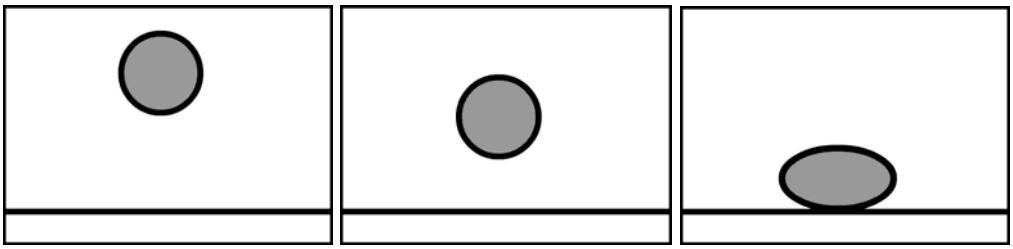
Animation Principles

The following 12 animation principles are those distilled from the combined wisdom of animators over several decades. Animators developed their own techniques in animating characters, and when these techniques were recognised as being effective, they were passed on to other animators. The principles were defined in the book *The Illusion of Life: Disney Animation (1981).*

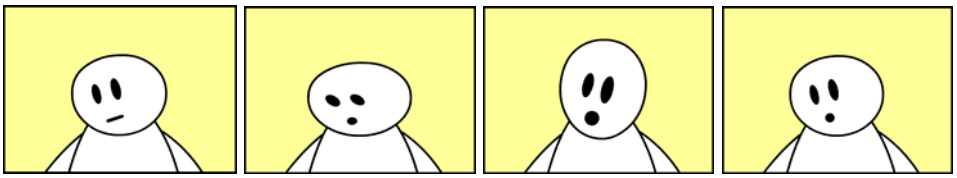
Although the principles were developed for traditional hand-drawn animation, they remain true for computer based animation, be it two dimensional or three dimensional.

Squash and stretch

This principle is used to convey a sense that an animated object has weight and volume. Imagine a ball bouncing up and down. As the ball strikes the ground it squashes downwards and stretches outwards to the sides, forming an oval shape. This principle can be applied to all manner of objects, particularly when they are in motion and strike another object or come to a sudden halt.



A bouncing ball squashes on its vertical axis and stretches on the horizontal axis as it strikes the ground.

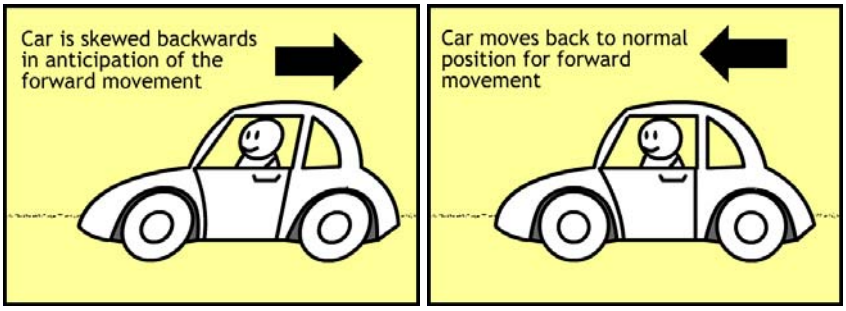


In the above example Mister Moonface is alarmed when opening a package. Squashing and stretching his face adds to the emotion in the scene. First his face

is squashed downwards, and then stretched upwards before returning to its normal shape.

