Graphic Era Hill University

Fundamentals of Animation

Course Code- BAG- 202

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Unit-1

Introduction to Animation

- Definition and scope of animation

- History and evolution of animation

- Types and styles of animation (2D, 3D, Stop Motion, Traditional)

- Understanding animation in different media platforms

What is Animation?

At its core, **animation** is the art of creating the illusion of motion by rapidly displaying a sequence of static images. But it's not just about moving pictures; it's about telling stories, evoking emotions, and bringing dreams to life. From hand-drawn traditional animation to cutting-edge computer-generated imagery (CGI) and everything in between, there are countless techniques and styles that fall under the umbrella of animation.

- Animation is the art of making drawings, images, or objects appear to move.

- It involves displaying a sequence of images, each slightly different from the last.

- Used to bring characters, ideas, and stories to life.

Scope of Animation

- **Entertainment**: Films, cartoons, digital games.

- **Education**: E-learning, explainer videos.

- **Advertising**: Motion graphics, product demos.

- **Scientific Visualization**: Medical, architectural.

!Guess!

The Movie Name

Guess

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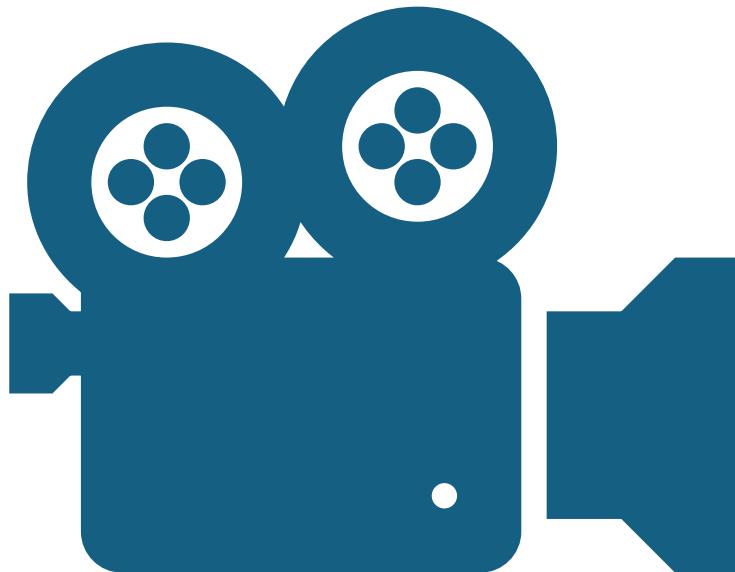
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History

How Animation Began?

Animation began as an evolution of early motion experiments, where people attempted to depict movement through sequential images. The journey of animation started with simple visual experiments and evolved into the sophisticated digital animations we see today.
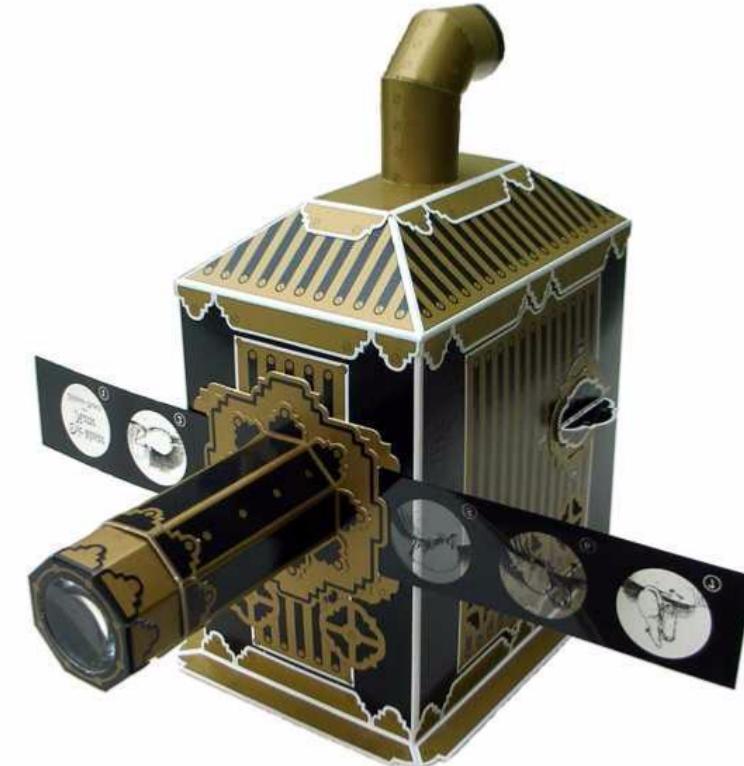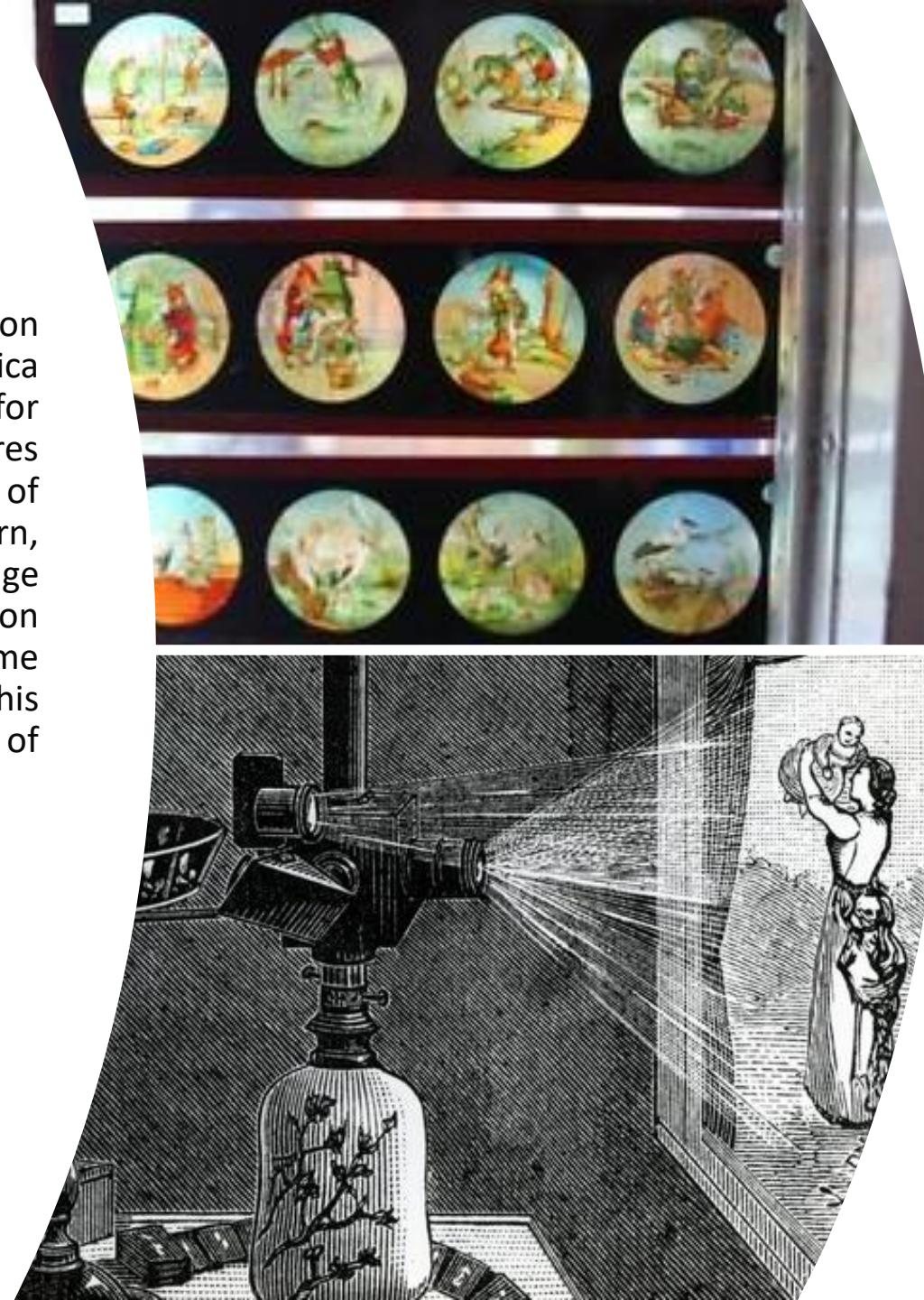
1. Cave Painting

