12 Principles of Animation
As taught by Frank Thomas and Ollie Johnston

Images assembled by: Sandee M. Chamberlain
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Kennesaw State University | School of Art & Design | Visual Arts | Animation
Frank Thomas and Ollie Johnston worked for the Walt Disney Animation Studios from 1934 to 1978 producing some of the most recognized animation of all time.
Upon retirement Frank and Ollie began to piece together a book about their experience as animators for the Walt Disney Studio. They touch on the history of animation, and give students of animation a set of principles to follow when attempting to successfully bring drawings to life. The result is a book that is an invaluable resource for the beginner and professional animator.

3. The Principles of Animation

“A new jargon was heard around the studio. Words like “aiming” and “overlapping” and “pose to pose” suggested that certain animation procedures gradually had been isolated and named. Verbs turned into nouns overnight, as, for example, when the suggestion, “Why don’t you stretch him out more?” became “Get more stretch on him.” “Wow! Look at the squash on that drawing!” did not mean that a vegetable had splattered the artwork; it indicated that some animator had successfully shown a character in a flattened posture.

Some of this terminology was just assigning new meanings to familiar and convenient words. “Doing” a scene could mean acting out the intended movements, making exploratory drawings, or actually animating it; and once it was “done,” the scene moved on to the next department. Layouts were done, backgrounds were done, recording was done, and, eventually, the whole picture had been done. Mixed in with these terms were the new names and phrases with more obscure meanings.

The animators continued to search for better methods of relating drawings to each other and had found a few ways that seemed to produce a predictable result. They could not expect success every time, but these special techniques of drawing a character in motion did offer some security. As each of these processes acquired a name, it was analyzed and perfected and talked about, and when new artists joined the staff they were taught these practices as if they were the rules of the trade. To everyone’s surprise, they became the fundamental principles of animation:

1. Squash and Stretch
2. Anticipation
3. Staging
4. Straight Ahead Action and Pose to Pose
5. Follow Through and Overlapping Action
6. Slow In and Slow Out
7. Arcs
8. Secondary Action
9. Timing
10. Exaggeration
11. Solid Drawing
12. Appeal
1. Squash and Stretch

Considered the most important discovery, squash and stretch allows organic and inorganic objects to come to life in an exaggerated manner. The squashed position can depict the form either flattened out by great pressure or bunched up and pushed together. The stretched position always shows the same form in a very extended condition. The movement from one drawing to the next became the very essence of animation.
THE BASIC BOUNCING BALL ACTION

1. As Ball falls its speed increases. Drawings are spaced further apart...
2. Notice ball stretches in falling + taking off.
3. At highest point it slows up. Drawings spaced closer. Resumes natural shape.
4. As ball hits it recoils. Becomes squashed.

NOTICE BALL follows a definite path of action. Study closely the spacing of ball along this path. Notice the basic similarity of this ball action to the hop and jump below. Also to the walk-run-leap-skip-etc.

A-C-E are like 5-7-12-14 above when character stretches. B is like recoil on 6-13 and D is like the normal 2-10-17.

STRETCH AND SQUASH ON HEADS

A cartoon head can be stretched or squashed to strengthen an expression. You will notice that the oval containing the eyes does not change greatly. Most variable is mouth area. Small details also react like the large form in which they are in.
**Aia | Expressions (Main goals: PLASTICITY & APPEAL)**

- **Neutral:**
  - In an `AIAIAIA` expression like this one, the eyes become thin as they stretch and they’re also pulled back against the teeth as they’re pulled downward by the cheeks.
  - Nose pushes affect overall eye shape (natural).
  - Cheek motion also affects the sides of the nose/nasal area slightly.

- **Smile:**
  - When there’s a smile, lips are stretched thinner and pulled in (inward) against the teeth.
  - The opposite happens here—lips thicken as they contract, and also pull forward in –z.
  - This also has the nose a bit.

- **Overall squash and stretch:**
  - When possible, with the rig, lips have neighboring areas affect each other organically, enhancing the softness, appeal and organic nature of the character.

- **Surprise:**
  - Eyes should be able to become fully round when open-wide, enhancing the sense of plasticity.
  - Pushes – compresses pull of the jaw stretches lips, nose, cheeks, and lower eyelids.
  - Iris on pupils have independent scale controls.
While it is good to have a technical mindset of what you are animating, thinking more practical and graphic can help you get your point across faster.

