Chapter 1

Basic Animation Concepts

What we'll cover in this chapter:

- What is animation?
- Frames and motion
- Dynamic versus static animation

Oh, how far the web browser has come! What started as a program for accessing text files over the network, soon revolutionized how we communicate and share, and has now evolved into a fully graphical, interactive programming environment. The most recent markup standard for these documents, HTML5, adds graphics capabilities that were previously available only with native applications. After a period of stagnation, modern web browsers benefit from a new wave of competition and innovation with HTML5 and JavaScript. The new canvas element provides a way to create standards-compliant games, applications, and animations that work across modern web browsers and mobile devices, including popular phones and tablets such as iPhones, iPads, and Android devices.

This book covers programming, math, and physics techniques used to make animations with the HTML5 canvas element and JavaScript. As you'll see, this provides developers with levels of power, control, and interactivity that, for the first time, are available in a standards-compliant web browser.

Before we dive into specific techniques and formulas for moving things around with JavaScript, let's take a quick look at exactly what animation is, some of the basic techniques behind it, and some concepts that you can use for your animations to make them more dynamic and interesting.

Whether this is your first time drawing with computers or you have previous experience using tools such as Adobe Flash, this book is a great guide to programmed animation. This book has undergone many changes since being ported from Flash to JavaScript, but it also demonstrates that the underlying
techniques and mathematical concepts are language-agnostic. We target the web browser here, but given modest graphics support wherever your coding environment, these formulas and examples are applicable anywhere.

Sure, you can skip this chapter if you can’t wait to write some code. But it’s strongly suggested you come back to it at some point. If nothing else, you’ll find some insights into how animation works.

**What is animation?**

Animation is motion. Motion is a change in the position of an object over time—one minute it is here, the next minute it is over there—and space between those two points. By applying mathematical formulas to an object’s location, you can determine its next position and affect the behavior of the movement—breathe life into it.

But animation is not just movement, it’s change in any visual attribute: shape, size, orientation, color, etc. A ball squishes, plants grow, faces contort—something changes. Some of the earliest computer animations cycled colors to simulate movement; for instance, you can make a waterfall composed of pixels in various shades of blue that appears to alternate hues with such frequency to look like falling water, though nothing on the screen has actually changed position.

Time is a fundamental component of animation. It is the mechanism used to express change in an object from one position to the next. And without time, there is no motion—it is a still image and not an animation. Consequently, without motion, we have no sense of time, even if it is present. Take for example, a video of an empty parking garage from a security camera. Without movement, it is impossible to decide if you are watching a live stream, a frame from 5 seconds ago, or an unchanging still image. Only when a plastic bag blows across the screen are you assured that time is present and further change can occur. Without time, nothing else happens in the picture.

This brings up another point, animation keeps us interested. If something changes, our brains naturally become curious. What changed? Why did it change? Did I cause it to change? Does this change fit within the mental model I’ve constructed for this object or do I need to adjust my assumptions? Temporal media types such as music and film are compelling because, as in life, we are not sure what will happen next. We may have a general idea, and discerning these patterns is pleasurable, but we find joy in tickling the boundaries of the unexpected. Nontemporal media—images, paintings, text—do not change; we may explore the details of the work and our understanding and interpretation might change over time, but the work will not. This is what makes animation so gripping. Change is inherent to the medium; it captures a part of our experience that we are naturally attuned to. Thus, we are able to get lost in a movie for hours or enthralled by a video game for days. If something is going to happen, generally we want to know what that is.

**Frames and motion**

Animation is a process that creates the *illusion* of motion. Nearly every form of projected motion media uses *frames* to accomplish this.