

Bring your *doodles* to life

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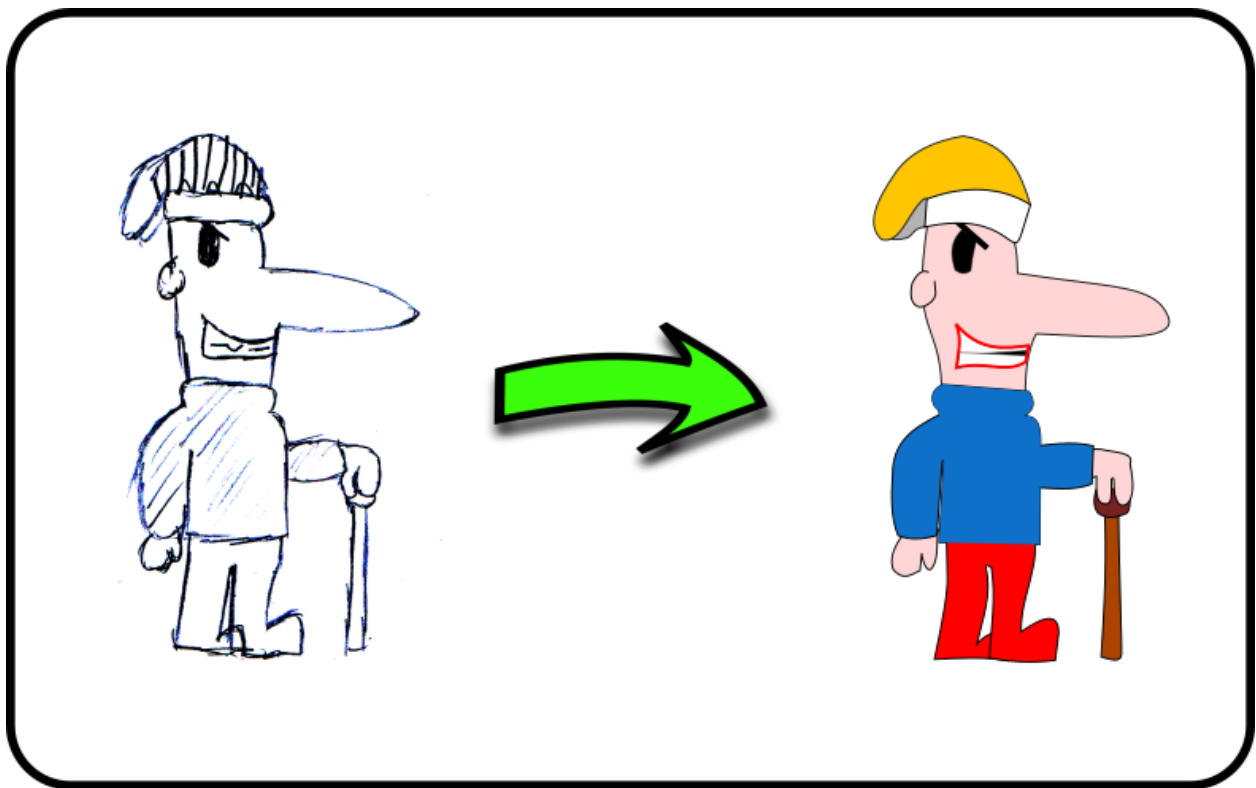
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You can find this guide online at:

<https://docs.google.com/document/d/12h9-9PIGK2W5lgcV-Xa8XpHAAPKlGr7SeeReA-TCv14/edit?usp=sharing>

Overview

Have you ever wanted to turn your drawings into animatable characters that you can use in your own animated cartoons or games? Well, we are going to show you how you can do just that using a freely available vector graphics package called Inkscape and a simple blocks-based programming language called Scratch.



Goals

There are 4 stages to this project.

1. Use Inkscape to turn a drawing into an electronic character.
2. Create a number of animation poses for your character.
3. Import your character poses into Scratch.
4. Write a simple code loop to “walk” your character across the screen.

