Principles of Animation

What is animation?

What is animation?

- Series of pictures of objects/characters in motion
- Displayed at some rate
  - film 24 fps
  - video 30 fps
- Examples
  - flipbooks
  - stop motion (claymation)
  - traditional hand animation (cel animation)
  - computer-assisted keyframing
  - motion capture
  - simulation

Principles of Animation

From Disney Animation : The Illusion of Life
by Thomas Johnson, Ollie Johnson

Truly wonderful but often out of print—buy it if you see it!

- From years of practice and trial and error, these principles became common practice

- Open question: how to support these principles in computer tools?
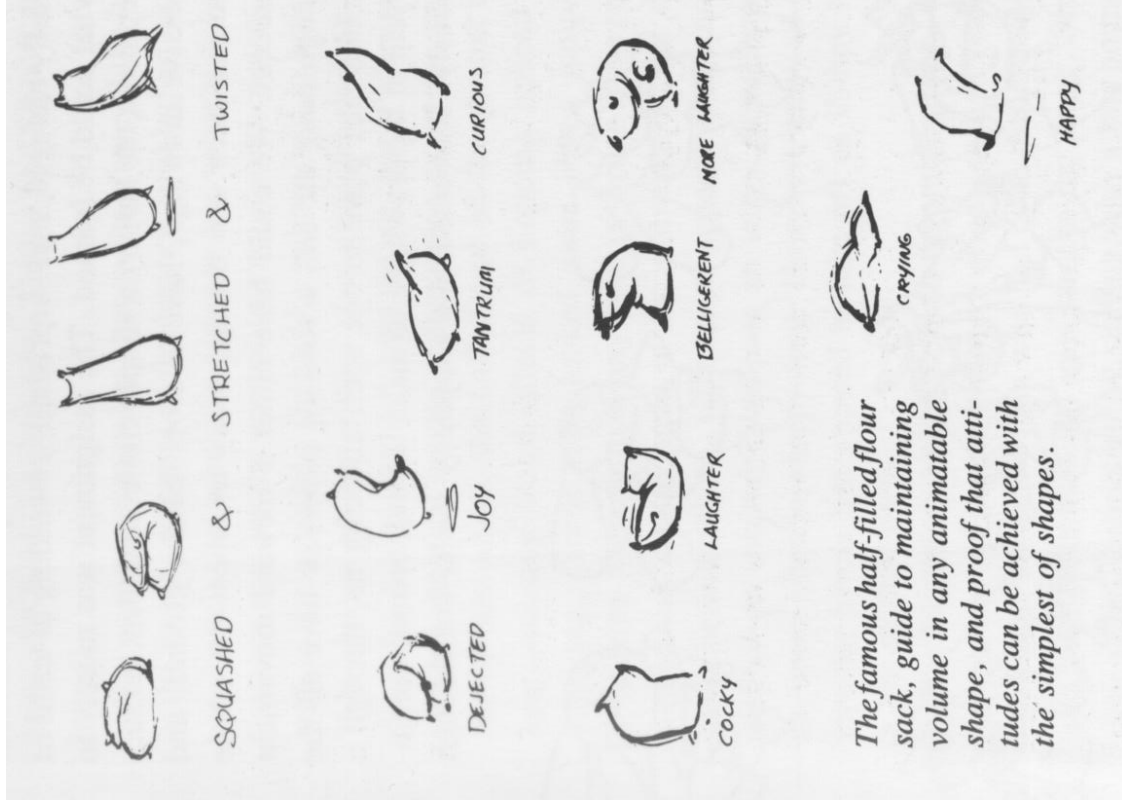
12 Principles

- Squash and stretch
- Anticipation
- Staging
- Pose to Pose
- Follow Through
- Slow In , Slow Out