Long before film and animation as we know it, people experimented with ways to represent motion visually.
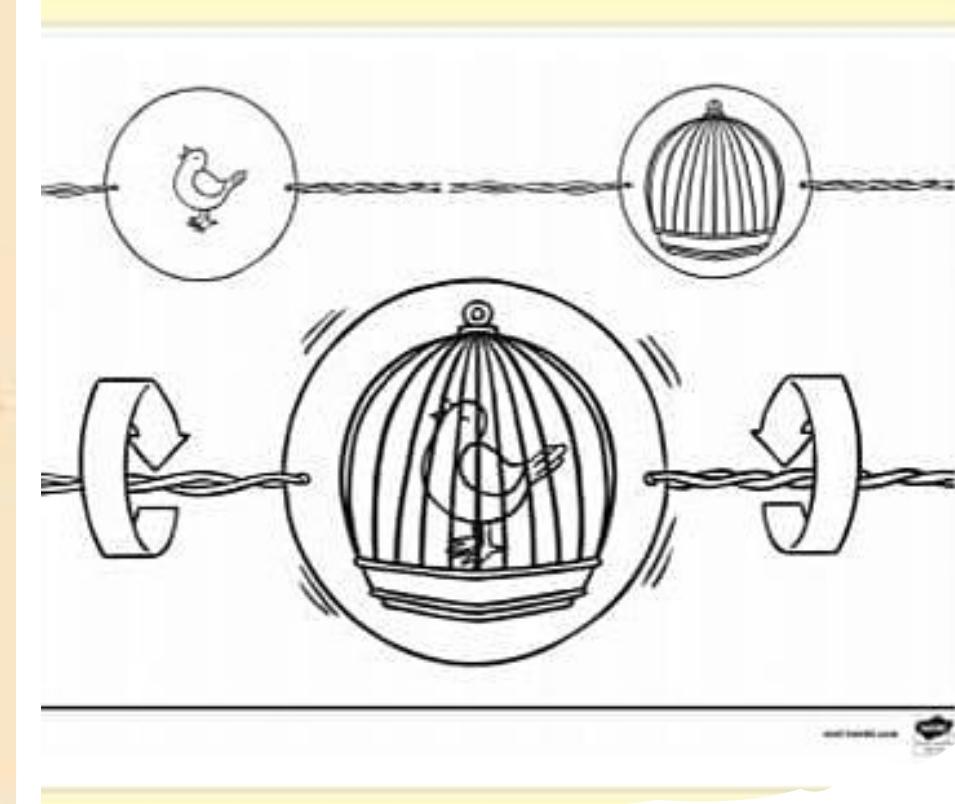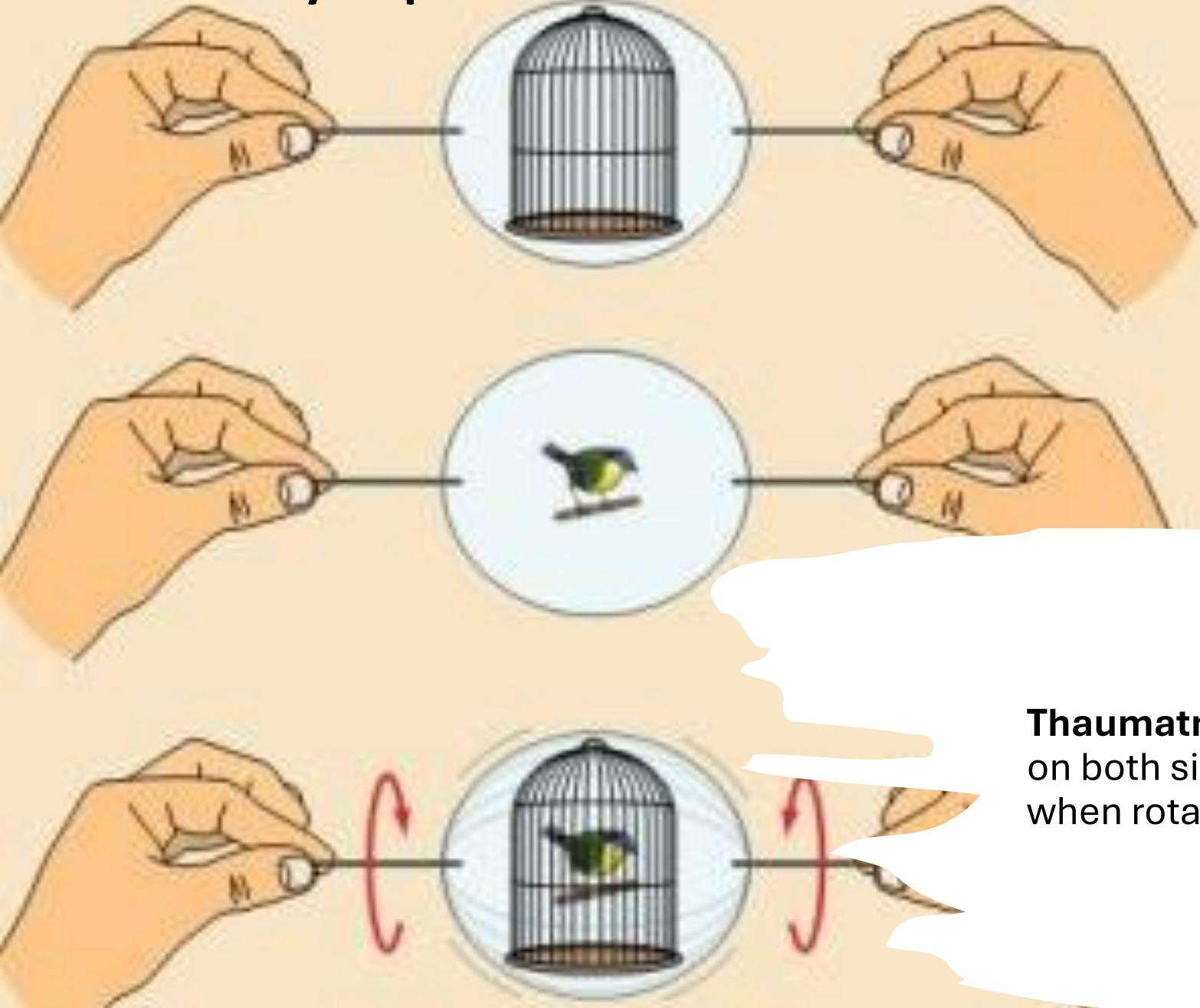
Prehistoric Cave Paintings (30,000 BCE): Some ancient cave paintings depict animals in different poses, suggesting an early understanding of movement.

