COMP4021
Internet Computing

# Introduction to SVG

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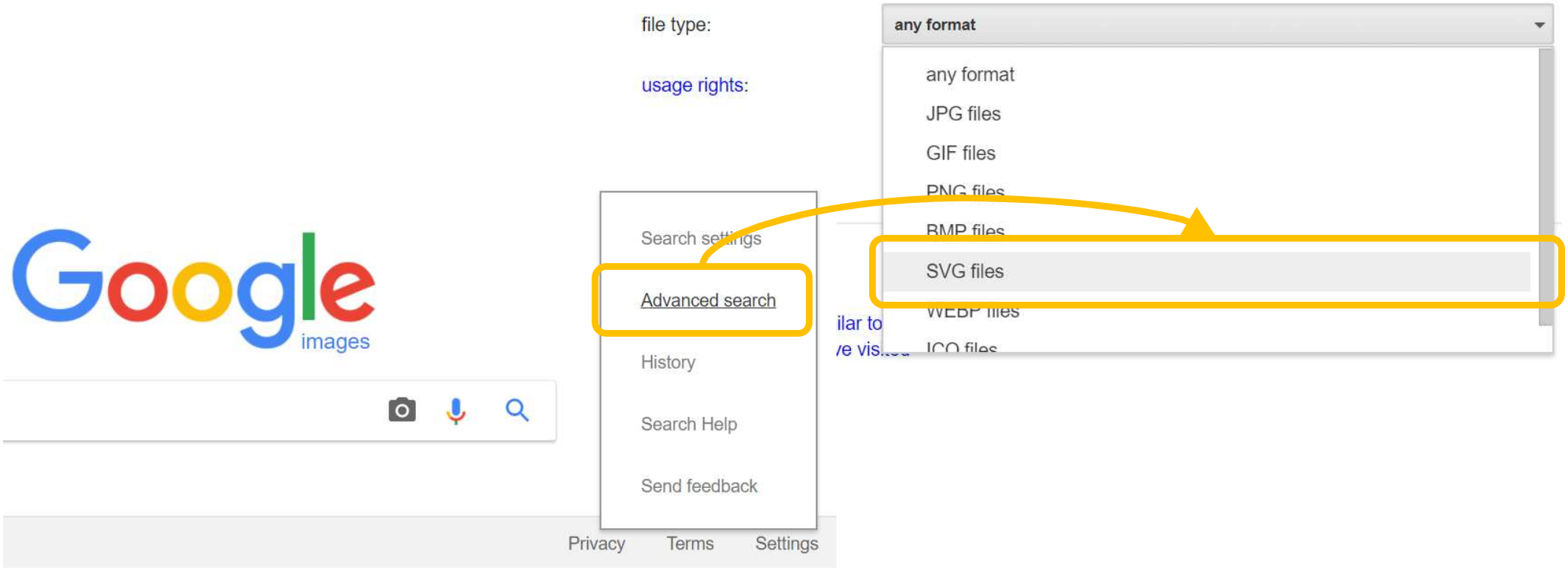
# SVG

- SVG is a vector graphics language for web pages
- You can use it to make logos, figures and charts easily
- In this presentation, we will look at how to create SVG content and the many different elements in SVG

# SVG Images on the Web

- Before we look at how you create SVG, let's see what are available on the web
- You can look for SVG images in Google by changing the search settings



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# Standalone or Embedded SVG

- SVG can be:
  - Used as a standalone file
    - Filename ends with `.svg`
  - Embedded inside an HTML file
    - Filename ends with `.htm` or `.html`

- Most examples in this discussion are standalone SVG files

# A Standalone SVG – HKUST.svg

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE svg PUBLIC
"-//W3C//DTD SVG 1.1//EN"
"http://www.w3.org/Graphics/SVG/1.1/DTD/
svg11.dtd">
<svg xmlns="http://www.w3.org/2000/svg"
     version="1.1"
     width="390" height="600"
     viewBox="0 0 390 600">

...SVG content...

</svg>
```

# Embedding SVG in a Webpage

```
<!DOCTYPE html>
<html xmlns='http://www.w3.org/1999/xhtml'>
<head>
    <title>HKUST Logo</title>
</head>
<body>
    <h1>HKUST Logo</h1>
    <svg xmlns="http://www.w3.org/2000/svg"
         version="1.1"
         width="185" height="300"
         viewBox="0 0 390 600">

    ...SVG content...

