COMP4021
Internet Computing

More on SVG

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Grouping and Gradients

- You have learned the basics of SVG, i.e. the shapes (lines, rectangles, circles and so on) that you can use for drawing, in the previous discussion

- In this presentation, we will introduce grouping and how to use gradients to improve the images

Grouping Things Together

- At the moment, your SVG shapes are added one by one in the SVG file

- If you have many of them, it will be hard to manage

- You can group SVG things together using the `<g>` tag to have a better organization of the SVG content

```
<svg ...>
  <rect ...>
  <circle ...>
  <circle ...>
  <circle ...>
  <circle ...>
  <circle ...>
  <path ...>
  <path ...>
  <circle ...>
  .
  .
  .
</svg>
```

Many more shapes here

Creating Groups

- Here is an example with two groups of ellipses:
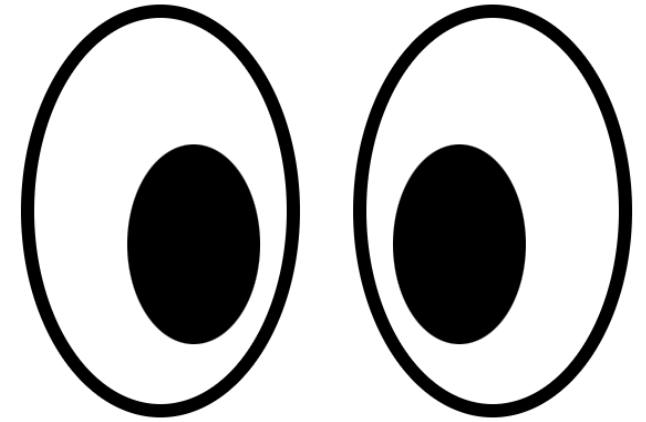
```
<svg xmlns="http://www.w3.org/2000/svg"
    width="300" height="200">
  <g id="right-eye">
    <ellipse ... />
    <ellipse ... />
  </g>
  <g id="left-eye">
    <ellipse ... />
    <ellipse ... />
  </g>
</svg>
```
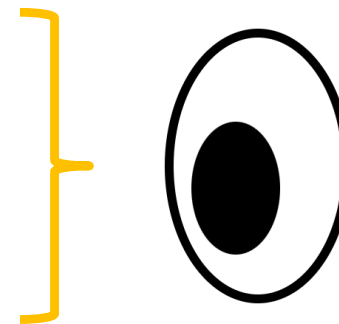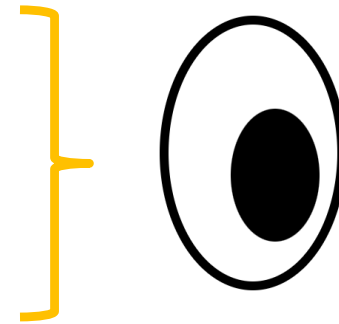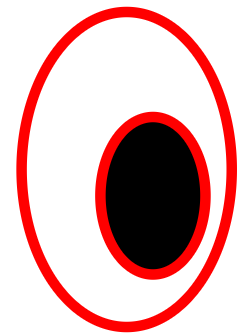
Ellipses are similar to circles except that they have two radii `rx` *and* `ry`

Other Use of Groups

- If you put SVG things into groups, you can also do these easily:

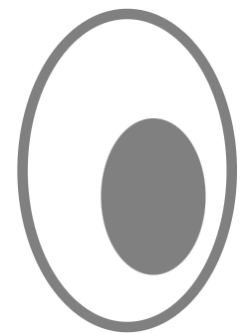 - Applying CSS properties to a group of SVG shapes, e.g.:

```
<g id="right-eye"
   stroke="red"
   stroke-width="4">
  <ellipse ... />
  <ellipse ... />
</g>
```

  - Writing JavaScript code for an SVG group, e.g.:

```
$("#right-eye").css("opacity", "0.5");
```