2. The Magic Lantern

1650 - The Industrial Revolution in Europe and North America sparked the creation for machines that produced pictures that gave the illusion of movement. The Magic Lantern, or Laterna Magica, is an image projector that uses pictures on sheets of glass. Since some sheets contain moving parts, this is considered the first example of projected animation.

3. Discovery of persistence of vision
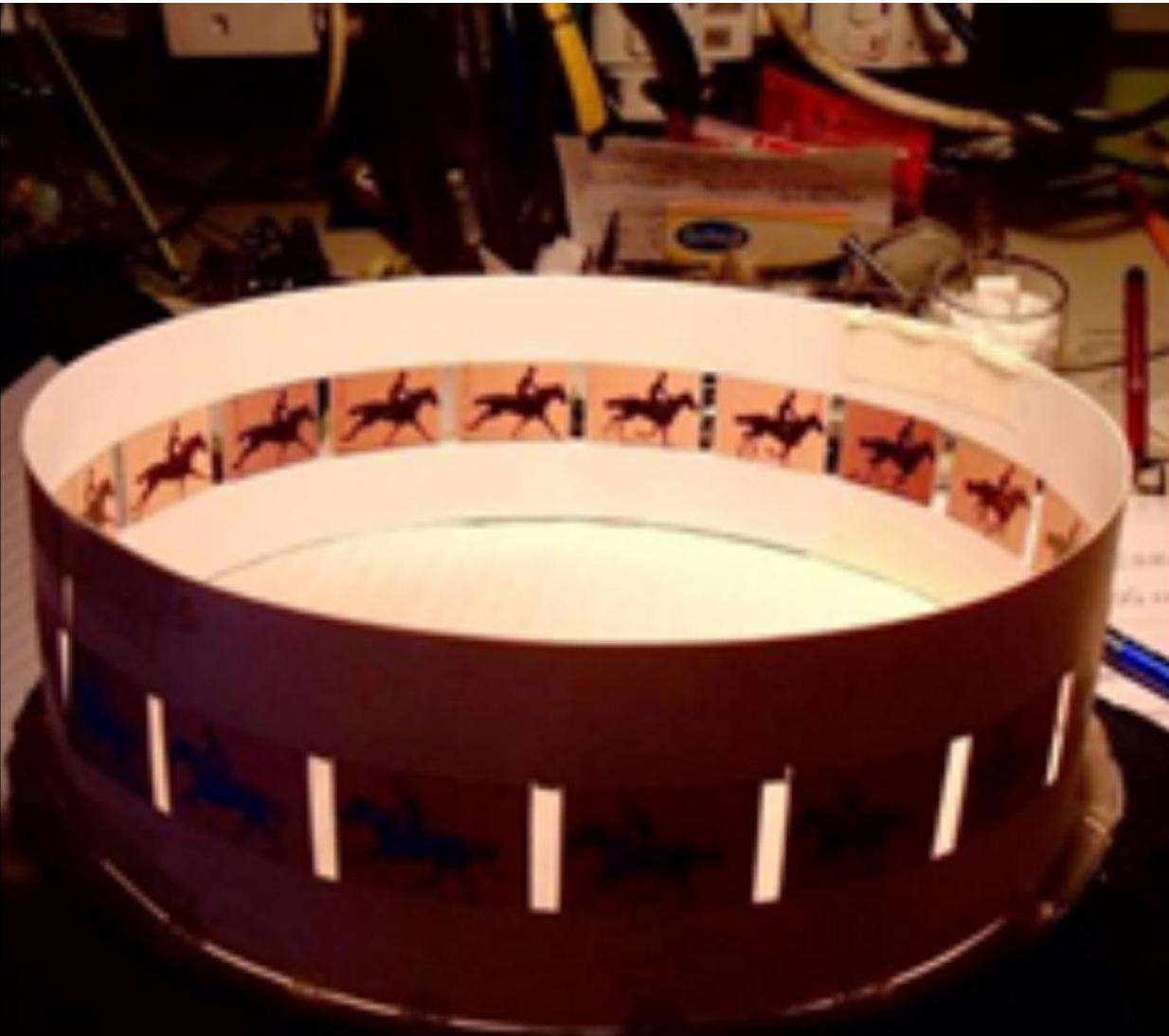
Thaumatrope (1825) – A spinning disc with images on both sides that created a combined picture when rotated.

Phenakistoscope, 1832

Phenakistoscope

1832 – Joseph Plateau, a Belgian inventor, created the phenakistoscope —to capture the "persistence of vision." The phenakistoscope consisted of a spinning cardboard disk that gave the illusion of movement when viewed in a mirror.

Zoetrope, 1834

Zoetrope

1834 – William George Horner invented the zoetrope — a rotating drum lined by a band of pictures that could be swapped out for different pictures.
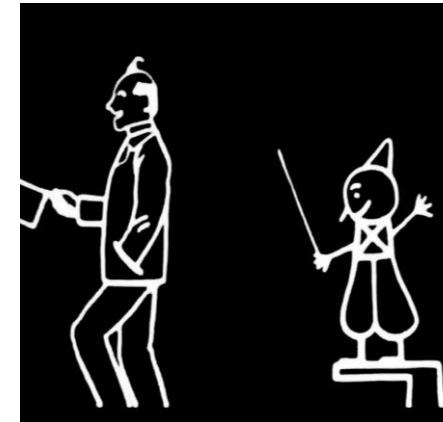
Praxinoscope (1877) – Used mirrors to improve the clarity of moving images.