    </svg>
</html>
```

HKUST Logo

# Starting to Use SVG

- To start using SVG, you make a simple SVG ‘drawing’ area, like this:

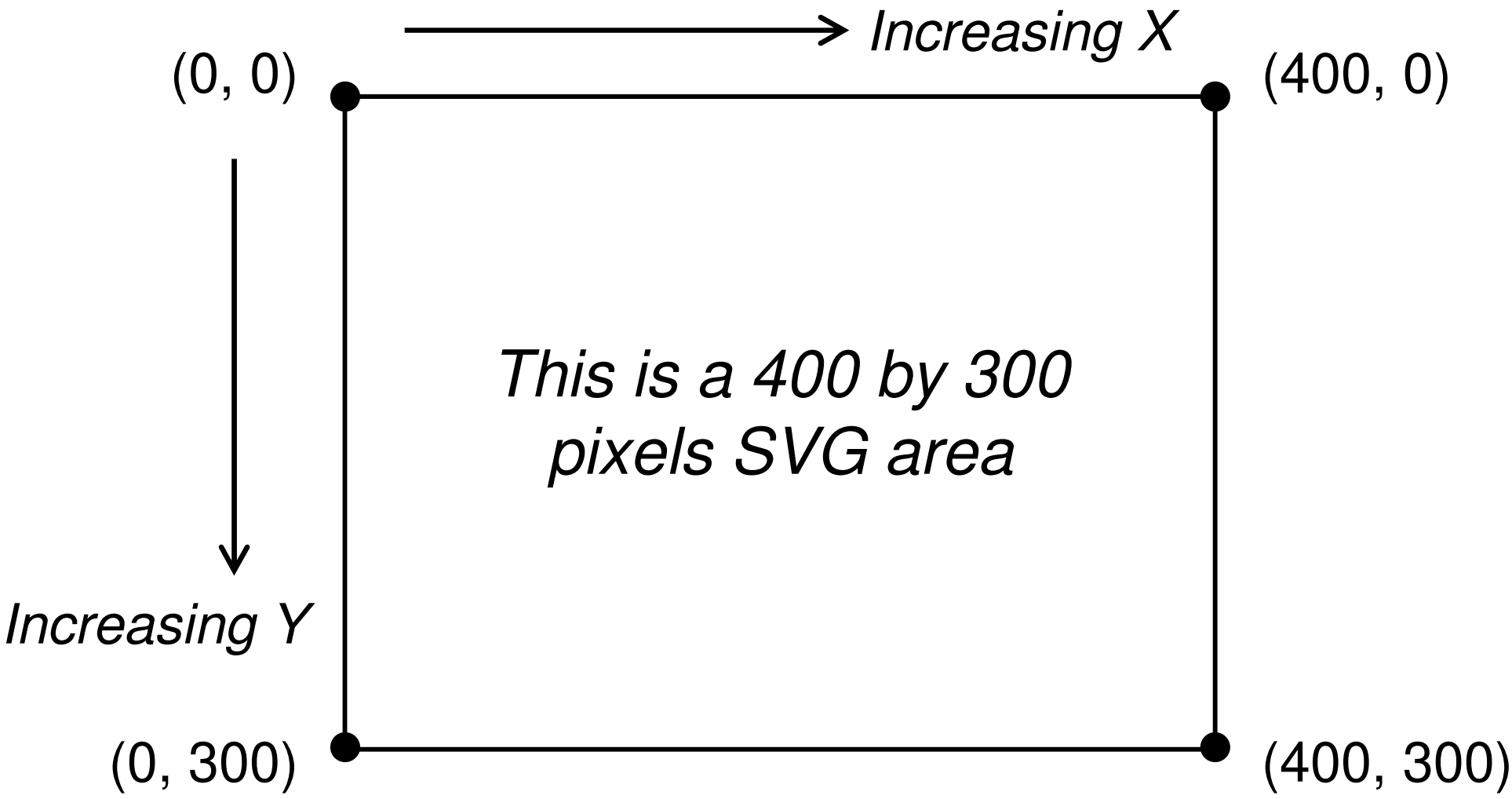
```
<svg xmlns="http://www.w3.org/2000/svg"
     width="400" height="300">

...SVG content...

