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Video Recording

Introduction

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POLITÉCNICA

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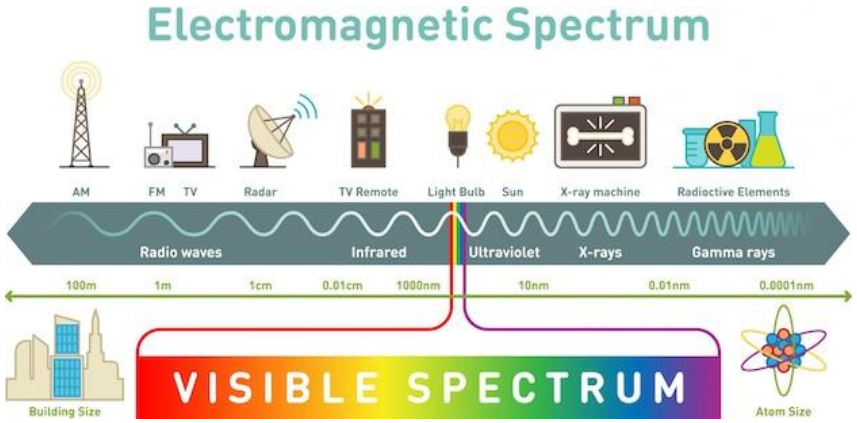
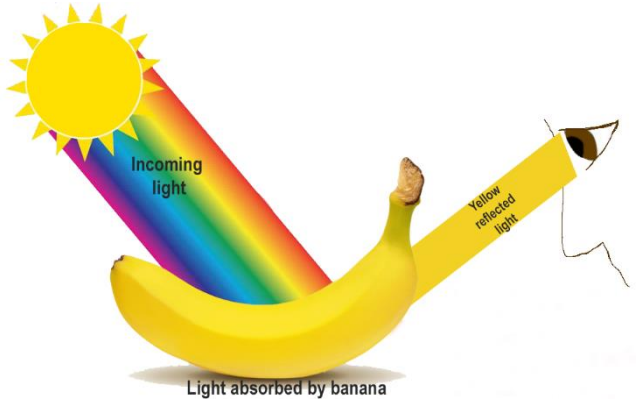
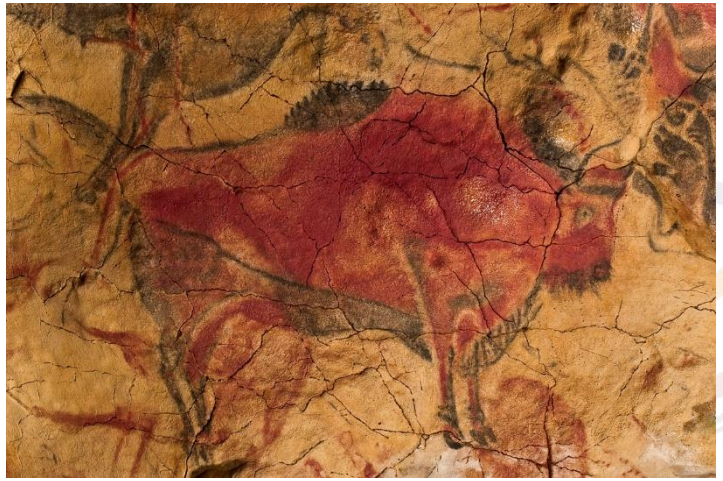
INTRODUCTION

- What's the image?
- In the physical sense, an image is created by the reflection or emission of light that reaches the viewer (eye or camera).
- In an artistic sense, painting is a means of expression through colors, lines, and shapes.
- In technology, an image is a signal.





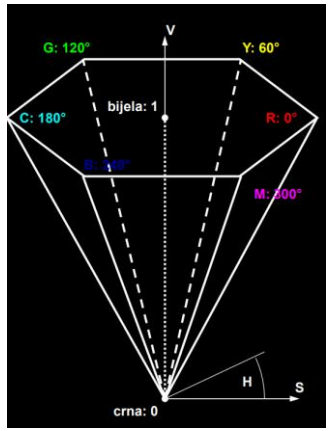


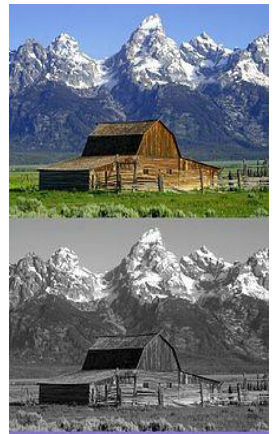
Color models– RGB

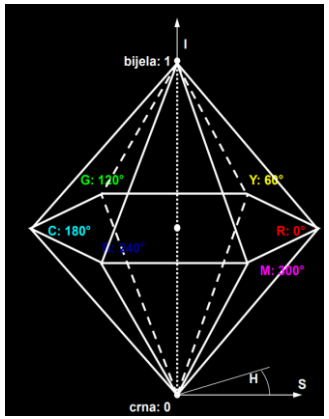
- Color is an important source of visual information.
- The eye distinguishes several thousand shades of color, and only a few tens of gray
- There are 3 types of cones on the retina
- RGB (Red-Green-Blue) is an additive color model in which the color white is added together
- Each color is characterized by three attributes: luminosity, hue or type of color (hue) and saturation (saturation)
- The RGB intensity is 0..255 or 0% up to 1004
- **RGB** is just a concept of additive color mixing, with no clearly defined primaries, white dots, and gamma functions. Covers 35% of the spectrum
- **sRGB is a standardized RGB** space with clearly defined parameters. Covers 35% of the visible spectrum