These devices all laid the foundation for the illusion of motion, which later became essential in animation and cinema.

4. Birth of Animation in Film (1900s - 1920s)

- Humorous Phases
- Fantasmagorie
- Felix the Cat

Felix the Cat. 1919
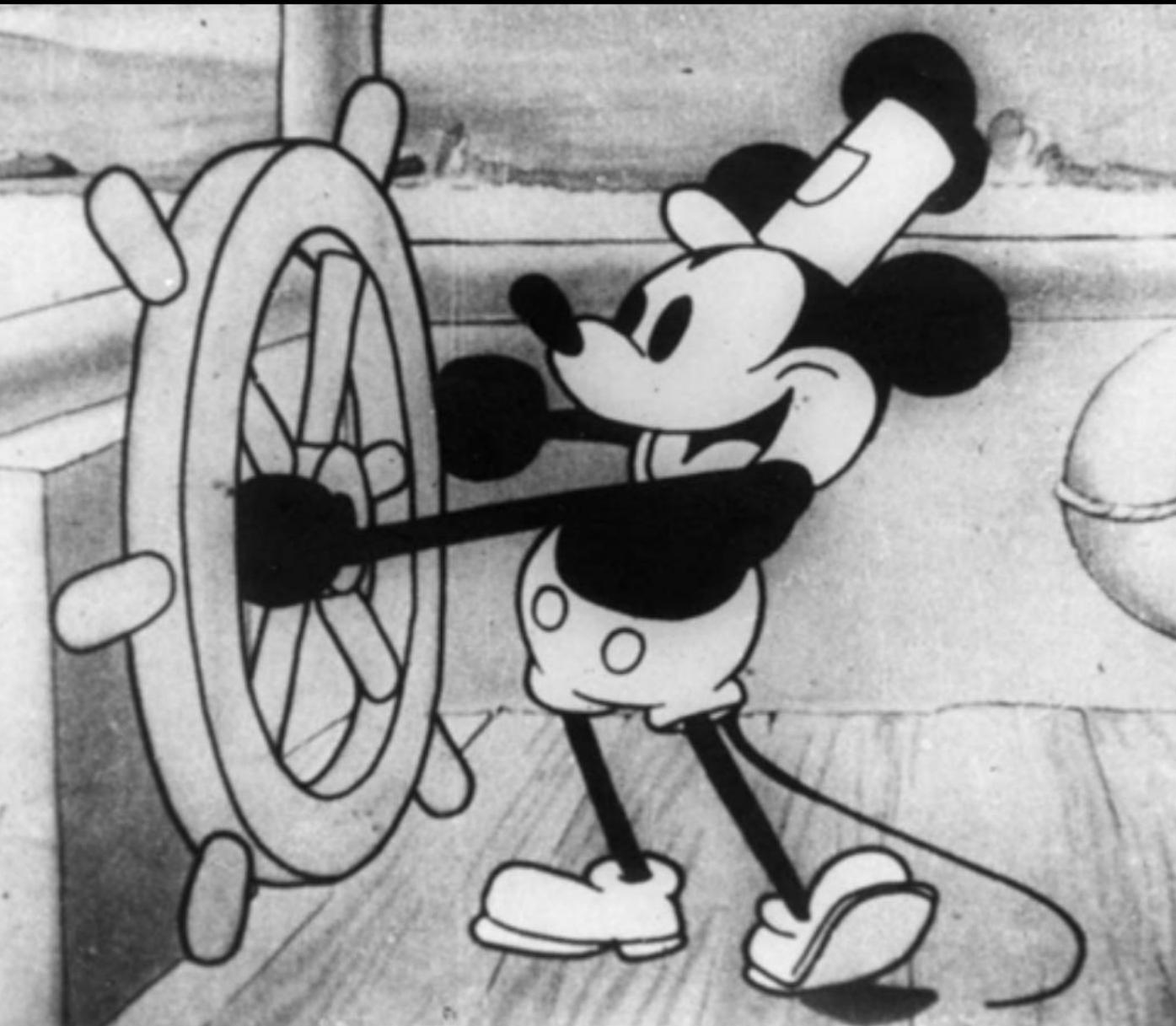
Humorous Phases
of Funny Faces, 1906

Steamboat Willie, 1928

5. The Rise of Animated Cartoons (1920s - 1950s)

Mickey Mouse

In 1928, young Walt Disney was working at his Laugh-O-gram Films studio in Kansas City, Missouri. After making a few minor changes to his first major character, Oswald the Lucky Rabbit, the character of Mickey Mouse was born. Disney made history when he produced *Steamboat Willie,* the first cartoon animation with synchronized sound.

Popeye and *Betty Boop*.

Fleischer Studios (1930s): Pioneered techniques like rotoscoping and produced *Popeye* and *Betty Boop*.

Snow White and the Seven Dwarfs

Disney's *Snow White and the Seven Dwarfs* (1937): The first feature-length animated film, setting a new standard.

6. From Traditional to Digital (1950s - Present)

Over the decades, animation evolved from hand-drawn to computer-generated imagery (CGI):

Hanna-Barbera (1960s-70s): Introduced limited animation for TV with shows like *The Flintstones* and *Scooby-Doo*.

Japanese Anime Boom (1960s-Present): Shows like *Astro Boy* (1963) popularized Japanese animation worldwide.

Pixar's *Toy Story* (1995): The first fully CGI-animated feature film.

Motion Capture & Real-Time Animation (2000s-Present): Films like *Avatar* (2009) use advanced CGI and performance capture.

Conclusion

Animation started as a curiosity with optical illusions and gradually evolved into a powerful storytelling medium. From simple hand-drawn sequences to AI-generated animation, it continues to push creative and technological boundaries.

Types and styles of animation

- **Traditional Animation**

- **2D Animation**

- **3D Animation**

- **Stop Motion Animation**

Traditional Animation

Traditional animation, also known as **hand-drawn** or **cel animation**, is a technique where each frame of a movie or animation is **drawn by hand**. This is the oldest form of animation where each frame is drawn by hand on paper **or transparent sheets** (cels). This process involves creating a series of individual drawings, each slightly different from the last, to create the illusion of movement when played in sequence.

1937: **"Snow White and the Seven Dwarfs"** – first full-length animated feature using traditional animation.

2D Animation

2D animation is a method of creating the illusion of movement in a two-dimensional space. This is done by displaying a rapid sequence of still images, with each image slightly different from the last. Since the visuals are flat, they have only height and width, lacking depth.

