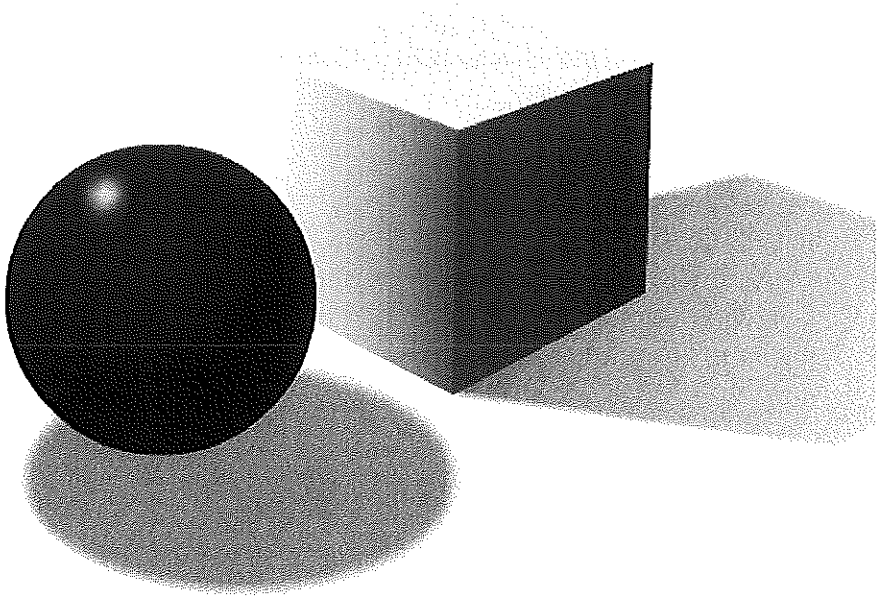
Creating the illusion of 3D in Flash



There are some simple rules about creating the illusion of depth.

- Size decreases with distance, meaning objects that are further away from the viewer appear to be smaller.
- Objects also overlap when one is in front of the other, hiding part or all of the farther object(s).
- Shading adds depth to an object by suggesting volume
- Shadows place an object in an environment.
- Blurring a background object causes a decrease in contrast and detail.
- Linear perspective is an illusion that occurs when parallel lines recede into the distance, they appear to get closer together.

Shading and Shadow

Shading adds depth to an object by suggesting volume, and shadows place an object in an environment. Both are also used together to indicate light sources in an image and help represent three dimensions in two-dimensional media.

Task - Shading a cartoon character

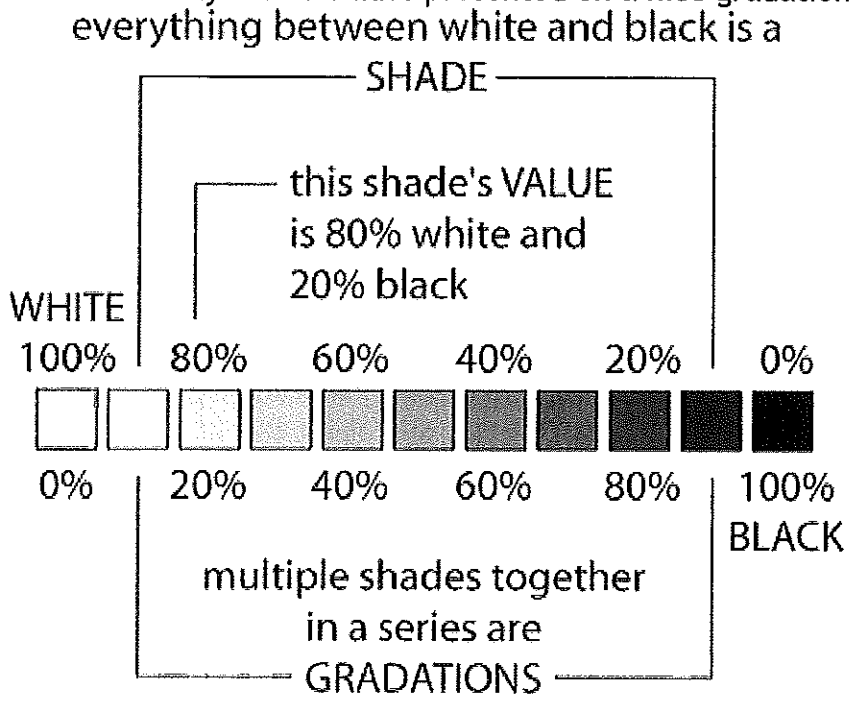
- Use the "Pencil" tool (Y) and a very different colour to draw lines to hold in the fill color. Drop in the fill color using the "Paint Bucket" tool (K) and then eliminate the stroke line by selecting it with the "Arrow tool" (V) and double - clicking on it to select all of it and then hit "delete" on your keyboard to remove the stroke.