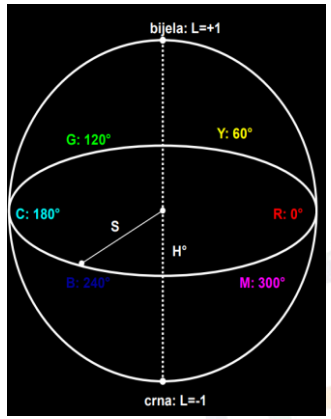
Other color models

- CMYK (Cyan, Magenta, Yellow, Black) - Subtractive color model
- LAB (Lightness, A, B) - Perceptual Color Model
- HSV (Hue, Saturation, Value) - Hue, Saturation and Brightness Model
- HSL (Hue, Saturation, Lightness) - Hue, Saturation and Brightness Model
- YUV - Video Production Model
- YCbCr - Digital Video Model
- XYZ - Standard Buoy Model (CIE)



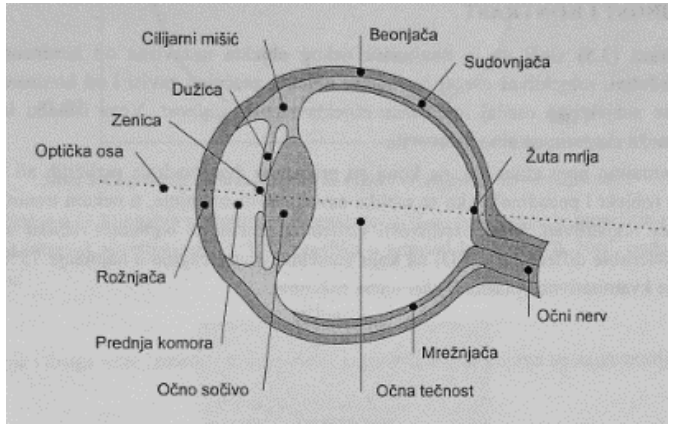


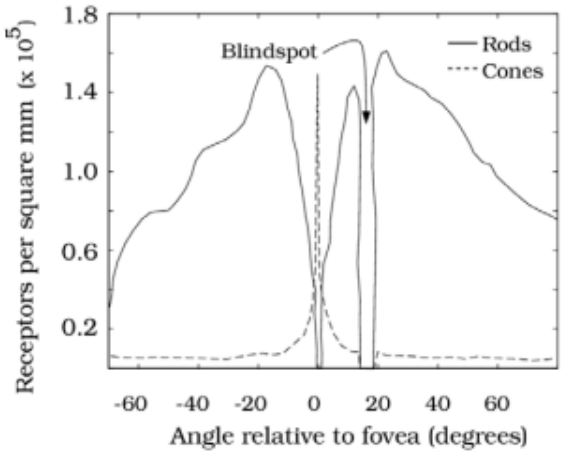




The human visual system

- The eye is like a sphere with a diameter of 20mm
- Key components:
  - Lenses and muscles
  - Retina (with photoreceptors)
  - Cones in the retina (fovea – the central part of the retina)
    - 6-7 million suppositories
    - A high level of sensitivity for the better
    - Active in bright light (photopic vision)
    - They don't participate in color recognition, which explains why we can't see colors in the dark
  - Rods (distributed in the rest of the retina, except the fovea):
    - 70-15 miliona rods
    - They are not sensitive to colors, they only differ in the level of light
    - High sensitivity to low light (scotopic vision) – key to night vision.