2D Animation is a form of animation where characters, objects, and backgrounds are created and animated in a **two-dimensional space.**

Types of 2D Animation:

Traditional (Hand-drawn) Animation – Artists draw each frame manually (e.g., Disney classics like *Snow White and the Seven Dwarfs*).

Digital 2D Animation – Created with software, which makes the process faster and more flexible (e.g., *Rick and Morty*, *Adventure Time*).

Cut-out Animation – Uses pre-made shapes or characters that are moved frame by frame (e.g., *South Park*).

3D Animation

3D animation is the process of creating moving, three-dimensional images in a digital context. Specially, where objects, characters, and environments are modeled in 3D space and then animated to simulate real-world motion. 3D animation involves **depth, volume, and perspective**, making it look more realistic and immersive.

Main Stages in 3D Animation:

Modeling – Creating 3D objects or characters.

Texturing & Shading – Adding colors, patterns, and surface details.

Rigging – Adding a skeleton to characters so they can move.

Animation – Making the model move (walk, run, talk, etc.).

Lighting – Simulating natural or artificial light.

Rendering – Generating the final image or video output.

Compositing & Editing – Combining with other elements, polishing, and finalizing.

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Stop Motion Animation

Stop motion animation is an advanced flipbook-style form of animation. It involves photographing and then physically manipulating objects within your frame. When the sequence of images is played rapidly, it creates the illusion of continuous motion.

Instead of drawing (like in 2D) or digitally modeling (like in 3D), **real-world materials** such as clay, puppets, paper cutouts, or everyday objects are used.

Common Types of Stop Motion:

Claymation – Uses clay figures (e.g., *Wallace & Gromit*).

Puppet Animation – Uses puppets with joints (e.g., *Coraline*, *The Nightmare Before Christmas*).

Cutout Animation – Flat characters made of paper/fabric moved frame by frame (e.g., early *South Park*).

Object Animation – Everyday objects animated (e.g., toys moving on their own).
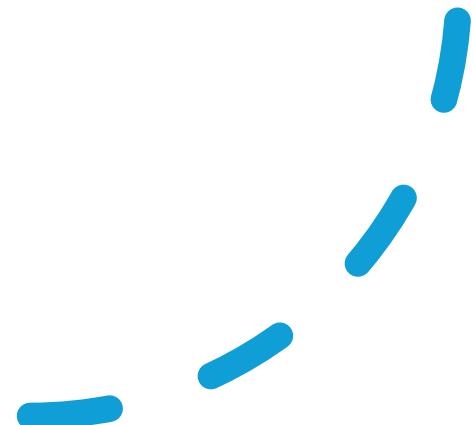
Unit-2

Principles of Animation

- Overview of the 12 principles of animation
- Keyframe animation and in-betweens
- Timing and spacing
- Application of squash and stretch, anticipation, and exaggeration

Overview of the 12 principles of animation

The 12 principles of animation are a set of guidelines developed by Walt Disney Studios animators Ollie Johnston and Frank Thomas, guidelines for creating realistic and engaging motion. "The Illusion of Life: Disney Animation." They are still widely used today in both traditional and computer animation to create the illusion of life, weight, and personality in characters and objects.

Here are the 12 principles of animation:

Squash and Stretch

Anticipation

Staging

Straight Ahead Action and Pose to Pose

Follow Through and Overlapping Action

Slow In and Slow Out

Arcs

Secondary Action

Timing

Exaggeration

Solid Drawing

Appeal

Here's a list of the 12 principles:

1. Squash and Stretch:

This principle adds a sense of weight and flexibility to objects as they move.

2. Anticipation:

This prepares the audience for an action by showing the character preparing for it.

3. Staging:

This refers to the clarity of an action or idea, ensuring the audience understands what is happening.

4. Straight Ahead Action and Pose to Pose:

These are two methods of creating animation; straight ahead involves drawing each frame in sequence, while pose to pose focuses on key poses and then filling in the in-betweens.

5. Follow Through and Overlapping Action:

Follow-through refers to parts of the body continuing to move after a character has stopped, and overlapping action involves different parts of the body moving at different rates.

6. Slow In and Slow Out (Ease In and Ease Out):

This principle creates a more natural movement by having the character accelerate and decelerate gradually.

7. Arcs:

Most natural movements follow an arc, and this principle helps create more realistic and fluid motion.

8. Secondary Action:

This adds extra details to the main action, like a character's hair swaying while they walk.

9. Timing:

This determines the speed and rhythm of the animation, impacting the overall feel and believability.

10. Exaggeration:

This adds emphasis and visual interest by exaggerating movements and poses.

11. Solid Drawing:

This refers to the ability to create believable and three-dimensional characters, even when using 2D animation.

12. Appeal:

This principle focuses on making the characters and the animation engaging and likable for the audience.

The 12 principles of animation

12 PRINCIPLES OF ANIMATION*

Squash and Stretch
Squashing and stretching an object or character to give the illusion of weight

Timing and Motion
Fewer drawings make an action faster and snappier while more drawings make an action slower and smoother

Anticipation
Preparation for an action

Staging
Presenting a scene in a way that makes it clear to the audience

Follow-Through and Overlapping Action
Loose parts of the body continue moving after the character stops and eventually catch up

Straight Ahead and Pose-to-Pose Action
Straight ahead is drawing a scene by starting out at the beginning and going to the end. Pose-to-pose draws out major actions then fills in the rest

Slow In and Out
More drawings at the beginning and ending of a sequence to show acceleration and deceleration

Arcs
Actions should follow an arc to give them a better flow

Exaggeration
Making actions more extreme to increase excitement

Secondary Action
A second action in the scene to complement the main action

Solid Drawing
Understanding the basics of three-dimensional form when creating objects or characters

Appeal
Giving a character personality to make them feel real and interesting

*Paraphrased from principles in *The Illusion of Life* by Ollie Johnston and Frank Thomas