- To create a darker tone color or lighter highlight color, open your "Color Mixer" window and using the slide bar, either drag it down to make the color darker, or raise it up to create a lighter shade.

- You can use the "Ink Bottle" tool (S) to click on a brush line to add a stroke to it. Then double-click on the stroke to select it so that you can move it and modify it. Doing this will give you a stroke line that is the exact same curve as the brush line it was taken from so you can use it as a fill line to create a tone or highlight.

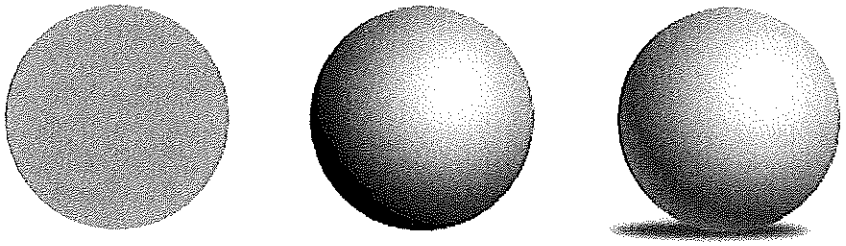
Shades, Value, and Gradations[1]

A shade is a combination of white and black to produce a particular shade of gray. All of the shades of gray between white and black are values, and when used together are also called gradations. Computers have made using value easy, with straightforward and evenly mixed values presented on a nice gradation scale.



Value is great for suggesting volume, creating spatial effects, changing mood, creating visual interest, and changing impact.

Suggesting Volume and Space



What's the difference between drawing a circle and a ball? Value. Because of the way the human brain interprets the world, value can be used to create the illusions of volume and space.

People naturally interpret that lighter values indicate a light source. By using shading our flat circle is instantly given volume, and becomes a sphere.

Shading and value can also be used to create shadows, further adding the suggestion of space and volume. Without shadows the sphere is floating in space. Lighter changes in value are also used at the far right edges of the sphere to suggest that light is being reflected back from a surface.

[1] http://www.atpm.com/9.07/design.shtml - *Quick Tips in Design* by Andrew Kator.

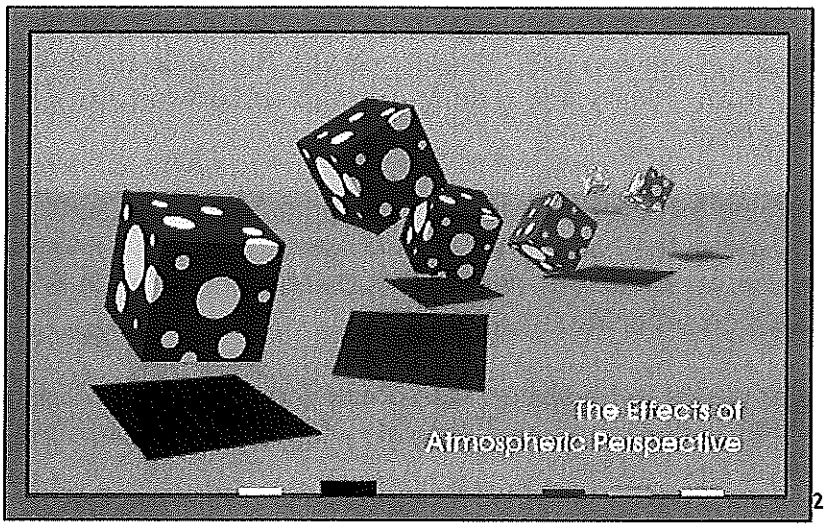
Why does the sphere with shading work to represent volume and space? The shadow matches the shape of the sphere and the shadow is off-centered to the left to match the direction of the "light source" which appears to be coming from the top-right. If the shadow were dead centered beneath the sphere, it wouldn't match the lighting direction and would be less convincing.