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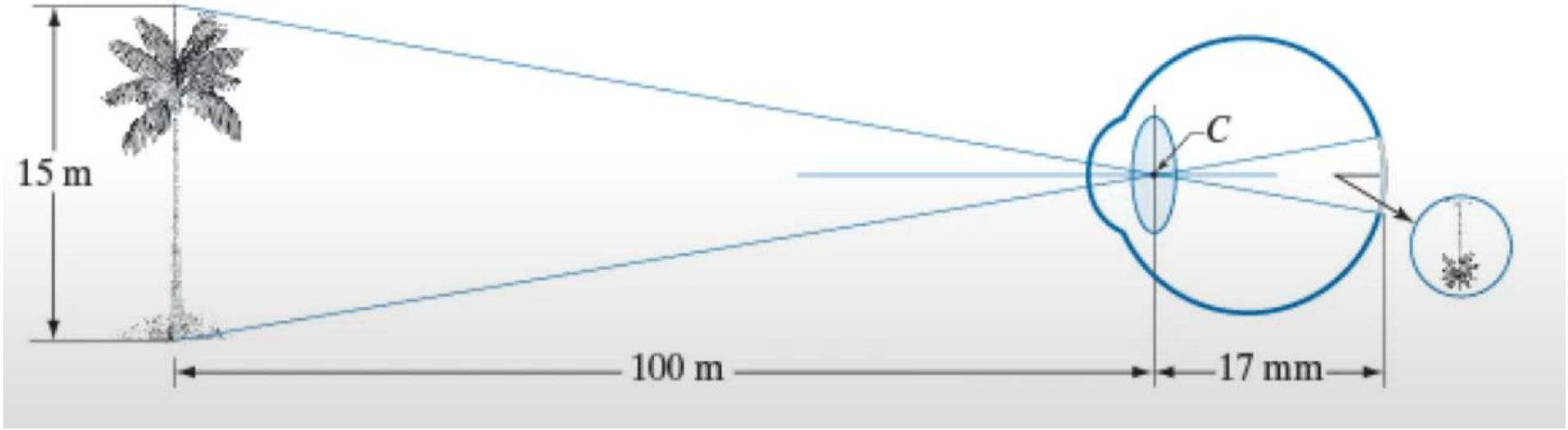
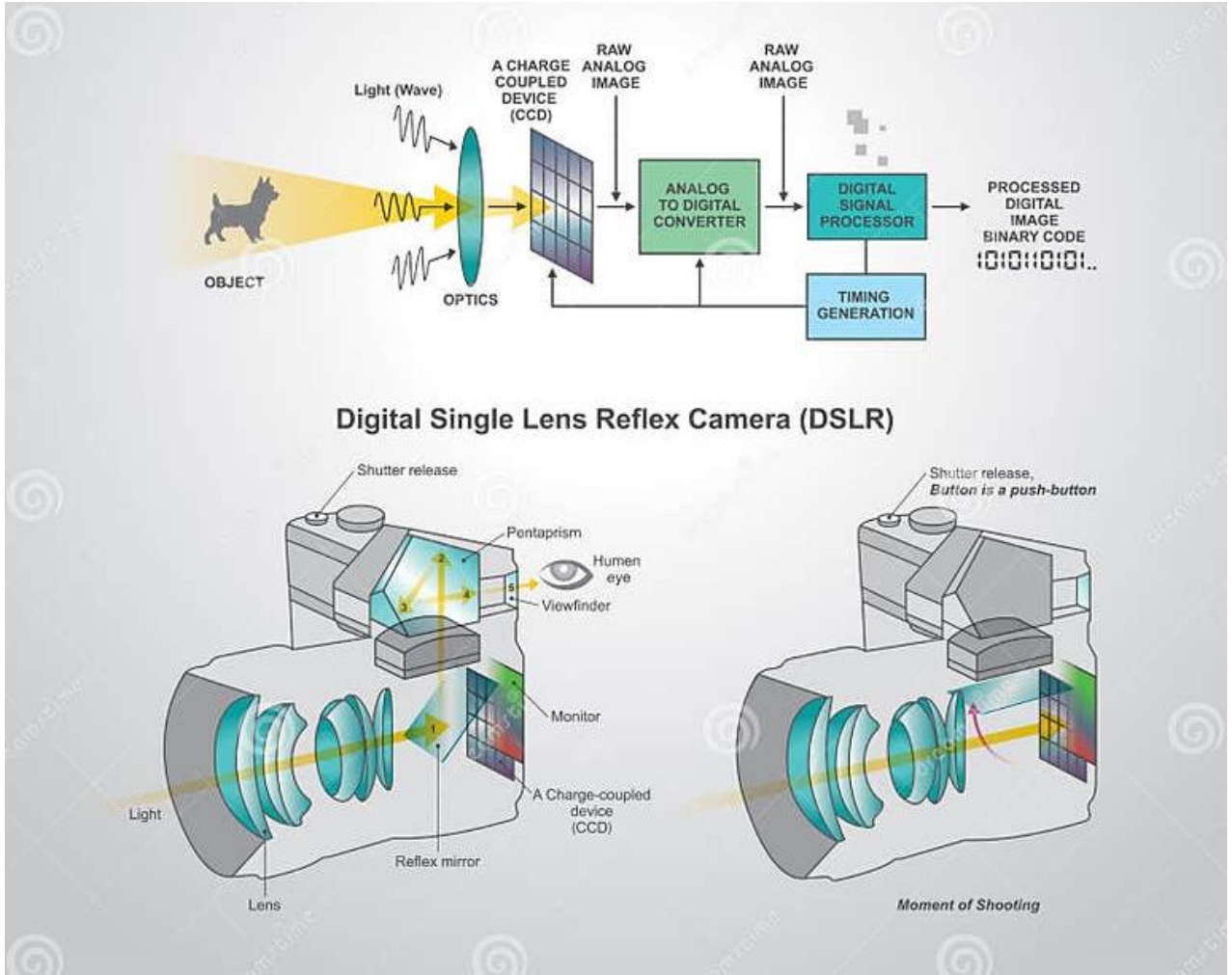
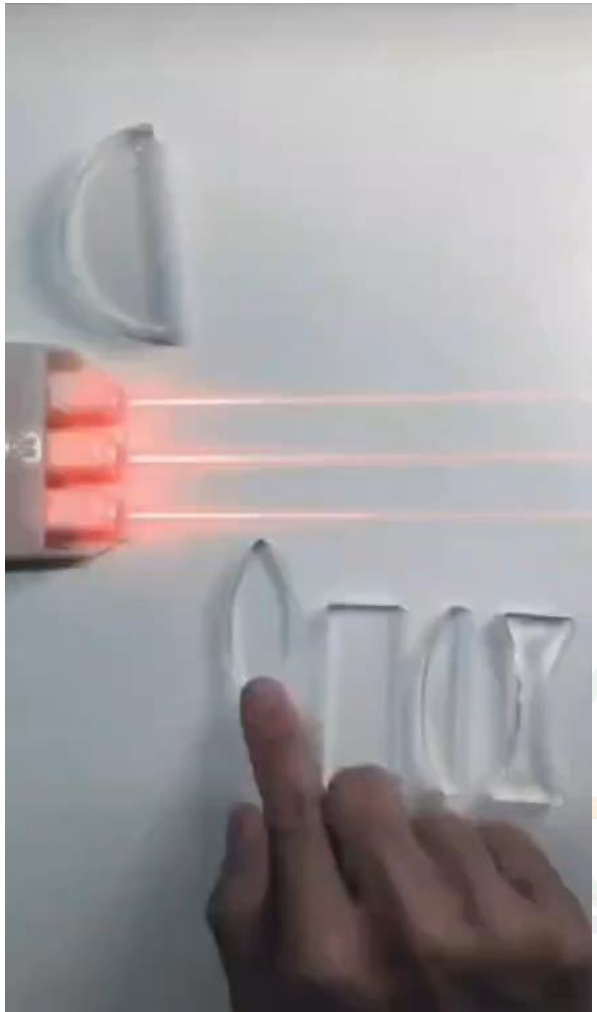
Perception

- **In conventional cameras**, the lens **has a fixed focal length**, and focusing is achieved by **varying the distance** between the lens and the sensor
- **In the human eye**, the distance between the center of the lens and the retina is fixed **(about 17 mm).** Instead of changing the distance, the focus is achieved by **changing the shape of the lens**, which changes the effective focal length in the **range of 14 to 17 mm**.



