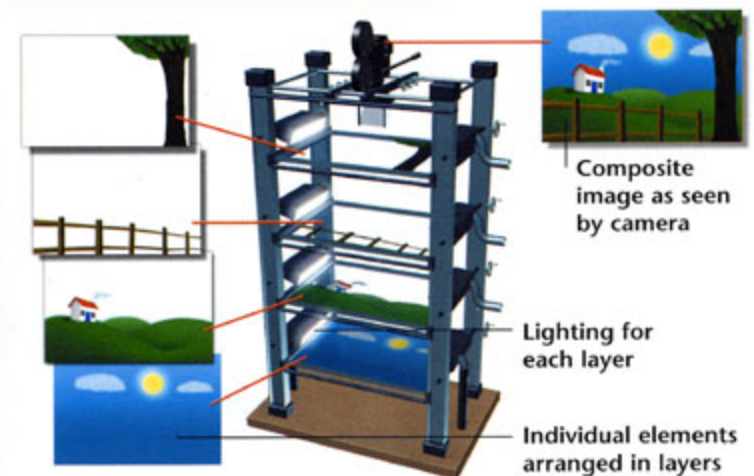
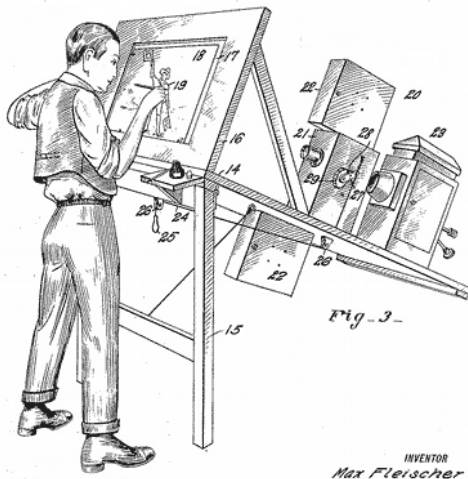


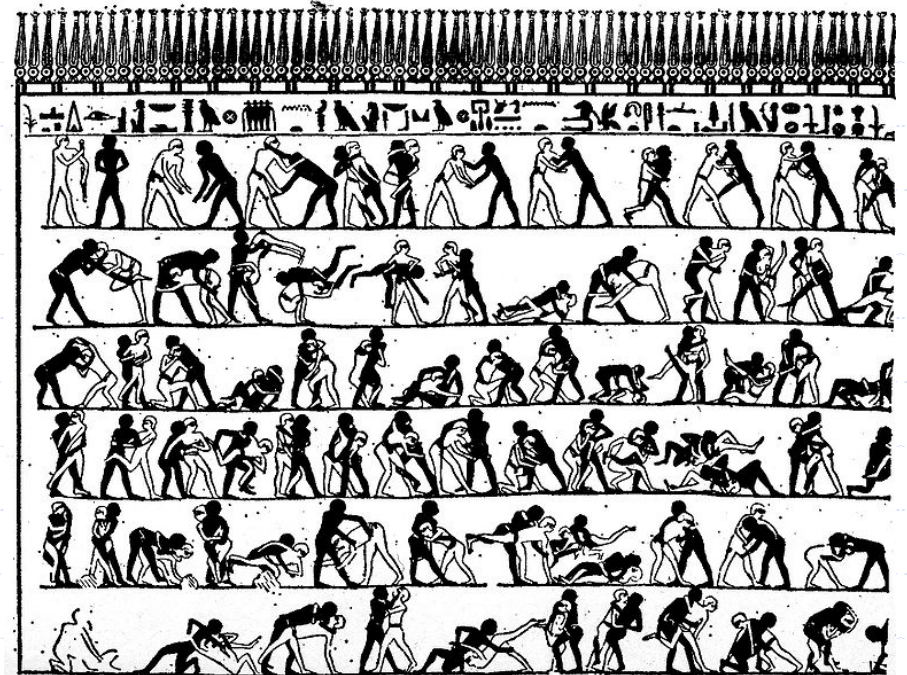
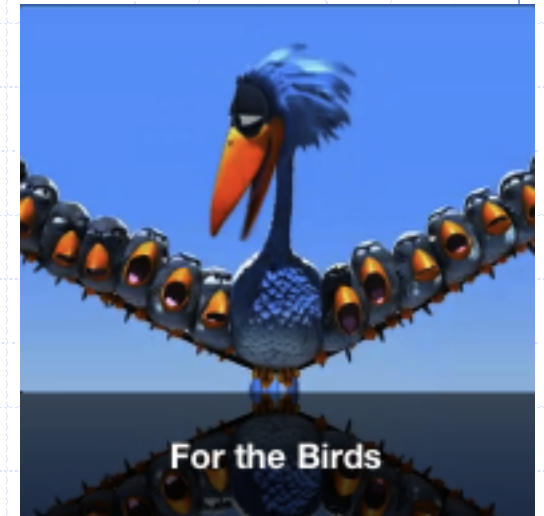
# Animation Basics