What You Will Need

1. **A computer**
2. **A scanned drawing**

For the purpose of this guide we'll be using a pre-scanned image file called *doodle.png*. The methods we show you work equally well for most line drawn images.

The scanned image file may already have been downloaded onto your desktop for you. If not, you can download it from [URL]

3. **Inkscape application**

Inkscape is an application for creating **vector graphics**.

If it isn't already installed on your computer, you can download and install it from <https://inkscape.org/>. We will be using version 0.92 here. Other versions will be okay for this task but their user interfaces may vary.

4. **Scratch application**

Scratch is a **blocks-based code development environment**.

You can find a browser-based version of Scratch at <https://scratch.mit.edu/> and you can download and install offline versions at <https://scratch.mit.edu/download>. We will be using version 2 (offline) here. Any version, either browser-based or offline, will do but their user interfaces may vary.

What You Will Learn

In order to take you through the process of creating your own animated game sprite from a drawing we will be covering the following simple vector graphics techniques. We will discuss these techniques in turn as the need for each arises.

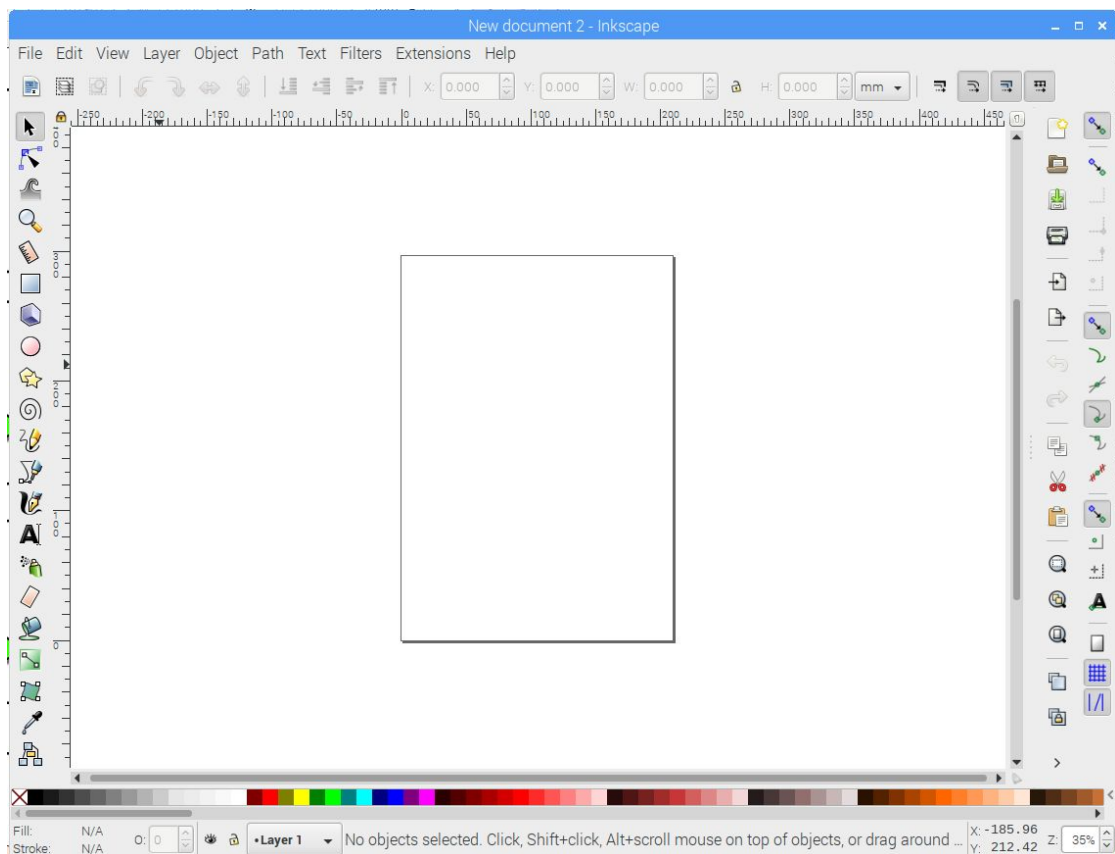
1. Creating shapes and colouring them with **Fill**, **Stroke** and **Transparency**
2. **Importing an Image** into Inkscape and making it **Opaque**
3. Creating arbitrary shapes with the **Bezier Tools**
4. Manually adjusting the corners and sides of shapes with the **Path Tool**
5. **Unions**, **Intersections** and **Differences** of two shapes

