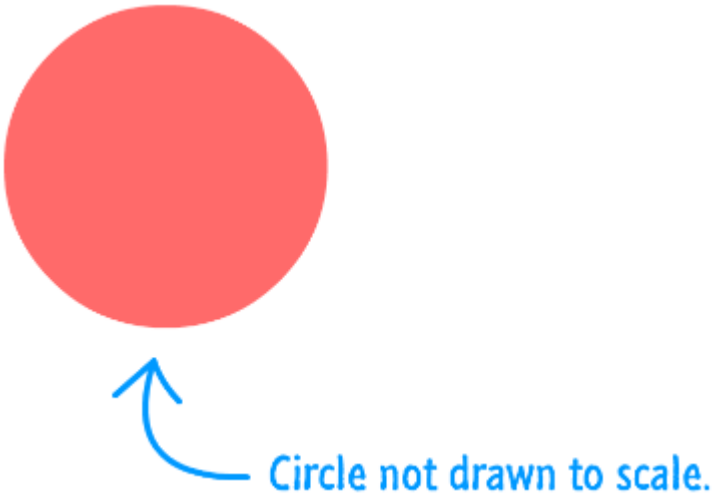
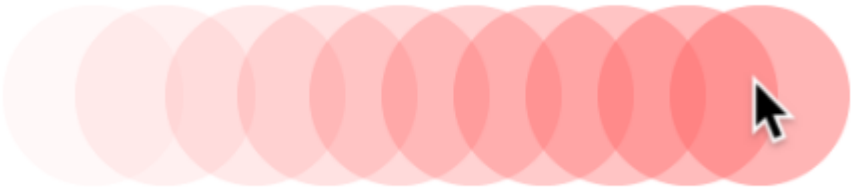
The Basic Approach

WE'LL COVER THE FOLLOWING

Before we get to the code, let's talk using English how we are going to make the circle follow our mouse. First, we all know that we need to draw ***something***, and that ***something*** will be a circle in our case:



Second, our circle is not going to be loitering around a single location inside our `canvas`. Our circle's position will change based on where exactly our mouse cursor is at any given time. This means that we need to redraw our circle each time the mouse position changes:



You put these two things together, you have the example that you see. Now, as you may have imagined going into this section, this example isn't a particularly hard one to wrap your head around. That doesn't mean there is nothing exciting going on behind the scenes, though. When we look at the JavaScript in the next few sections, we'll touch upon some things that you may not have realized were relevant for this example.

Getting Started

You probably know the drill by now, but the first thing we need is an HTML page with a canvas element ready to run. If you don't already have a page ready, then put the following into a blank HTML page:

```
<!DOCTYPE html>
<html>

<head>
  <title>Canvas Follow Mouse</title>
  <style>
    canvas {
      border: #333 10px solid;
    }

    body {
      padding: 50px;
    }
  </style>
</head>

<body>
  <canvas id="myCanvas" width="550px" height="350px"></canvas>

  <script>
    var canvas = document.querySelector("#myCanvas");
    var context = canvas.getContext("2d");

  </script>

</body>

</html>
```

If you preview this page in your browser, you'll notice that there really isn't much going on here. There is a `canvas` element, and this element has the **id** value of **myCanvas**. As a timesaver, I provide you with the two lines of code needed to access the `canvas` element and its rendering context. If all of this is new to you, take a few moments and review the Getting Started with the Canvas tutorial, for the rest of what you will see will assume you have a basic understanding of how to do things on the `canvas`.