Defining Things in SVG

- You can define things in a 'definitions' area of SVG

- Those things can then be used in the rest of the SVG (as many times as you want)

- Here are some useful things you can define:

  - Gradients
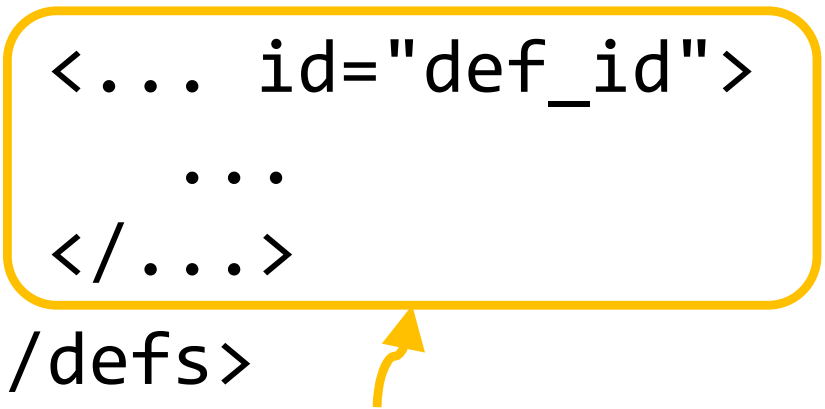 - Patterns
  - Clipping paths
  - Filters

We will briefly look at gradients in this discussion

The `<defs>` Area

- You first define something you want to use in the `<defs>` area, with a specific id

- An SVG element can then use the defined thing by referring to that id

```
<svg ...>
  <defs>
    <... id="def_id">
      ...
    </...>
  </defs>
  <...  #def_id  ... />
</svg>
```

SVG Gradients

- The SVG `fill` attribute we have used so far is a solid flat colour, for example:

```
<rect width="700" height="100"
      x="50" y="50" fill="blue" />
```
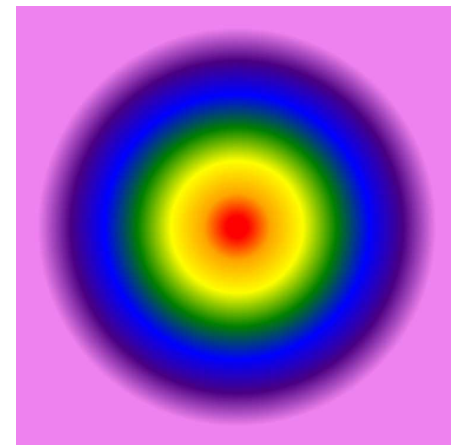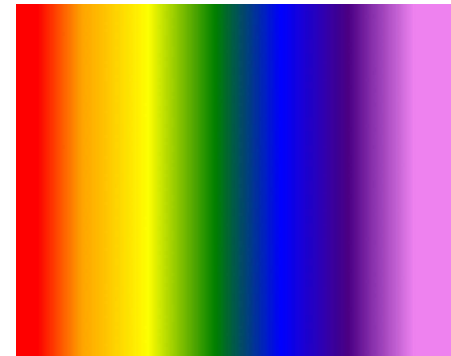
- Using SVG gradients you can create a smoothly changing gradient of colours in the colouring of SVG elements

