The 12 fundamental principles of animation
(As listed in "Disney Animation - The Illusion of Life" by Frank Thomas & Ollie Johnston)
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1. Squash & Stretch: Organic objects tend to have some degree of malleability. When forces act upon them they will deform appropriately depending on the nature, direction and degree of the forces. One important thing to remember when applying this concept to your animations is: if volume is not maintained, your object will appear to be expanding or contracting. For instance, if you squash a tennis ball vertically, it should simultaneously widen horizontally.

2. Anticipation: The setup before the main action. It lets the audience know that something is about to happen. For instance: reaching behind you with your fist before delivering a punch.


4. Straight Ahead Action vs Pose to Pose: Two methods of animating. Straight ahead involves stepping through the individual frames of your scene & manipulating them sequentially. Pose to pose involves defining the extremes and then filling in the spaces inbetween. Stop motion can only be done via Straight Ahead. Cel animation can be done either way.

5. Follow Through & Overlapping Action: Follow through is an extension of a main action. For instance, the continuation of a tennis stroke after the ball contact (the main action). Follow-through is also evident when a secondary appendage (tail, antenna) at some distance from the source of the main force is indirectly driven by it. Follow-through will occur later than the main action because the force takes longer to get there. When an object in motion changes direction, stops accelerating or stops completely, secondary parts of that object will continue in the original direction after the change in the main force. A woman's dress fluffing forward after she stops walking. A ponytail bouncing in an "S" motion when someone jumps up and down. Follow-through is often reduced if an appendage has (and uses) its own muscles. When a cat runs, the muscles of its tail often tighten to reduce follow-through & maintain balance. Overlap is the concept that not all moving parts of your body will start and end on the same frame. If you turn your head and point, your arm movement might begin before your head finishes turning. Overlap is nonexistent if the head and arm start & stop on the same frame or if the arm waits to move until the head has completed its motion. Such non-overlapped motions tend to look robotic.

6. Slow In & Slow Out: Organic motion tends to accelerate and decelerate into and out of action. (Except when met with a force that causes an abrupt stop or direction change.) This type of motion often does not apply to mechanical objects.

7. Arcs: The parts of an articulated skeleton move as a result of joint rotations. When a wrist travels from point A to point B, it gets there as a result of elbow and shoulder (etc) rotation. The motion will tend to arc because of this. It is possible to move one's wrist in a straight line but a lot of continuous compensatory adjustments in the rest of the arm are required in order to achieve this particular motion and such movements tend to look less organic (or at least more deliberate - like a straight punch). If you want a character to animate like a robot, simply ignore the concepts of arcs, overlap and slow in/slow out.

8. Secondary Action: Any motion that is secondary to the main action. Drumming your fingers on your knee while talking, ie. 2ndary actions often reveal emotional subtleties or hidden thoughts. If the 2ndary action pulls the viewer's attention away from the main action, though, it becomes the main action.

9. Timing: Varying speed of motion can indicate different types & strengths of forces. Timing can demonstrate different attitudes. Turning one's head very quickly implies a different motivation from doing so slowly. Fast walks can imply determination. Slow walks can imply depression. Metronomic timing is usually undesirable.

10. Exaggeration: Exaggeration is used to increase the readability of emotions and actions. Animation mediums don't deliver all of the same information as in real life. A video screen is not truly 3-D. Sound comes from a single source. Depth perception is not interactive. Because of the limited information being presented, it's often necessary to exaggerate what is being presented in order to effectively tell the story of a particular performance. Effective exaggeration isn't always accentuating a motion though. Significantly decreasing an action is also a type of exaggeration. Accentuating the subtleties that is. Completely stopping a character's motion for an unnaturally long period of time can demonstrate a particular emotion: Impatience or disgust, ie. Exaggeration is, of course, especially apparent in cartoon-style animation.

11. Solid Drawing: In cel animation, each individual drawing should be a successful work of art on its own. This
adds to the appeal & readability of a performance. It is also important to stay "on model". Each drawing should look like the character being presented. It is distracting when the size of a character's head is inconsistent during the course of an animation.

12. Appeal: Is the presentation of your idea pleasant to look at? (Or unpleasant if that is the intention). Are general aesthetics being effectively applied (composition, character design, color, camera angles, etc)?

And 12 more...

13. Simplicity & Readability: Don't unnecessarily overcomplicate your scene, character or performance. Do just enough to tell the story. Too much secondary and too many details can sometimes confuse the issue and make the idea being presented unclear.

14. Posing: A subset of "staging". Interesting poses are extremely important to effective & natural-looking animation. Pay attention to center of gravity issues (does your character look like he's going to fall down?). It’s usually a good idea to avoid too much symmetry in your poses. One hip is often a little higher than the other. Weight is rarely distributed evenly over both feet. How does the silhouette read?

15. Composition & Texture: If you “freeze” any individual frame in your scene, will the resulting still image be a well composed work of art? Do the elements of your scene work together visually? Are different objects moving too symmetrically? If so, is this intentional? Are your object’s trajectories too linear? Or perhaps too complex? Is there enough variety in the trajectories of the individual elements? Are important elements of your scene hidden behind less important elements? Pay attention to the overall “texture” when animating groups of objects or characters. Is there enough variation in the movements of the individual elements? Consider a school of fish or a flock of birds or a field of grass reacting to the wind. What is the overall feel of the group? Is every bird flapping its wings at the exact same frequency? Is the wind affecting every blade of grass in exactly the same manner at exactly the same time? Are the individual elements supposed to be working together? If so, are you using an appropriate amount of variation between these individuals? Are your synchronized swimmers exactly synchronized, or are there minor variations in the movements of each one?