- Arcs
- Secondary Action
- Timing
- Exaggeration
- Solid Drawing
- Appeal

Introduced to the computer animation community in 1987 in a SIGGRAPH course by John Lasseter
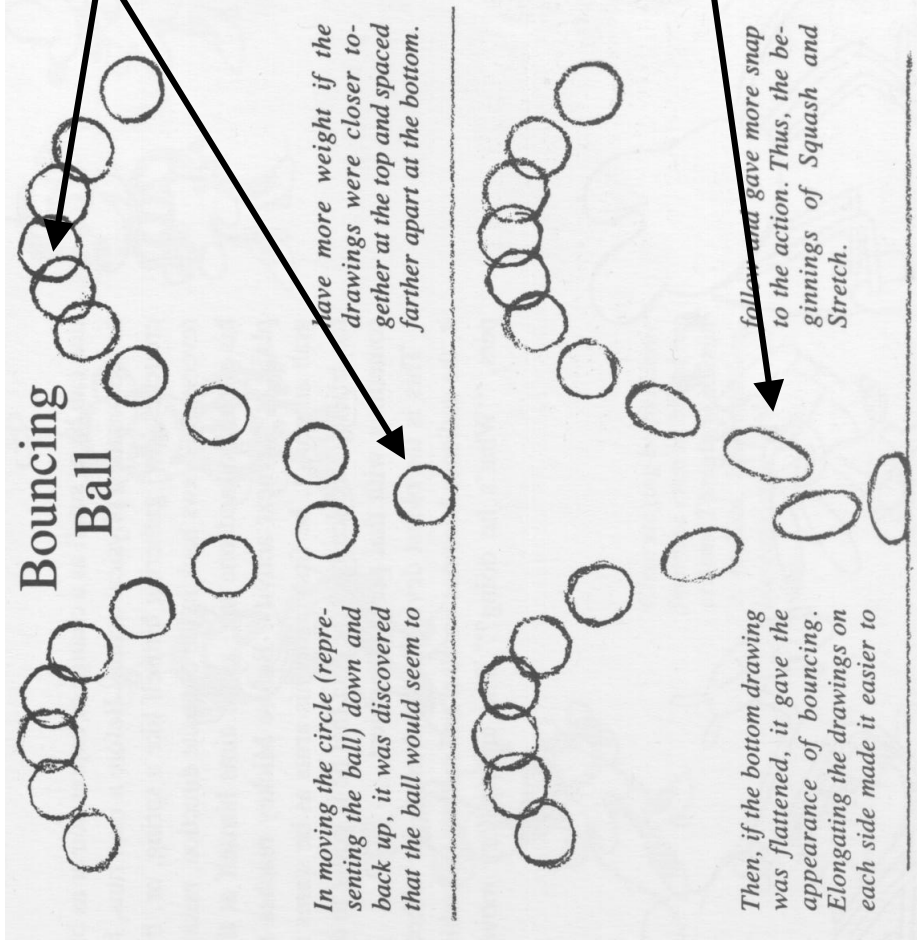
The flour sack

- Characters composed of living flesh do not move rigidly (muscle flex, skin sags, etc)
- Preservation of volume is key
- Disney animators demonstrate with a half filled bag of flour

Do we have computer-created animation that is as expressive as this?

