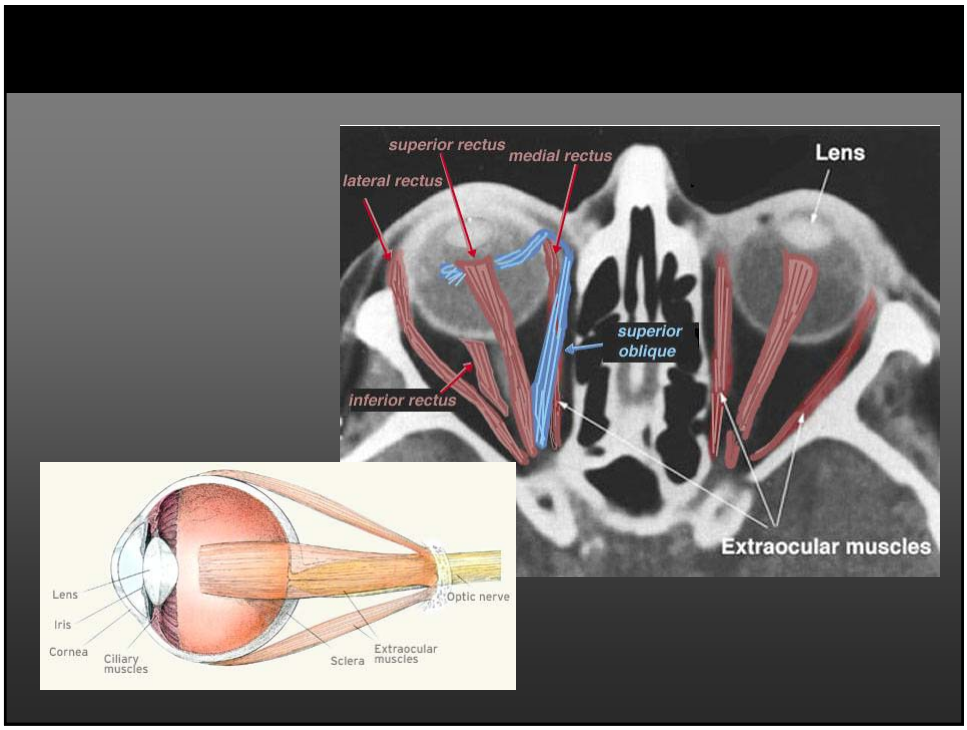
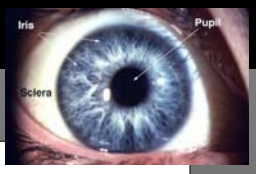


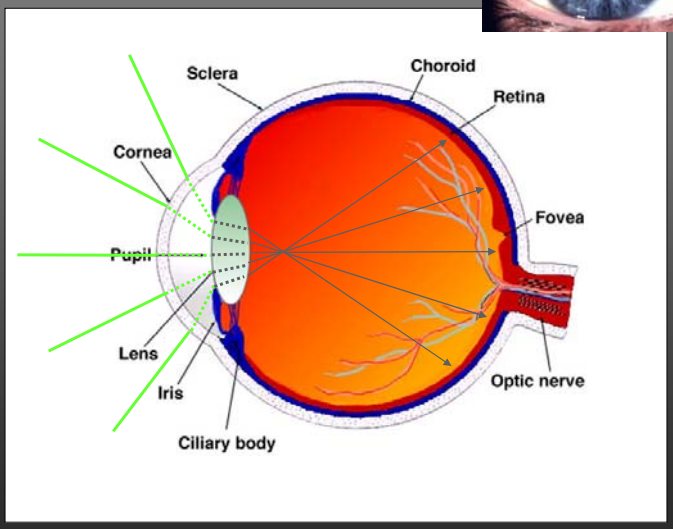
Fig. 3. The visual pathways from retina to visual cortex of the human brain.



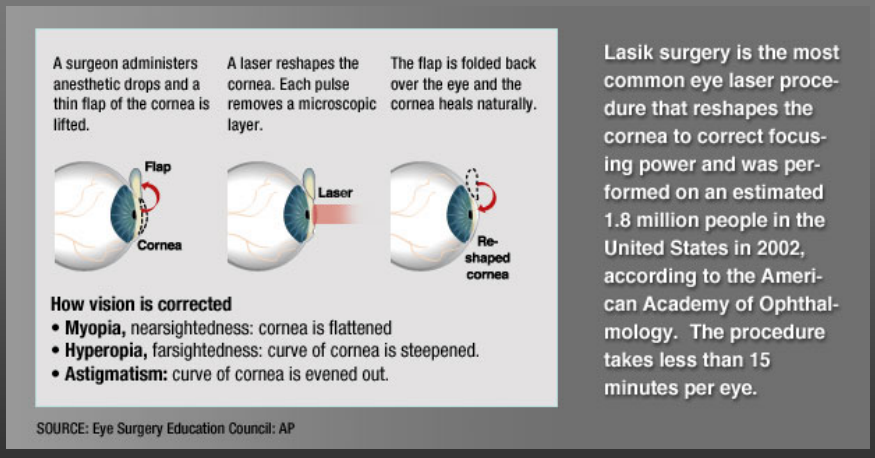
Structure of the Eye



- Cornea
- Iris
- Lens
- Retina
- Fovea



Laser Surgery



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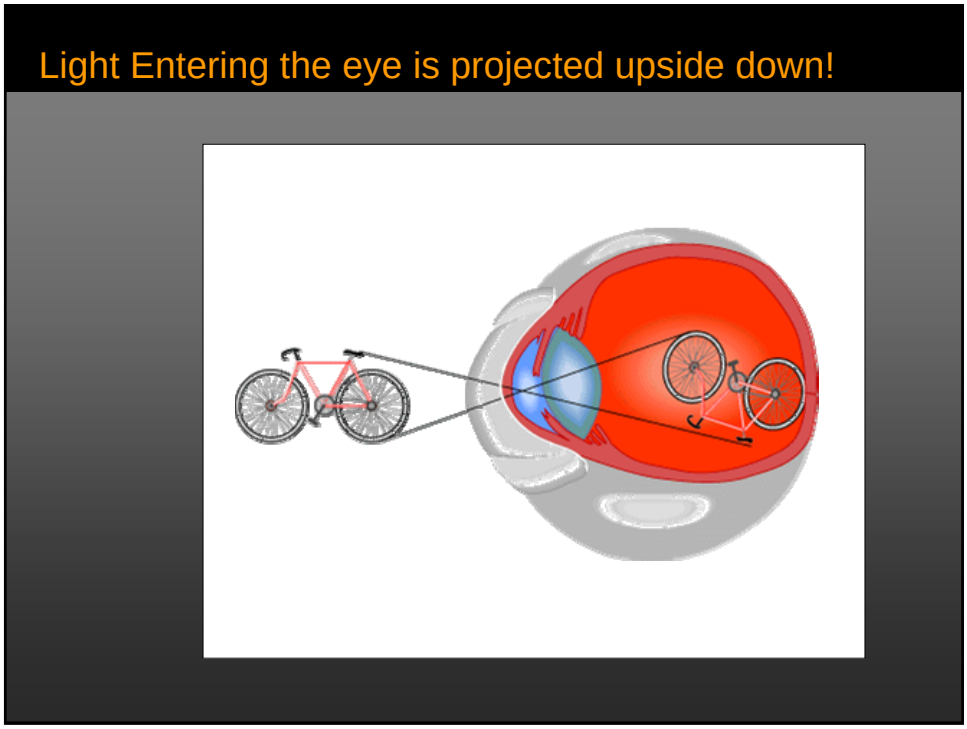

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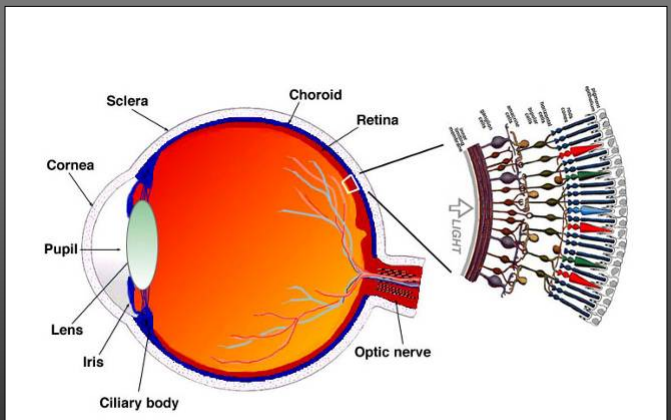
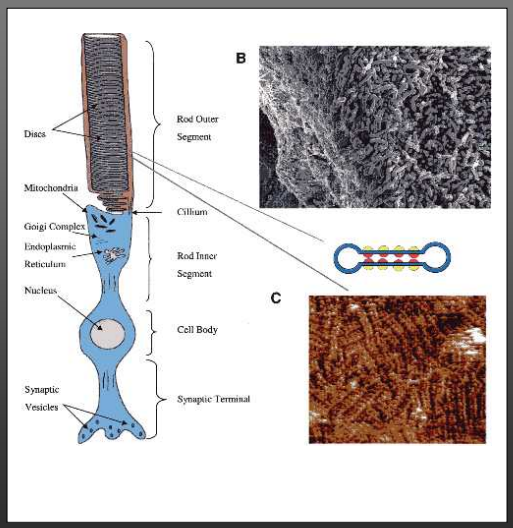


Fig. 1.1. A drawing of a section through the human eye with a schematic enlargement of the retina.

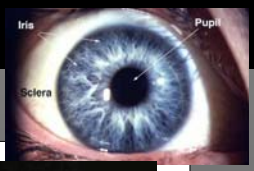
Cones and Rods

The interior back wall of the eye wall is the Retina containing light sensitive cells a photoreceptors known as **Rods** and **Cones**

- **Rods** - 120 million
  principle for peripheral vision and low light levels (Scotopic Vision)
- **Cones** - 8 million
  responsible for normal (Photopic vision) and for focusing on fine detail…..cones also contain pigment and allow to see color…but they can differ or sensitive



Structure of the Eye



The fovea is responsible for sharp central vision (also called foveal vision), which is necessary in humans for reading, watching television or movies, driving, and any activity where visual detail is of primary importance.

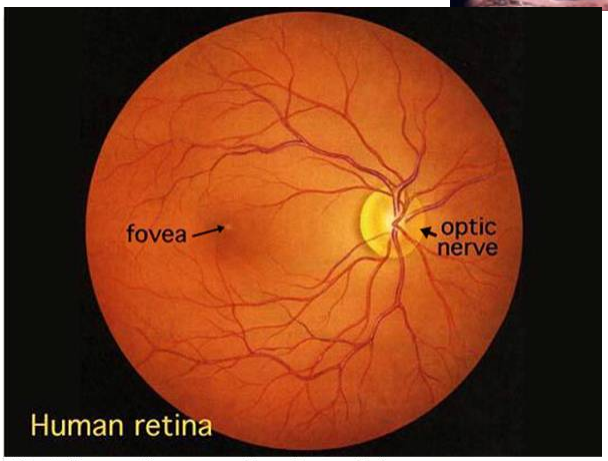
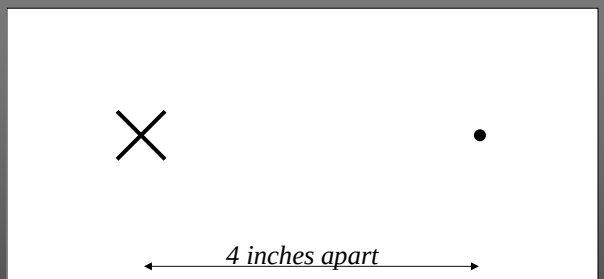


Fig. 1. Human retina as seen through an opthalmoscope.