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DEVELOPING LIVING CONTENT
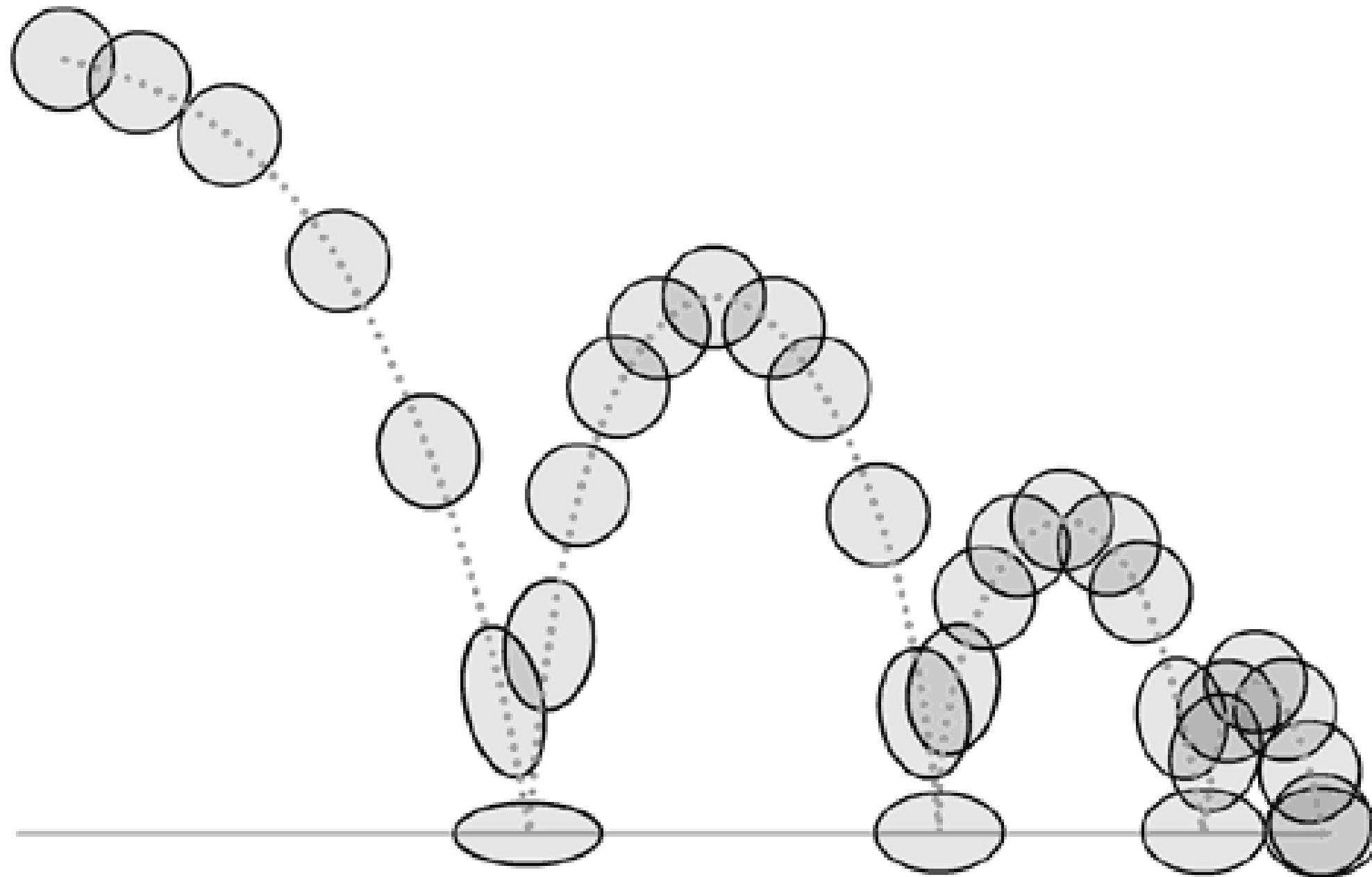
Application of squash and stretch, anticipation, and exaggeration
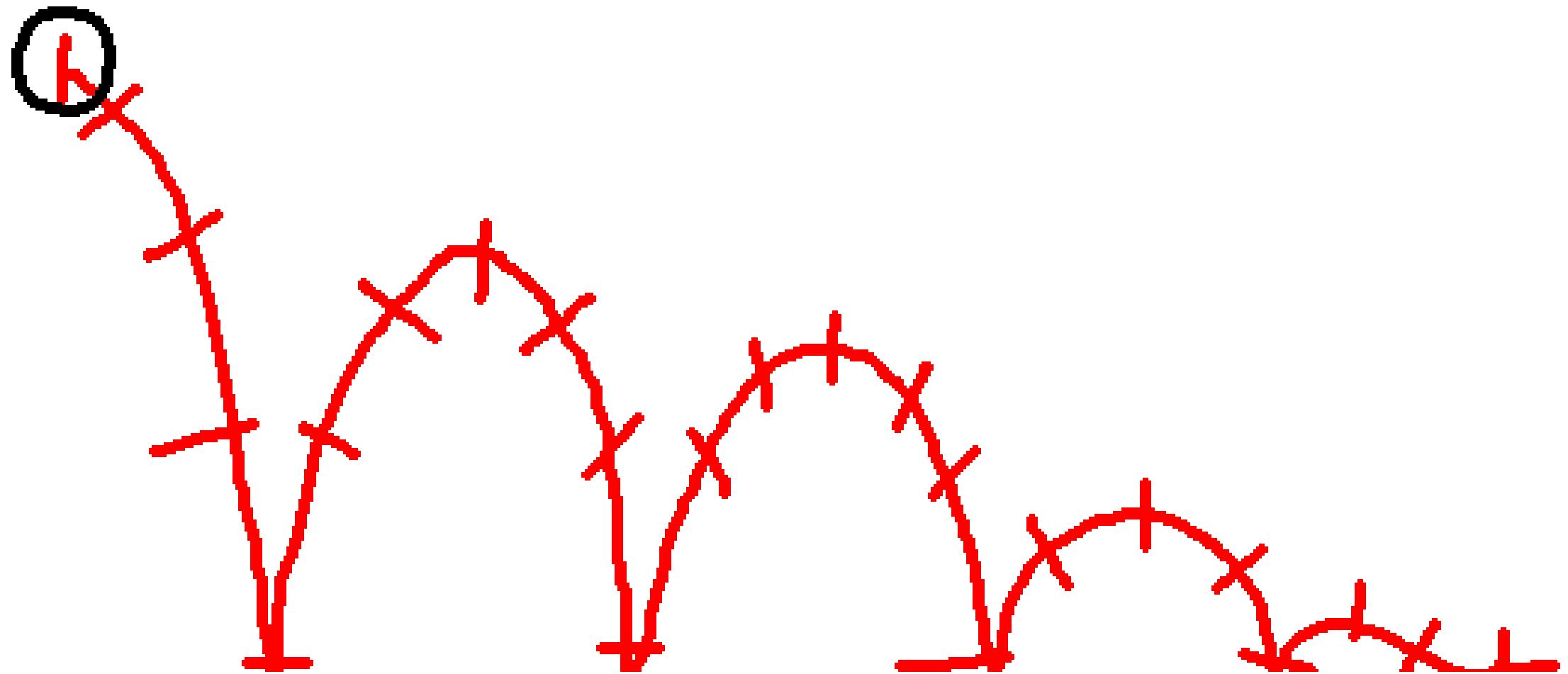
Squash and Stretch

Squash and Stretch is the technique of distorting an object's shape to emphasize motion, weight, flexibility, and impact, while maintaining its overall volume.

Squash: Used when an object is **compressed** by force or impact (e.g., when a ball hits the ground).
Stretch: Used when an object is **extended** (e.g., during fast motion or just before a jump).

