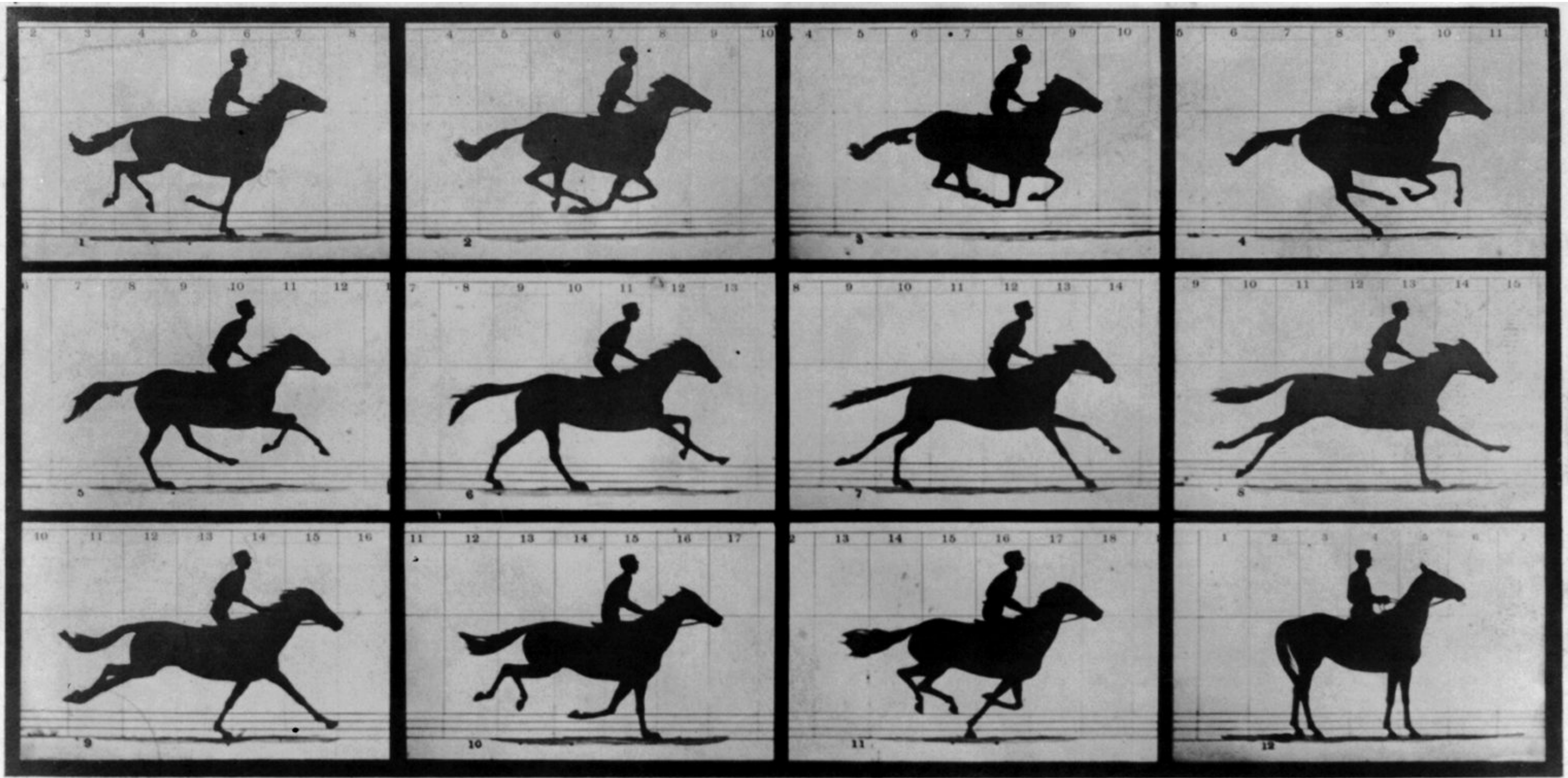
Animation & Video

An Introduction

First, video starts with animation.

Premise of Animation

the persistence of vision



MORSE'S Gallery, 417 Montgomery St., San Francisco.