Find your Blind Spot



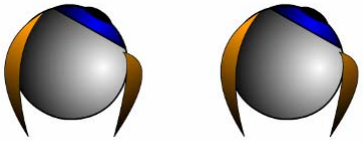
1. *On a scrape piece of paper draw an **X** and a **dot**.*
2. *Hold the paper with your right hand in front of your face about 4-6 inches away.*
3. *Cover your left eye with your left hand and focus on the **X** with your right eye.*
4. *Flip the paper around for the left eye.*

Field of Vision

The generation of saccadic eye movements

As we saw, only the fovea of the retina sees in detail.

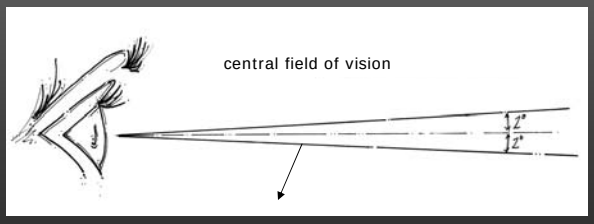
Saccades point the fovea to objects of interest, like the words in this sentence.



Vision is impaired during these movements. To minimize this time, saccades are very fast (faster than any other movement).
These high velocities are generated by a **phasic burst** of action potentials to the muscles (up to 1000 action potentials per second).

Eye's Field of Vision

- Central field of vision:
  - ~2 degrees above and below the direct line of sight
  - Visual acuity (ability to see detail) is best in this range
- Peripheral area:
  - Horizontal area to the sides of the central vision
  - Vertical areas above and below the central field of vision
- Brightness and motion best seen in peripheral vision



Processing of Visual Information

- Color Perception
  this visual process provides us details regarding the color of a surface or an object
- the cones detect color…..a normal person is trichromatic…we see all colors
- **Color Deficiencies in the Visual System** - color blindness

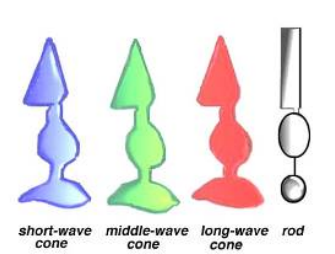


Fig. 13. There are four photoreceptor types in the human retina. Short-wavelength cones (blue), medium wavelength cones (green), long wavelength cones (red) and rods.

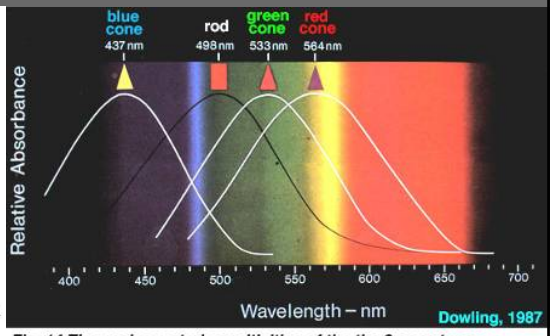


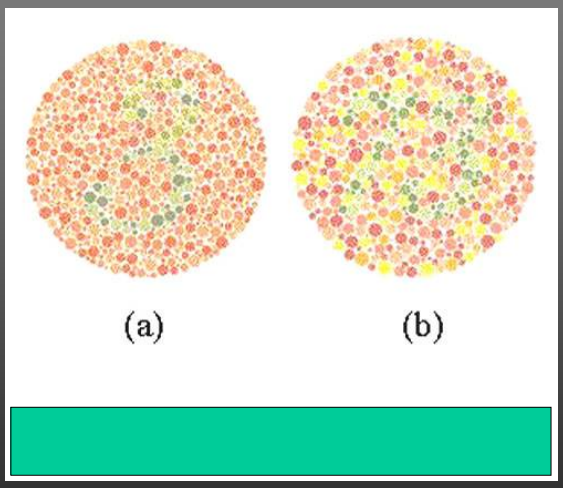
Fig. 14.The peak spectral sensitivities of the the 3 cone types and the the rods in the primate retina (Brown and Wald, 1963). From Dowling's book (1987).

Color Vision Tests

Confusion lines form the basis of many color vision tests such Pseudoisochromatic plates.

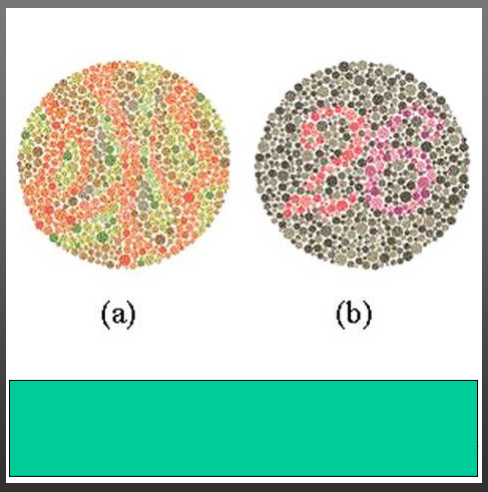
Pseudoisochromatic plate tests are also commonly used in the clinic to screen for color vision deficiency. Colors are carefully chosen based on the confusion lines.

The most commonly used pseudoisochromatic plate in the clinic would be the Ishihara Isochromatic plates (for screening red-green color vision deficiency) and the Tritan (F-2) plate.



pseu·do·i·so·chro·mat·ic (s d - s -kr -m t k) *adj.*
Being apparently of the same color, as of certain charts used in testing colorblindness

Color Vision Tests



Day & Night 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.

Scotopic – Night Vision (Rods vision)

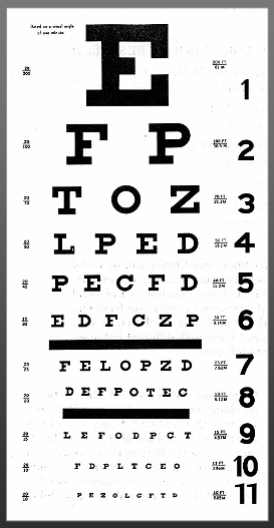
The rod is responsible for night and peripheral vision.

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/m^2 adaptation luminance).

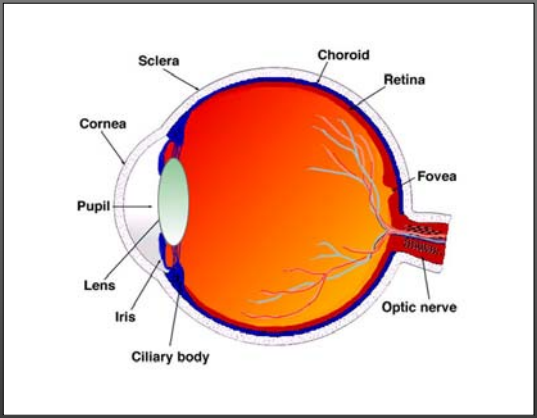
Measuring Vision

- Visual Acuity (20/20 Vision)
  Snellen Eye Chart: *the first number is refers to the distance from the chart, the second is what a normal person can read the chart….20/20 is normal…but, 20/60 says that person could read 20 feet what normal person can read at 60 feet*
- *Contrast Sensitivity*
- *Contrast Detection*



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



Common Defects:

Myopia: can't focus on far objects (Near-sighted)

Hyperopia: can't focus on near objects (Farsightedness)

Astigmatism: distortion in the shape of the lens

Presbyopia: lens loses it elasticity….corrected with bifocals to read near

Functions Performed by the Eye

You can NOT control

- Adaptation

  How?

  1. The Pupil Size changes,
  2. Photochemical - the cones and rods bleach
  3. Transient – over time

You can control

- Accommodation

  How?

  1. The lens changes shape to focus
- Eye Movement

  How?

  1. The eye can move smoothly or jump using six muscles around the eye
  2. Binocular – using both eye…..Monocular – using one eye

Visibility and Visual Performance

- Contrast
- Size
- Background Luminous
- Viewing Time

Contrast

Background Luminous

Size

Lighting

Viewing Time

What is the next word?

Happy

Processing of Visual Information

- **Depth Perception**
  this visual process provides us details regarding the distance to an object

  Your eye determines distance by 3 methods (size, moving, stereo)

- **The size a known object has on your retina** - If you have knowledge of the size of an object from previous experience, then your brain can gauge the distance based on the size of the object on the retina.

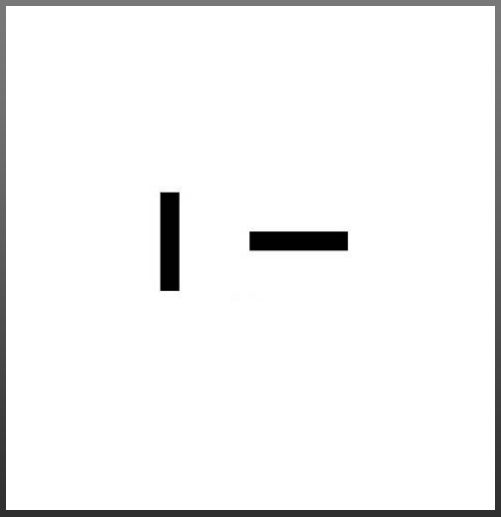
  Pictorial cues*….sizes of objects that you are similar with….books, chairs….light and shadow provide clues…..directional light…….*

- **Moving parallax** - When you move your head from side to side, objects that are close to you move rapidly across your retina. However, objects that are far away move very little. In this way, your brain can tell roughly how far something is from you.

- **Stereo vision** - Each eye receives a different image of an object on its retina because each eye is about 2 inches apart. This is especially true when an object is close to your eyes. This is less useful when objects are far away because the images on the retina become more identical the farther they are from your eyes.

  Binocular Clues*…seeing on object with both eyes…..more information is provided…stereo vision…..a one eyed person lack depth perception*

Depth Perception - Binocular Cues



Binocular rivalry can be demonstrated by placing your pen between yourself and the computer screen.

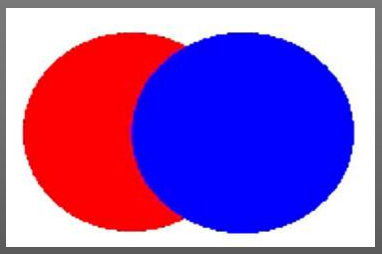
Keep your eye on the tip of your pen and notice the two bars merge….

What do they form?

(You may need to slowly move the pen from the screen toward you.)

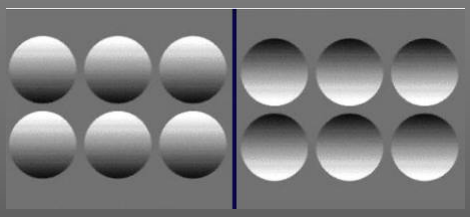
Depth Perception - Monocular Cues

Relative Size: Retinal image size allow us to judge distance based on our past and present experience and familiarity with similar objects. As the car drives away, the retinal image becomes smaller and smaller. We interpret this as the car getting further and further away. This is referred to as size constancy. A retinal image of a small car is also interpreted as a distant car.