- ◆ Science of animation (Why does it work?)
  - “persistence of vision” on the retina?
  - Desire of the brain to make sense (Gestalt theory)
- ◆ (Old) Technology of animation
  - Flipbook, Thaumatrope, Zoetrope
  - Rotoscope
  - Multiplane camera (for cel animation)



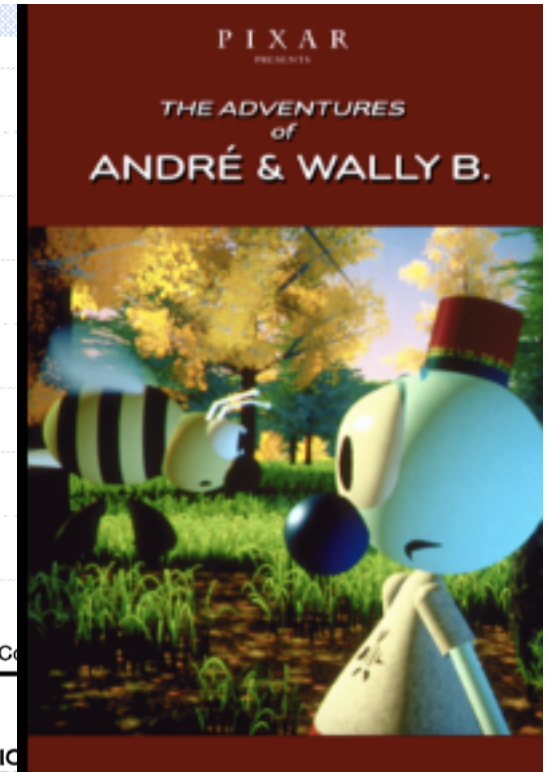
# Animation Basics

- ◆ Psychology of animation: Tells a Story
  - Have an intro, a peak, a punch-line
- ◆ Animation quality depends (still) on
  - Rate of image display
  - Amount of difference between images
  - Position of changing images



# Computer Animation

- ◆ What do you need for a great animation:
  - Study Walt Disney
  - Computing power
- ◆ Principles to Traditional Animation applied to 3D computer animation
- ◆ Tricks to Animating Characters with a Computer



## PRINCIPLES OF TRADITIONAL ANIMATION APPLIED TO 3D COMPUTER ANIMATION

John Lasseter  
Pixar  
San Rafael  
California

*"There is no particular mystery in animation... it's really very simple, and like anything that is simple, it is about the hardest thing in the world to do."* Bill Tytla at the Walt Disney Studio, June 28, 1937. [14]

### ABSTRACT

This paper describes the basic principles of traditional 2D hand drawn animation and their application to 3D computer animation. After describing how these principles evolved, the individual principles are detailed, addressing their meanings in 2D hand drawn animation and their application to 3D computer animation. This should demonstrate the importance of these principles to quality 3D computer animation.

CR Categories and Subject Descriptors:

I.3.6 *Computer Graphics* : Methodology and Techniques - Interaction techniques;

I.3.7 *Computer Graphics* : Three-dimensional Graphics and Realism - Animation;

J.5 *Computer Applications* : Arts and Humanities - Arts, fine and performing.

General Terms: Design, Human Factors.

Additional Keywords and Phrases: Animation Principles, Keyframe Animation, Squash and Stretch, Luxo Jr.

The last two years have seen the appearance of reliable, user friendly, keyframe animation systems from such companies as Wavefront Technologies Inc., [29] Alias Research Inc., [2] Abel Image Research (RIP), [1] Vertigo Systems Inc., [28] Symbolics Inc., [25] and others. These systems will enable people to produce more high quality computer animation. Unfortunately, these systems will also enable people to produce more bad computer animation.