Perception


Light (Wave)
A CHARGE COUPLED DEVICE (CCD)
RAW ANALOG IMAGE
RAW ANALOG IMAGE
OBJECT
OPTICS
ANALOG TO DIGITAL CONVERTER
DIGITAL SIGNAL PROCESSOR
PROCESSED DIGITAL IMAGE BINARY CODE
TIMING GENERATION
Digital Single Lens Reflex Camera (DSLR)
Shutter release
Pentaprism
Humen eye
Viewfinder
Monitor
Light
A Charge-coupled device (CCD)
Reflex mirror
Lens
Shutter release,
Button is a push-button
Moment of Shooting



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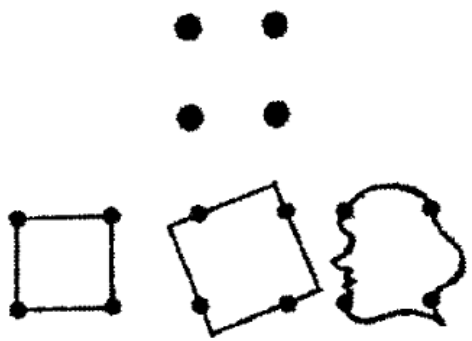
Perception

- … but, perception is subjective.?
- Through visual perception and through the sense of sight, a person becomes aware of objects, their shape, colors, and the relationship between them
- An image becomes visible only when it has a meaning.

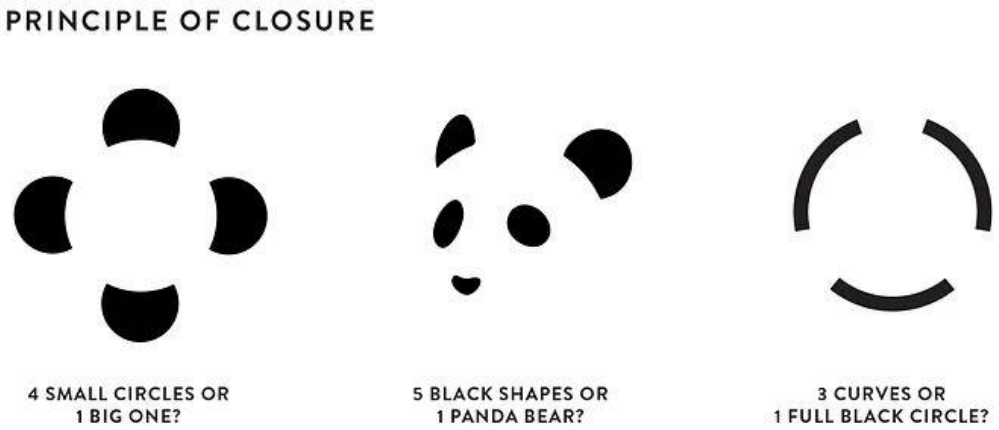
Perception

- Perception is based on wholes, not individual parts
  - According to Gestalt theory, when we perceive something, we do not only see individual parts (lines, dots, colors), but we organize them into forms – complete shapes that have meaning.
  - Our brains naturally tend to group elements into meaningful wholes.
- Form is not just the sum of its parts
  - A key principle of Gestalt psychology is that "the whole is greater than the sum of its parts."
  - For example, when we look at a face, we don't just perceive the eyes, nose, and mouth separately, but we perceive them as the whole face.
- Changing the arrangement of elements changes perception
  - If we change the arrangement of the same elements, we get a completely new perception.
  - For example, if we take five randomly arranged points, we can only see them as points. But if we arrange them in the shape of a star, we will immediately recognize the shape. Another example is when we move parts of an image – the brain will interpret them differently.



Perception

- Law of Closure
  - The brain tends to fill in the gaps and form complete images, even when some parts are missing.
  - Example: If we see a group of lines that suggest a circle but are not connected, we still perceive a circle.



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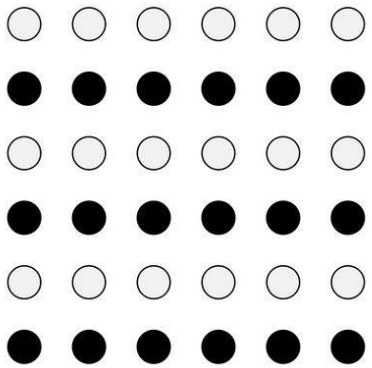
Perception

- Law of Similarity
  - Elements that are similar (in shape, color, size, or lighting) are grouped together and perceived as part of the same whole.
  - Example: In chess, we see black and white squares as separate groups, not random points.



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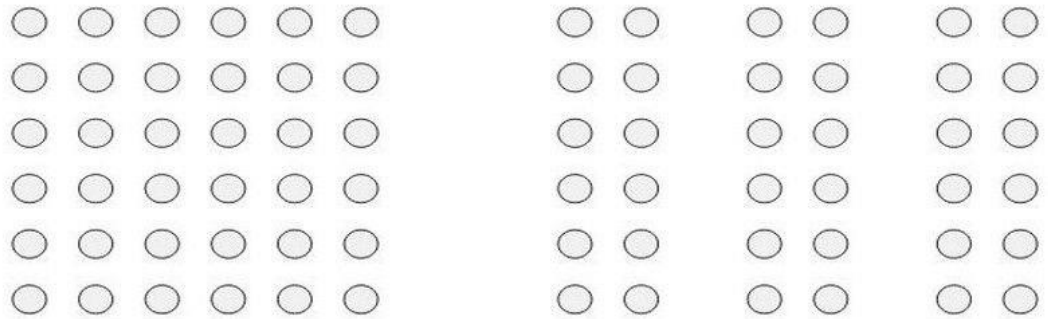
Perception

- Law of Proximity
  - Elements that are close to each other are perceived as part of the same whole.
  - Example: Sentences with words that are close together act as logical units, while randomly arranged letters do not form meaningful forms.