Anticipation

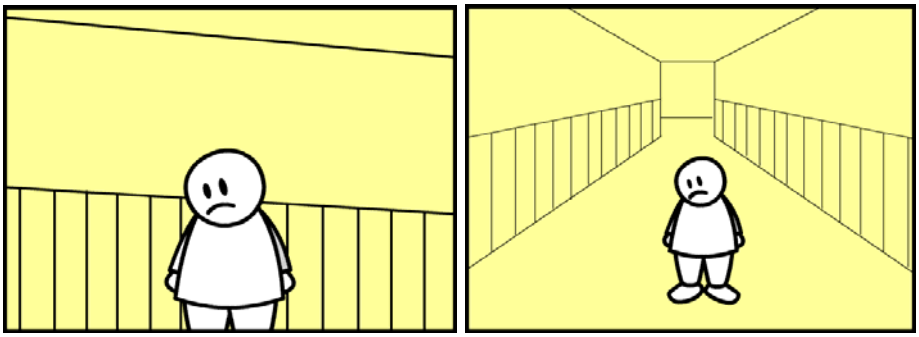
Prior to performing a major action, a character will perform an action as s/he prepares to perform the major action. For example a jumping character may bend down prior to jumping in the air. Another example is when a golfer performs a backstroke, prior to performing a forward stroke to strike the ball.



In the frame on the left, Mister Moonface' car pulls back slightly, in anticipation of moving forward.

Staging

Staging is a technique in visual storytelling. It is important to ensure that the audience can clearly see what is happening in a story, so staging a scene helps to do that. Staging can involve using different camera shots such as close-up, medium or long shots and also using different camera angles. Using different viewpoints can help to create a mood or to show a character's emotions. It is also important to ensure that a character's pose can be clearly seen and that there is no distracting background that may prevent the audience from following the storyline.



In the medium shot on the left Mister Moonface looks sad, however the long shot on the right places him in an isolated location, emphasising his loneliness and sadness.

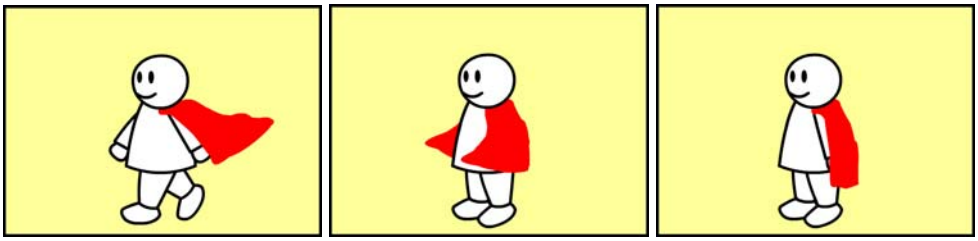
Straight Ahead Action and Pose to Pose

Straight ahead action involves drawing a series of animation frames, in turn, from the beginning through to the end. In using this technique it can be easy to lose size and proportions of a character and to accurately gauge the timing of an action, and the effect can look rushed. However, straight ahead action can be very effective, and can be used with great effect in chase or comic action scenes.

Pose to pose animation is a planned method of animating. Typically the animator draws the first and last poses of an action then draws the in-between frames. This allows the animator to control the animation better than when using the straight ahead technique; allowing better control over size, proportion and timing. The main poses or frames of the animation are known as the key frames and the frames in between are known as the in-betweens or simply 'tweens'.

Follow Through and Overlapping Action

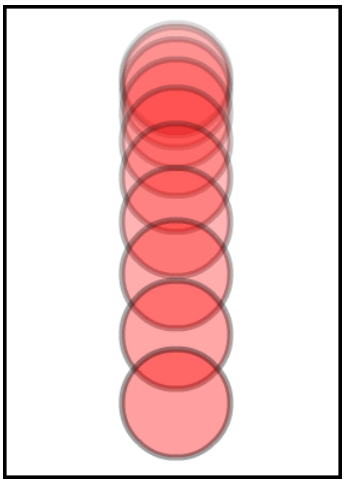
This type of action can best be described with an example. A cat character begins to run, the body moves forward, but the trailing tail of the cat may linger behind to catch up a few frames later. As the cat comes to an abrupt halt its tail continues to move forward, but again finally catches up with the cat a few frames later. This type of action occurs when parts of a character move at a slightly different rate than the main mass of the character. His type of action can be applied to clothes on a character, long hair or to other trailing items.



Mister Moonface' cape billows out behind him as he walks. When be comes to an abrupt halt, the cape continues moving forwards, wrapping around him, before falling into its natural position.