Interposition: Interposition cues occur when there is overlapping of objects. The overlapped object is considered further away.

Depth Perception - Monocular Cues



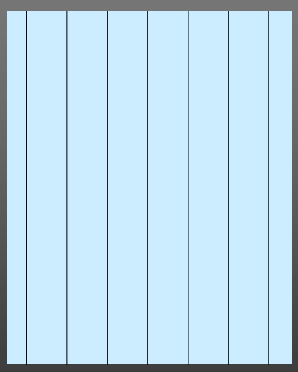
Light And Shade: Highlights and shadows can provide information about an object's dimensions and depth. Because our visual system assumes the light comes from above, a totally different perception is obtained if the image is viewed upside down.

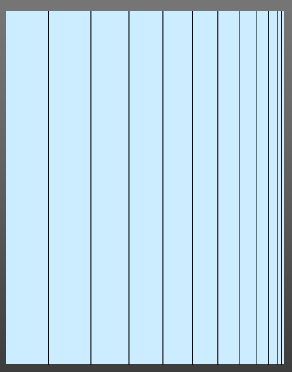
Depth Perception - Monocular Cues

Linear Perspective: Parallel lines such as railway lines converge with increasing distance.

Aerial Perspective: Mountains in the distance appear more blue.

Depth Perception





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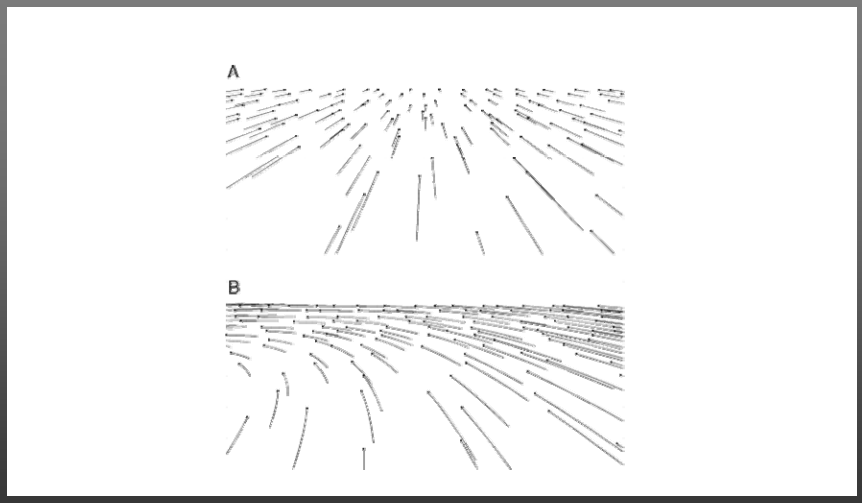
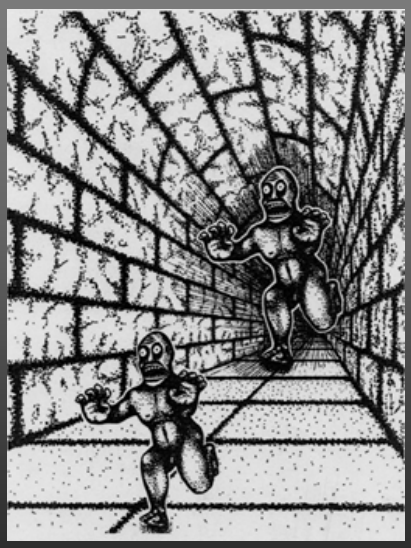


A) Radial dot flow generated from a straight-line path across a ground plane. The direction of motion can be determined by finding the focus of expansion, the point in the flow field where there is no horizontal or vertical motion. This may not be explicitly present, but can be extrapolated from the motion of other points in the image. B) Curvilinear dot flow generated from a curved path across a ground plane, also with a fixed gaze.

Monster Illusion



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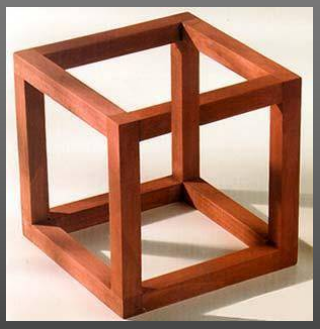
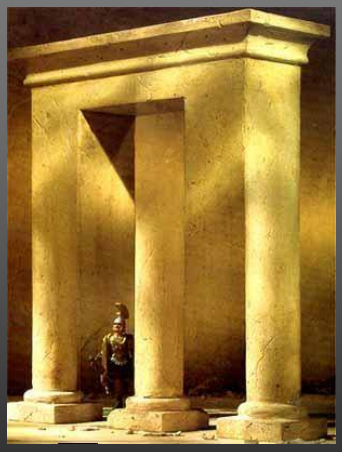




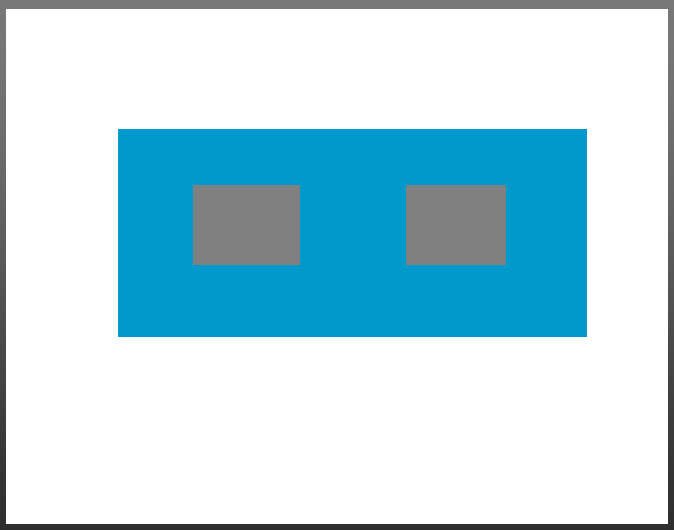
The balconies on this New York apartment block either appear to tilt upwards or downwards depending on the angle they are viewed from. The higher you look the stronger the appearance of the tilt

Processing of Visual Information

- Brightness Perception

  this visual process provides us details regarding the brightness of a surface or an object

Brightness Perception



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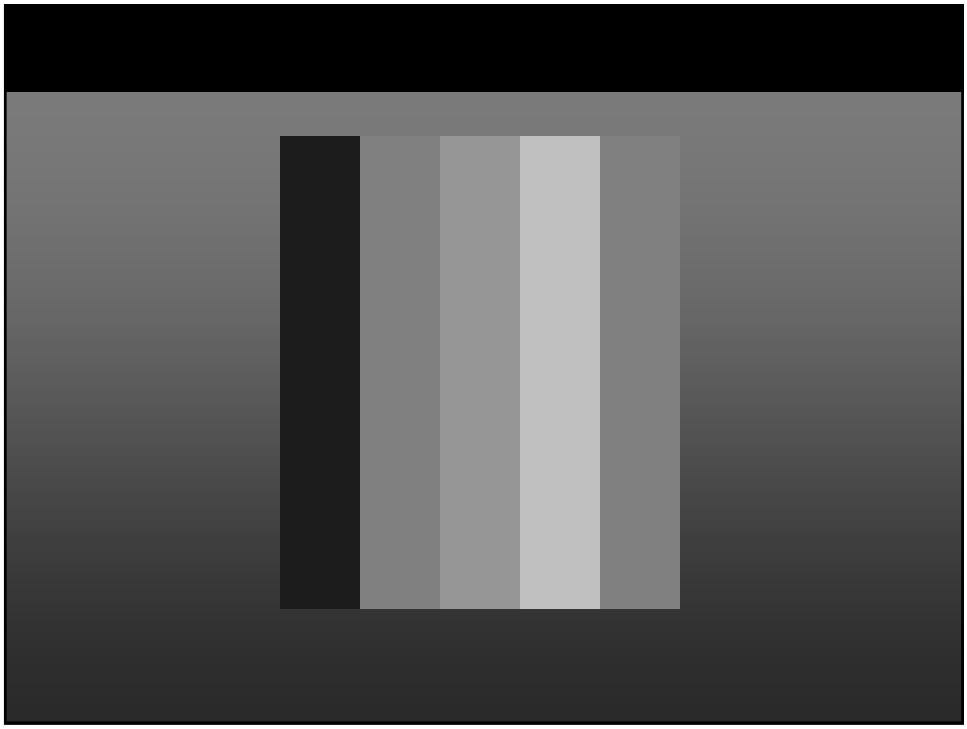
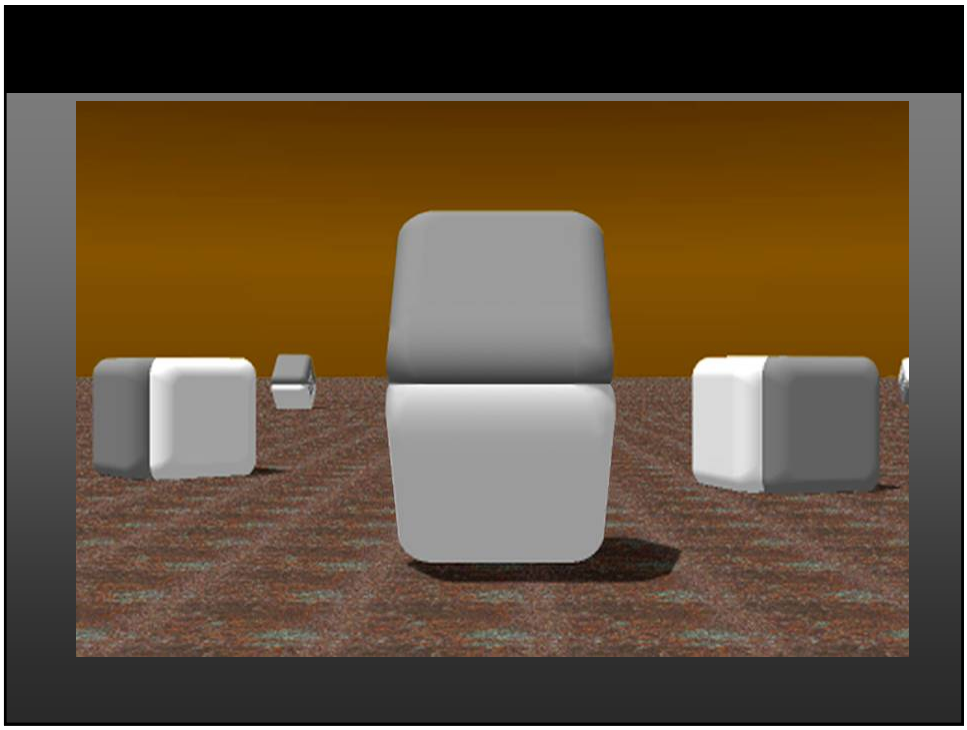
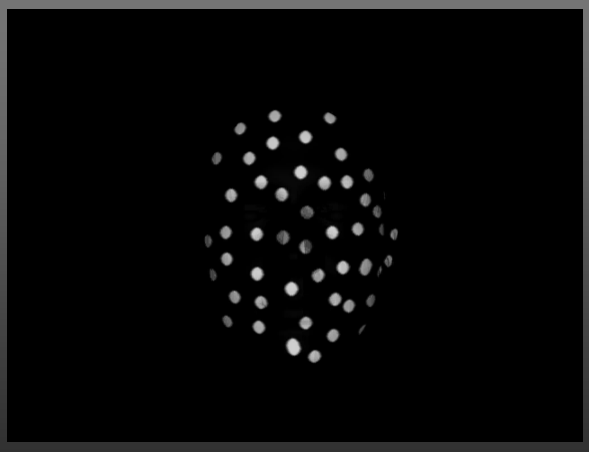




Processing of Visual Information

- Motion Detection
  this visual process provides us details regarding the motion to an object
- Different cells respond to different type of movement…and can adapt light light levels
- Moving or static perceived movement in all directions is perceived
- Our visual system is capable of taking a series of stationary views and …..and appears to be a continuous moving scene…(ie individual frames in a stroboscopic manner, such as movies)
- Lamps strobe…up to 120 times a second….