</svg>
```

*Creating an SVG area with a size of 400 by 300 pixels*

- You then add text and shapes into it

# The SVG Coordinate System

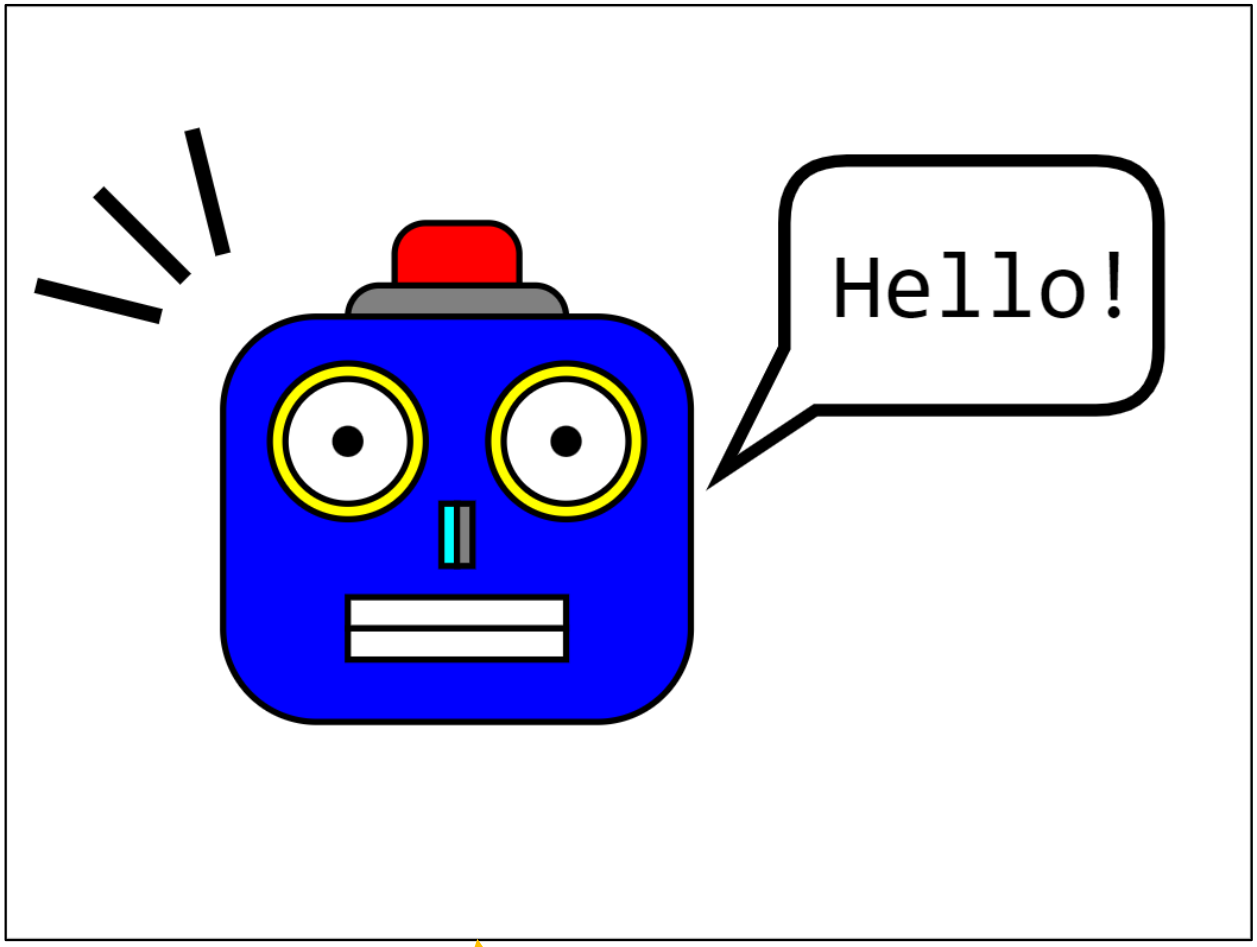
- Here is the coordinate system in a 400 by 300 pixels SVG area:



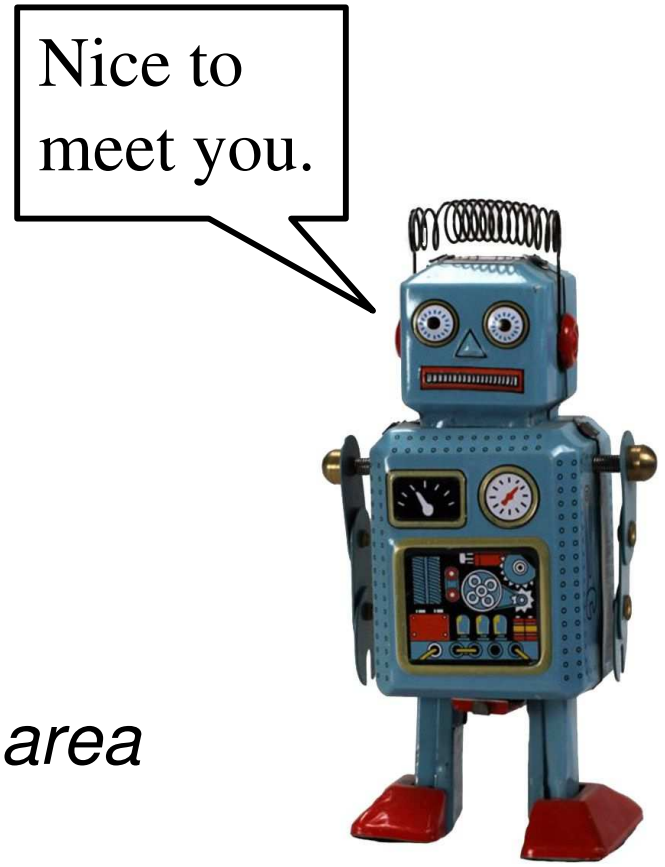
# SVG Drawings

- You can add many kinds of shapes into an SVG area
- We will talk about the more commonly used ones:
  - Lines
  - Rectangles
  - Circles
  - Paths
  - Text

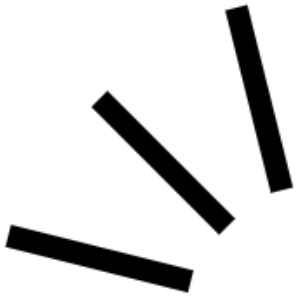
# Let's Draw a Robot Head!




*400 by 300 pixels SVG area*

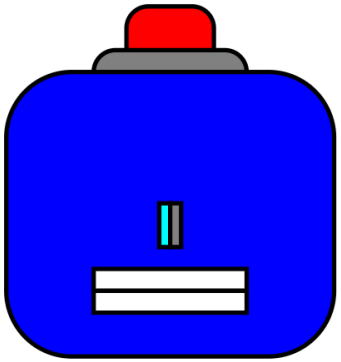


# The Robot Parts

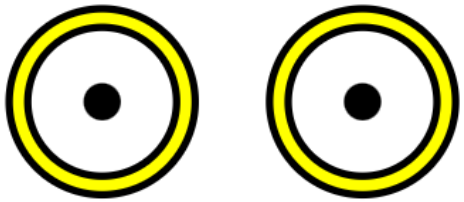


- You can use lines to draw these:

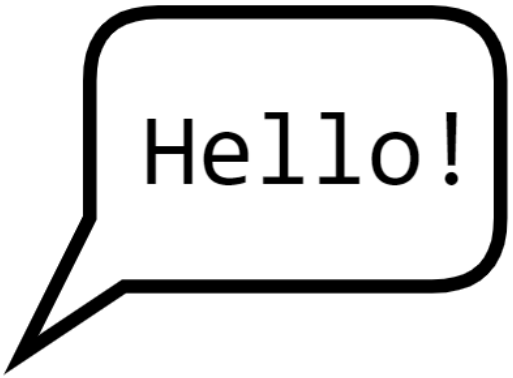
rectangles to draw these:



circles to draw these:



a path and a piece of text to draw this:

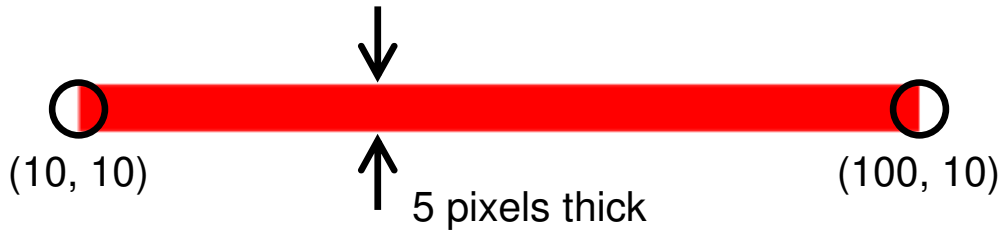


# Using Lines

- You can use the SVG `<line>` element to draw a line between two points (x1, y1) and (x2, y2)
- For example, you can draw a red line from (10, 10) to (100, 10) using this code:

```
<line x1="10" y1="10" x2="100" y2="10"
      stroke="red" stroke-width="5" />
```

- See details in the next slide



# Drawing a Line

- This is the first point (10, 10)

- This is the second point (100, 10)

```
<line x1="10" y1="10" x2="100" y2="10"
      stroke="red" stroke-width="5" />
```

- This is the colour and width of the line
- This closes the `<line>` tag, which is required for SVG

# Closing Tags

- In HTML, you do not need a closing tag for elements that do not enclose any content such as `<img>` and `<br>`
- SVG works differently so that all elements must have a closing tag
- If the element does not enclose anything, the tag can be closed by a '/' at the end

`<line ...`*attributes*`... />`

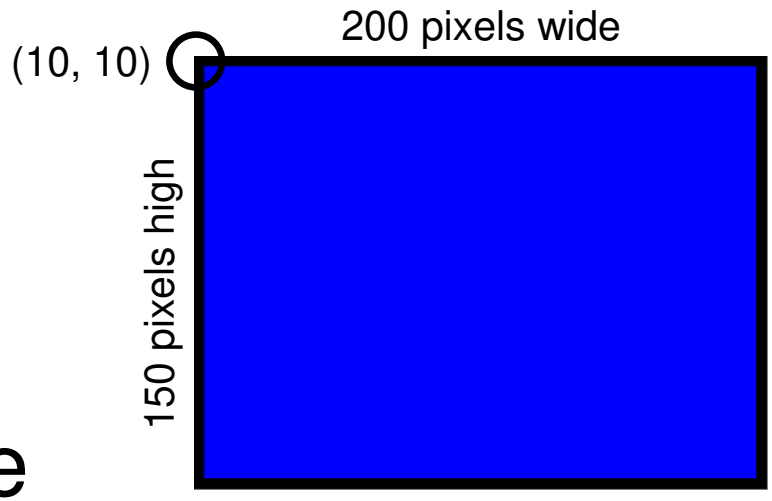
*Close the tag*

# The Robot Lines

- You can draw as many lines as you want
- You can then use this code to draw the three lines near the corner of the robot:

```
<line x1="60" y1="40" x2="70" y2="80"
      stroke="black" stroke-width="5" />
<line x1="30" y1="60" x2="58" y2="88"
      stroke="black" stroke-width="5" />
<line x1="10" y1="90" x2="50" y2="100"
      stroke="black" stroke-width="5" />
```

# Using Rectangles




- Creating a rectangle in SVG is very similar to creating a line
- You can use the `<rect>` element to draw a blue rectangle at (10, 10) with a size of (200, 150), e.g.:

```
<rect x="10" y="10"
      width="200" height="150"
      stroke="black" stroke-width="4"
      fill="blue" />
```

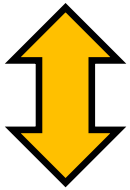
*A black outline for the rectangle*

*Fill the rectangle with blue*

# Using CSS

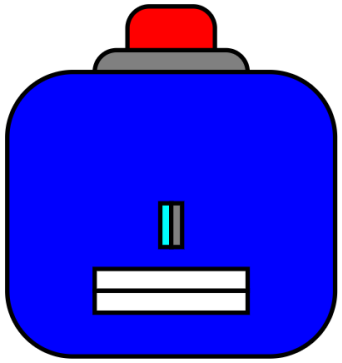
- You can use the `style` attribute to specify the visual styles, e.g.:

```
<rect ... stroke="black" stroke-width="4"
          fill="blue" />
```



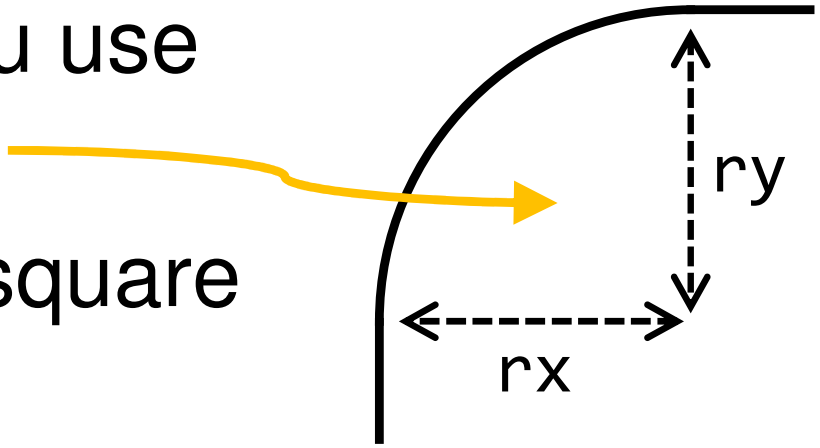
```
<rect ... style="stroke: black;
           stroke-width: 4; fill:blue" />
```

- You can also use the `class` attribute, style sheets and CSS selectors if you want to

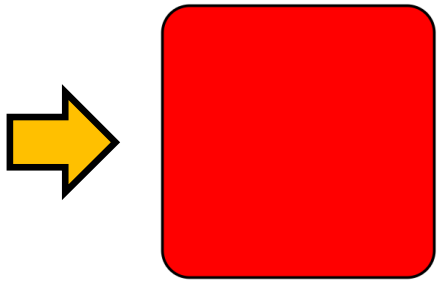


# Making Rounded Corners

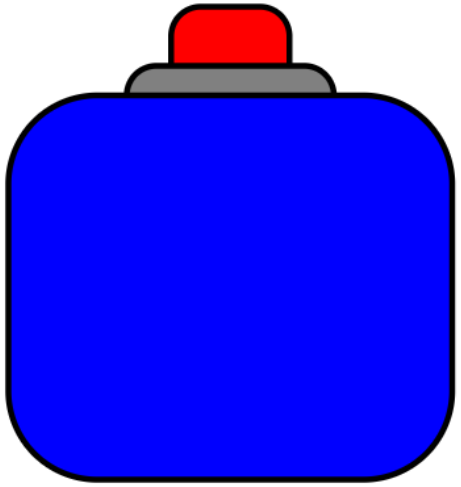
- If you look at the target robot head, it has rounded corners
- To do that in `<rect>`, you use the `rx` and `ry` attributes
- Here is an example red square with rounded corners:




```
<rect x="10" y="10"
      width="100" height="100"
      stroke="black" fill="red"
      rx="10" ry="10" />
```

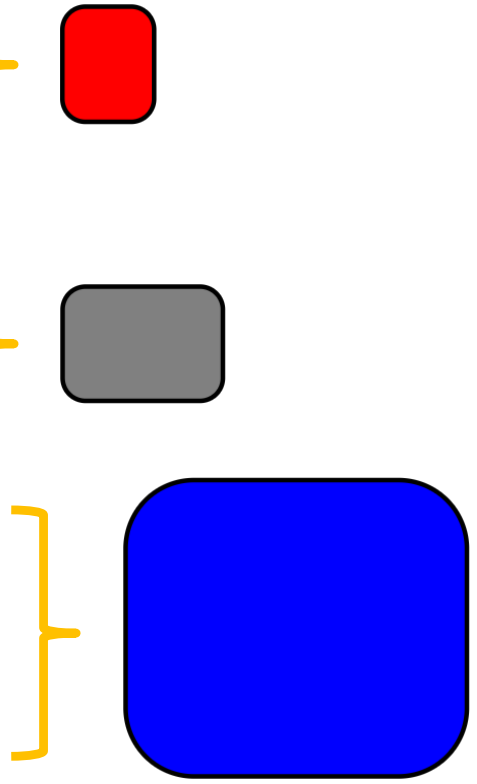


# The Robot's Face



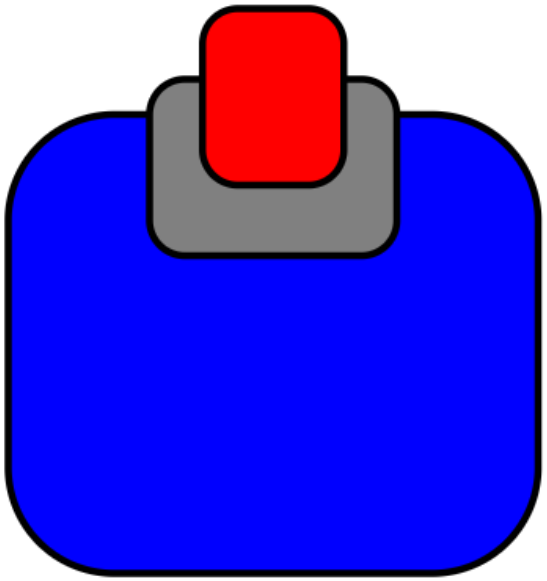
- You can use the following three rectangles to make the face