Task - Creating and shading balls

1. Select the oval tool and a bright colour to create a filled ball with no stroke.
2. Select a grey colour and the oval tool to create a small shadow under the ball. Place the shadow to the right side of the ball.
3. Select the fill and change it to radial gradient.
4. Select the gradient Transform tool. This tool modifies a gradient fill within a shape.
5. The centre handle moves the centre point of the gradient.
6. Based on the location of the shadow, there is a light source above and to the left of the ball. Move the gradient up and to the left side of the ball to reflect this.
7. The scale transformer is the middle handle on the right.
8. Click this and resize the gradient.
9. Insert a new layer and call it highlight.
10. Select the oval tool and draw a white oval near the top left of the ball.
11. Select the oval and convert it to a movie clip symbol.
12. Click the Filters tab in the Properties panel.
13. Add a Blur filter of about 10 to create a feathered highlight. You may need to select the highlight and rotate it into a better position.
14. Click on the shadow and repeat the movie clip - Blur filter process to create a more realistic shadow.

Background Blurring and Atmospheric or Aerial Perspective

If you have played with photography, you will know that when the camera is focused on a close object, the background may appear blurred. Blurring the background in an image simulates this effect while also decreasing contrast and detail.



[2]

Objects in the distance become obscured by our atmosphere, including humidity and particulate (dust, pollen, smoke, and pollution). This effect is called aerial perspective. Distant objects viewed through clean air will take on a blue or blue-gray color. Humidity and fog shift the color more to gray. Brown, violet, or orange can be used to mimic pollution and smoke.

Another effect from the atmosphere upon distant objects is a change in contrast. Objects viewed from a distance will have less detail and lower contrast with fewer lights and darks. Shadows, highlights, and reflections are less extreme or not present at all when viewed from a distance. Use more contrast in foreground objects and less in the background to suggest depth and focus attention. [3]

Task - Adding blur and atmospheric perspective

1. Open the *depth_cues.fla*.
2. Notice that there is a mad scientist on stage. Select him and convert him to a Movie Clip by choosing **Modify -> Convert to Symbol -> MovieClip**. Name it *mc_scientist*.
3. Add a new layer and place another instance of the movie clip on it.
4. Reposition the new instance to be just behind the original's left elbow and scale the new movie clip to 70%.
5. From the **Properties Panel**, select **Brightness** from the **Colour styles** drop down box and decrease his brightness to about 20%.
6. This time, from the **Filters Panel**, click on the + button to add a filter to the movie clip.
7. Choose **Blur** from the **Pop up** menu and set the blur to about 3 in both the X and Y directions.

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[2] http://studiochalkboard.evansville.edu/ap-aerial.html

[3] http://www.artsconnected.org/toolkit/watch_space_perspective.cfm - has a great little Flash movie which combines both linear and aerial perspective

Animating Depth
Animation is an illusion. In Flash, it can be achieved through the movement of an object's position or a change in its appearance over time. By changing content in each frame (or letting Flash change the content by designating keyframes) you create animation.

Dolly
Two familiar camera moves are the pan and the tilt. With these two moves, the camera pivots from side to side (panning) or up and down (tilting) to follow the action. No 3D effect.

However, dollying involves considerably more camera movement. When you dolly, you physically move the camera forward or backward. This movement in the z - direction creates an illusion of depth. This can be simulated in Flash by scaling multiple images on separate layers.

The front layer needs to be scaled more than the rear layers. The best effects are obtained by trial and error as well repositioning the scenes to simulate movement sideways as well as in and out.