Visual Perception

The modern view of visual perception is one of dynamic processes that go beyond the simple replication of visual information provided to the retina.

For over 80 years Gestalt psychologists have argued that the act of perception creates a Gestalt, a figure or form that is not a property of an object observed but represents the organization of sensations by the brain.

This dynamism is thought to be crucial for the performance of simple, everyday visual tasks such as the recognition of an object that is partially occluded. Thus, the study of how the brain is capable of filling in the missing pieces is an important topic; one that has most often been carried out through the use of illusory contours and optical illusions.

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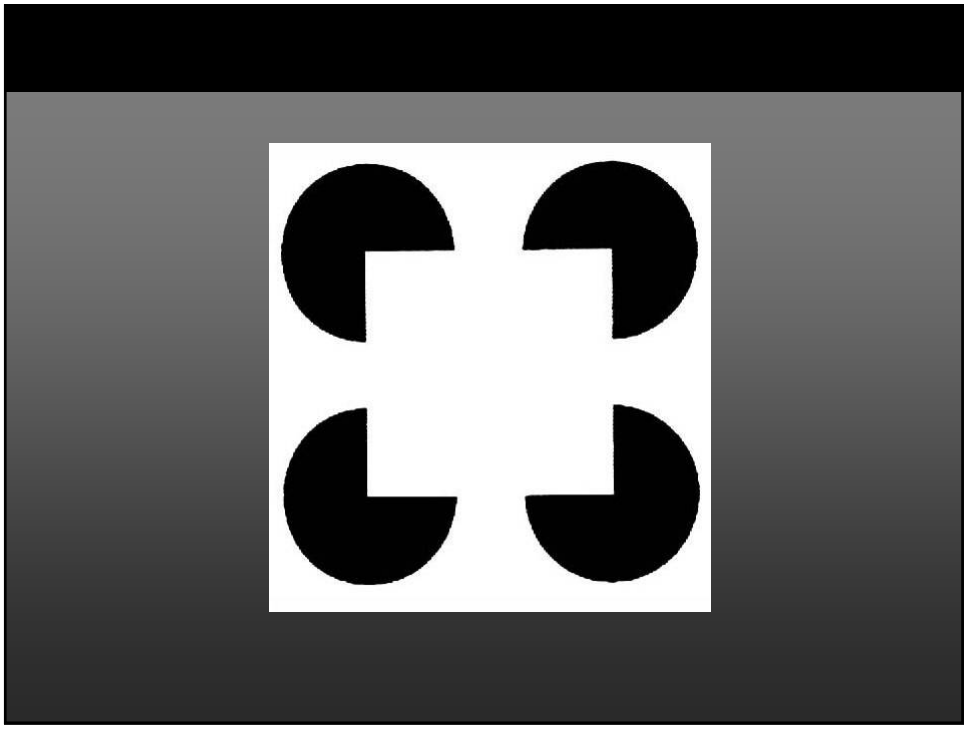

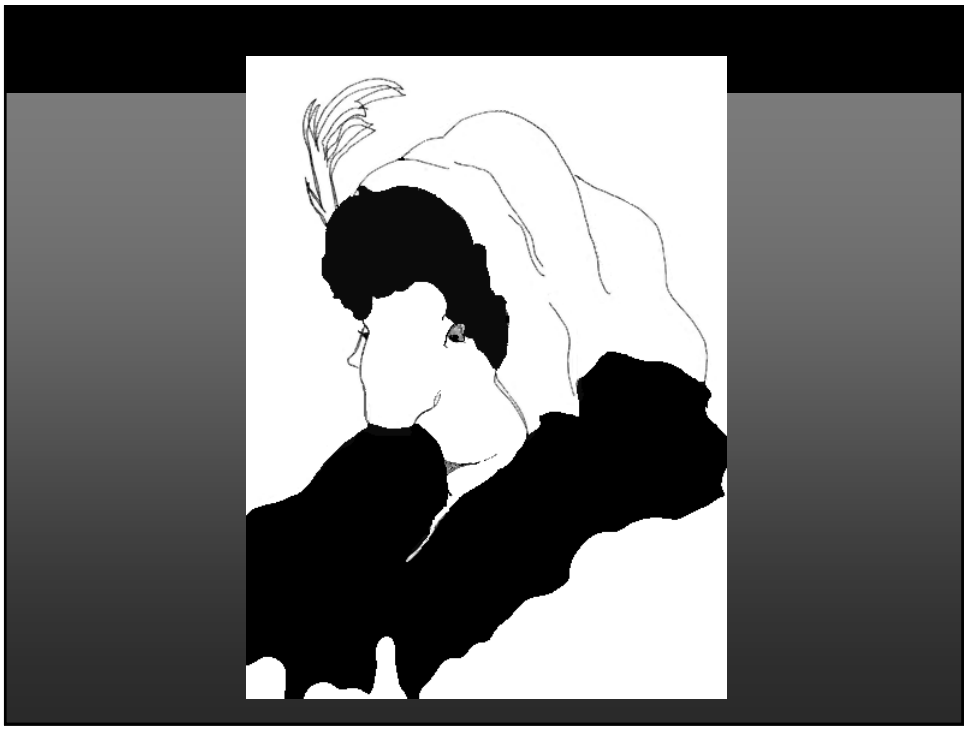

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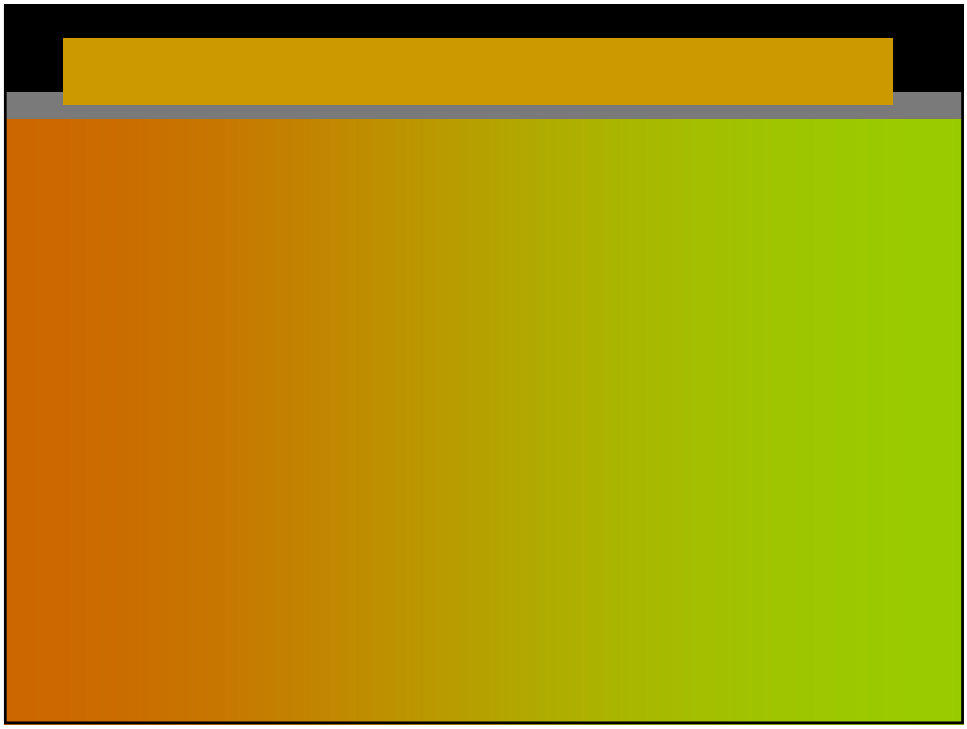