SQUASHED & STRETCHED & TWISTED

DEJECTED   JOY   CURIOUS

COCKY   LAUGHTER   BELLIGERENT   NOEE LAUGHTER

TANTRUM   CRYING   HAPPY

The famous half-filled flour sack, guide to maintaining volume in any animatable shape, and proof that attitudes can be achieved with the simplest of shapes.
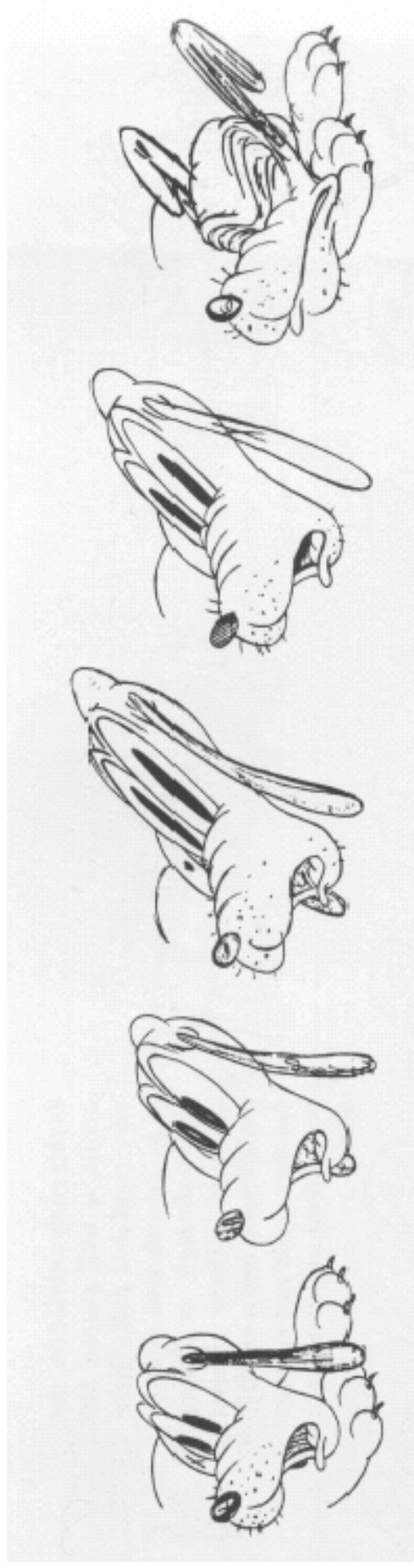
Classic Example of Squash and Stretch

Weight is given to the ball using timing

Add squash and stretch to further define the motion and show the speed of the ball

A 2D representation of motion blur

Bouncing Ball

In moving the circle (repre-senting the ball) down and back up, it was discovered that the ball would seem to

...ave more weight if the drawings were closer to-gether at the top and spaced farther apart at the bottom.

Then, if the bottom drawing was flattened, it gave the appearance of bouncing. Elongating the drawings on each side made it easier to

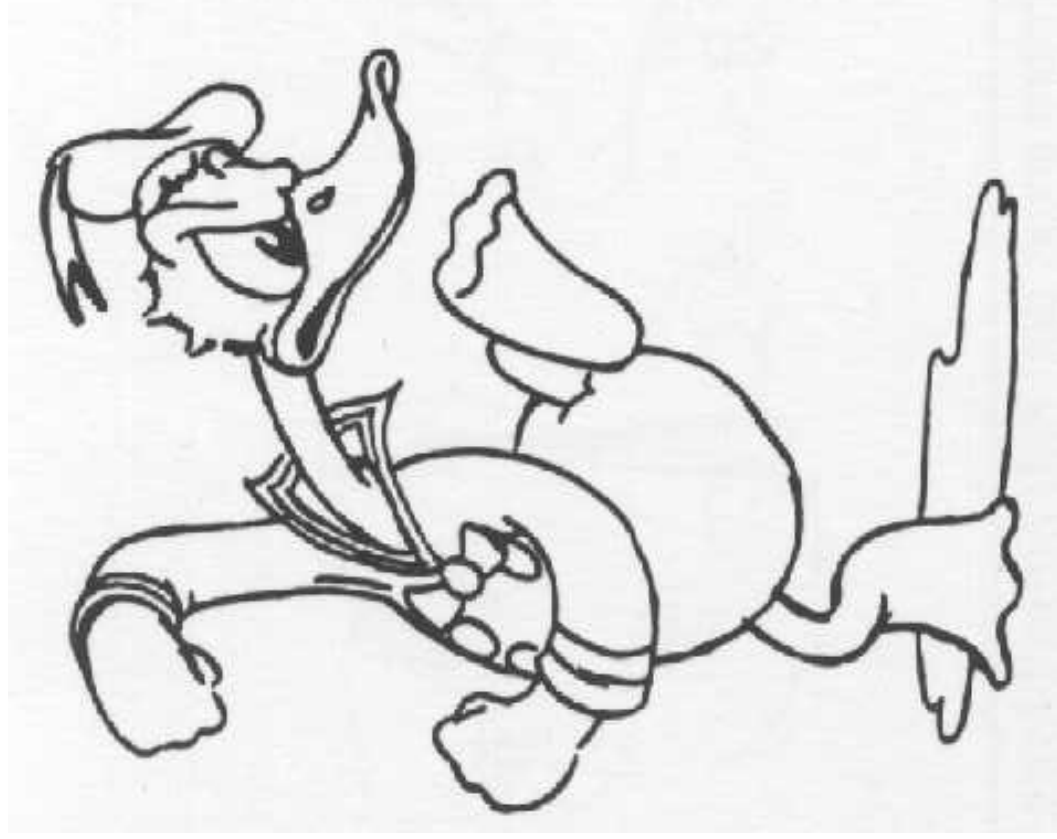*...follo...and gave more snap to the action. Thus, the be-ginnings of Squash and Stretch.*