Symmetrical
- Having drawings leaning towards more asymmetry gives more visual interest than having a symmetrical drawing.

Asymmetrical

Technical

Practical

Think about Contrast. The easiest one to show is the Squash and Stretch principle. Use it for your character expressions too!

HARD VS SOFT
- Hard meaning things that do not change in form, or do not exaggerate shape as much.
- Soft meaning there is a lot of movement in squash and stretch. In this case, the cranium is hard and won’t change as much compared to the mouth, which is more expressive.

Determine what parts of your character are hard or soft.
2. Anticipation

An audience must be taken through a planned sequence of actions that will lead them clearly from one activity to the next. The viewer must be prepared for the next movement and expect it before it actually occurs. This is achieved by preceding each major action with a specific move that anticipates for the audience what is about to happen. This movement can be as small as a change of facial expression or as big as the broadest physical action – think about the set up for an over the top sword fight.
A man with a heavy mallet is going to throw it on an anvil.

It's slow lifting -

Back Arch Forward Again

Delay Head

It turns up remaining free

Back Arch Forward Again

Anticipates the throw by going down -

Back Arch Forward Again

Wow, I'm able to throw it.

The sound (or try accent) comes of the frame after this.

It comes on the rebound after the contact where the mallet leaves the anvil.

So we try to find all the various possibilities to convey weight visually -

Can we delay places?
Go past and slow?
Use up and down?
Break the joints?
Reverse the body arch?
Shift the weight?

Usually the anticipation is slower - less violent than the action.

Slow anticipation... ZIP! = first action

A runner - will go back before going forward.

Ready - sit - go.

Any action can be enhanced if there is an anticipation before the action.

The rule is: "Before we go one way - first go the other way."
Anticipation  (go opposite direction slightly before going forward)

Overlap and Secondary Action on the Follow-through
3. Staging

This is the most general of principles, it covers so many areas and goes back so far in the theater. The meaning however is very precise, it is the presentation of any idea so that it is completely and unmistakable clear. An action is staged so that it is understood, a personality so that it is recognizable, an expression so that it can be seen, a mood so that it will affect the audience. Each is communicating to the fullest extent with the viewers when it is properly staged.
COMPOSITION • STAGING • DRAMA

The drama portrayed by the composition first catches the eye, and then directs the eye to the center of interest by curious devices. As shown on page 170, the characters may bend forward and look at it, or the abstract design may point at it, intersect it, frame it, circle it, or bend around it (just as parentheses do). The character is accented by color difference, contrast, or tone; it is clear of detracting detail (see duck above) and isolated; and it may also balance the composition in importance.

Compositions can balance like a scale with equal heights (areas), or as a balance of interest, any small, isolated object of great importance can balance a huge object.

Characters are fit and woven together in a group with rhythm lines, straight lines that align, and areas that fit in patterns.

The alignment of character abstract lines creates circular and curved rhythm lines and the horizontals, verticals, and diagonals.

The viewer's eye level is important when he looks at grandeur or big monsters from a worm's-eye view, or when he looks down at small things.

Appreciate the value of silhouettes to define and clearly tell the story in two dimensions; even in groups they define all alone (as shown on page 178).
4. Straight Ahead Action and Pose to Pose

There are two main approaches to animation. The first is Straight Ahead Action, which means literally that you begin with the first drawing and then the second and so forth. Pose to Pose animation is where the animator will draw out key poses in an animated scene to block out the action, once the key poses are just right the animator will fill in the animation with what are called in-between drawings to polish off feel and timing.
Examples of the emotional "Johnson touch." Scary grease a pot and a bag to Ping in "Old King Cole." Delusions. "What an effect tracing can have in an animated cartoon," says Johnson.

(c) Walt Disney Company, from "The Illusion of Life"
5. Follow Through and Overlapping Action

This is the term for animation that is applied to items that are attached to a character that do not move independently. When a character entering a scene reached the spot for his next action, the character often has to come to a sudden stop. This will look stiff and not natural unless items such as clothes, hair, necklaces, tails (with the exception that a tail can also have secondary action), and so on keep moving after the character has stopped and then settle into place.
Study the delayed action of the squirrel’s tail.