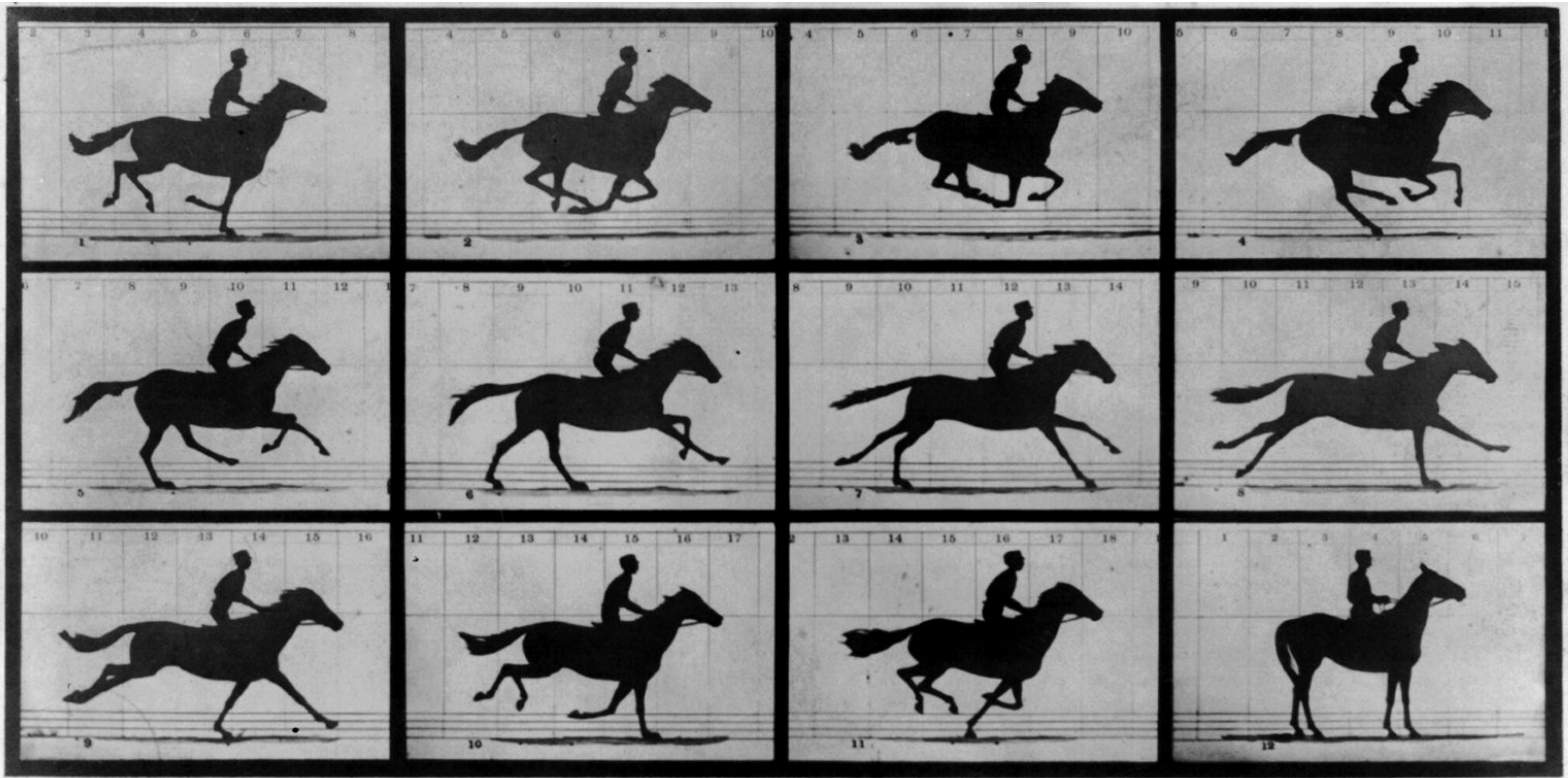
THE HORSE IN MOTION.

Illustrated by
MUYBRIDGE.

AUTOMATIC ELECTRO-PHOTOGRAPH.

One of the earliest instruments of optical illusion using persistence of vision is the **zoetrope**, created by a mathematician, William Horner, in 1833.