Slow In and Slow Out

Also known as 'easing' or 'ease in – ease out' this technique is used when drawing a character performing a movement. Movements tend to build in speed, starting slowly and getting faster, then slowing down to a stop. When a car starts moving, it builds up to speed, and then when it brakes it slows down before stopping. This effect can be achieved by creating more frames of animation at the start and end points of a movement, with each of the drawings less widely spaced.



This diagram shows a number of animation frames of a falling ball. As the ball falls it accelerates due to the effect of gravity. The frames at the start of the movement are close together, when the ball is falling slowly. At the end the frames are further apart as the ball is moving more quickly. This is an example of the use of the slow-in principle.

Arcs

Most actions do not occur in a straight line (except movements such as mechanical machine actions). For example a character's arms swing in a pendulum motion – in

an arc. This should be remembered when drawing the frames of a movement, whether it is a head turn, a walking character, or a more complex movement.

Secondary Action

A secondary action is an action that supports the main action of a character. For example, the main action of a walking character is the leg movements; however there will also be secondary actions such as arms swinging, head bobbing up and down or a scarf waving in the breeze. Each of these actions is secondary, supporting actions that add realism to the main action.

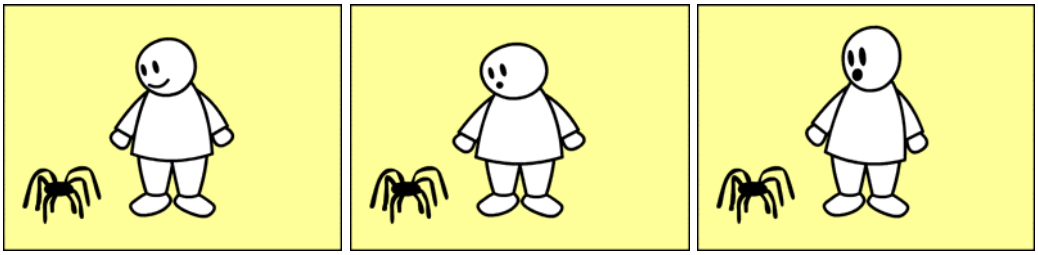
Timing

Accurately matching the timing of an action in animation is difficult to achieve without much trial and error. Many animators use video of real people and things as a reference to decide how many frames of animation are needed to accurately time a movement. Most animation is made up of frame changes on every two frames of film, which is known as animating 'on twos'. Sometimes, with fast movements, this results in a jerky motion that looks unnatural. In order to overcome this animators will draw every frame of the animation to make it appear smooth. Animating 'on twos' reduces the amount of work an animator has to do, but animating 'on ones' is sometimes required for fast movements or complex things such as accurate lip-synch for talking characters.

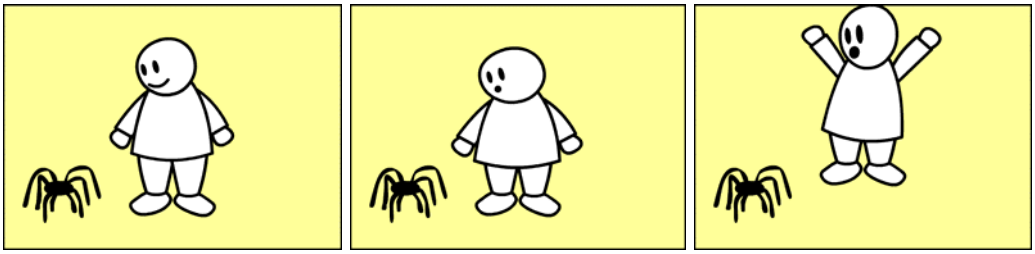
Exaggeration

Exaggeration is the use of caricature and slight exaggeration to emphasise movement and actions. Animation contains less detail than real life, so sometimes it is difficult to accurately portray expressions and emotions, so they must be exaggerated to make them more obvious. For example a character throwing a ball will lean back more than they would in real life as they wind up for the throw. As the character throws the ball and releases they will follow through with a much more exaggerated arc of motion. The principle of squash and stretch is an exaggeration in itself, as the animator will usually squash and stretch an object more than it would in real life. Exaggeration can also be applied to facial features to help portray emotions. Sometimes a character's whole body will be

exaggerated, for example when a character gets a sudden scare and jumps up in the air with fright.