Two Types of Gradient
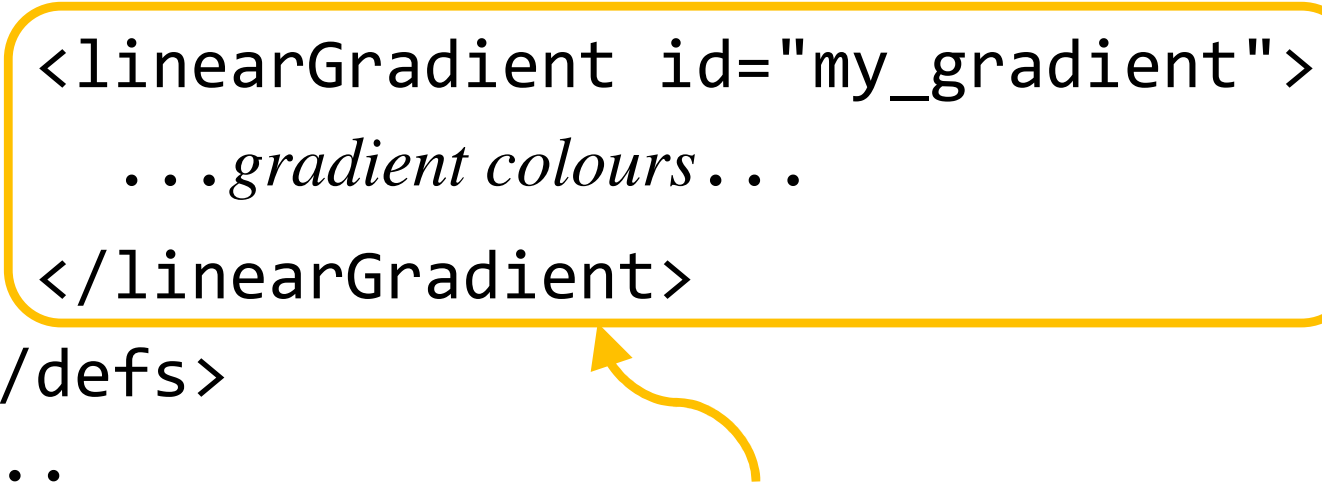
- There are two types of SVG gradient:
  - *Linear gradients*, that change colour linearly along a line

  - *Radial gradients*, that change colour from the centre of a shape and radiate outwards

Using the Defs Area

- The gradients are defined in the `defs` area and then referred to using their ids

```
<svg ...>
  <defs>
    <linearGradient id="my_gradient">
      ...gradient colours...
    </linearGradient>
  </defs>
  ...
  <... fill="url(#my_gradient)" .../>
  ...
</svg>
```

Gradient Colours

- The content of a gradient is a list of colours defined in different positions

- Each colour is specified by the `stop` tag with a particular `offset` and `stop-color`
  - Offset is the positioning of the colour from 0 to 1
  - Stop colour is the colour used at that position

- For example, here is a red colour positioned at 50% of a gradient:

```
<stop offset="0.5" stop-color="red" />
```

A Simple Linear Gradient

- A simple black and white two-colour gradient can be created like this:

```
<linearGradient id="gradient">
    <stop offset="0" stop-color="white" />
    <stop offset="1" stop-color="black" />
</linearGradient>
```

- Applying the above gradient to a rectangle results in the fill colour shown on the right

A Simple Radial Gradient

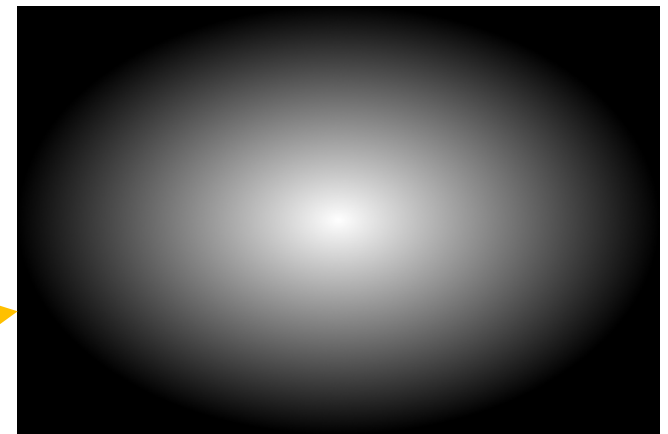- The previous example can be easily changed to a radial gradient like this:

```
<radialGradient id="gradient">
    <stop offset="0" stop-color="white" />
    <stop offset="1" stop-color="black" />
</radialGradient>
```