From “Cartoon Animation” by Preston Blair
6. Slow in and Slow out

Based on the idea of the animator wanting to show off the extremes or key poses in an animated sequence, the animator would draw more in-betweens around these poses to draw the audiences' attention to the key pose. These drawings or movements are also about the feeling of the animation, think about the way it feels to be on a rollercoaster, as the ride reaches the arc of a hill in the track the cars slow down for effect before dropping into the next plunge.
Timing - Constant Speed

Timing - Slow Out

Timing - Slow In

Timing - Slow In & Slow Out

SLOWING OUT
EASING OUT
OR CUSHIONING IN

SLOWING IN
EASING IN
7. Arcs

Animators use arcs to make sure that the animation of a character for example looks solid and the proportions stay the same, even if squash and stretch is being applied. Arcs can be plotted everywhere a character has a joint and something that moves from that joint, for example a hand would move on an arc that is designated by the wrist and so on. In 3D animation the rotation tool has made this principle clear to use.
To get some flexibility in an arm swing, we'd drag the hand—

(1) Maintain the arc

Going this way

And coming back
ARM MOVEMENTS


THE WRIST MAINTAINS THE ARC.

WITH THE LEG, THE HEEL MAINTAINS THE ARC.
Most actions follow arcs. Generally, an action is in an arc. Most of the time the path of action is either in a wavelike arc or in a sort of figure 8:

But sometimes it is angular or straight. Straight lines give power.

And of course the bones don’t shrink and grow – they maintain their length.
8. Secondary Action

This principle deals with actions that happen in addition to the characters primary action. For example if you have a character that is walking down the street, the action of walking would be primary. If that same character raises an arm to wave at someone while they are walking, the arm movement and wave is the secondary action. The secondary action usually works to always support the primary action.
SECONDARY ACTION

ANIMATOR: Bill Tytla — Snow White.

Doc is flustered as he tells the other dwarfs to put Grumpy in the washtub. The primary action is the body jumping up and down, but Doc’s confusion is shown by having his arms follow a different pattern from his body; the head bobbing with dialogue is still another action. These secondary actions add excitement without conflicting with the basic movement.
9. Timing

Timing is everything; in an animated film there are 24 frames per second, some animators will shoot on twos meaning that for every 2 frames of film one drawing will be held, therefore for one second the animator would do 12 drawings. Animators play with timing all of the time, sometimes you hold a drawing or image for 3, 4, 1 frames and so on, until the desired look appears in the playback. Timing also has to do with the spacing of your drawings.
"CAN'T DO THIS"

"THEY"

1

"CAN'T"

2

"ME!"

3

"TO"

4

"CAN'T DO THIS"
<table>
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<th>FRAME RATE COMPARISON CHART</th>
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**Chart Description:**
- The chart compares frame rates for NTSC, PAL, and Film formats.
- Each column represents a different frame rate: 30, 15, 25, 12.5, 24, 12 frames per second.
- The rows indicate the sequence of frames.
- The diagram on the left illustrates the timing relationship between different frame rates. The sketches show the dynamic movement, emphasizing the differences in speed and rhythm for each format.
10. Exaggeration

Also known as pushing the pose, exaggeration has to do with taking an action and pushing it to the next level for clarity of story. It is what makes a drawing sometimes look “cartoony” but with great effect will get the action or expression of a character across to the audience with zero confusion to what is going on in the scene.
11. Solid Drawing

Pertaining to an artist draftsmanship skills, solid drawing has to do with the understanding of drawing. Creating a visual that becomes three dimensional on a two dimensional surface is the main goal of solid drawing. Drawing through the form and thinking about staging for your animation, does the silhouette make sense for the action and then make sure it is believable as a solid object.
This is what's called a "wooden" character.

Each eye, ear, arm, hand, finger, leg, collar, shoe, etc., looks the same as its counterpart. The result is a very stiff looking pose.

This character looks more natural simply because each part of the body varies in some way from the corresponding opposite part.

Eyes in perspective

Fingers that vary give the hands a more dynamic look.
12. Appeal

The last principle is appeal and this is one of the most important principles to learn. To have appeal the image does not always have to be what is considered a traditionally pretty or a beautiful image, villains have an appeal all their own. Basically, appeal is like the hook of a good novel it grabs an audiences attention so they will stick with the story, appeal in the sense of film uses unique imagery to gain attention and then wow with the actions and good storytelling.
LOONEY TUNES

THAT'S ALL FOLKS.