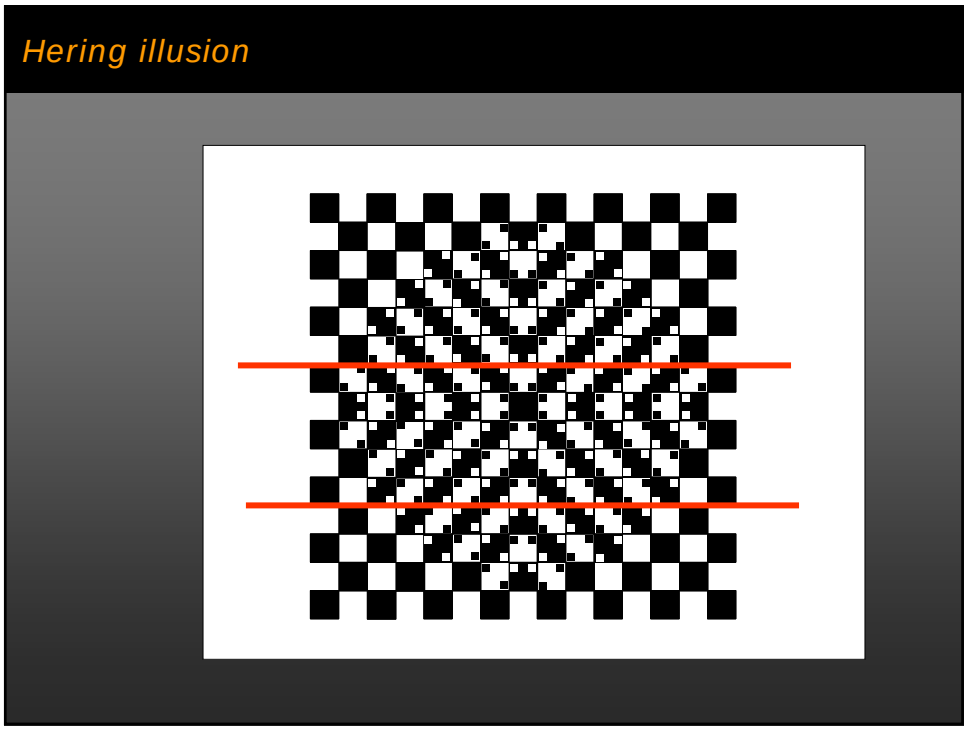

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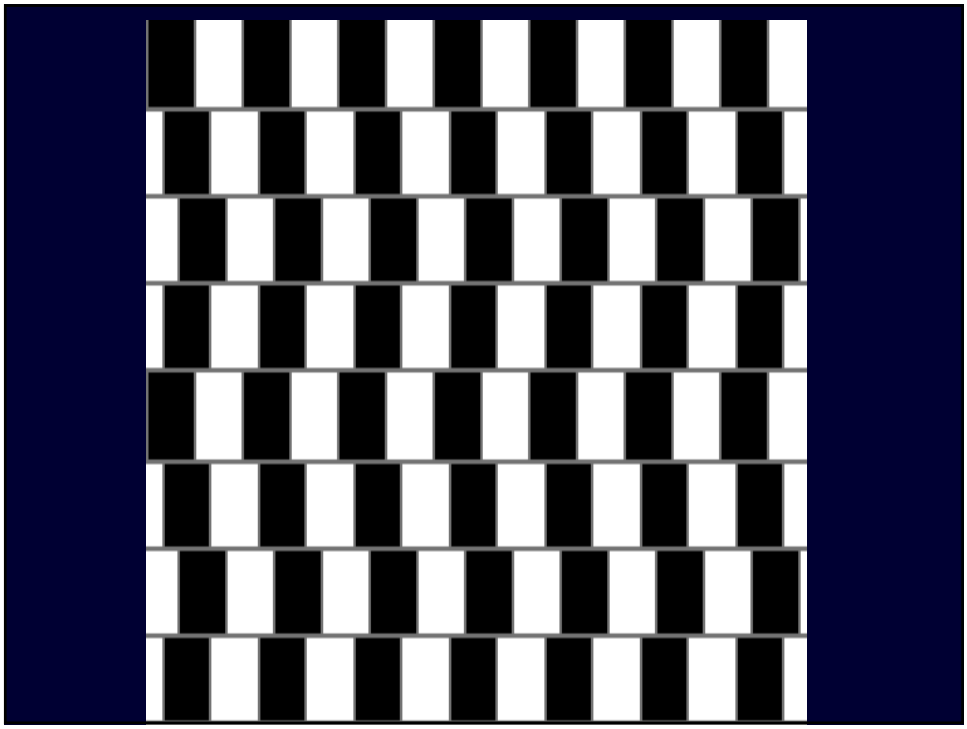

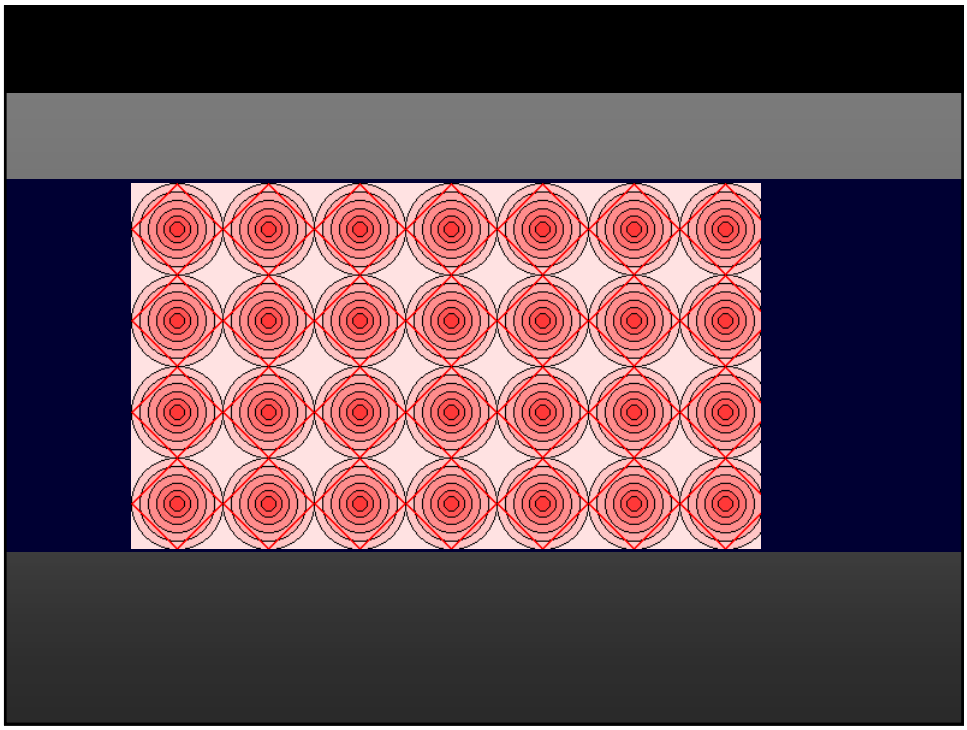

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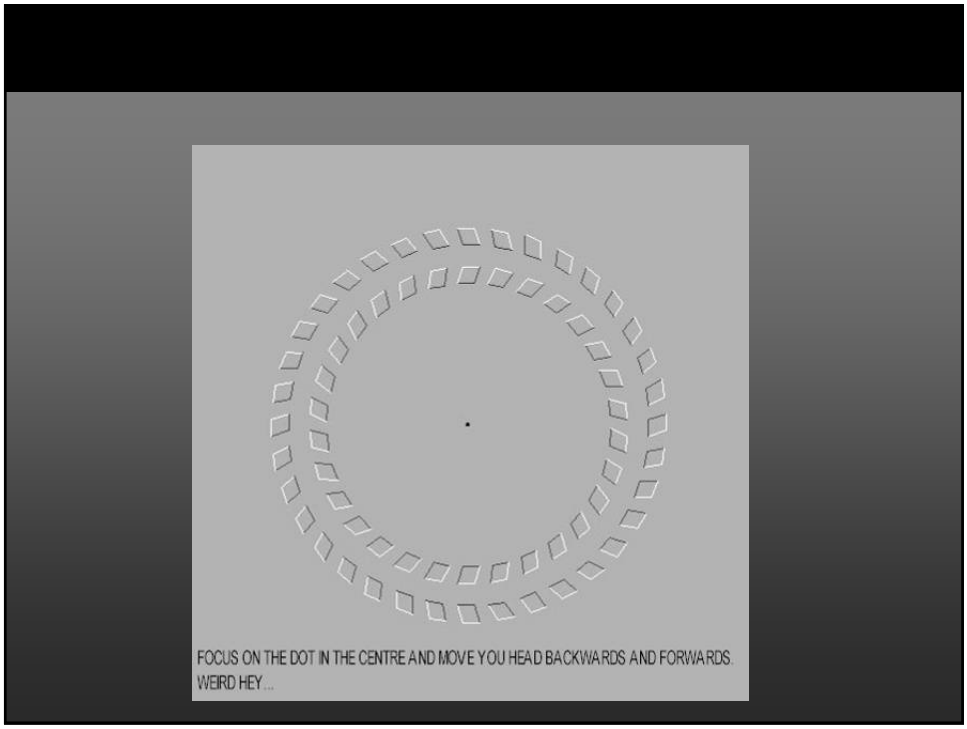
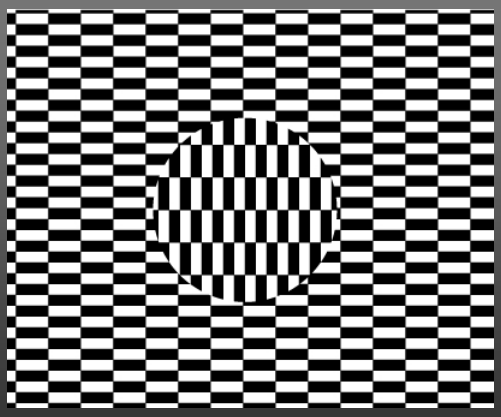


Ouchi Illusion



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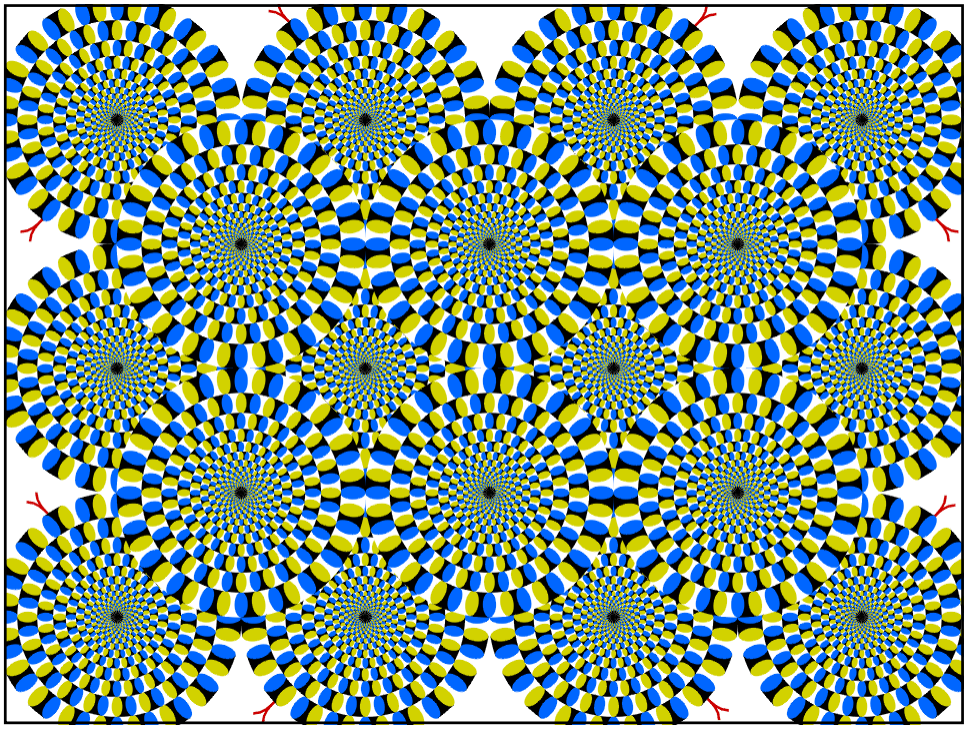

