THE TWELVE PRINCIPLES OF ANIMATION

History
The twelve principles of animation date back to the 1920s and the early Hollywood animation studios. They were used mainly by the Disney studio, which produced a distinctive and influential style of exaggerated animation. There is an excellent video showing the principles at https://vimeo.com/93206523.

1 Squash and Stretch
Distorting the shape of an object or figure to emphasize its movement – before, during, and after an action. An example is at http://vimeo.com/6940084. In this way a ball hitting a wall squashes and flattens just as it does in real life, but when it is away from the wall and traveling fast it is unrealistically stretched along its path. This gives a greater sense of movement to the viewer.

2 Anticipation
An action occurs in three parts:

1. the preparation for the action - this is anticipation
2. the action
3. the termination of the action

Anticipation can be physical preparation, such as pulling back your foot before kicking a ball. It can also attract the viewer’s attention to the right place on the screen to prepare them for an event. A good example of this is the opening scene of Luxo Jr (you can see this at http://users.soe.ucsc.edu/~yonge/animations-pixar). The parent lamp is looking off-screen to the right and then reacts to something out of frame. This sets up the viewers to look at that side of the screen so they are prepared when the small lamp enters the scene. A properly timed anticipation enables the viewer to better understand a rapid action, e.g., preparing to run and then dashing off-screen. Anticipation can also create the perception of weight or mass, e.g., a heavy or old person might put their arms on a chair before they rise, whereas a smaller person might just stand up.

3 Staging
The objective of staging is to lead the viewers eye to where the action will occur so they do not miss anything. This means that only one action at a time should occur or else the viewers may be looking at the wrong thing. The main object should be contrasted in some way with the rest of the scene. A good example is motion, since the eye is drawn to it in an otherwise still scene. In a scene with everything moving, the eye is drawn to a still object or to one with a different color.

The animator must use different techniques to ensure that the viewer is looking at the correct
object at the correct time. For example, in Luxo Jr, the parent appears first, and so is the center of attention. Then the child bounds in, moving rapidly, so the center of attention shifts to him. At a certain point Luxo Jr stops and looks up at the parent, refocusing the attention.

### 4 Straight Ahead action and Pose-to-Pose action

Straight Ahead Action is mainly used in hand drawn animation and is produced when the animator starts at the first drawing in a scene and then draws all subsequent frames until the end of the scene. This creates very spontaneous and zany looking animation and is used for wild, scrambling action.

Pose-to-Pose Action is when the animator carefully plans out the animation, draws a sequence of poses, i.e., the initial, some in-between, and the final poses and then draws all the in-between frames (or an inbetweener or the computer draws those frames). This is used when the scene requires more thought and the poses and timing are important. A good example of pose-to-pose action is Pixar's short animation Presto; this can be found in [http://users.soe.ucsc.edu/~yonge/animations-pixar/](http://users.soe.ucsc.edu/~yonge/animations-pixar/).

### 5 Follow Through and Overlapping Action

Follow through happens after an action. When a character throws a ball its hand continues to move after the ball is released. In the movement of a complex object different parts of the object move at different times and different rates. For example, in walking, the hip leads, followed by the leg and then the foot. As the lead part stops, the lagging parts continue in motion. Overlapping means starting a second action before the first action has completely finished. This keeps the interest of the viewer, since there is no dead time between actions.

### 6 Slow In and Slow Out (Bezier)

Blender (and indeed most animation programs) defaults to Bezier interpolation between keyframes. Moving slowly away from a starting position and slowing again to come to a stop is a characteristic of most objects that have mass – arms and vehicles, for example – but is unrealistic for the definition of part of a continuing motion, such as the rotation of a clock hand or a planet. In this case the Bezier slow in, slow out motion should be replaced with Linear (even) interpolation in the Graph Editor.

### 7 Arcs

Mechanisms and creatures are made up of rigid elements with hinges between. Everything therefore moves in simple or complex arcs. If you use Inverse Kinematics to move a foot with the leg following don’t move it along a straight line; think about how it will actually move. How easy is it for you to move your hand along a precisely straight line? Arcs and Bezier interpolation are for organic characters; straight lines and linear interpolation for machines and robots.

### 8 Secondary action

Nothing happens in isolation: as a arm moves, so does the cloth of a sleeve and shoulder. When a vehicle starts, the aerial bends back and then oscillates. The tail follows the dog. A fat figure bounces as it moves. The trailing electrical of Luxo Jr follows his movement. Make sure your characters don’t look like they’re made of concrete.

### 9 Timing and Motion

The speed of an action, i.e., timing, gives meaning to movement, both physical and emotional meaning. The animator must spend the appropriate amount of time on the anticipation of an action, on the action, and on the reaction to the action. If too much time is spent, then the viewer may lose attention, if too little, then the viewer may not notice or understand the action.
Timing can also affect the perception of mass of an object. A heavier object takes a greater force and a longer time to accelerate and decelerate. For example, if a character picks up a heavy object, e.g., a bowling ball, they should do it more slowly than picking up a light object such as a basketball. Similarly, timing affects the perception of object size. A larger object moves more slowly than a smaller object and has greater inertia. These effects are done not by changing the poses, but by varying the spaces or time (number of frames) between poses.

10 Exaggeration
An extension of Squash and Stretch, the exaggeration of pose, physics, expression, and action enhances a storyline. Too much makes the animation comical, however: are you wanting the character to be taken seriously or not? Wikipedia has a useful and entertaining entry on this at [http://en.wikipedia.org/wiki/Cartoon_physics](http://en.wikipedia.org/wiki/Cartoon_physics).

11 Solid drawings
Make your drawn character appear to inhabit a 3D world. For 2D animators this system is developed using turnaround sheets; search for this on Google to find examples.

12 Appeal
Creating a design or an action that the audience enjoys watching. Appeal means something that the audience will want to see. This is equivalent to charisma in a live actor. A scene or character should not be too simple (boring!) or too complex (can’t understand it). One principle to achieve this is to avoid mirror symmetry. Asymmetry tends to be more interesting and appealing, within limits. Again referring to Luxo Jr., the smaller lamp is appealing because of its size, its enthusiasm, and its character.

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