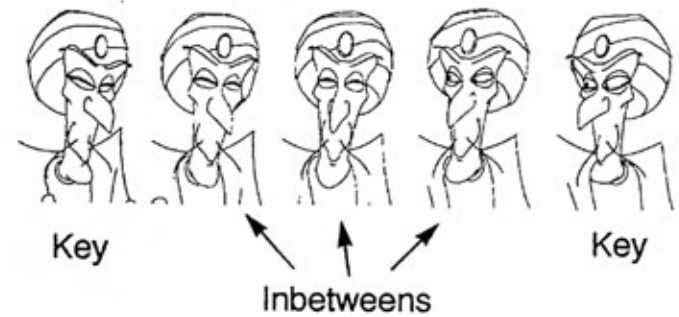
Much of this bad animation will be due to unfamiliarity with the fundamental principles that have been used for hand drawn character animation for over 50 years. Understanding these principles of traditional animation is essential to producing good computer animation. Such an understanding should also be important to the designers of the systems used by these animators.

In this paper, I will explain the fundamental principles of traditional animation and how they apply to 3D keyframe computer animation.

### 2. PRINCIPLES OF ANIMATION

Between the late 1920's and the late 1930's animation grew from a novelty to an art form at the Walt Disney Studio. With every picture, actions became more convincing, and characters were emerging as true personalities. Audiences were enthusiastic and many of the animators were satisfied, because it was close to Walt Disney's that the level of animation and acting

# Animation Theory



## ◆ Learn from Walt

- Identify major events by **keyframes** and let software do the “**tweening**”
- Animate thoughts, **ideas**, intentions, **not** mechanical movements!
- Do not animate what is irrelevant
- **Ease-in** and **ease-out** follows the physics of motion
- **Overshooting** a resting point reflect the kinetic energy of motion
- Create **anticipation** with setup, action, follow-through
- **Stretching** and **Squashing**
- **Exaggeration** provides accent of an action
- Develop character **appeal**

## ◆ Animate camera

## ◆ Animate light source



# Tricks of Walt

## ◆ Attract viewer's attention

- Before moving, a character
  - ◆ blinks,
  - ◆ backs up a little,
  - ◆ hesitates

## ◆ Timing is everything

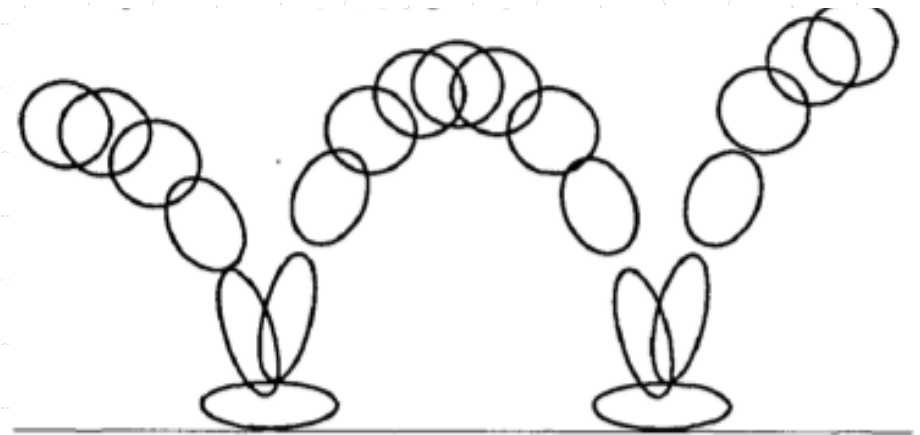
- While the action happens, movement
  - ◆ Slows down/Speeds up
  - ◆ Zooms in/out

## ◆ Movement should be made obvious

- e.g. put marks on a rotating ball

## ◆ Get Physical

- Convey weight
  - ◆ The supporting surface squeezes
- Convey size
  - ◆ Compare with known size
- Convey softness/hardness
  - ◆ Through collision



# Camera Animation

- ◆ Even when no object moves, you can have animation
  - See Regen (rain)
- ◆ Panning
  - Camera looks in a fixed direction, but moves
- ◆ Orbiting
  - Camera looks at a fixed location, but moves
- ◆ Tracking
  - Camera looks at a fixed location, moves along a fixed path



# Classics

## ◆ Classics

- Luxo, Jr. <http://www.pixar.com/shorts/ljr/index.html>
  - ◆ Spinoff: Luxo gets a buzz <http://www.youtube.com/watch?v=5CKnnDr0da4>