Drawing the Circle

The first thing we are going to do is draw our circle. Inside your `script` tag, add the following code after where we have the line with the `context` variable:

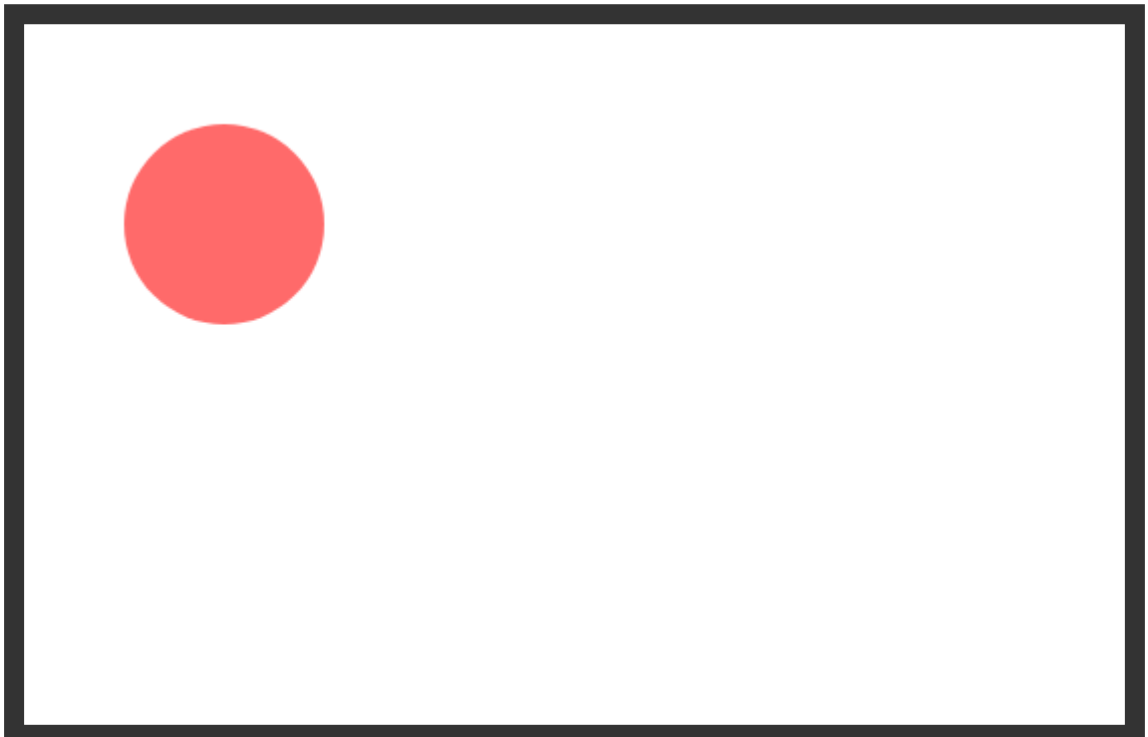
HTML JavaScript

javascript

```
var canvas = document.querySelector("#myCanvas");
var context = canvas.getContext("2d");

function update() {
  context.beginPath();
  context.arc(100, 100, 50, 0, 2 * Math.PI, true);
  context.fillStyle = "#FF6A6A";
  context.fill();
}
update();
```

output



All we are doing here is defining a function called `update` that contains the code for drawing our circle. Note that we not only define the `update` function, we also invoke it as well right afterwards. This means that if you test your page in the browser, you will see something that looks as follows:

Our circle has a radius of 50 pixels and is positioned at the (100, 100) mark. For now, we are going to keep the position of the circle fixed. That won't last for long as you'll see shortly once we get the mouse position!

Getting the Mouse Position

The next step is where the magic happens. We are going to add the code that deals with the mouse. There are two parts to this code. The first part is listening for the mouse movement on the `canvas` element and storing that mouse position somewhere accessible. That is easy. The second part is ensuring our mouse position takes into account the position of our `canvas` element. That is less easy, but one we looked at in the Working with the Mouse article. We'll tackle both of these parts in the next two sections.

Listening for the Mouse Event

Let's look at the code for the first part...um...first. Go ahead and add the following code just above your `update` function:

```
var mouseX = 0;
var mouseY = 0;

canvas.addEventListener("mousemove", setMousePosition, false);

function setMousePosition(e) {
  mouseX = e.clientX;
  mouseY = e.clientY;
}
```

What this code does is pretty straightforward. We are listening for the **mousemove** event on our `canvas` element, and when that event is overheard, we call the `setMousePosition` event handler function thingaroo:

```
function setMousePosition(e) {
  mouseX = e.clientX;


  mouseY = e.clientY;
}
```

All the `setMousePosition` function does is assign the current horizontal and vertical mouse position to the `mouseX` and `mouseY` properties. It does that by relying on the `clientX` and `clientY` properties that the `MouseEvent`-based event argument object provides.