In the above example Mister Moonface is startled by a spider. His reaction is to jump with fright. His facial expression is exaggerated, as are the shape of his head and the movement of his upper body.



In the second example, Mister Moonface' reaction is exaggerated even further, to the extent that he actually jumps off the floor. More extreme exaggeration is used for comic effect in cartoons.

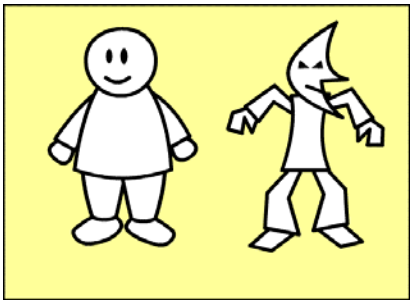
Solid Drawing

Solid drawing is using drawing techniques to make a flat object appear to be a solid three dimensional mass. This includes the use of shading and shadow to make flat two dimensional objects appear to have depth.

Appeal

Appeal is the animated character's version of an actor's charisma. Appeal does not necessarily mean attractive, it can apply to evil or villainous characters as well as heroes and animals. In animation terms, appeal means that a character is easy to read – they have a clear personality and usually some visual clues that tell the audience about the character. A simple example is a timid animal character with

wide eyes, drawn in bright colours and a villain character drawn with dark colours and beady eyes.



Mister Moonface' next door neighbour is Mister Midnight. While Mister Moonface is a happy and fun character, Mister Midnight is nasty and scheming.

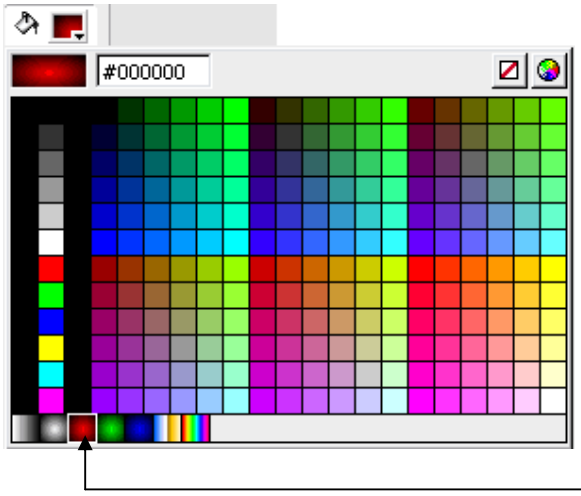
Creating a simple character animation using motion tweens

In this tutorial you will learn to create a simple animated character in Adobe Flash. The character will be a simple egg shape, with a face and you will make it jump up and down on the spot. You will create 5 keyframes and use Adobe Flash to create the tweens. You will use several animation principles in the tutorial –

- Solid Drawing to create a shaded character that looks three dimensional
- Anticipation to make the character anticipate its upwards jump
- Squash and Stretch to make the character jump more realistically
- Timing - to adjust the speed off the animation to make it look more natural

1. Open the Adobe Flash authoring tool and create a new Flash File.

2. Select the Oval Tool and set it's Fill Colour to one of the default radial gradients and it's Stroke Colour to none.

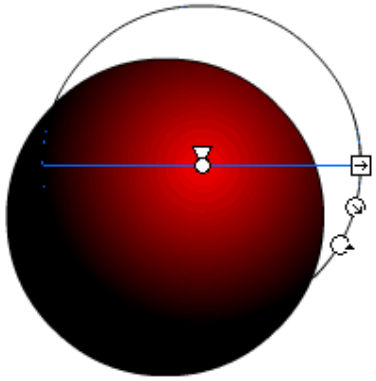


Radial Gradients are found at the bottom of the Colour Picker

3. Draw a circle shape on the bottom third of the stage.

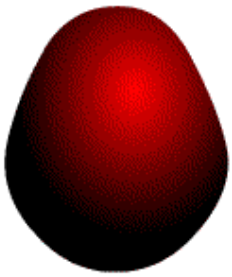
4. Select the Gradient Transform Tool (sometimes hidden under the Free Transform Tool). Select the circle you drew earlier and drag the centre point of

the gradient fill upwards and to the right. This creates a circle with shading, making it look more three dimensional.