Squash and Stretch

Approximately maintain volume...but drastically change physical characteristics over time

Anticipation and Staging

- Tell the audience what you are doing before you do it

- Can be as simple as facial expressions or as broad as the body windup

- Don't surprise your audience unless it is intentional!
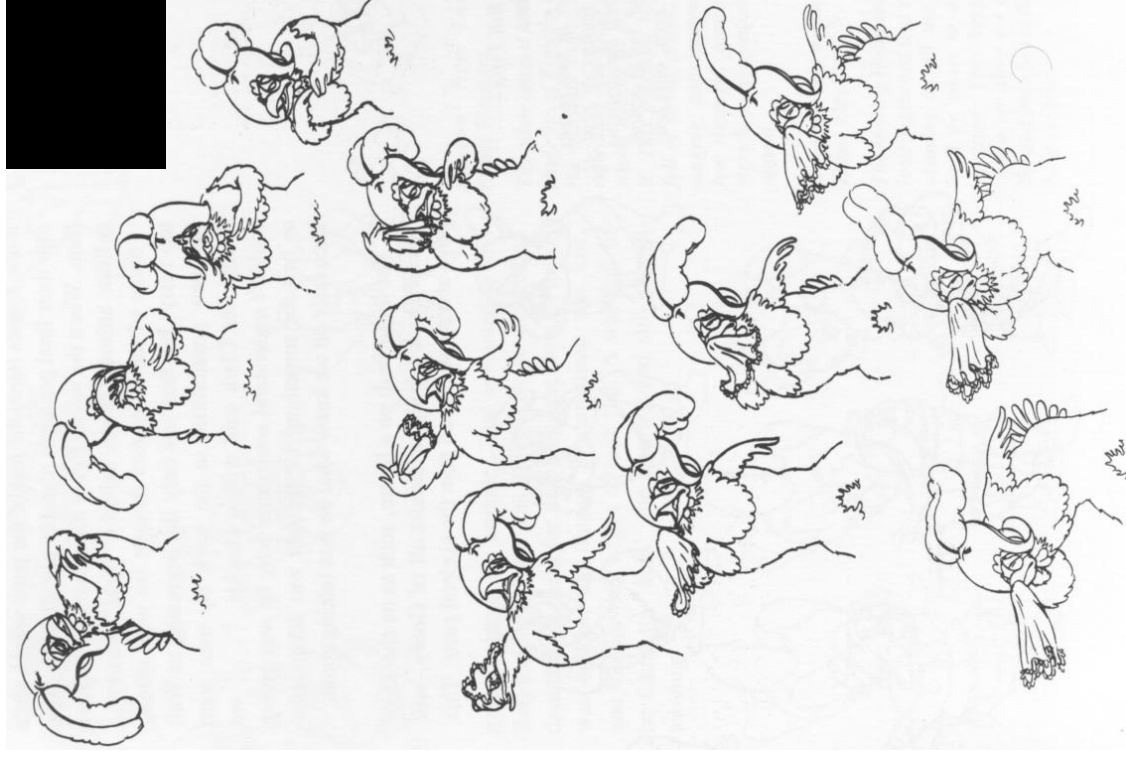
What is Donald about to do?