some examples…



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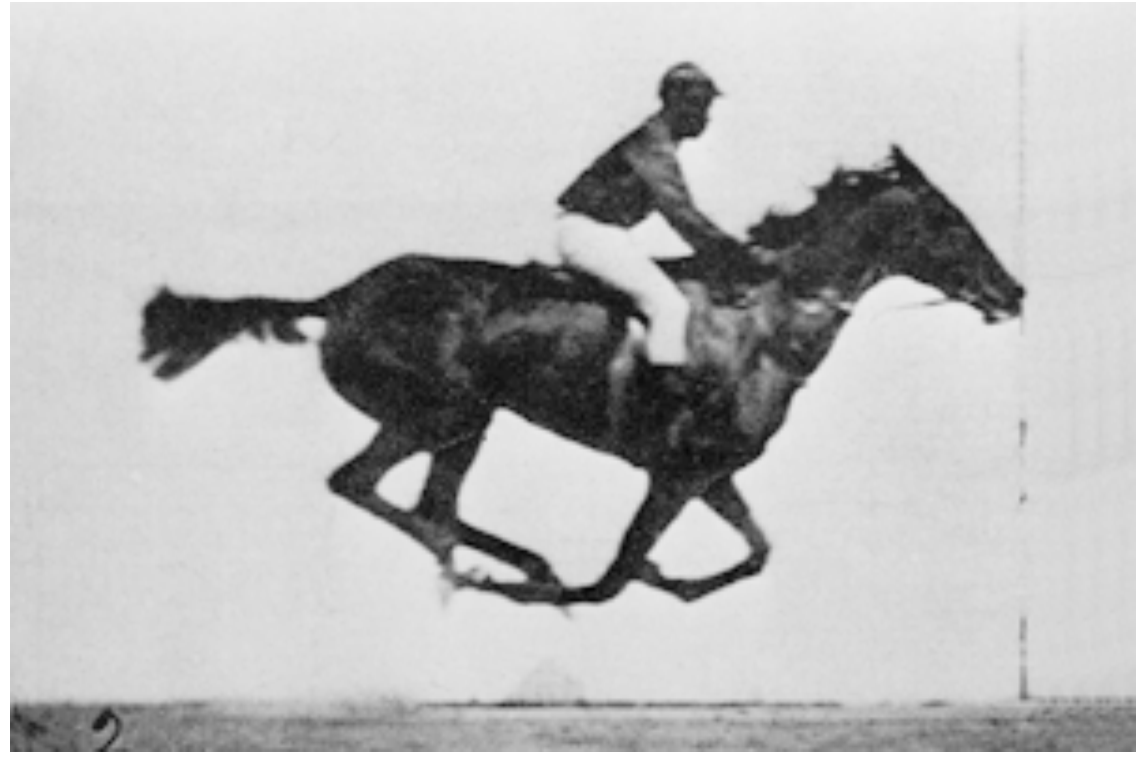
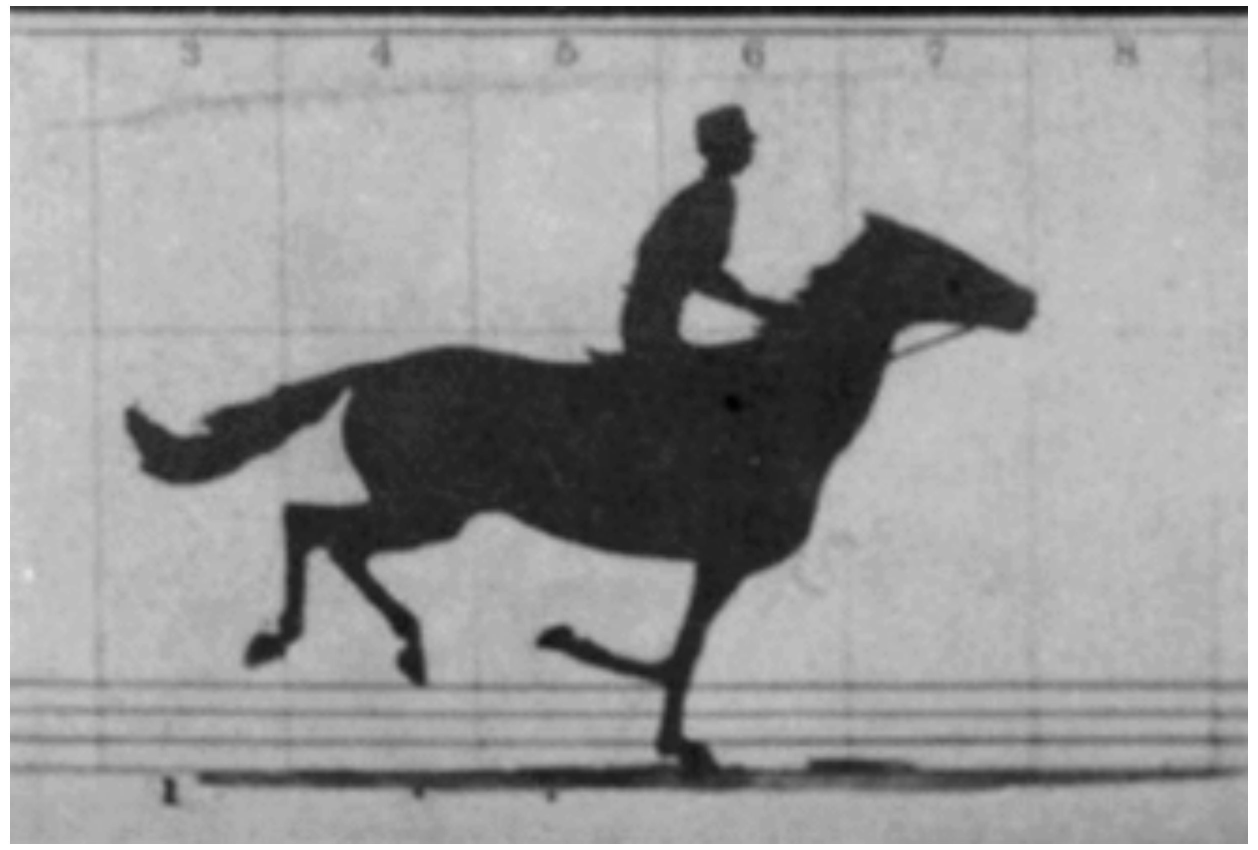
Muybridge Study

- 1878, each shot taken less than two-thousandths of a second apart.
- published in 1882
- he used this work as basis of his zoopraxiscope invention





Zoopraxiscope

[zoh-uh-prak-suh-skohp]

Muybridge first demonstrated his zoopraxiscope to the public in 1882. It is often quoted as the first ever moving picture.

It was a glass disc with painted photographs in sequence. He projected light through it to a screen.