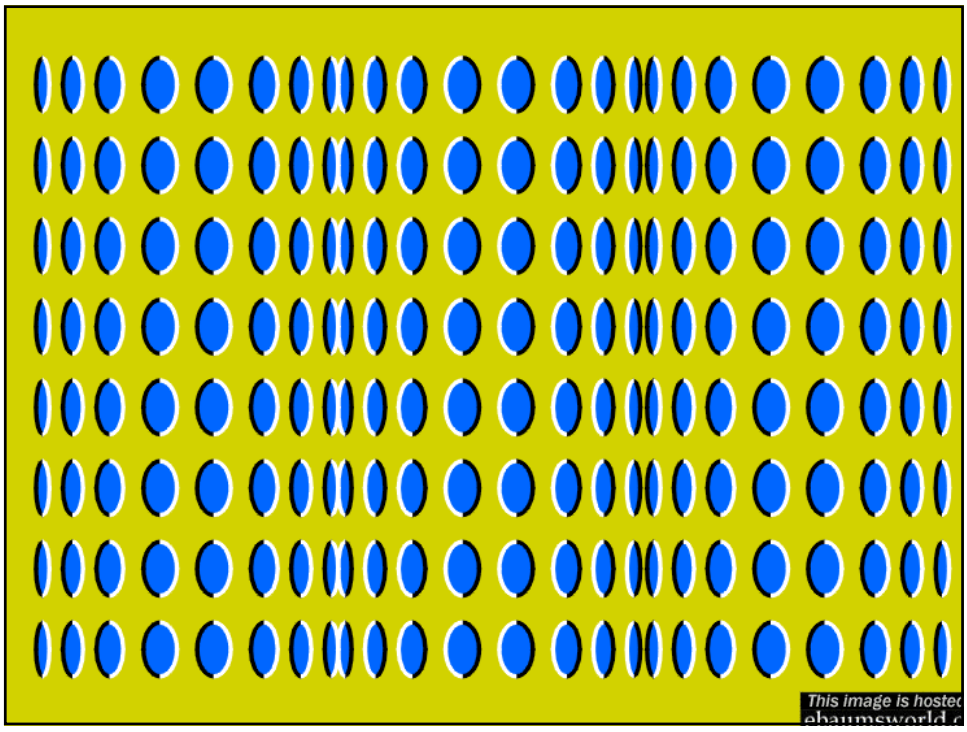

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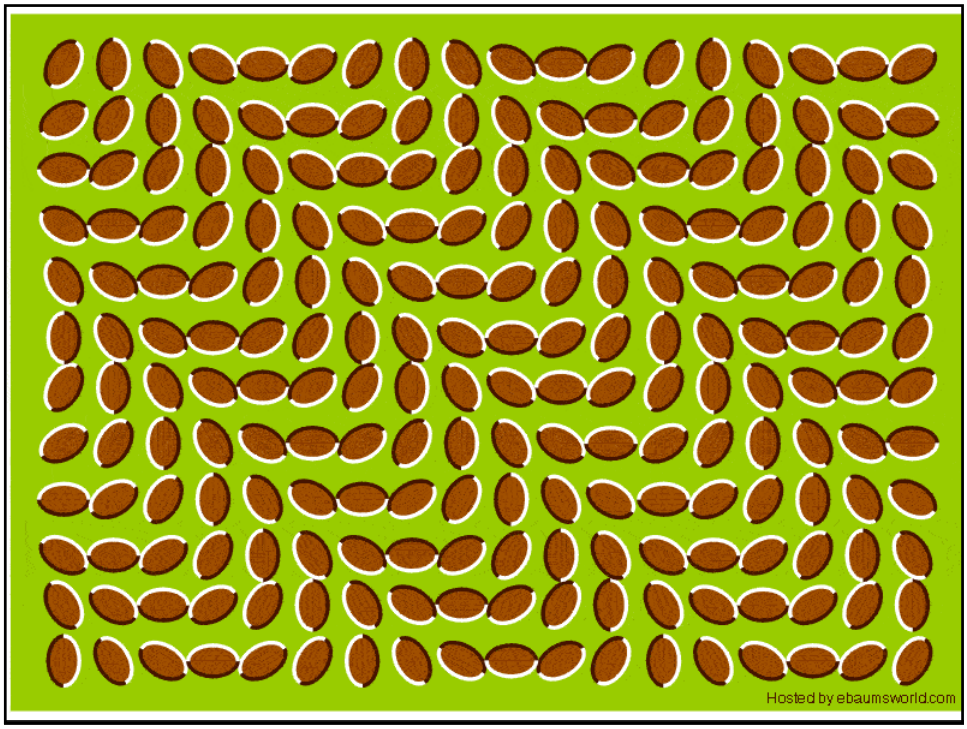

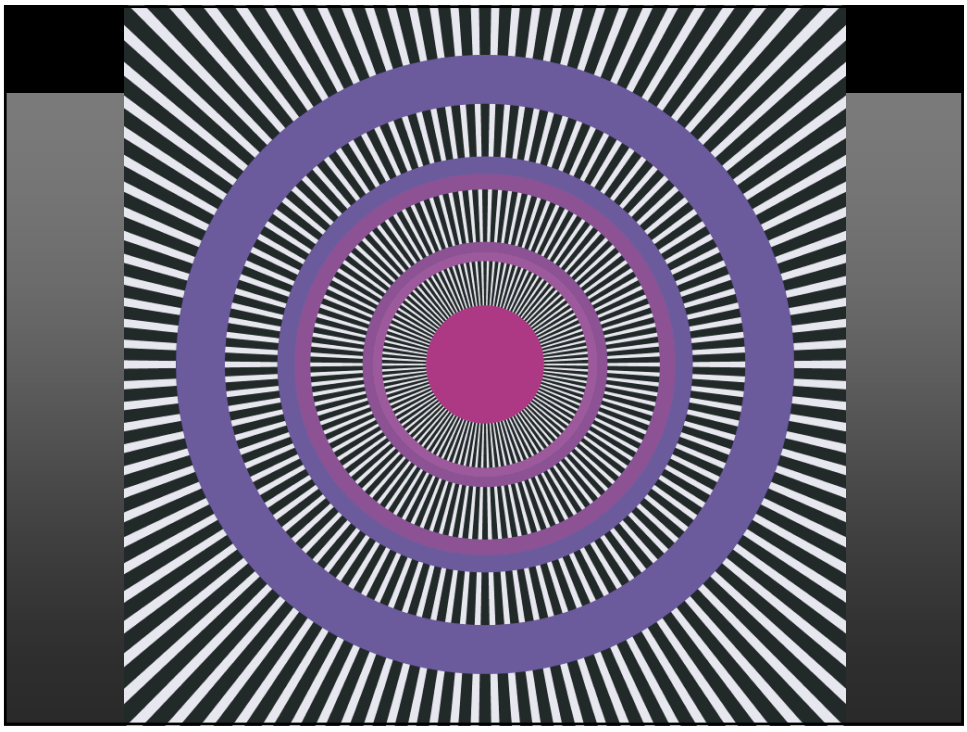

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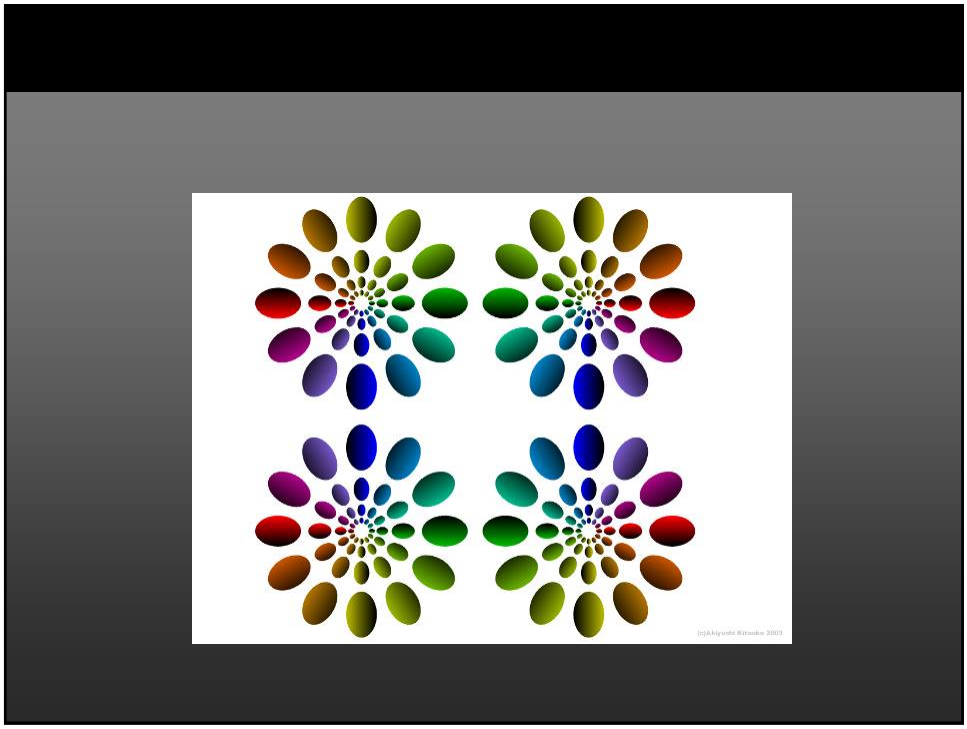

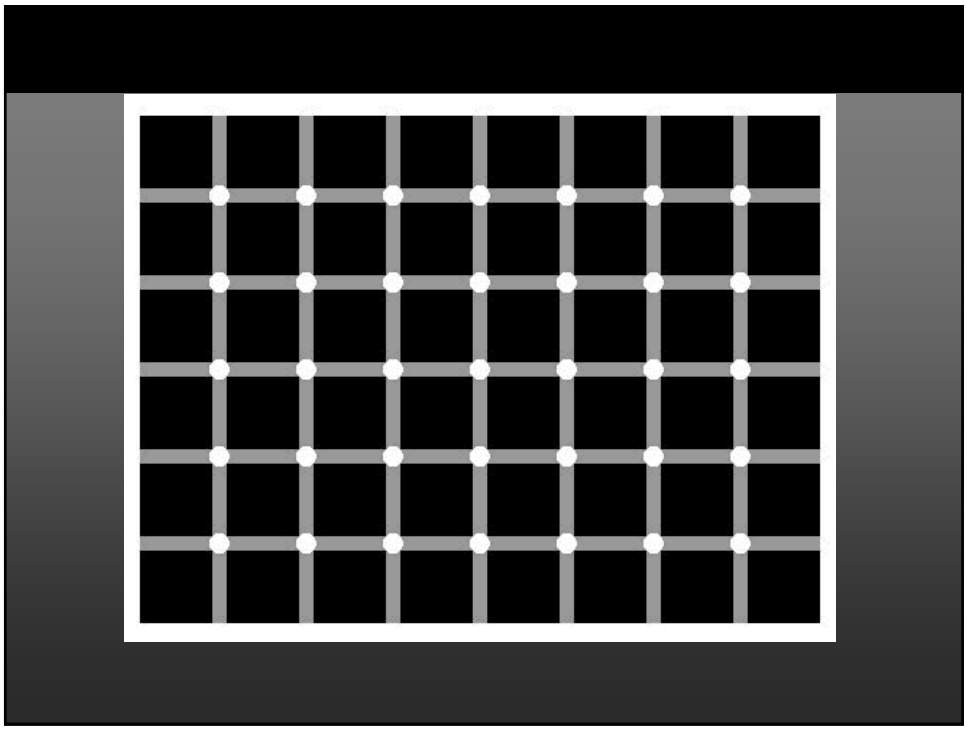

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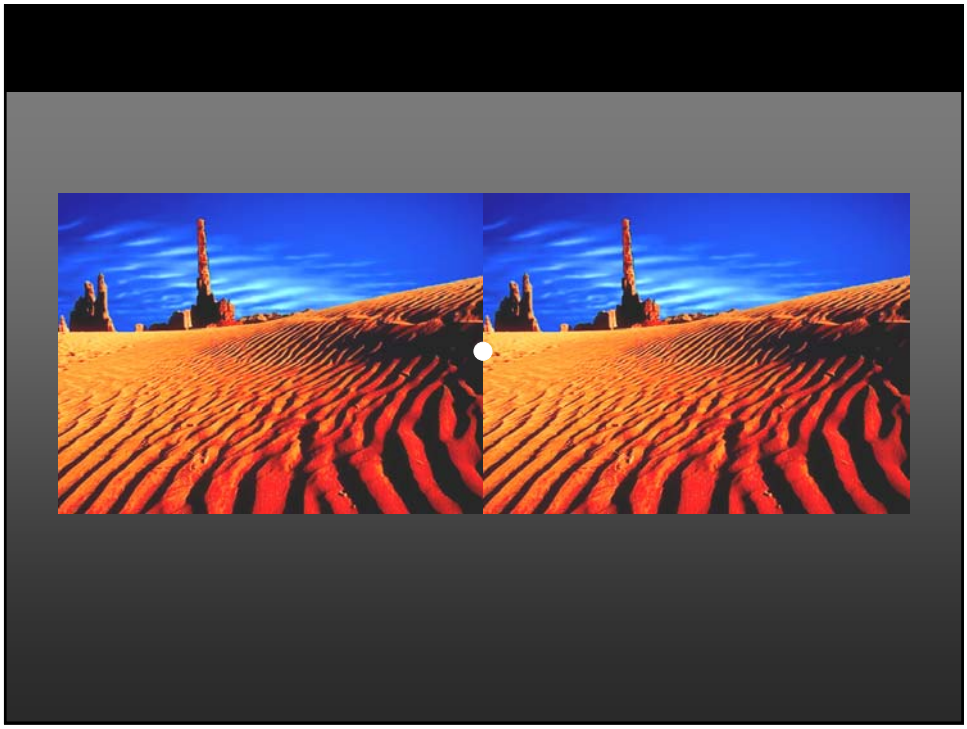