Straight Ahead and Pose to Pose

- Two methods of drawing a scene
- Straight Ahead Action
  - Start with an idea in mind and draw all frames until done
  - Good for frantic motion such as a character jumping around in excitement
- Pose to Pose
  - Draw the key frames first
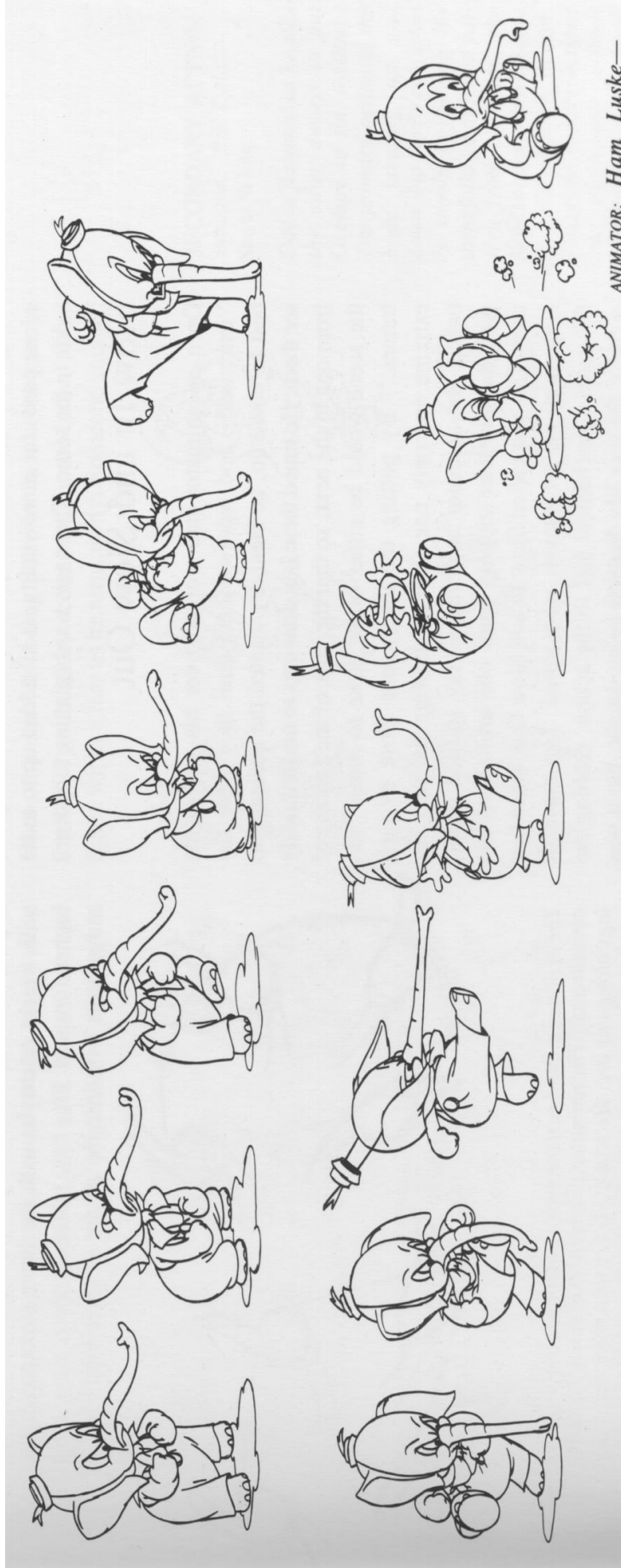 - Fill in the in-betweens

  An idea which isn't supported by computer tools

Follow Through and Overlapping Action

- Everything should not have to stop at once when a pose is reached

- The way the action is completed can tell us a great deal about a character. The opposite of anticipation...tell the audience what happened!

Follow Through

Slow In and Slow Out

- Animator specifies the primary or key frames which are most important

- In order to stress these frames, move slowly away from one key frame , quickly in the in between frames, and slowly into the next frame

- Most time is spent on/near the key frames

Arcs

- Motion in straight lines is not organic

- Most human motion happens on curved trajectories or arcs

Timing

The number of drawings determine the amount of time it takes on the screen

–no inbetweens: character hit with a huge force and his head is nearly snapped off