from: http://www.wildfilmhistory.org/person/180/Eadweard+Muybridge.html

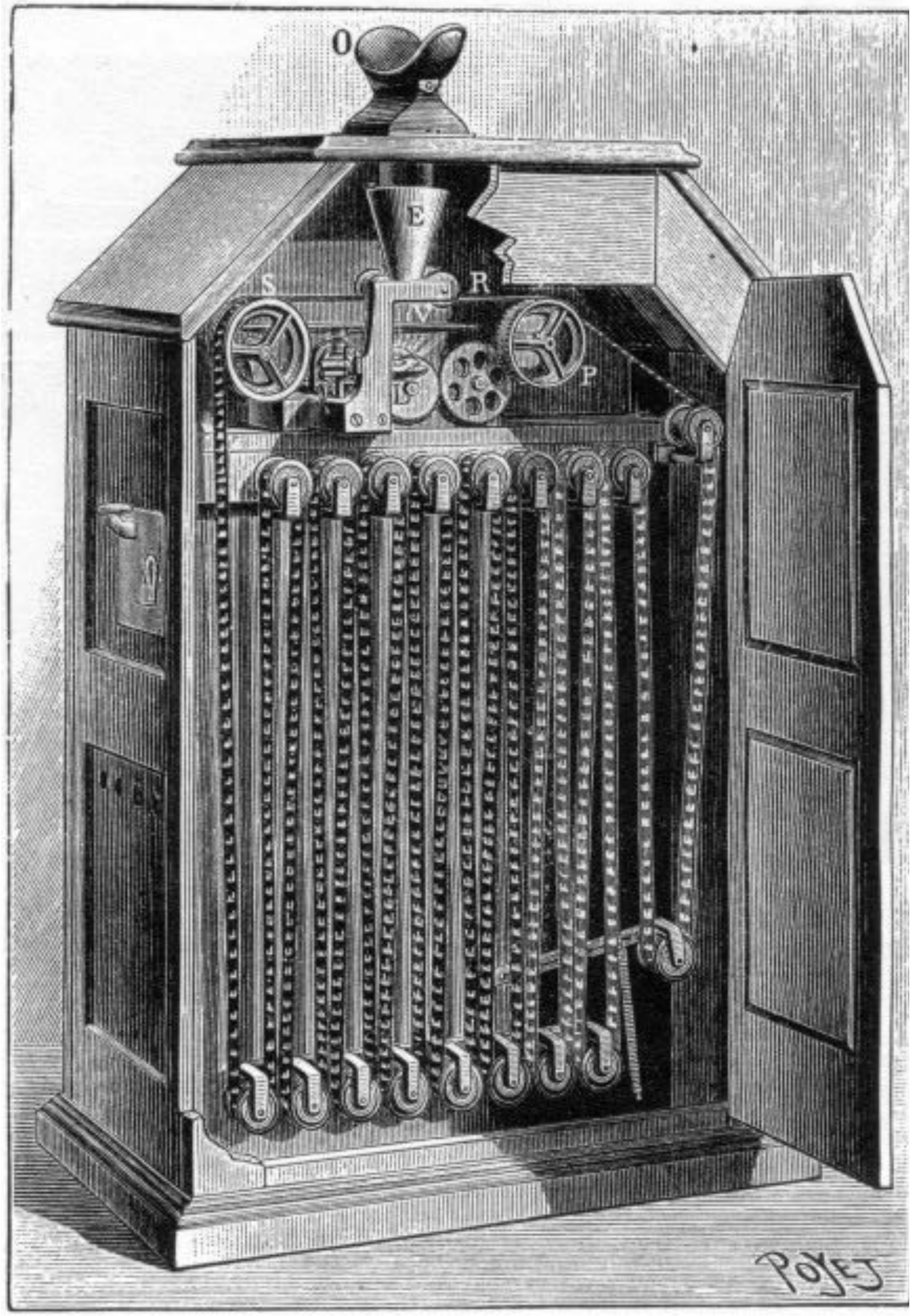
And it lead to this….