Getting the Exact Mouse Position

The mouse position stored by the `mouseX` and `mouseY` properties currently only store the position from the **top-left corner of our browser window**. They don't take into account where the `canvas` element is located on the page, so the mouse position values we have right now are going to be inaccurate. That is not cool.

To fix that, we have the `getPosition` function that we saw earlier:

```
function getPosition(el) {
  var xPosition = 0;
  var yPosition = 0;

  while (el) {
    xPosition += (el.offsetLeft - el.scrollLeft + el.clientLeft);
    yPosition += (el.offsetTop - el.scrollTop + el.clientTop);
    el = el.offsetParent;
  }
  return {
    x: xPosition,
    y: yPosition
  };
}
```

Add this function towards the bottom of your code below the `update` function. You can put this function towards the top if you want, but I generally prefer helper functions like this to be towards the bottom of our code...and out of sight!

Anyway, the way you use this function is by passing in the element whose position you are interested in. This function then returns an object containing the x and y position of the element. We will use this function to figure out where our `canvas` element is on the page and then adjust our `mouseX` and

`mouseY` values accordingly.

To use the `getPositio`n function and fix the `mouseX` and `mouseY` values, make additions and modifications in line 1 and 8-9.

```
var canvasPos = getPosition(canvas);
var mouseX = 0;
var mouseY = 0;

canvas.addEventListener("mousemove", setMousePosition, false);

function setMousePosition(e) {
  mouseX = e.clientX - canvasPos.x;
  mouseY = e.clientY - canvasPos.y;
}
```

The `canvasPos` variable now stores the position returned by our `getPosition` function. In the `setMousePosition` event handler, we use the returned x and y values from `canvasPos` to adjust the value stored by the `mouseX` and `mouseY` variables. Phew!

Moving the Circle

In the previous section, we got the mouse code all setup with the `mouseX` and `mouseY` variables storing our mouse's current position inside the `canvas`. All that remains is to hook these values up with our drawing code inside the `update` function to have our circle's position reflect the mouse position.

First, we are going to turn our boring update function into the target of a `requestAnimationFrame` callback. This will ensure this function gets sync'ed up with our browser's drawing rate (around 60 times a second). This is a very simple modification. Go ahead and add the line 7 towards the bottom of the `update` function:

```
function update() {
  context.beginPath();
  context.arc(100, 100, 50, 0, 2 * Math.PI, true);
  context.fillStyle = "#FF6A6A";
  context.fill();

  requestAnimationFrame(update);
}
update();
```

What we are going to do next is pretty epic. We need to update our circle

drawing code to use the `mouseX` and `mouseY` values instead of using the fixed

(100, 100) position that we specified initially. Make the change in line 7 to the `context.arc()` call:

```
function update() {
  context.beginPath();
  context.arc(mouseX, mouseY, 50, 0, 2 * Math.PI, true);
  context.fillStyle = "#FF6A6A";
  context.fill();

  requestAnimationFrame(update);
}
update();
```

HTML JavaScript

javascript

```
1  var canvas = document.querySelector("#myCanvas");
2  var context = canvas.getContext("2d");
3
4  var canvasPos = getPosition(canvas);
5  var mouseX = 0;
6  var mouseY = 0;
7
8  canvas.addEventListener("mousemove", setMousePosition, false);
9
10 function setMousePosition(e) {
11   mouseX = e.clientX - canvasPos.x;
12   mouseY = e.clientY - canvasPos.y;
13 }
14
15 function getPosition(el) {
16   var xPosition = 0;
17   var yPosition = 0;
18
19   while (el) {
20     xPosition += (el.offsetLeft - el.scrollLeft + el.clientLeft);
21     yPosition += (el.offsetTop - el.scrollTop + el.clientTop);
22     el = el.offsetParent;
23   }
24   return {
25     x: xPosition,
26     y: yPosition
27   };
28 }
29
30 function update() {
31   context.beginPath();
```

output

Your circle is following the mouse position (rock on!), but your circle's earlier positions aren't being cleared out (sigh!). While this creates a cool finger painting effect, that isn't quite what we were going for. The fix is to clear out everything in the `canvas` before drawing our circle at its new position, and that is much more simple than it sounds.