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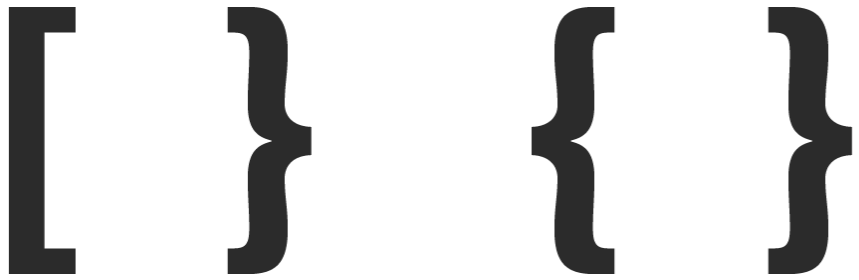
Perception

Law of Symmetry

- Symmetrically arranged elements are perceived as connected, even when they are at a greater distance.
- Example: When we see two symmetrical shapes, the brain connects them and perceives them as a whole.



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Perception

Law of Continuity

Our brain tends to follow lines, curves, and repetitive patterns instead of perceiving them as random.
Example: When we see overlapping lines, we follow their natural flow, instead of separating them into individual segments.

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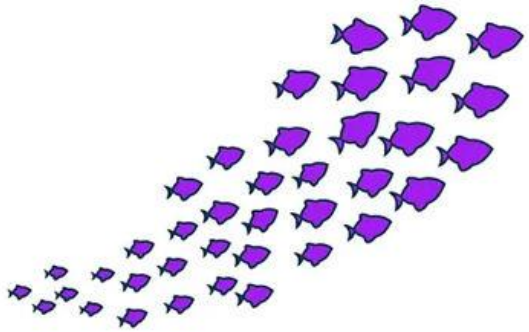
Perception

- Law of Common Fate
  - Elements moving in the same direction are perceived as part of the same group.
  - Example: A flock of birds flying in the same direction is seen as a single unit, not as individual birds.



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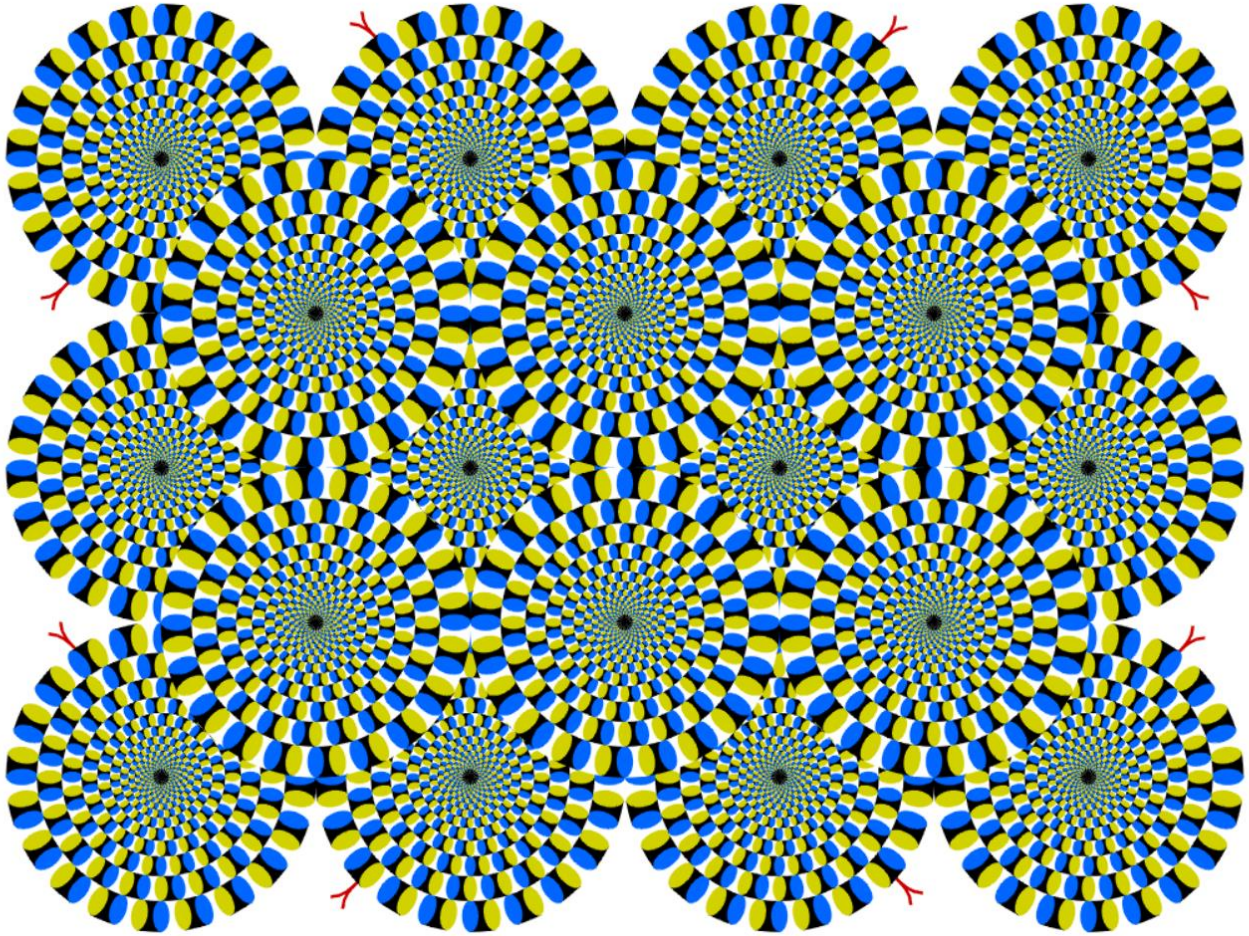
Perception



Perception

Perception and perspective - how we see the world?