```
<rect x="125" y="70" width="40" height="50"
      stroke="black" stroke-width="2"
      fill="red"
      rx="10" ry="10" />
<rect x="110" y="90" width="70" height="50"
      stroke="black" stroke-width="2"
      fill="gray"
      rx="10" ry="10" />
<rect x="70" y="100" width="150" height="130"
      stroke="black" stroke-width="2"
      fill="blue"
      rx="30" ry="30" />
```



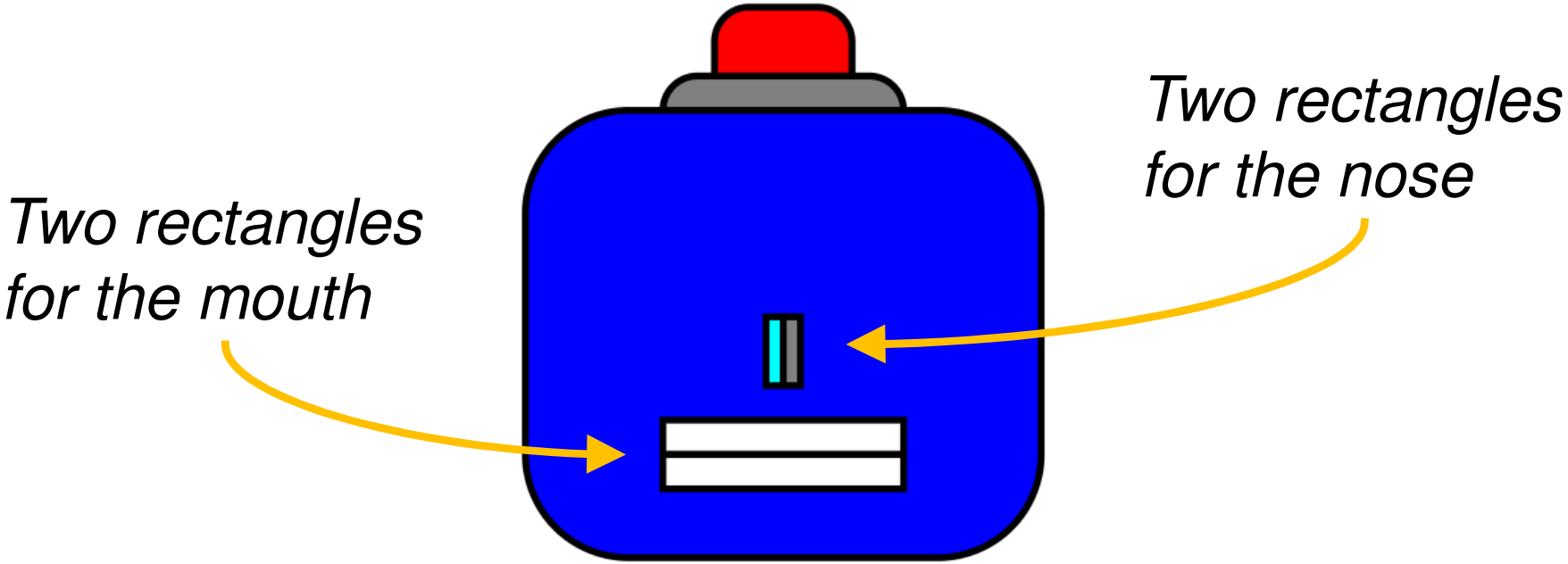
# Drawing Order

- In the previous slide, the three rectangles overlap each other
- The drawing order of the rectangles follows their order inside the SVG file, i.e. the first element in the file is drawn first, then the second element, and so on
- If the three rectangles are put in the opposite order, they will look like this:

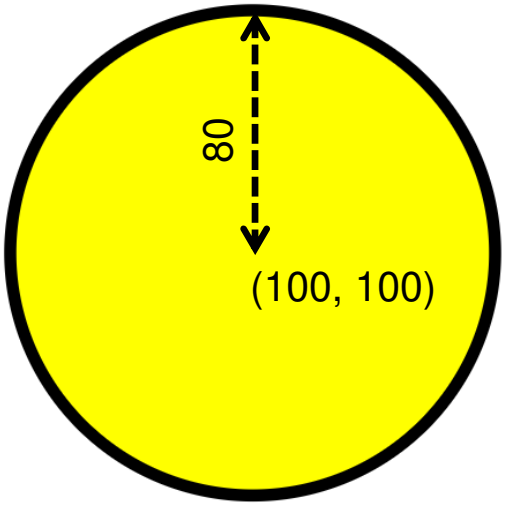


# The Robot's Nose and Mouth

- After creating the robot's face, you can use four more rectangles to create a nose and a mouth in the face



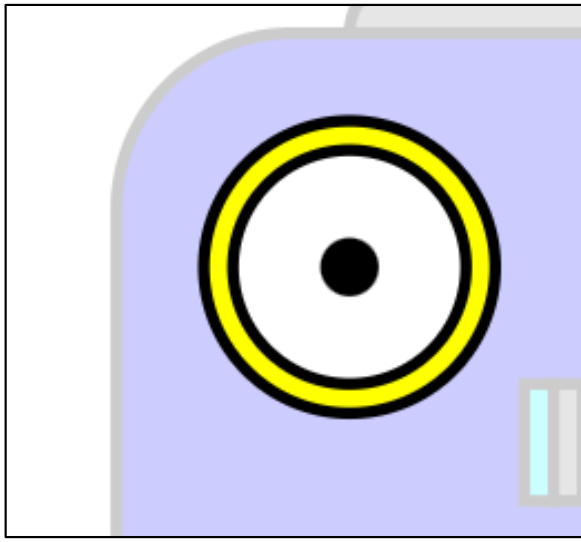
# Using Circles




- You can draw a circle using the `<circle>` element
- Here is an example that draws a yellow circle having a radius of 80 and centred at (100, 100)

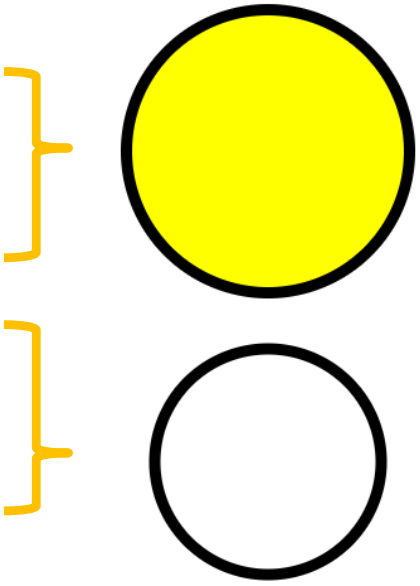
```
<circle cx="100" cy="100" r="80"
        stroke="black" stroke-width="4"
        fill="yellow" />
```

# The Robot's Eyes

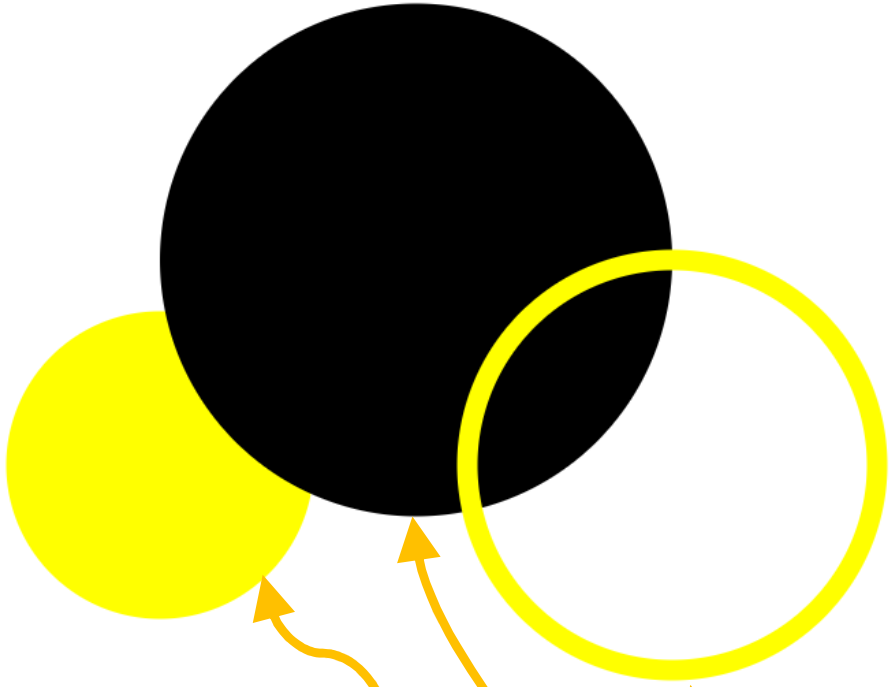


- You can easily create one eye of the robot using three circles:

```
<circle cx="110" cy="140" r="25"
        stroke="black" stroke-width="2"
        fill="yellow" />
<circle cx="110" cy="140" r="20"
        stroke="black" stroke-width="2"
        fill="white" />
<circle cx="110" cy="140" r="5"
        fill="black" />
```



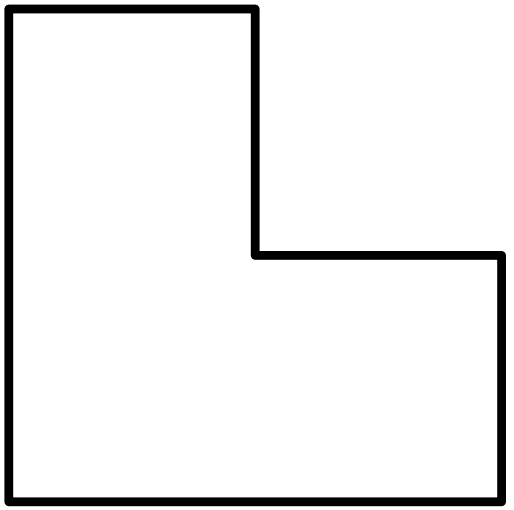
# Outline and Fill Colours



- If you do not specify the `stroke` and `stroke-width` attributes, the shapes will not have any outline
- If you do not specify the `fill` attribute, the shape will be filled with black
- If you want a hollow shape, you need to specify the `stroke` attribute and set the `fill` attribute to `none`

# Using Paths

- Sometimes you have shapes that cannot be made using basic shapes such as rectangles and circles
- For example, you would not be able to make an L-shape shown on the right using only two rectangles



- Using the `<path>` element allows you to build your own shape

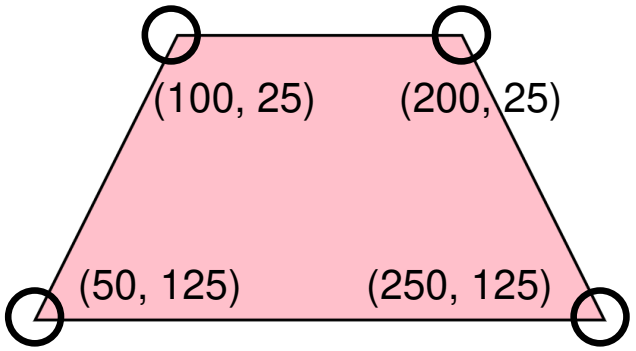
# Creating Paths

- A path is a kind of drawing language in itself
- You can describe any shape/path using these:

| | |
|---|---|
| `M` | Move to |
| `L` | Draw a straight line to |
| `H` | Draw a horizontal line to |
| `V` | Draw a vertical line to |
| `C` | Draw a cubic curve to |
| `S` | Draw a smooth cubic curve to |
| `Q` | Draw a quadratic curve to |
| `T` | Draw a smooth quadratic curve to |
| `A` | Draw an arc to |
| `Z` | Finish/ go back to the beginning |

*You don't need to understand these*

# Path Examples

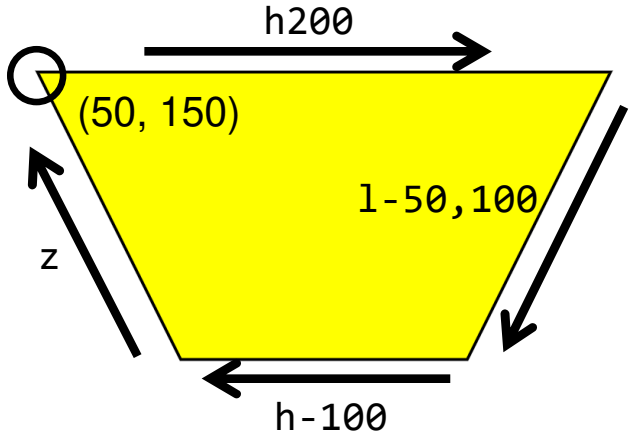



- For example, here is a path:

```
<path d="M100,25 L200,25 L250,125 L50,125 Z"
      fill="pink" stroke="black" />
```

- You can change the command letters to small letters; in that case, the commands will use relative movement, like this:

```
<path d="M50,150 h200 l-50,100 h-100 z"
      fill="yellow"
      stroke="black" />
```



# Using Text

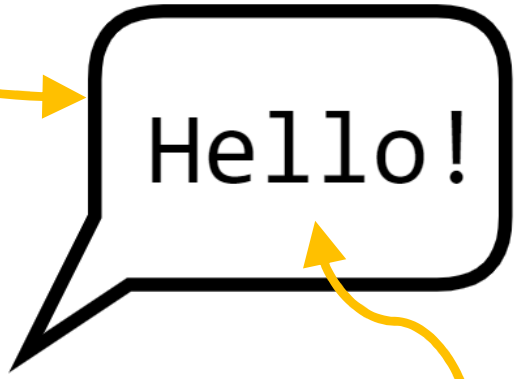
- Text can be added by the `<text>` elements
- For example, you can put a piece of text "I am inside SVG!" at (50, 100)

```
<text x="50" y="100"
      font-size="30" fill="navy">
  I am inside SVG!
</text>
```

# Robot's Speech Bubble

- You can then draw the speech bubble of the robot using a path and text

```
<path d="M230,150
         l20,-40
         l0,-40
         q0,-20 20,-20
         l80,0
         q20,0 20,20
         l0,40
         q0,20 -20,20
         l-90,0
         z"
      stroke="black" stroke-width="4"
      fill="white" />

<text x="265" y="100"
      font-family="monospace" font-size="30">
    Hello!
</text>
```




*This means using a 'fixed width' font*

# Creating SVG in Graphical Editors

- If you find it difficult to ‘draw’ pictures by typing in SVG inside a text editor, you can use some graphical editors
- For example, here are two editors that can create SVG:
  - Adobe Illustrator
    - It can output graphics as SVG and it is available in the Virtual Barn
  - SVG Edit (https://github.com/SVG-Edit/svgedit)
    - This is a free online editor for SVG