To make this fix, go ahead and add the line 2 of code towards the top of the `update` function:

```
function update() {
  context.clearRect(0, 0, canvas.width, canvas.height);

  context.beginPath();
  context.arc(mouseX, mouseY, 50, 0, 2 * Math.PI, true);
  context.fillStyle = "#FF6A6A";
  context.fill();

  requestAnimationFrame(update);
}
```

The line we added contains a call to the `clearRect` method, and this method is

responsible for clearing all pixels from a `canvas` region. The way we use it is

by passing in the dimensions of the region we want to clear, and what we do is pass in the full dimensions of our `canvas` to get everything cleared out:

```
context.clearRect(0, 0, canvas.width, canvas.height);
```

This ensures that our circle is being drawn onto a blank surface with no traces of earlier draw operations remaining. If you preview your page in your browser at this point, our example should work perfectly.

HTML JavaScript

javascript

```
var canvas = document.querySelector("#myCanvas");
var context = canvas.getContext("2d");

var canvasPos = getPosition(canvas);
var mouseX = 0;
var mouseY = 0;

canvas.addEventListener("mousemove", setMousePosition, false);

function setMousePosition(e) {
  mouseX = e.clientX - canvasPos.x;
  mouseY = e.clientY - canvasPos.y;
}

function getPosition(el) {
  var xPosition = 0;
  var yPosition = 0;

  while (el) {
    xPosition += (el.offsetLeft - el.scrollLeft + el.clientLeft);
    yPosition += (el.offsetTop - el.scrollTop + el.clientTop);
    el = el.offsetParent;
  }
  return {
    x: xPosition,
    y: yPosition
  };
}

function update() {
    context.clearRect(0, 0, canvas.width, canvas.height);
```

output

Why use requestAnimationFrame?

You may have noticed that all of our drawing-related code is inside the `update` function that is looped by the `requestAnimationFrame` function. There is no animation going on here. We are just moving our mouse cursor around, and we want to update our circle's position only when the mouse cursor positions. Given all that, why wasn't all of our drawing code inside the **mousemove** event handler instead? That would look something like the following:

```
canvas.addEventListener("mousemove", setMousePosition, false);

function setMousePosition(e) {
  mouseX = e.clientX - canvasPos.x;
  mouseY = e.clientY - canvasPos.y;

context.clearRect(0, 0, canvas.width, >canvas.height);

context.beginPath();
```

```
  context.arc(mouseX, mouseY, 50, 0, 2 * Math.PI, true);
  context.fillStyle = "#FF6A6A";

  context.fill();
}
```

If you were to make this change (and get rid of the `update` function completely), our example will still work. Our example may even work just as well as our `requestAnimationFrame` approach.

The reason has to do with us helping our browser not do unnecessary work and doing the “right” thing since our **end goal** is to draw something to the screen. When it comes to drawing things onto the screen, we want to be in-sync with when the browser is ready to paint the pixels. The **mousemove** event has no idea when the browser is ready to draw to the screen, so our event handler will unnecessarily try to force your browser to paint the screen. The only way to avoid that is to do what we did and use the `requestAnimationFrame` function.

We separated the code for updating our mouse position from the code for actually drawing to the screen. This ensures that we only draw our new circle when the browser is ready. When the circle is about to be drawn, we ensure that the mouse position at that time is as accurate as possible. Win. Win. Win. (Yes, it’s a rare triple win situation!)