- Applying the gradient to the same rectangle makes the result on the right
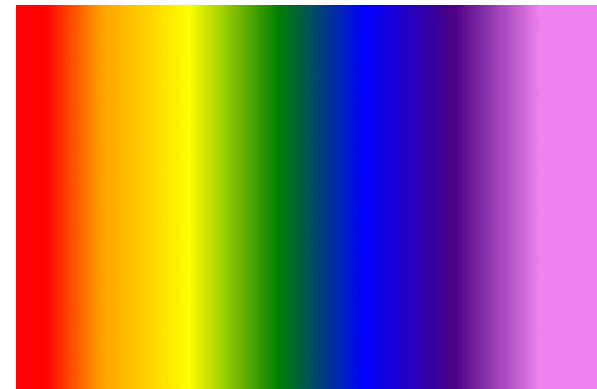

The radial gradient has an oval shape if the SVG element does not span a square area

A Rainbow Gradient

- With more colours you can create a highly varied gradient such as the rainbow colour shown below:

```
<linearGradient id="gradient">
    <stop offset="0.05" stop-color="red" />
    <stop offset="0.15" stop-color="orange" />
    <stop offset="0.3"  stop-color="yellow" />
    <stop offset="0.45" stop-color="green" />
    <stop offset="0.60" stop-color="blue" />
    <stop offset="0.75"
         stop-color="indigo" />
    <stop offset="0.9"
         stop-color="violet" />
</linearGradient>
```

Rainbow Radial Gradient

- Similarly, the rainbow can become a radial gradient like this:
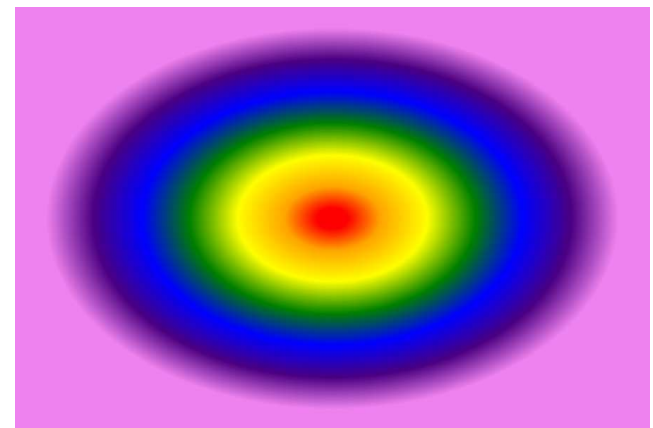
```
<radialGradient id="gradient">
    <stop offset="0.05" stop-color="red" />
    <stop offset="0.15" stop-color="orange" />
    <stop offset="0.3"  stop-color="yellow" />
    <stop offset="0.45" stop-color="green" />
    <stop offset="0.60" stop-color="blue" />
    <stop offset="0.75"
        stop-color="indigo" />
    <stop offset="0.9"
        stop-color="violet" />
</radialGradient>
```

The Line in a Linear Gradient

- A linear gradient, by default, changes its colour from left to right horizontally

- You can change the orientation of the line using a set of attributes: x1, y1, x2, y2

- These attributes specify a line within the gradient area and the change of colour then starts from (x1,y1) to (x2,y2)

- An example is shown in the next slide

Changing the Line

- In this example, the line inside the gradient starts from the top-left hand corner to the bottom-right hand corner of the area

```
<linearGradient id="gradient"
    x1="0%" y1="0%" x2="100%" y2="100%">
    <stop offset="0"   stop-color="red" />
    <stop offset="0.5" stop-color="black" />
    <stop offset="1"   stop-color="violet" />
</linearGradient>
```


(x1,y1)

(x2,y2)

Changing a Radial Gradient

- You can similarly change the way a radial gradient works, as shown below:

```
<radialGradient id="gradient"
        fx="60%" fy="60%"
        cx="20%" cy="30%" r="80%" >
    <stop offset="0"
        stop-color="black" />
    <stop offset="1"
        stop-color="white" />
</radialGradient>
```

The starting point of the gradient

The target circular area