The Gradient Transform Tool has several draggable handles that alter the position, scale and rotation of a gradient fill.

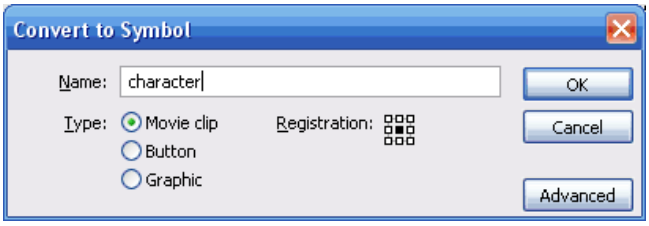
5. Select the Free Transform Tool and drag the circle to creat a more oval shape. You can also use the Selection Tool to drag parts of the edge of the oval to make a more irregular shape.



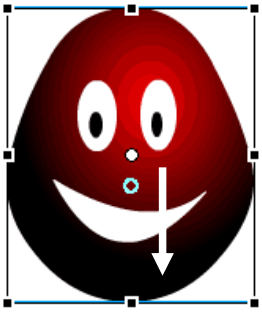
6. Select the Oval Tool again and set it's Stroke Colour to none and its Fill Colour to white. Draw a small oval on top of the original oval to create an eye. Repeat the procedure to create the character's second eye. Also use the oval tool, with the Fill Colour set to black, to draw the eye pupils. Sometime is is easier to do this when zoomed in close – use the Zoom Tool to work more closely on the drawing.

7. Use the Brush Tool, Pencil Tool or Line Tool to give the character a mouth shape.

8. Next select the whole drawing by choosing *Edit – Select All* from the menu bar. With the drawing selected, convert it to a symbol. Select *Modify – Convert to Symbol* from the menu bar. Name the symbol *character* and ensure the symbol type is set to either Graphic or Movie Clip



9. With the *Free Transform Tool* selected, drag the centre point of the drawing to the bottom centre of the drawing. This will make the drawing scale properly when we use Squash and Stretch animation principle later.



Drag the centre point down to the bottom middle.

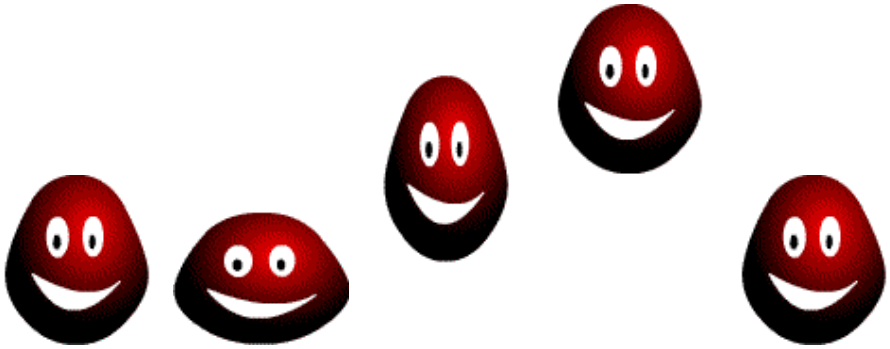
10. Next, create the keyframes of the animation. In the *Timeline*, add keyframes at frames 5, 10, 15 and 20. To do this select the frame then choose *Insert – Timeline – Keyframe* from the menu bar or press *F6*.

11. Ensure frame 5 is selected in the *Timeline*. Select *the Free Transform Tool* and drag the top middle handle on the character downwards to squash the character to about 2/3rds of its original height. Drag either the left middle or right middle handles to stretch the character outwards. This represents the character bending down, ready to spring in the air.

12. Select frame 10 in the *Timeline*. Drag the character upwards until it is about half its height off the ground. Use the Free Transform Tool to stretch the character's height and to squash its width.