•People only see as much as they know

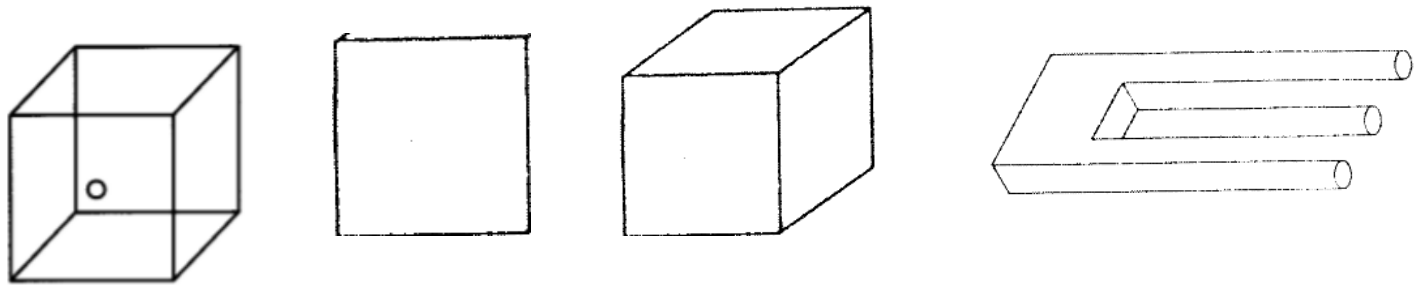
- Perception related to learning and experience.
- For example, people of the past may not have been able to understand perspective in art because they didn't have the developed visual conventions we use today.

•Rudolf Arnheim and the theory of perception

- Rudolf Arnheim, a well-known art and film theorist, argues that people do not see "**pure reality**", but what is shaped through **their experience and knowledge**.
- This means that perception is not only a physiological process, **but also a mental process of interpreting an image**.

•Perspective and two-dimensional images

- A **correct drawing in perspective**, but which can be confusing because **perspective is not something the brain automatically understands** – it is learned through experience and cultural norms.
- A **picture with a two-dimensional drawing of a cube** shows how **our brain interprets space**, but depending on the context, confusion can occur.



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Perception

1. **The Three Levels of Perception in Film: The Physiological Level of Perception**
   We notice changes in light, contrast and color when we watch a movie.
   These changes are compared with previous images, which allows the perception of movement (the phenomenon of film illusion).
2. **Psychophysiological Level**
   At this level, **images connect with our memory** and create meaning.
   For example, if we see a series of shots in which a person moves, the brain puts them together into one logical whole.
3. **Psychological level**
   Film relies on our ability to connect images and make stories.
   Gledalac gradi očekivanja na osnovu montaže – ako vidimo pištolj u jednom kadru i čoveka u sledećem, očekujemo da će pištolj biti upotrebljen.

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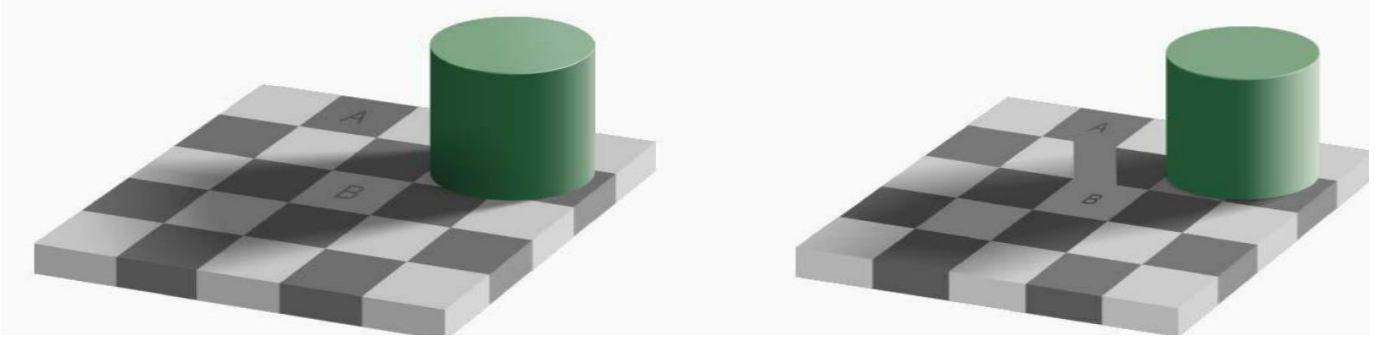
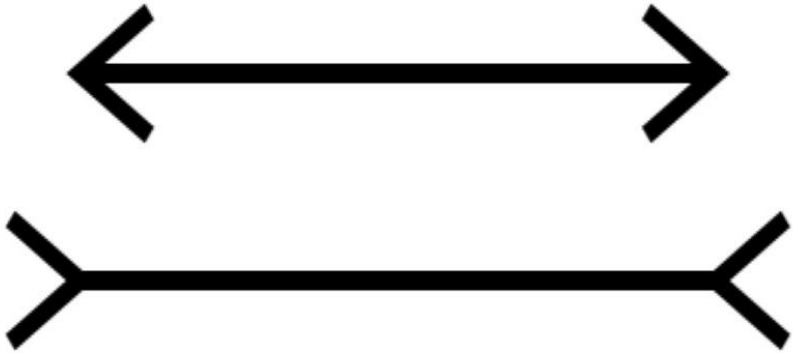
Image Relativity