6. Hiding overlaps by **Raising** and **Lowering** our shapes on the **Object Stack**
7. **Rotating** shapes and moving the **Centre of Rotation** (for limb movements)
8. **Grouping** and **Ungrouping** objects (for limb movements)

Instructions


1. Open the Inkscape application

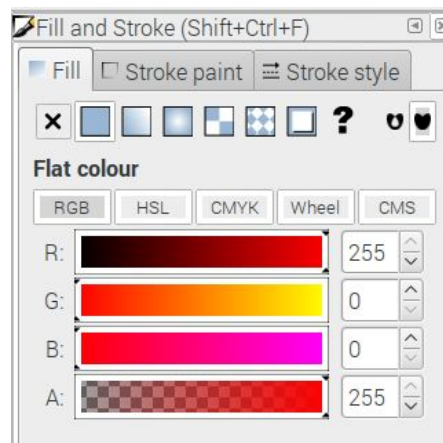
How you do this will vary from computer to computer. On a Raspberry Pi you might find this in the on your desktop in the Raspberry menu under **Graphics >> Inkscape**. If successful, you will be presented with a screen that looks something like this:



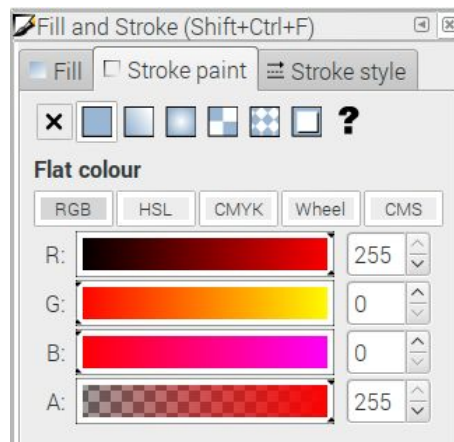
2. Colour: Fill, Stroke & Transparency

In this step we will learn how to create some shapes and play with the fill colour and the border. We will also learn about *transparency* and how we can use it to our advantage.

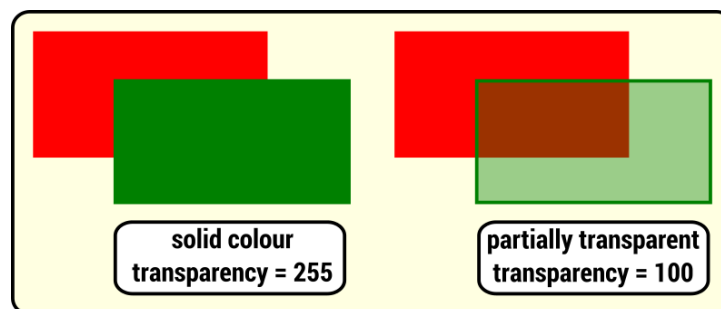
- a. **Create a shape:** Click on the **Rectangles & Squares Tool**  in the panel on the left side of the screen. In the main application window, click and hold down the left mouse button, drag the mouse to another point on the screen let go of the mouse button. You have now created your first shape!
- b. **Play with the fill colour:** Select **Object >> Fill and Stroke** from the menu. The following window will appear. Click on the **Fill** tab. Now change the values in the **red** (R), **green** (G) and **blue** (B) boxes to any number between 0 and 255 and hit ENTER. You have now changed the fill colour of your shape.



- c. **Play with the border colour:** *Stroke* is Inkscape's word for *border*. Click on the **Stroke Paint** tab in the **Fill & Stroke Tool**. Change the R, G & B values in this window (again choosing a number between 0 and 255) and hit ENTER. You have now changed the border colour of your shape.