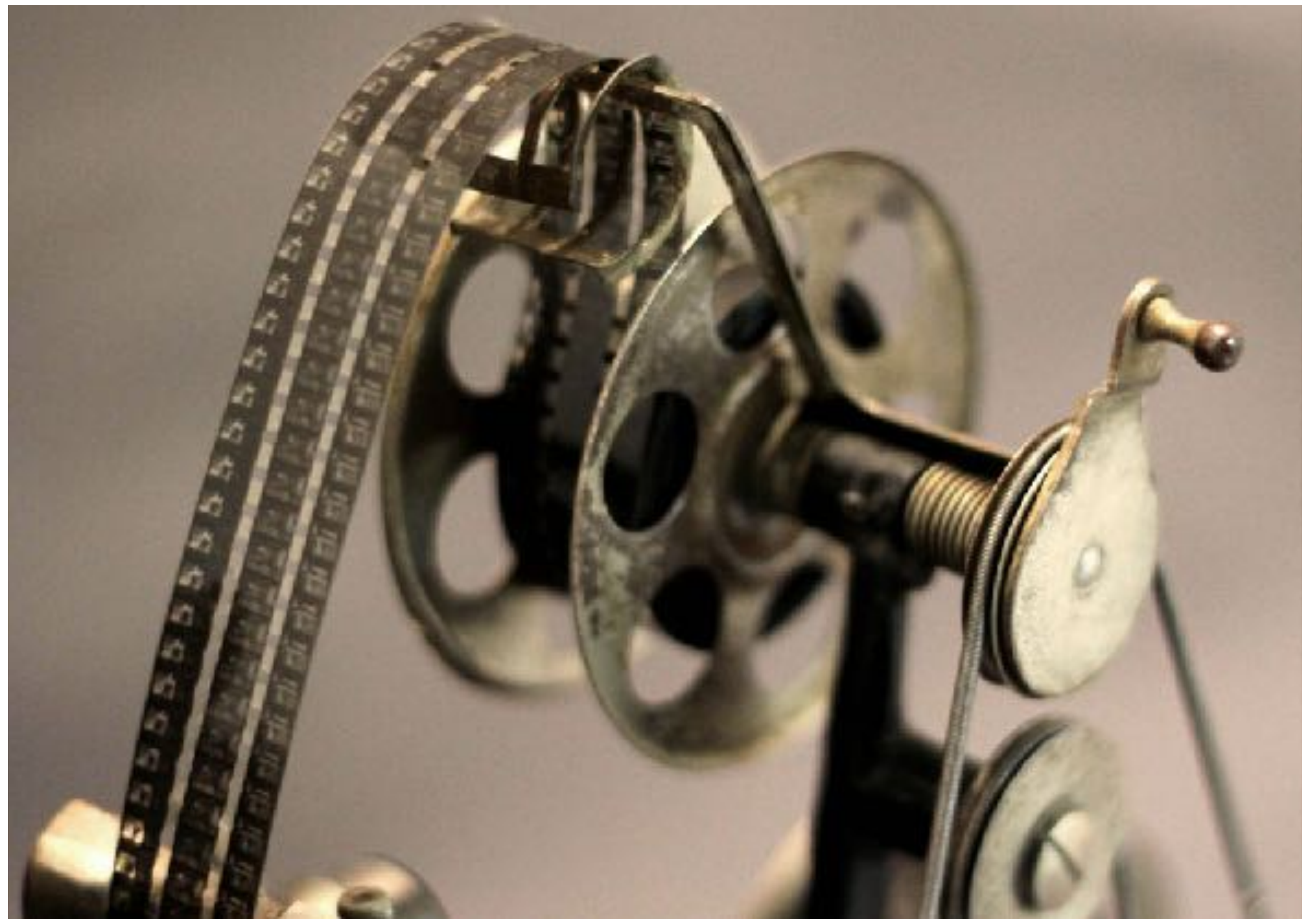
Kinetoscope

Thomas Edison

Thomas Edison used Muybridge's idea as the foundation for this invention.

It was a projection device using perforated film to move images past a peephole for a single viewer to watch.





Film

Film is produced in this way, where still images are captured at a rate of ~24-30 images per second.

The human eye typically cannot see anything faster than 30 fps.

Newer Animation Techniques

Cel Animation + Computer Animation

Cel Animation

- Cel animation is where a distinctly separate graphic is represented in each "frame" of an animated sequence.
- The word 'cel' comes from celluloid film, which is what "film" was once made from.
- This is the most traditional form of animation.

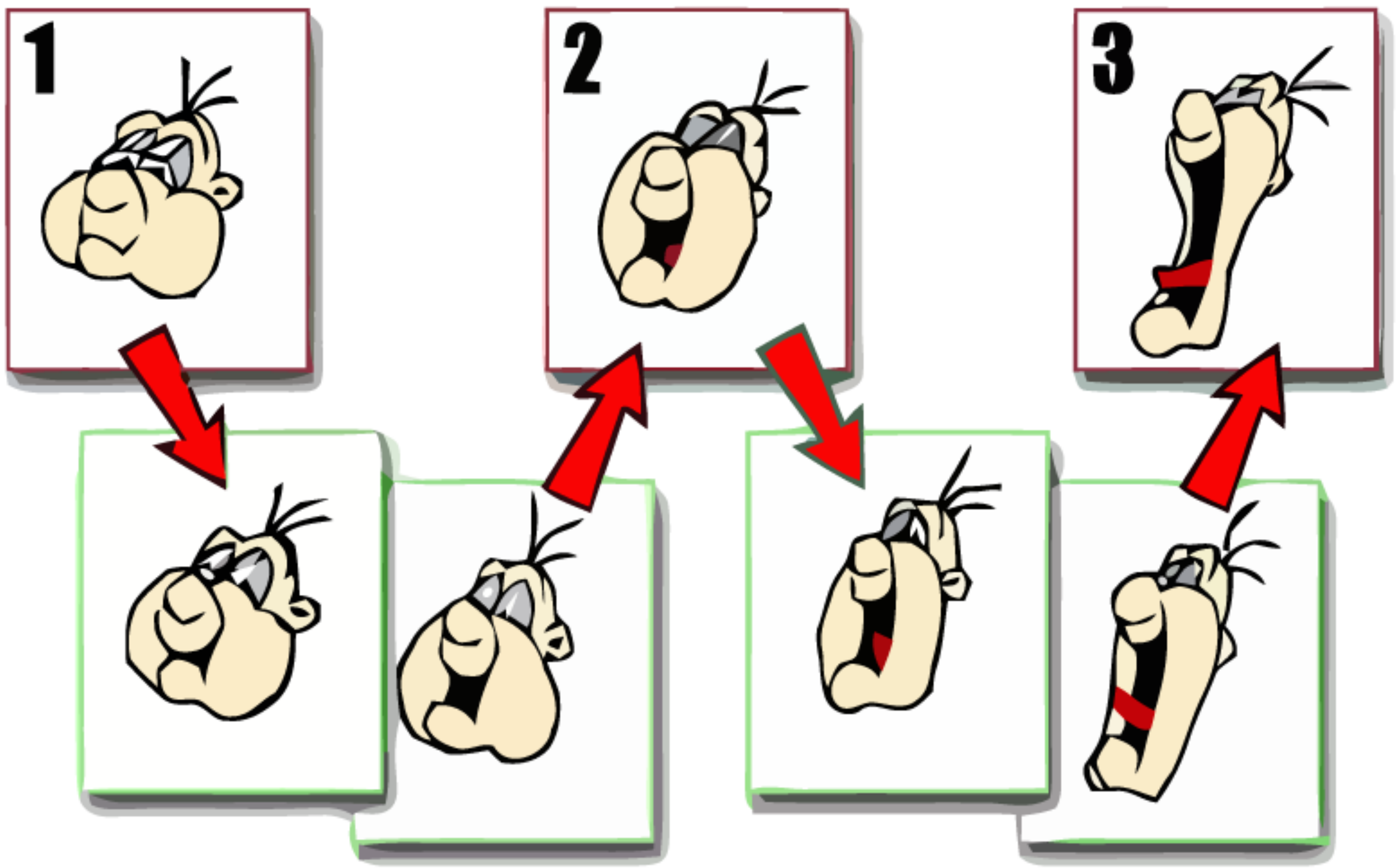
Cel Animation Concepts

Keyframing and Tweening

Keyframing and Tweening

In cel animation, we have keyframes that determine the start and stop points of major visual changes.