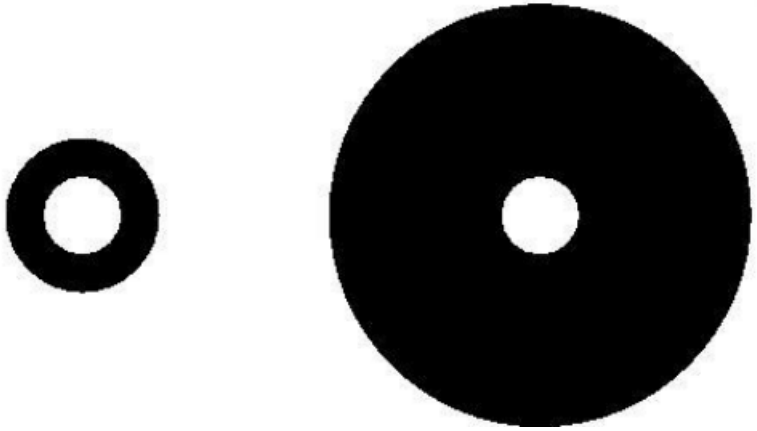
- A picture is worth a thousand words
- The average TV viewer trusts the image more than the sound.
- Almost 90% of the sensory information about the world around us comes from visual perception.
- To see is to believe with your eyes
- Are we willing to claim that what we see is the truth?