Anticipation

Anticipation is the **preparation before the main action**. It is used to prepare the audience for an action. An animator uses anticipation to make an action feel more realistic and to help the audience understand what's about to happen.

Examples:

1. Jumping:

Before the jump → the character **bends their knees** (this is anticipation).

Then jumps up.

Without the bend, the jump would look sudden and unnatural.

2. Throwing a Ball:

Before throwing → the hand goes **backward** to build energy.

Then the ball is thrown forward.

This backward motion is anticipation—it shows where the energy is coming from.

3. Throwing an Object: Whether it's a baseball, a stone, or a pie, a character will always wind up first. They'll pull their arm back, sometimes even rotating their body, to build up power. This backward motion is the anticipation for the throw.

Anticipation

Exaggeration

Exaggeration is a core principle of animation that enhances clarity, adds energy, and makes movements more appealing and expressive by pushing actions, poses, and emotions beyond their natural limits. It makes the core idea of an action more apparent, transforming static or dull motions into dynamic, relatable, and entertaining performances that help define a character's personality and convey emotions effectively.

Examples:

Facial Expressions:

A tiny gasp might become a character's jaw practically hitting the floor.

Movement:
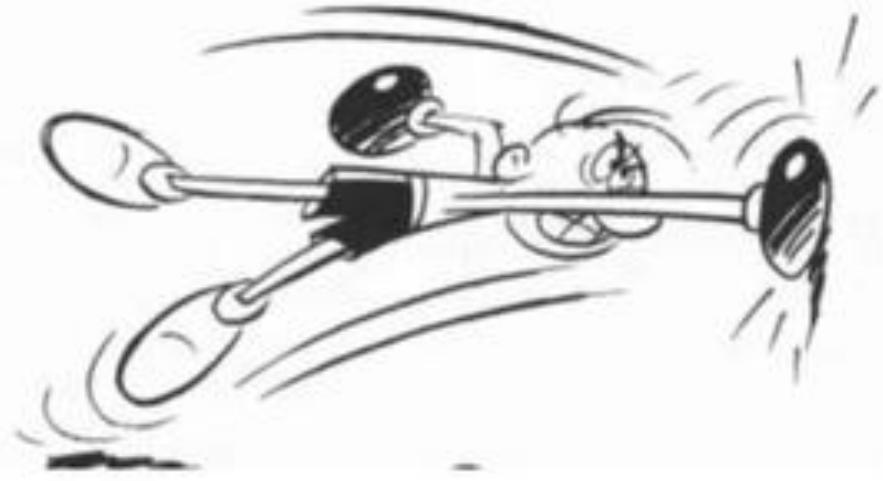
A simple jump can be exaggerated with an added bounce or a longer hang time in the air.
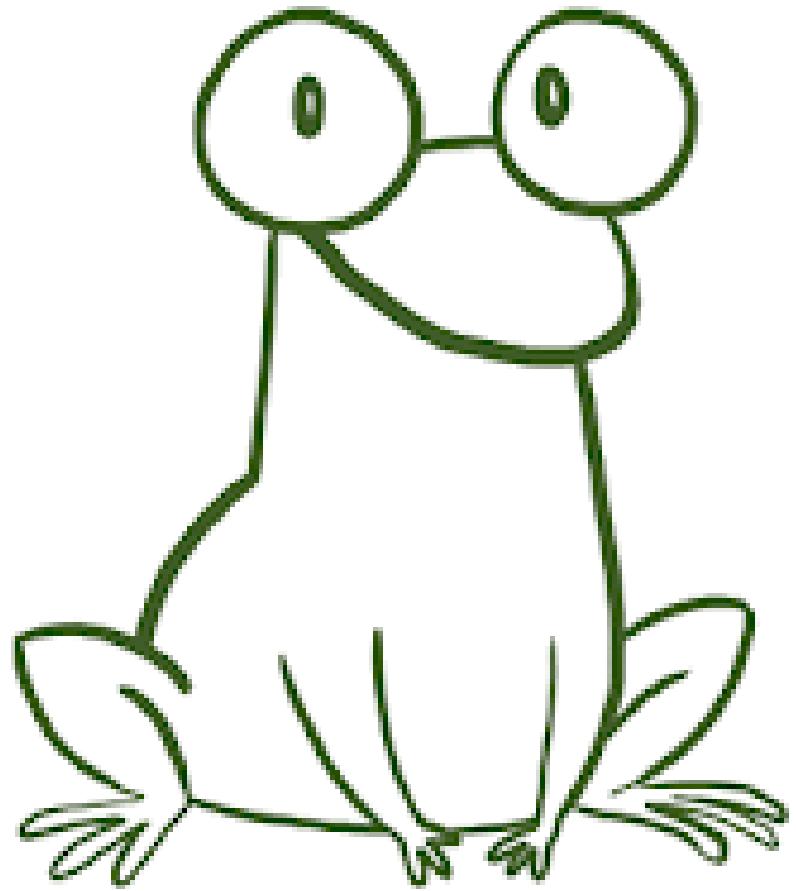
Sound:

Sound effects like a character's footsteps might be amplified to emphasize a movement.

Visuals:

Extreme color changes or distortions can highlight intense emotions or actions.
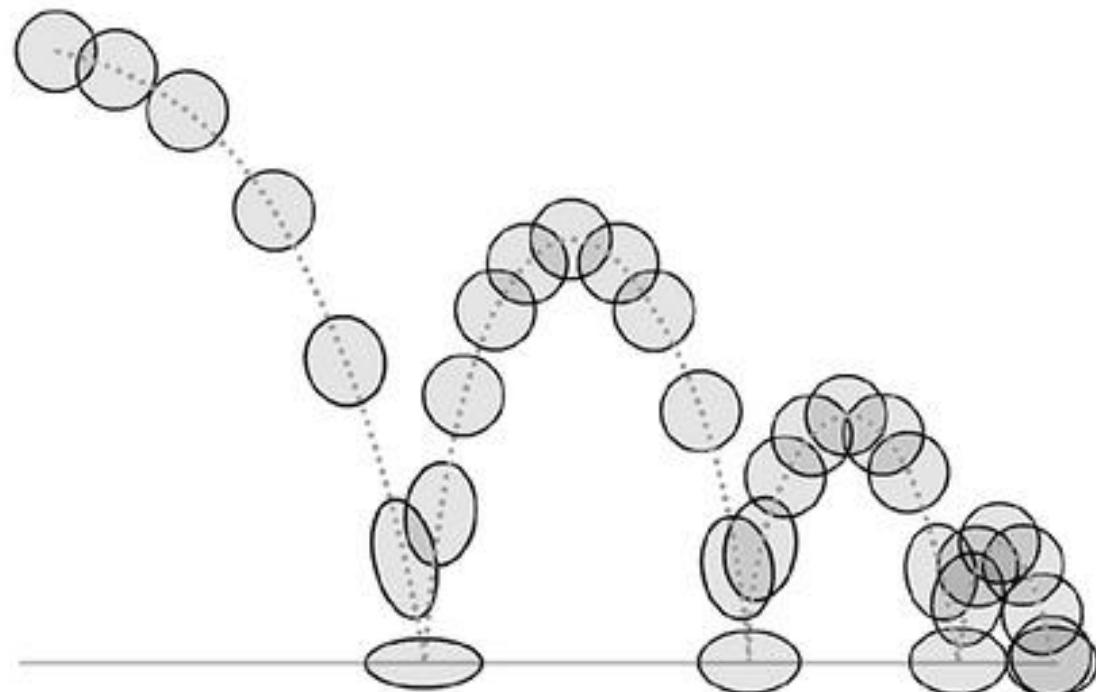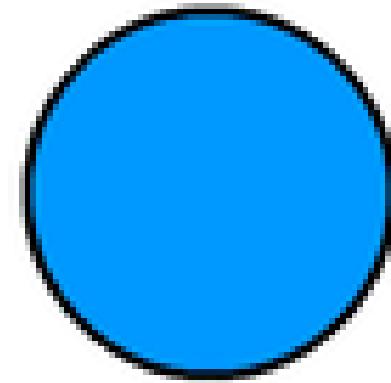
Key Framed Animation