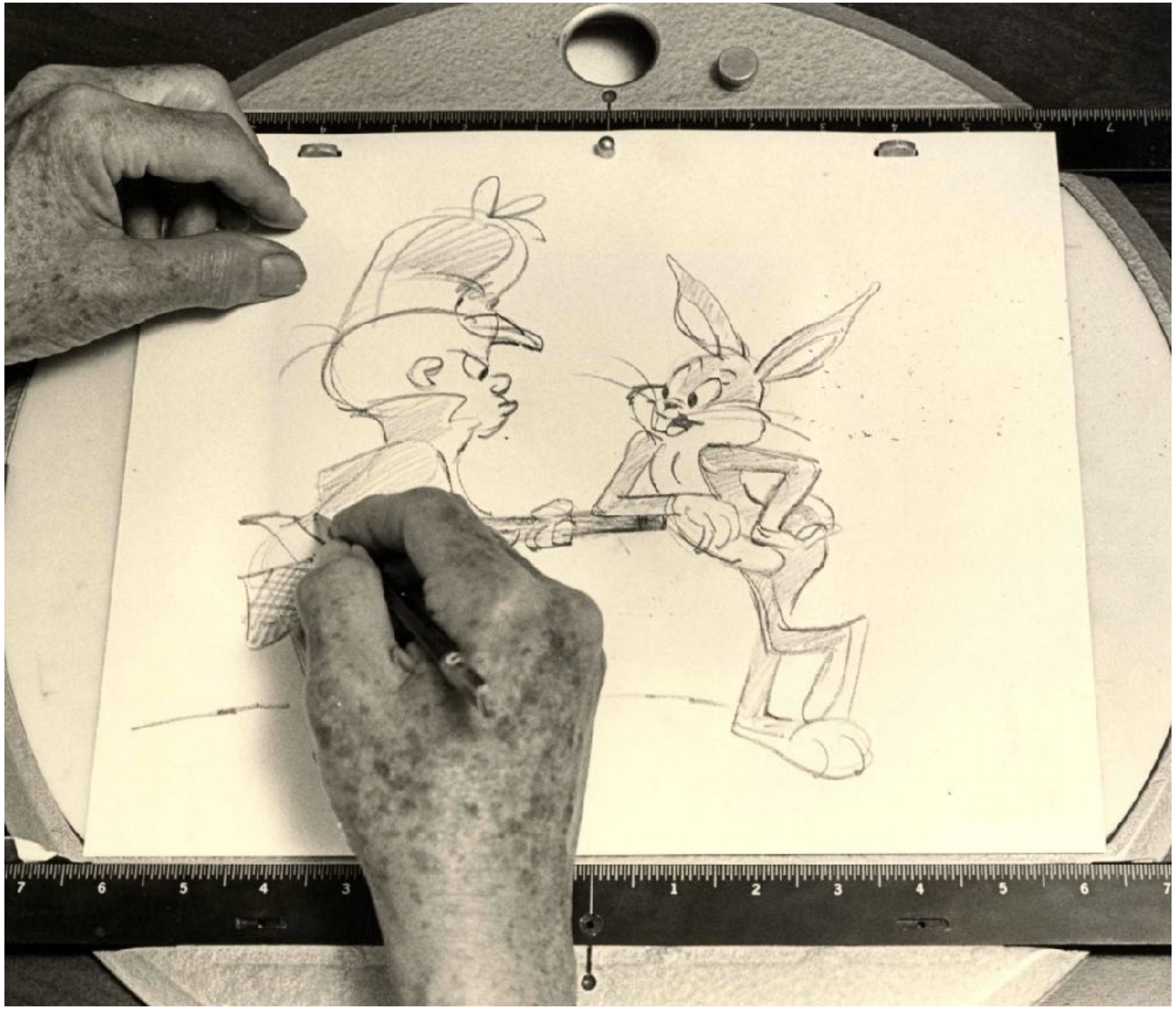
The frames that are rendered in between to transition the changes are referred to as "tweening" frames.



Whoa!

In traditional hand-rendered animation, all tweened frames must still be hand-rendered at ~24-30 images per second of film...it's staggering.

That means millions of drawings for a feature length movie.