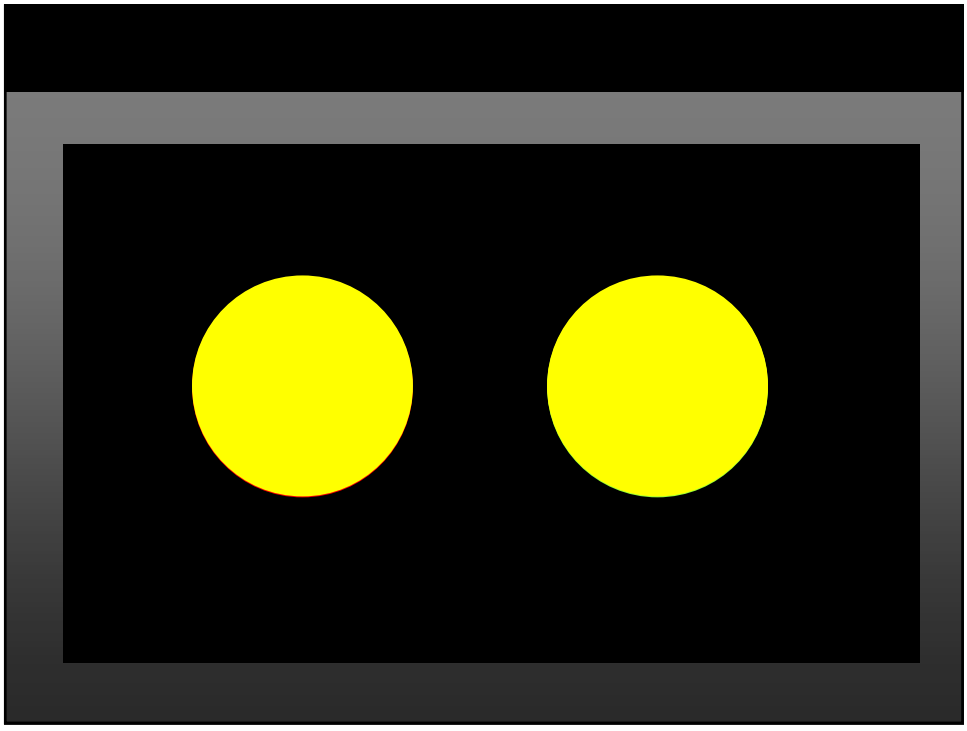

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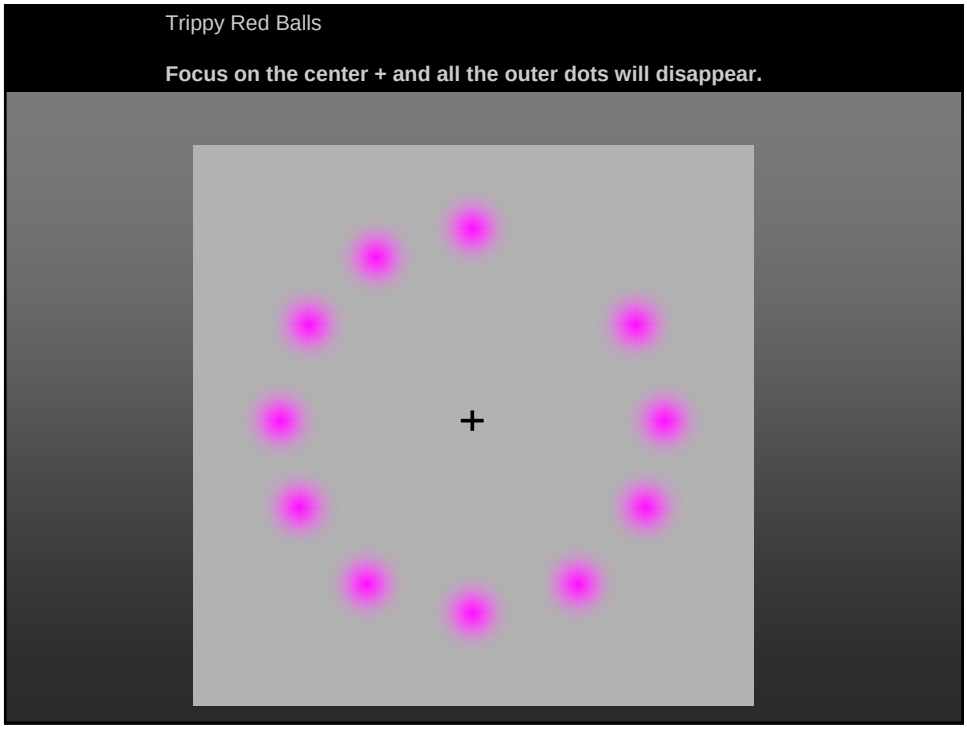

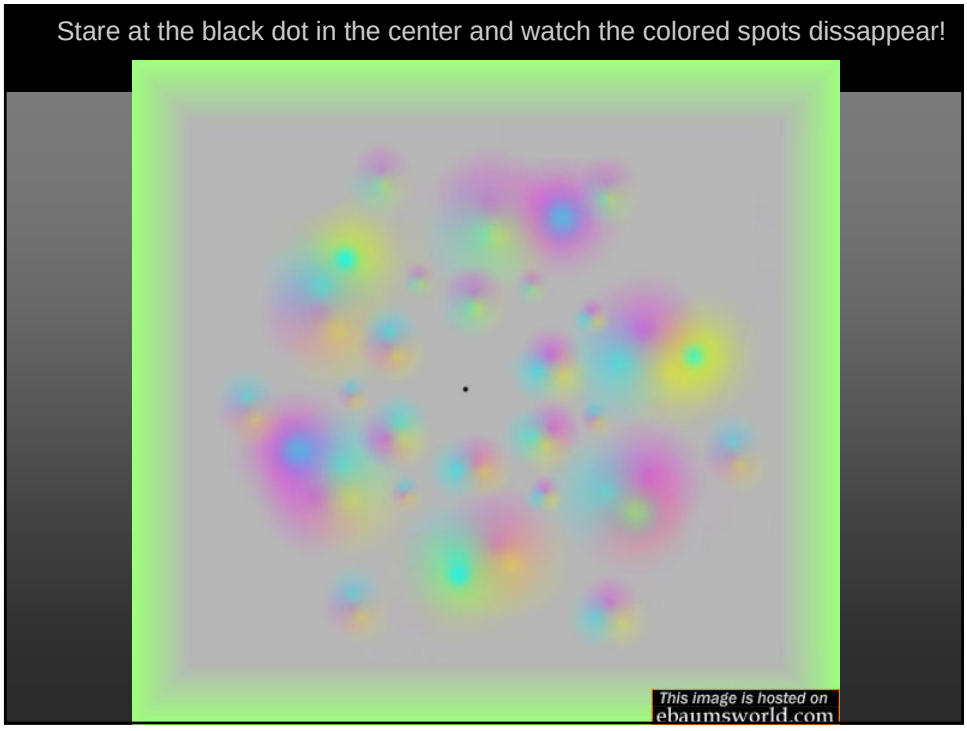

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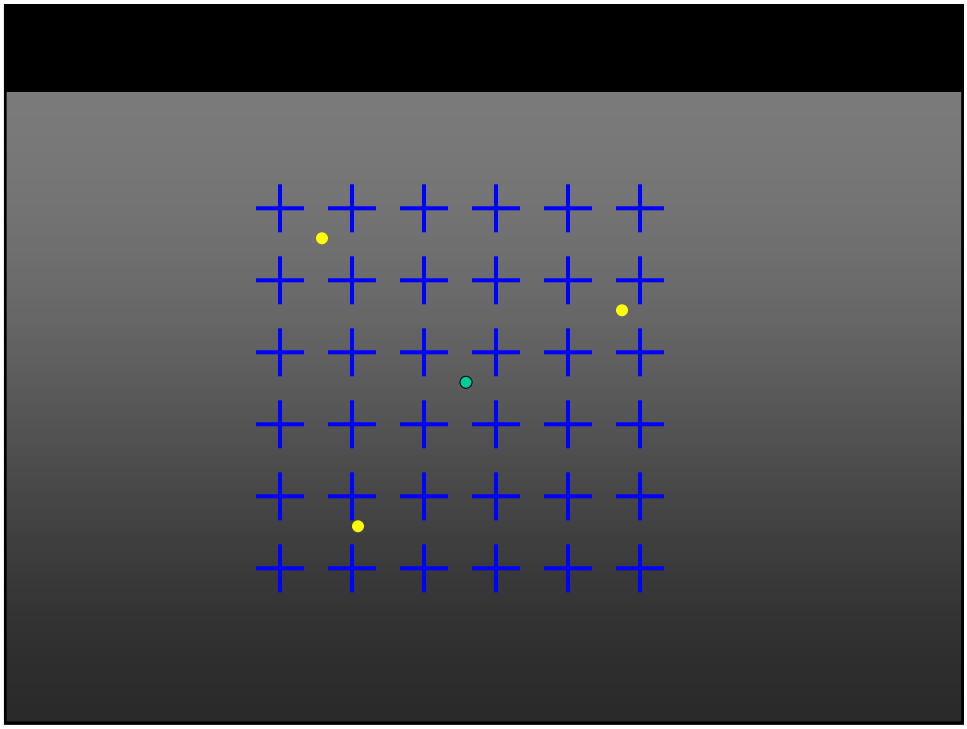