Keyframe animation is a fundamental technique in animation where you define specific "key" moments or poses for characters or objects. That represent the starting and ending positions (and sometimes other properties) of an object.

Here's a breakdown of the key aspects:

• **Keyframes:** These are the crucial frames where you define the starting and ending points of a particular action or change. They dictate the position, rotation, scale, and other properties of an object at specific points in time.

• **In-betweening (or Tweening):** This is the process of generating the frames that lie between the keyframes. Traditionally, this was a laborious manual process done by "in-betweeners." Modern animation software automates this significantly, making the process much faster and more efficient.

Timing and spacing
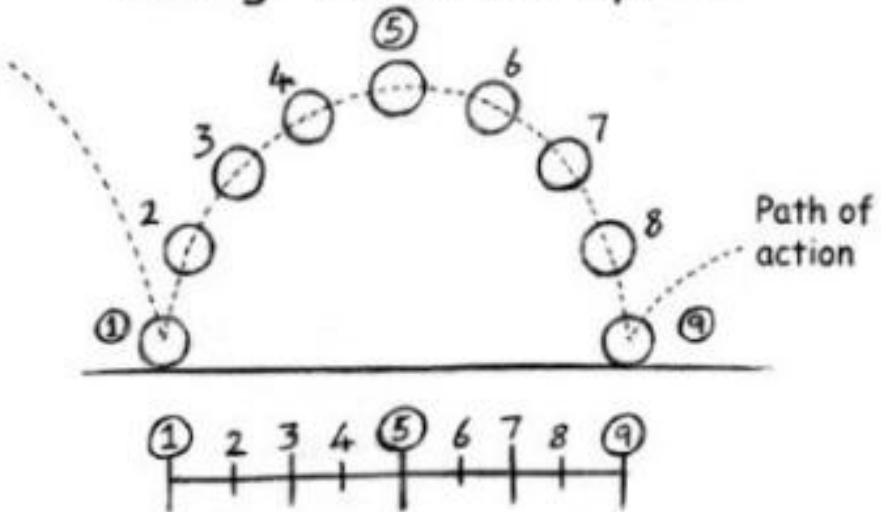
Timing and Spacing: These are critical elements controlled by the animator through the placement and adjustment of keyframes.

- **Timing** refers to the number of frames allocated to an action, which determines its speed. Fewer frames mean a faster action, while more frames result in a slower action.

- **Spacing** refers to the distance between the in-between frames. Closer spacing creates smoother, more gradual movement, while wider spacing creates faster acceleration or deceleration.
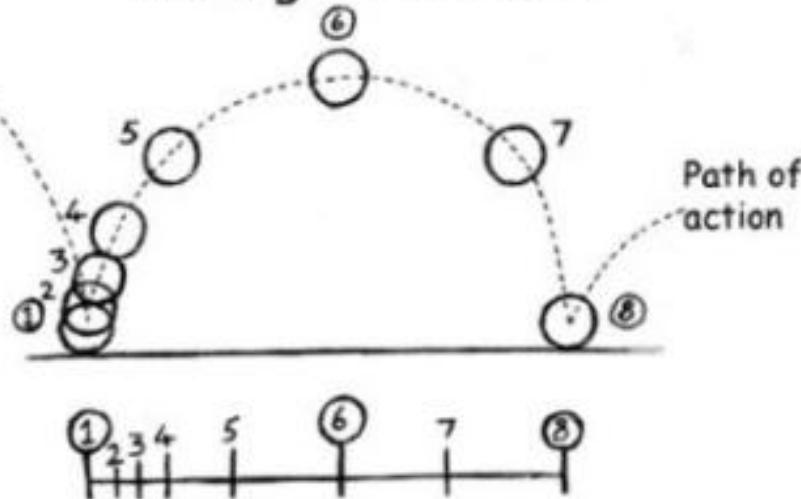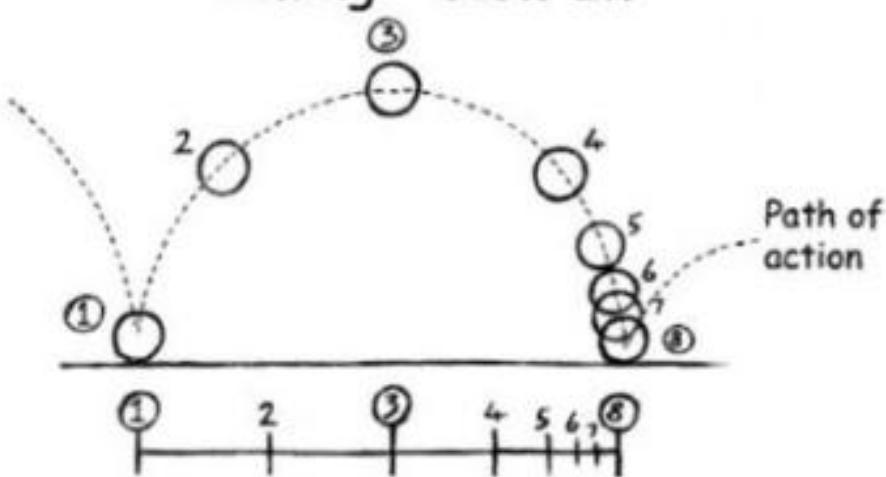
Timing - Constant Speed

Timing - Slow Out

Timing - Slow In

Timing - Slow In & Slow Out