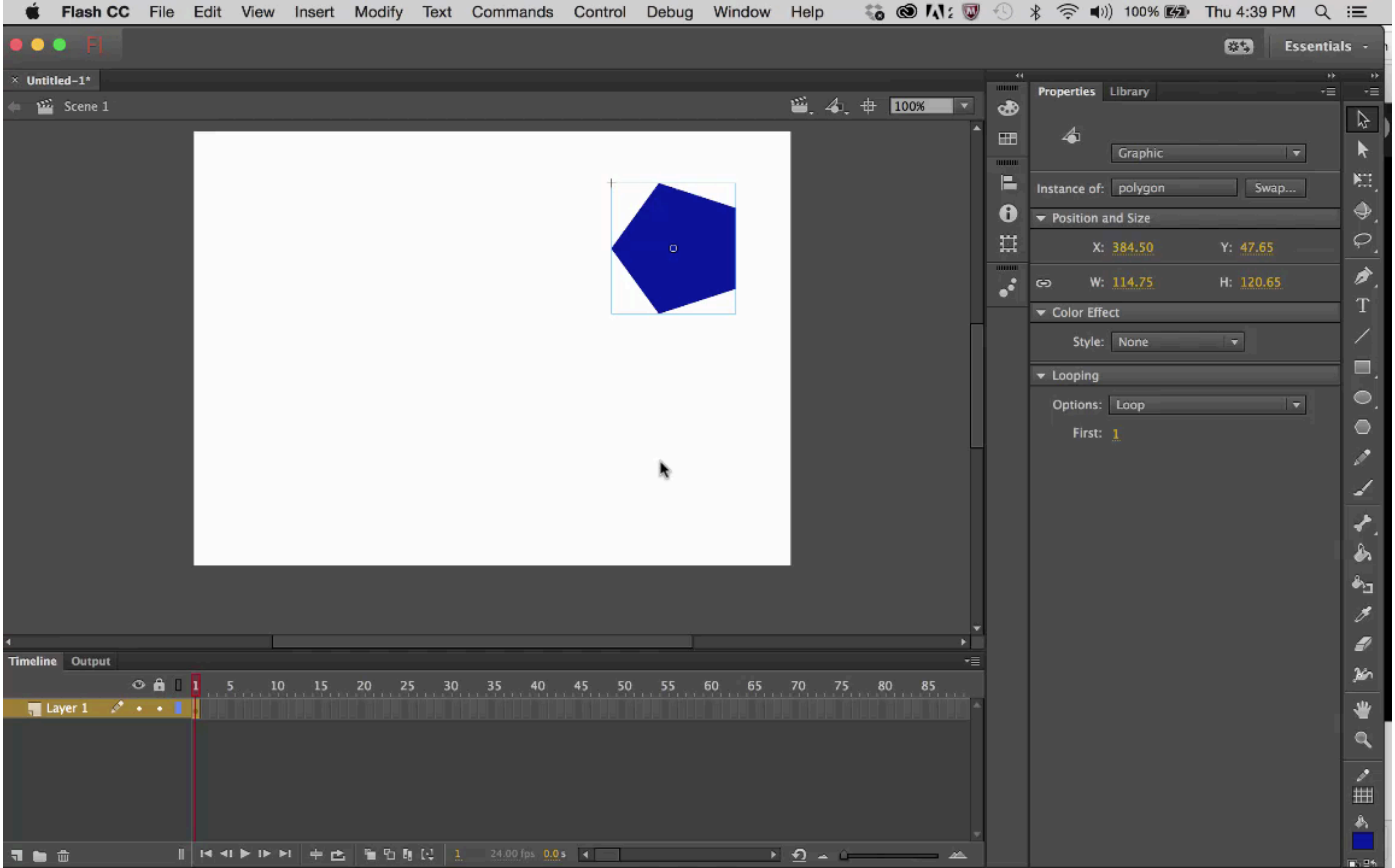
First animated cartoon: Fantasmagorie, 1908

Computer Animation

Computer animation typically has the same concepts as traditional cel animation (frame-by-frame options, key framing, and tweening), but the main practical difference is in how tweens are generated.

In vector-based animation, you can potentially have **two** keyframes (beginning and end), whereas traditional hand-rendered animations might need many keyframes.

An object's properties can be mathematically altered as it moves along a vector path between two anchor points in computer animation.