Task - Dollying
1. Open the *landscape_dolly.fla*.
2. Notice that there is a simple alien scene with 4 layers; sky, background, middle ground and foreground on separate layers.
3. Select the foreground scene by clicking in Frame 1 of the foreground layer.
4. Convert the drawing into a **Graphic symbol**.
5. Repeat this process for the remaining scenes.
6. Go to the timeline and select the empty frame 60 and drag down to select each frame 60 in each layer.
7. Click on **F6** or choose **Insert -> Timeline -> Keyframe** to insert a keyframe at frame 60 in each layer.
8. Make the **Transform Panel** visible and select frame 60 in the foreground layer.
9. Rescale this scene to 160%.
10. Repeat this process for the middle ground and background scenes - not the sky. However, rescale these scenes less, to about 140%.
11. Click an empty frame somewhere between 1 and 60 on the foregreound layer and drag down to select all the middle and backgrounds too.
12. From the **Properties Panel**, select **Motion** from the **Tween type** drop down box.
13. Test your movie.
14. Go back and change the scaling to see any differences.
15. Reposition your scenes to make it appear like you are moving sideways as well as into the scene.

Parallax scrolling
Parallax scrolling is defined as different layers/planes of graphics and/or animation which scroll across the screen at different rates depending on their perceived relation to the viewer, creating an illusion of depth.

Objects that are in the background and furthest away appear smaller and move slower when compared to objects in the foreground that appear larger and move quickly.

This can be achieved by nesting graphic symbols within a movie clip. The reason being that movie clips have a timeline that allows them to run independently of the main movie timeline.

This allows you to create movie clips that contain images moving at different speeds across the screen.

The basic philosophy is that in the foreground, which moves fastest, you tween graphic symbols to scroll from left to right over say 60 frames in a movie clip. For the middle ground image, which moves slower, you duplicate the graphic symbol several times and tween them in a movie clip to scroll over many more frames.

Task - Parallax Scrolling

1. Open the *parallax_scrolling.fla*.
2. Notice that there is a movie clip of a walking man on stage and a tree in the library as well as 4 layers in the timeline, walker and ground which are locked and middleground and background - which we will work on.
3. Click in frame 1 of the background layer and drag a tree onto the stage.
4. Click and drag the instance of the tree to the left edge of the Stage. Center the top of the tree to the left of the stage.
5. While the tree is still selected, choose **Edit -> Copy** then **Edit -> Paste in Place**. This will duplicate the tree in the same position.
6. Click and drag the tree to the right edge of the Stage whilst holding down the Shift key to constrain vertical movement.

You need to have these trees in the same vertical position for the parallax to appear as continuous movement, both edges must match.

7. Create a forest of trees by pasting several more trees and positioning them on the Stage.

8. Select all trees and choose **Edit -> Copy** then **Edit -> Paste in Place.**
9. While they are still selected, click and drag whilst holding the Shift key to align the right most tree to the tree on the left edge of the stage.

10. Delete the tree in the middle of the forest. (on top of the left edge tree)
11. Select all trees and **Group** them.
12. Convert this group into a graphic symbol by selecting **Modify -> Convert to Symbol -> Graphic Symbol** - name it *rear_trees*
13. Nest this symbol in a movie clip by selecting **Modify -> Convert to Symbol -> MovieClip**. Name it *mc_rear_trees*.
14. Double click on the Movie Clip.
15. Insert a new keyframe on frame 60.
16. Select the row of trees on the stage and click and drag (holding Shift) and align the left most tree to the left edge of the stage.
17. Click an empty frame somewhere between 1 and 60 and from the **Properties Panel**, select **Motion** from the **Tween type** drop down box.
18. Save and test.
19. To remove the hesitation, open the Movie Clip and insert a new keyframe at frame 59 and remove frame 60 from the timeline.
20. Repeat this process with the same tree for the middle ground, but this time;
    a. scale the tree by 200% to make it larger
    b. decrease its brightness to about 35% to make it darker
    c. only use about 6 trees
    d. tween the symbol over about 40 frames to make it move faster.
21. Don't forget to correct for the slight pause in the animation.

Linear or One Point Perspective

To create effective linear perspective, you need to;

- establish a horizon line
- a vanishing point on that line, and
- multiple orthogonal, or vanishing, lines.

The horizon line is a horizontal line that runs across the page to represent the viewer's eye level and delineate where the sky meets the ground. The orthogonal lines, which distort objects by foreshortening them, create the optical illusion that objects grow smaller and closer together as they get farther away. These imaginary lines recede on the paper to meet at one point on the horizon called the vanishing point.[4]

[4] http://www.newgrounds.com/portal/view/98074 - a tutorial showing how to creating one and two point perspective.