13. Select frame 15 in the *Timeline* and drag the character upwards until it is own height off the ground.

14. Test the animation by choosing *Control – Test Movie* from the menu bar. A small playback window opens and you will see the keyframes being played back. The animation is very jerky as there are no in-between frames.



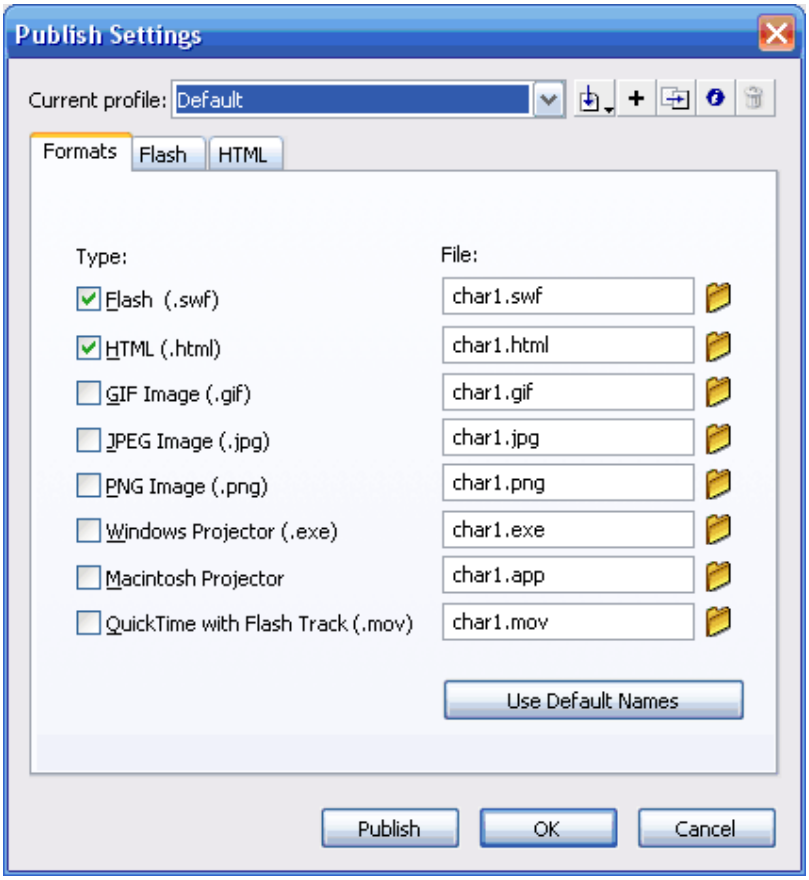
15. Next you will add tweening to your animation.

16. Select any frame between 1 and 5. In the *Property Inspector* set the Tween to *Motion*. Select any frame between 5 and 10. In the *Property Inspector* set the Tween to *Motion*. Select any frame between 10 and 15. In the Property Inspector set the Tween to *Motion*.

17. The animation is now complete. Test it by choosing *Control – Test Movie* from the menu bar. The animation will play in a small window. You will notice that the animation is quite slow, playing back at the default speed of 12 frames per second. This is too slow for this type of motion. First close the playback windows, then change the playback speed of the movie by choosing *Modify – Document* from the *Menu Bar* and setting the Frame Rate to 24. Test the movie again and the animation will look more natural.

18. Finally you should save and publish your animation. Save the file by *Choosing File – Save As* from the menu bar and choosing a suitable filename and folder. The file will save as a .fla file.

19. To publish your animation, choose *File – Publish Settings*. You will see a number of options as shown in the diagram below:



In this dialogue box you can choose how to publish your animation so that it may be shared with others. The most common method is to choose both Flash (.swf) and HTML (.html) which creates a web page with the Flash file embedded within it. Select these options and select the Publish button. The resulting files will be saved to the same folder as the Flash .fla file you saved in the previous step. In later versions of Adobe Flash the file *AC_RunActiveContent.js* is also created for compatibility with modern Web Browsers.

You can use the Help menu in Adobe Flash to find out more about the other publishing options and when you could use them.