Flash CC
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Essentials
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Graphic
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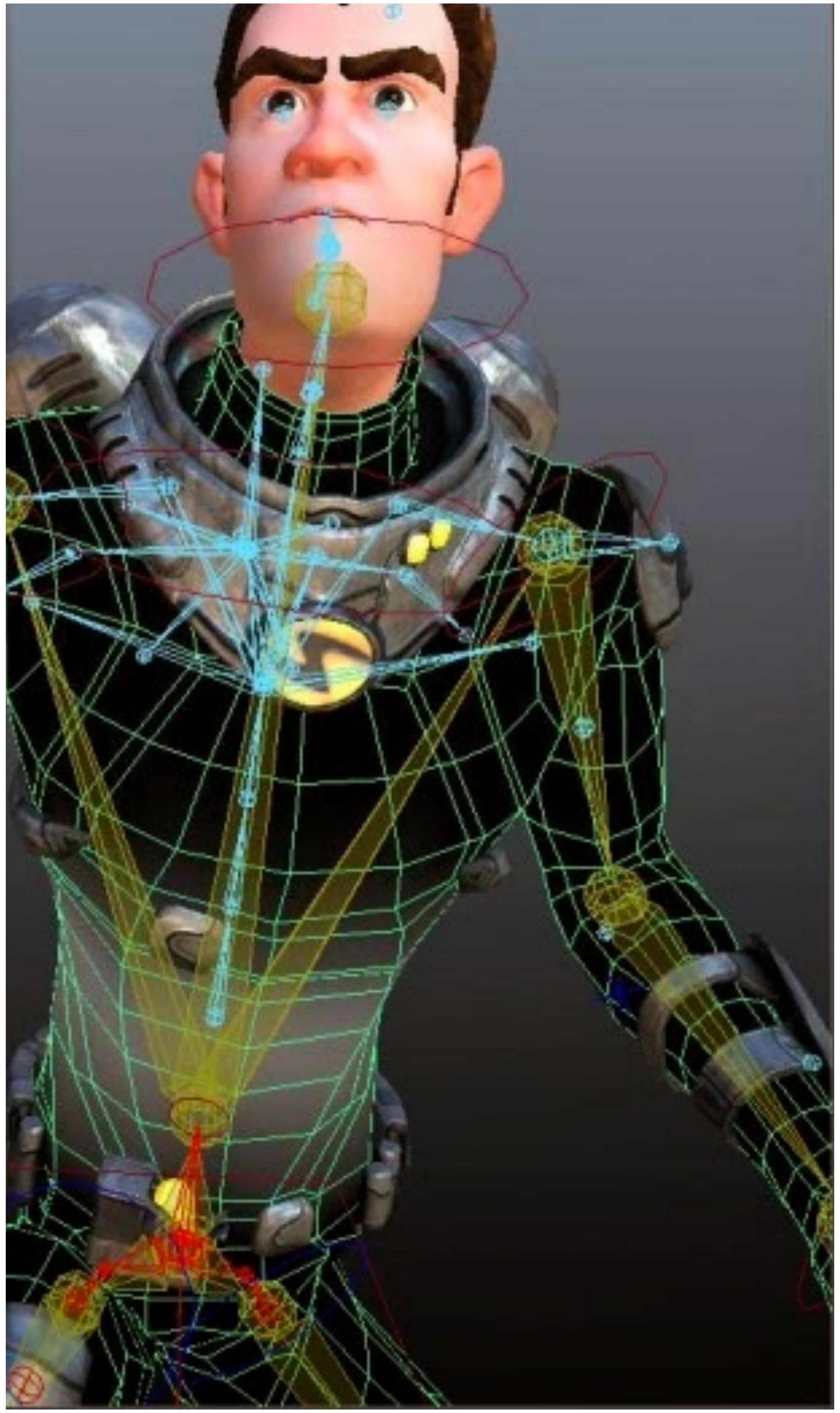
Swap...
Position and Size
X: 384.50
Y: 47.65
W: 114.75
H: 120.65
Color Effect
Style: None
Looping
Options: Loop
First: 1
Timeline
Output
Layer 1
1 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85
24.00 fps
0.0 s

Kinematics

Kinematics is an even more intricate level of computer-rendered animation in 3D animation.

It is the study of how the individual parts of a whole will move based on physical laws, and specifically how the joints articulate in relationship to the parent structures.

There's a great tutorial about the theory of kinematics at toonboom.com (https://www.toonboom.com/resources/video-tutorials/video/inverse-kinematics-basics).



Video

Analog and Digital

Analog TV signals were once the standard, where the signal was transmitted via radio frequency and picked up by antennae.

The most common video broadcast standards were once:

NTSC - 4:3
PAL - 4:3

NTSC was U.S.

PAL was European.

Now the most
common DIGITAL
video broadcast
standards are:

"ATSC 1.0"
720p - HD
1080i - Full HD

The ATSC 3.0 standard is in the process of being adopted but isn’t universally available due to high resolutions:

1080p - Full HD
4KUHD - Ultra HD

Understanding Scanning

Progressive Scan, Interlacing, Overscanning, Underscanning

Progressive Scan

- Draws horizontal lines on the screen from top to bottom in a single pass.
- This is indicated in a display’s resolution with the letter "p" after the vertical number of lines it is capable of drawing.
- For instance: **1080p**
  This represents a 1920px wide x **1080px tall** resolution.

Interlacing

- Draws horizontal lines on the screen from two fields and interlaces then together.
- This is indicated in a display’s resolution with the letter "i" after the vertical number of lines it is capable of drawing.
- For instance: **1080i**
  This represents a 1920px wide x **1080px tall** resolution.
- Interlacing is generally considered to be less desirable than progressive scanning in digital video.

Overscanning

- To accommodate a display's bezel, video is often shot so that it slips slightly under a TV's edge. This means the TV overscans so that we don't see any borders.
- You can almost think of overscanning like a digital video bleed in the same way we create print bleeds for trimming paper on a printing press.

Safe Title Area

- As a result, always leave the outermost 15% of your frame free of titles or text because it can be lost due overscanning and conversion between computer/tv/video format translations

Digital High Definition Resolutions

- Digital high definition video typically has a 16:9 ratio for most TVs and 21:9 for most movies.
- Many movies on TVs incapable of 21:9 ratios will have letter boxing (or black bars at top/bottom)
- Most TVs have a resolution of:
  - 1280 x 720 … **720p** (minimum HD resolution)
  - 1920 x 1080 … **1080p/i**


480i : SD / NTSC
720p : HD
1080p : Full HD
2560 x 1440p : Quad /QHD
3840 x2160 : Ultra /UHD
4096 x 2160 DCI (Digital Cinema Standard

Codecs and Digital Video Containers

What is the difference?

"**Codec**" comes from "**coder**" and "**decoder**,"
which suggests what they do:

they code (**compress**) files for **storage** and
decode (**decompress**) files for **viewing**.

Codecs

- Codecs are NOT file types.
- They are simply compression schemes.
- The most common one that you will find compatible with most video containers today is H.264/MPEG-4.
- H.264/MPEG-4 is the codec you should use for projects in this class.

Video Containers

- They are architectures that comprise movie file types.
- Examples: .mov, .avi, .ogg, .mp4, etc.
- They also include metadata about the movie.
- When saving a video, you have to choose the video container format separately from choosing the codec.