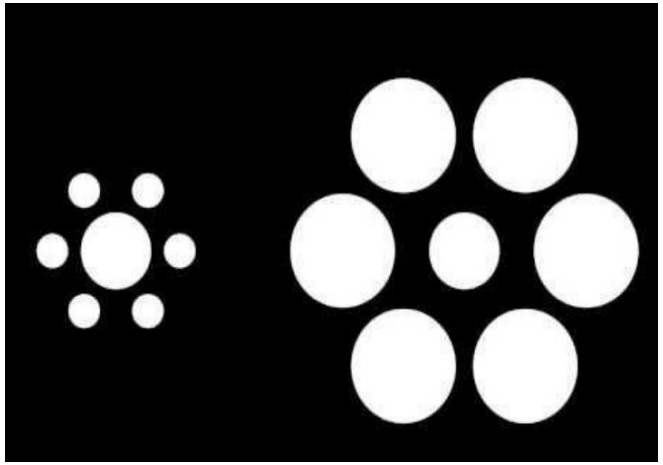
Image Relativity

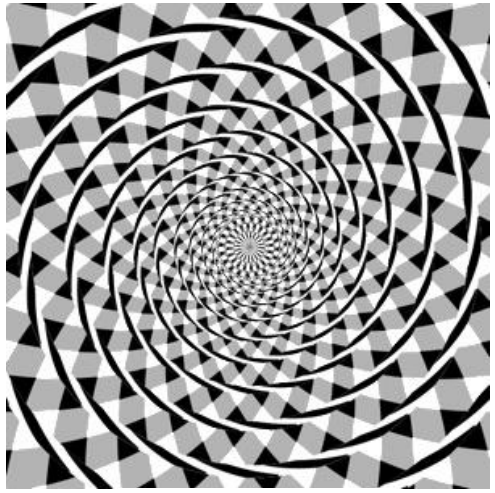




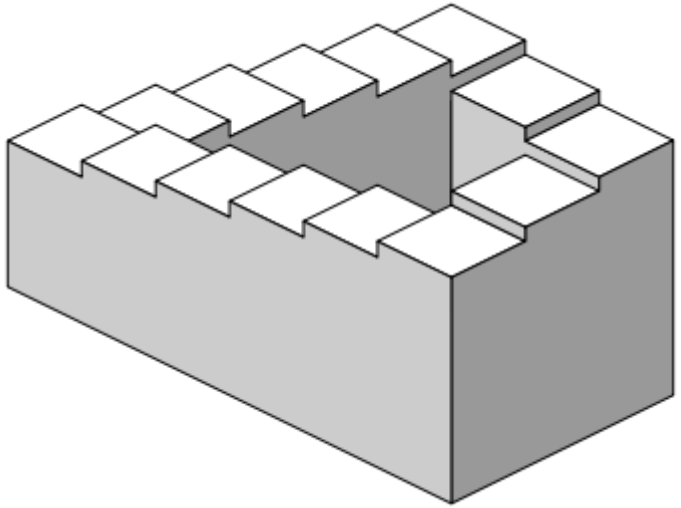
Miler-Lajerova iluzija sa strelicama



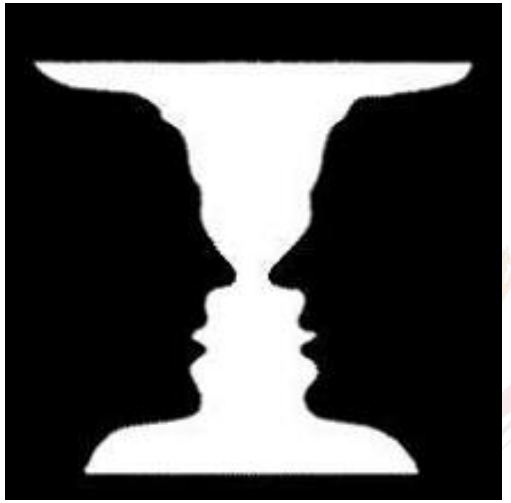




Frejzerova spirala



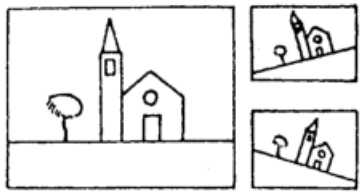
Nemogući oblici – iluzije Ešera

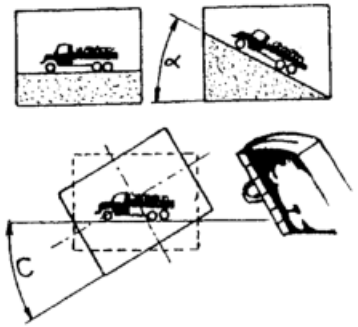


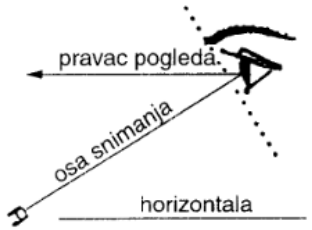
Dvosmislene slike – Rubinov pehar

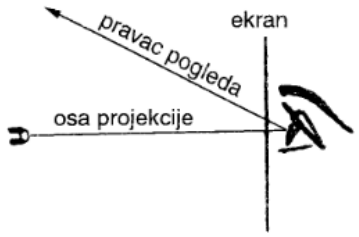
Image Relativity

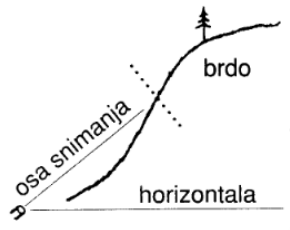
- Illusions are the **rule of perception**, **not the exception**.
- The film uses **technique and editing** to manipulate the viewer's perception.
- **The film does not show reality, but its interpretation**
- Perspective and when it affects how the viewer perceives the scene.
- Angles (camera angles) can make an object appear larger, smaller, tilted, or stable.











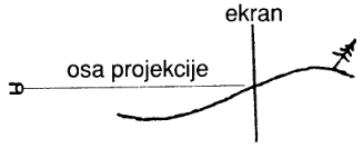


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Image Relativity

- **Fast Motion)**
  - It is achieved by shooting at a lower frame rate so that in normal playback the movement appears faster.
  - It is used for comic effects, time-lapse or speed accentuation.
- **Slow Motion**
  - It is achieved by shooting at a higher frame rate and playing back at standard speed, which slows down movement.
  - It is used for action scenes, sports analysis, and drama accentuation.
- **Reverse Motion**
  - Shooting a scene backwards or playing a movie backwards to make it seem as if things are going back to the beginning.
  - It is used for special effects (broken objects are assembled, water flows backwards).

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Image Relativity

- **Stop Motion & Freeze Frame**
  - Stop motion uses to capture thumbnails of an object shifted by small degrees to create a motion effect (as in doll animation).
  - Freeze frame stops the image at one point to emphasize the scene.
- **RIR (Rear Projection**
  - The background is projected behind the actors as they act, often used in old films to drive a car or travel by train.
- **Induced Motion**
  - When the background moves, while the object is standing still, the brain interprets that the object is moving.
  - It is often used in films for the illusion of movement in space or the wind.

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Image Relativity

- **Iris Wipe & Vignetting**
  - Zatvaranje objektiva ili tamnjenje ivica kadra radi prelaza između scena ili stvaranja fokusa.
- **Stop (Jump Cut, Méliès Trick)**
  - An object or person disappears or reappears when the frame is cut and the scene is changed.
  - It was first used in Georges Melliès' films for magical effects..
- **Mirror Shots**
  - Using mirrors to show scenes that otherwise could not be captured directly.

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Image Relativity

- **Forced Perspective**
  - Manipulating the size of objects using the camera angle (as in The Lord of the Rings, where the hobbits look smaller next to Gandalf).
- **Miniatures & Matte Paintings**
  - Using small models instead of real objects to save on the budget and create large scenes (e.g. Star Wars).

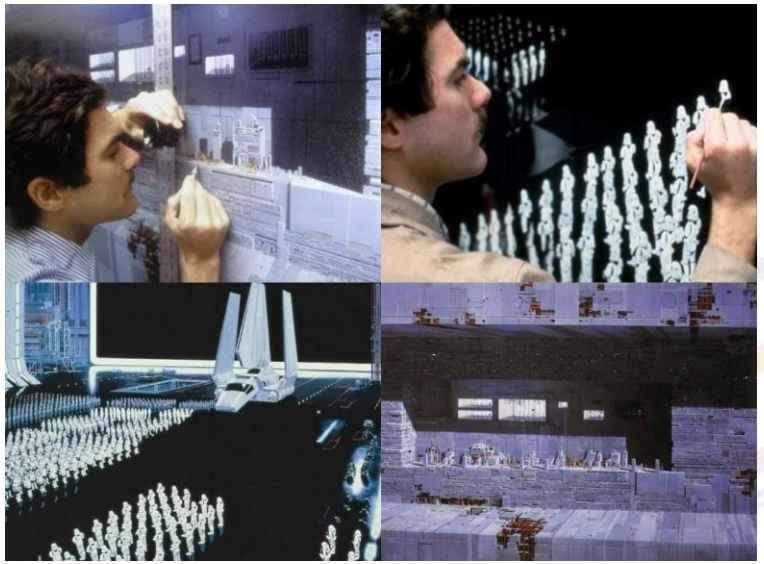

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Image Relativity

- **CGI (Computer-Generated Imagery)**
  - Digitally created effects, animations, and 3D models that are added to the scene.
  - It is used to create realistic fantasy worlds (Marvel movies, Avatar).
- **Green Screen / Blue Screen (Chromakeying)**
  - A technique where actors are filmed in front of a green or blue background, which is later replaced by a digital environment.
- **Motion Capture (Mocap)**
  - Using sensors on an actor's body to record their movements and transmit them to digital characters (Gollum in LOTR, Thanos in Marvel).

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Image Relativity

- **Deepfake and AI manipulation**
  - Using artificial intelligence to replace actors' faces, bring deceased characters to life, or create hyper-realistic animations.
- **Virtual and augmented reality(VR & AR)**
  - It allows you to capture scenes entirely in digital space and interactive visual effects.
- **Bullet Time (The Matrix Effect)**
  - A combination of multiple cameras that capture the same scene from different angles, allowing for a slow-motion effect with a change of perspective.
- **Real-time face and body recognition**
  - The use of AI to modify expressions and bodies in post-production (de-aging effect in films)).

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Questions & Answers

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