16. Forces: An object moves when forces are applied to it. Consider where these forces are coming from. Are they being generated from within (desire, intention, muscle movement) or from without (gravity, the wind, a push from another character)? The origin, magnitude, direction & duration of these forces will dictate how your characters move. How is your character affected by these forces? Does your character resist them or does he “go with the flow”? Do multiple forces cancel out one another? Understand a force’s “attack & decay”, How powerful is the initial “hit” of the force? How long does an object continue reacting to the force? Consider the material of the object. Rubber “decays” slower than cloth.

17. Weight: Demonstrating the implied mass of a character. This is a function of the proper application of squash & stretch, anticipation, follow through, overlap, timing, exaggeration, and slow in/slow out. Whether or not a character looks especially heavy or especially light when getting up from a chair is dependent upon how these principles are applied. A heavier object requires more force to set it in motion. This is often demonstrated by increasing anticipation.Likewise, it requires more force to slow, stop or reverse the direction of a heavier object. Placement of your character’s center of gravity is an important aspect of weight. Physics rules indicate that a static object’s center of gravity must be directly above or below the average of its point(s) of suspension. For instance, when you stand on one foot, your COG needs to be directly above your support foot. Otherwise, you will begin to fall. Of course, this all changes if you are in motion. Pay attention to pivot/leverage points as well. Watch out for isolated body part movements. Even the simplest arm move often involves contributing motion from the shoulder & torso. Keeping your individual body parts appropriately working together is another way of indicating weight.

18. Non Symmetrical Motion: To maintain natural-looking performances, it is usually desirable to break up the motion of individual body parts so they are not doing the exact same thing at the exact same time. ie: when slapping your character’s hands on a table, you might want one hand to hit a frame or two before the other.

19. Details: Sometimes the difference between a good animation and a great animation comes from effective attention to detail. You never know where a viewer's eyes may be wandering. Just because the main focus of a shot is on your character's face, don't forget to animate the toes. Details like thigh muscles jiggling when a foot hits the ground add to the naturalism of a performance & can help tell the story. Keep in mind, however, that it is usually not desirable to confuse the action with too many details. (see principle #13) Watch out for technical glitches such as geometry intersections and IK “pops”. Material integrity is also an important detail to consider. Is it appropriate to squash & stretch a rigid object such as a stone? Some animators will do this as an aesthetic choice. Others prefer to follow realistic rules of physics. And don’t try to hide animation errors behind overly
detailed modeling, lighting, texture maps & particle effects. This is an undesirable variation of the “attention to
detail” concept.

20. Planning Ahead: It's always a good idea to plan out a performance before starting. Act out the motion with a
stopwatch and take down some numbers. This is very important in stop motion where it's impossible to go back
and fix an individual part of a performance after it has been filmed. It's especially important to plan ahead when
you have a deadline. Most of us rarely have the opportunity to animate by trial and error. As the carpenters say:
Measure twice, cut once.

21. Hookups & Continuity: To maintain flow and readability, each scene needs to “cut” properly with the next.
Are the spacial relationships between your characters consistent from one scene to the next? Does an object’s
trajectory look like it continues sensibly after a camera cut? Does the new camera position confuse the clarity of
the action? If you cut away from a particular action then return later, do the changes in the scene make sense with
the length of the time lapse? Do your actions overlap? Should they? Sometimes it is desirable to intentionally
break the rules of continuity, but care should be taken when doing so.

22. Acting: Animation is acting. Always keep this in mind. What is your character's motivation & emotional
state? Such information should be revealed in your performances. A shot’s story can't be told if the characters are
simply moving through the scene without any indication of intention or personality. Always ask “why?” Every
movement should have a purpose. Arbitrary motions rarely contribute anything to a character’s performance.
Contrasts are an important element in acting as well. Animating the same character with significant contrasts in
timing can imply completely different personalities & motivations.

23. Blocking/Refining: A third method of animating as opposed to Straight Ahead or Pose to Pose. This method
(very often utilized in CG) involves initially establishing the overall posing, timing and trajectories of your
character as a "blocking" phase. Details are added after these global issues are refined and approved. Similar to
the (sometimes) preferred method of painting where the overall composition and colors are established rather
abstractly and the image slowly comes together as a whole as the details are refined with smaller and smaller
brushes. As opposed to finishing one corner of the painting before moving on to another. This blocking/refining
method is especially desirable in CG so that global timing can be refined before there are a huge number of
keyframes to tweak.

24. Understanding The Principles: It's not enough to simply be able to recite these principles from memory. To
animate effectively, you must truly understand them. These principles need to be applied appropriately, and
sometimes certain ones need to be left out entirely. Squash & stretch isn't necessarily appropriate on a bowling
ball. A cat does not crouch down in anticipation before jumping up because its natural posture is already an
anticipatory crouch. If you are asked to make your character look heavier, you can only accomplish this if you
truly understand which principles need to be applied and how. Rules are made to be broken, but one must truly
understand a rule before it can be broken creatively and appealingly.

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