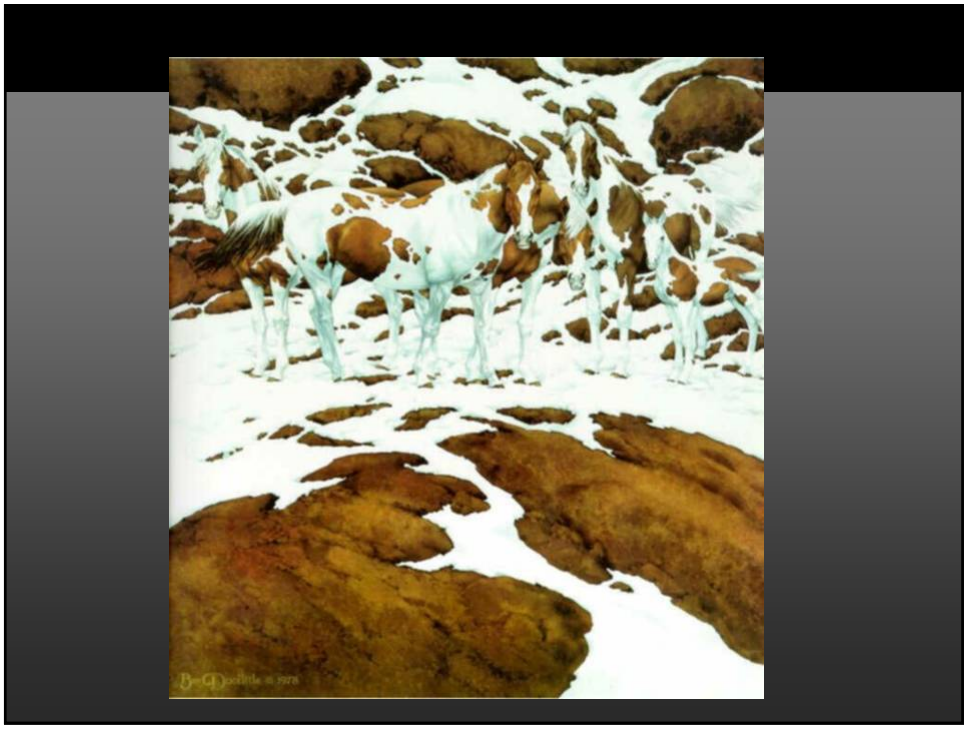

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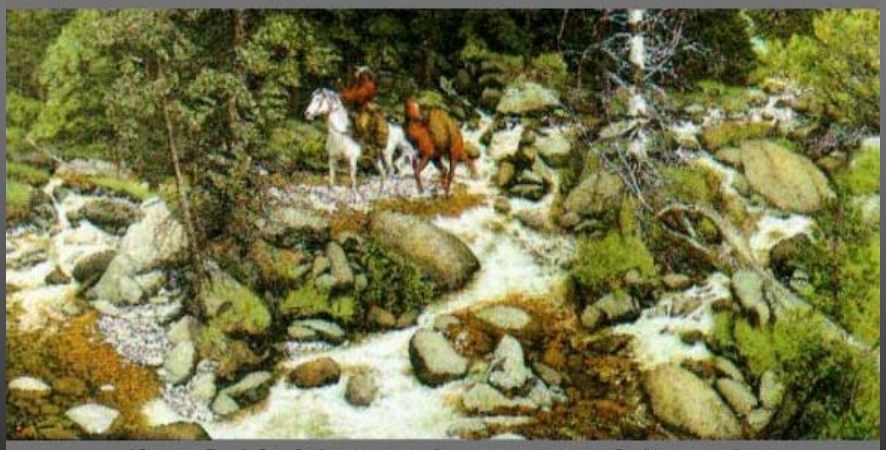
There are 11 human faces in the picture. Can you find them all ?
Normal people find 4 or 5 of them.
If you find 8 of them, you have a extraordinary sense of observation.



If you find 9 of them, you have a sense of observation above of the average.
If you find 10 of them, you are very observer.
If you find 11 of them, you are extremely observer.

I cdnuolt blveiee taht I cluod aulaclty uesdnatnrd waht I was rdanieg The phaonmneal pweor of the hmuan mnid Aoccdrnig to rscheearch taem at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoatnt tihng is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it wouthit a porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe. Such a cdonition is arppoiately cllaed Typoglycemia :)-

Amzanig huh? Yaeh and yuo awlyas thought slpeling was ipmorantt.

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Count the F's in that sentence.
Count them ONLY ONCE!

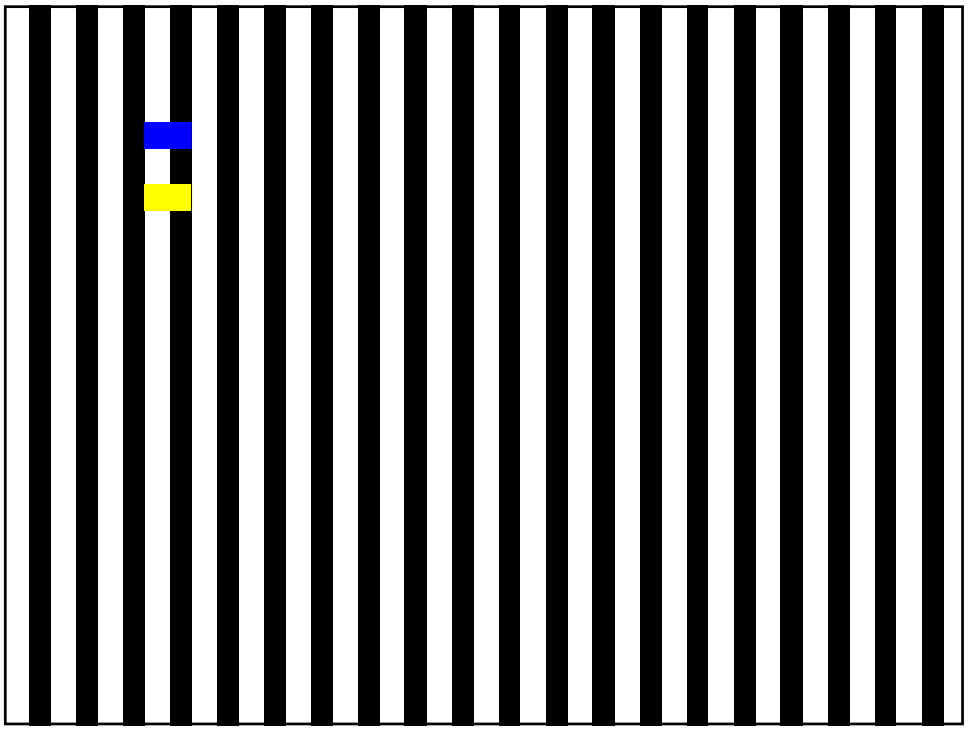
FINISHED FILES ARE THE RE-
SULT OF YEARS OF SCIENTIF-
IC STUDY COMBINED WITH
THE EXPERIENCE OF YEARS.

ANSWER:

There are six F's in the sentence.

A person of average intelligence finds three of them.

If you spotted four, you're above average.
If you got five, you can turn your nose at most anybody.
If you caught six, you are a genius.



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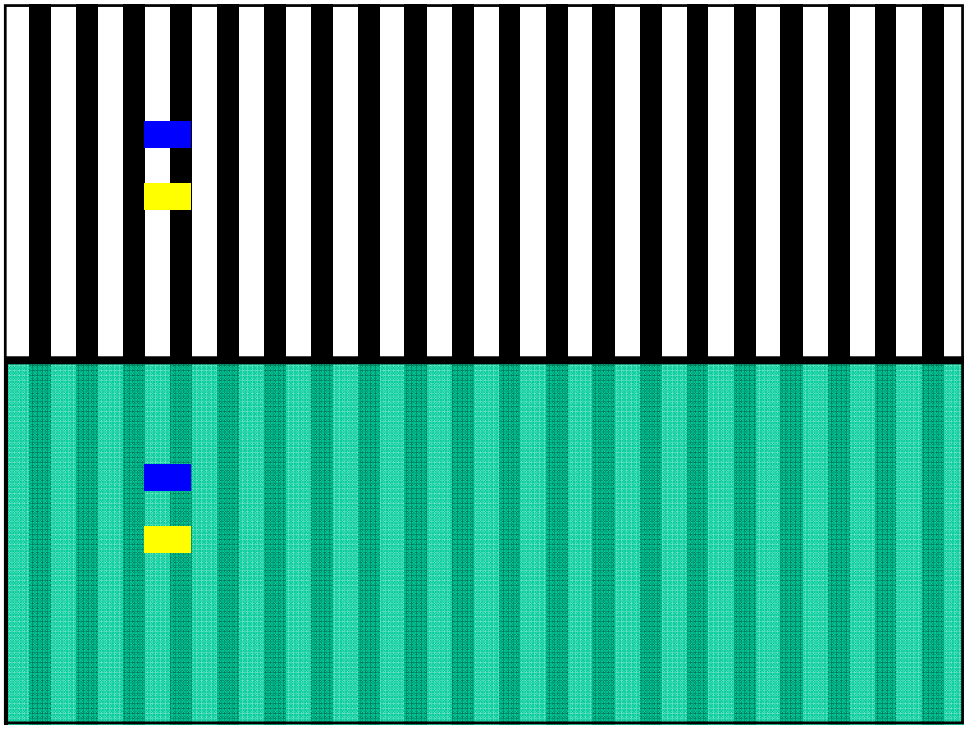

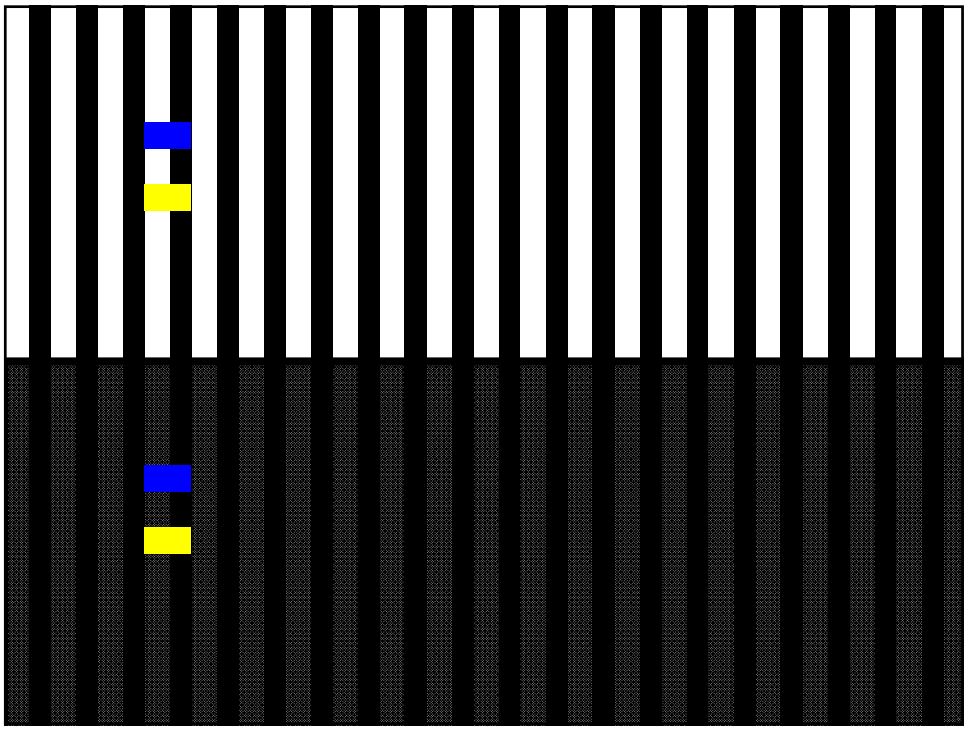

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