–two : nervous tic, muscle spasm

–five: Come on...hurry

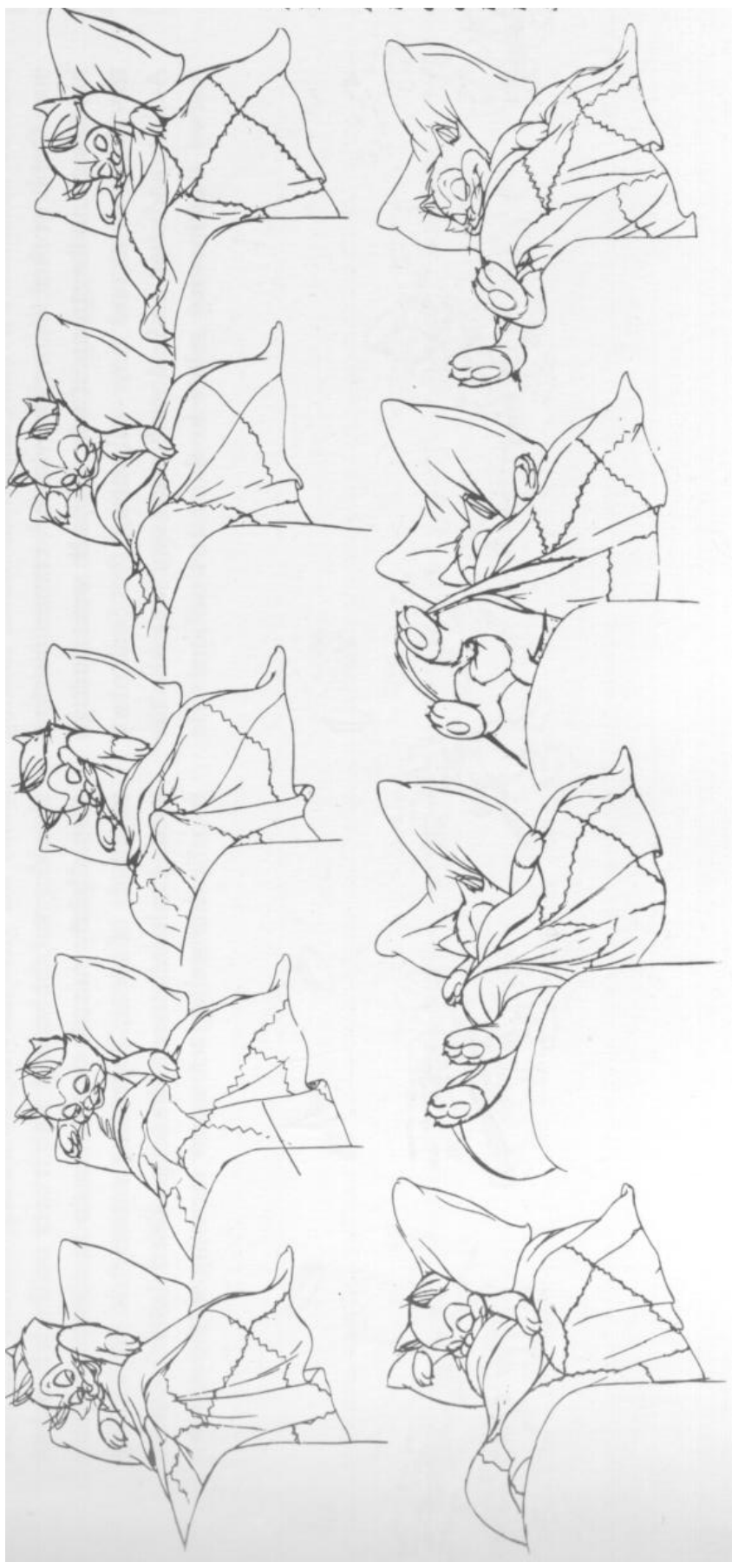–seven: tries to get a better look at something

–ten: stretches a sore neck

Exaggeration

- Walt Disney wanted exaggeration with believability

- To him, realism meant "convincing" like real people are.

- If the character was sad, make him sadder, if he was tired, make him more tired...

Secondary Action

- Action aside from that of the primary character
- Must not distract the audience

Solid Drawing and Appeal

- Animators must know how to draw before they can animate (definitely a computer analog to this one!)

- Appeal is what makes people want to look at a character...even a villain can have appeal