- d. **Play with the border thickness:** Click on the **Stroke Style** tab in the **Fill & Stroke Tool**. Change the number in the **Width** field (perhaps double or halve the number that is there) and hit ENTER. You have now changed the thickness of your shape's border.
- e. **Play with transparency:** Repeat step (a) to create a second rectangle that overlaps the existing one. Open the **Fill** tab of the **Fill & Stroke Tool**, and change its fill colour to make it stand out against the first rectangle. You will see a 4th value labelled **A** under the RGB values. This is *transparency*. A value of 255 is a solid color. A value of 0 is fully transparent (or *see-through*). Set the A value to a range of values and see what happens. Can you see how the hidden part of your first rectangle starts to become visible from behind the second?



Being able to adjust the transparency of shapes to see what's behind them will be very useful to us when we come to tracing our drawing. For instance, once we have created a shape for the head, we will want to still be able to see where the facial features of our drawing are to trace around them also.

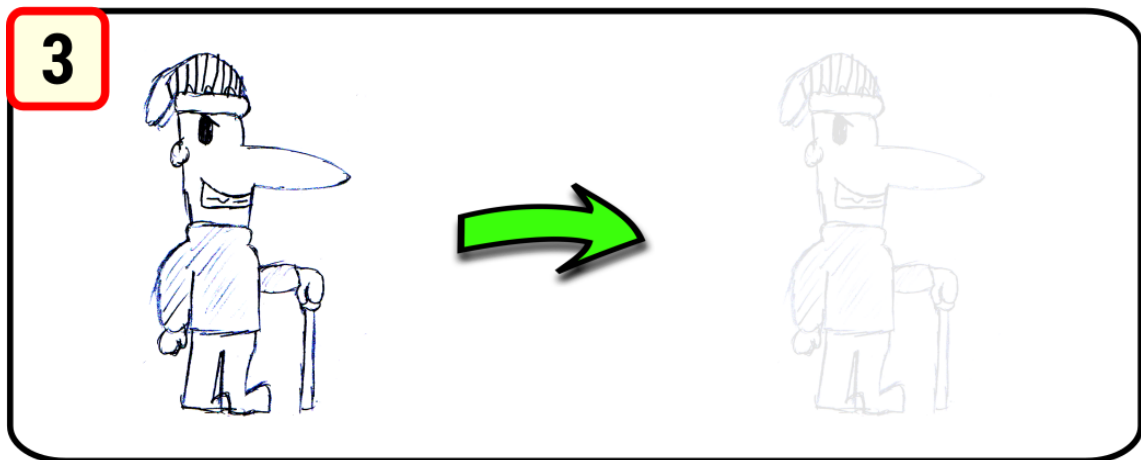
We no longer need these shapes. Clear them from the screen by selecting each one in turn and pressing the **Delete** button on the keyboard. Let's now move on to our drawing...

3. Import the scanned image file (doodle.png)

In this step we will learn how to import an image into Inkscape.

- Select **File >> Import** from the menu (**CTRL+I** is a keyboard shortcut for this).
- Browse to the *doodle.png* file on your PC
- Click on the **Open** button to select the file.
- Click on the **Okay** button in the dialog box that appears.

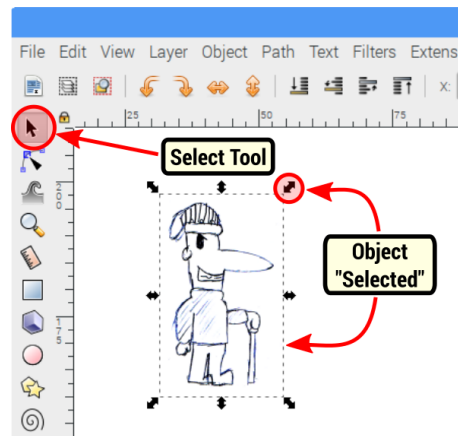
4. Make the imported image opaque



In this step we will learn how to make an image opaque.

We are going to be tracing regions of our drawing over the imported image. We can see what we are doing much more clearly if we make that image faint - making our image *opaque* does that for us.

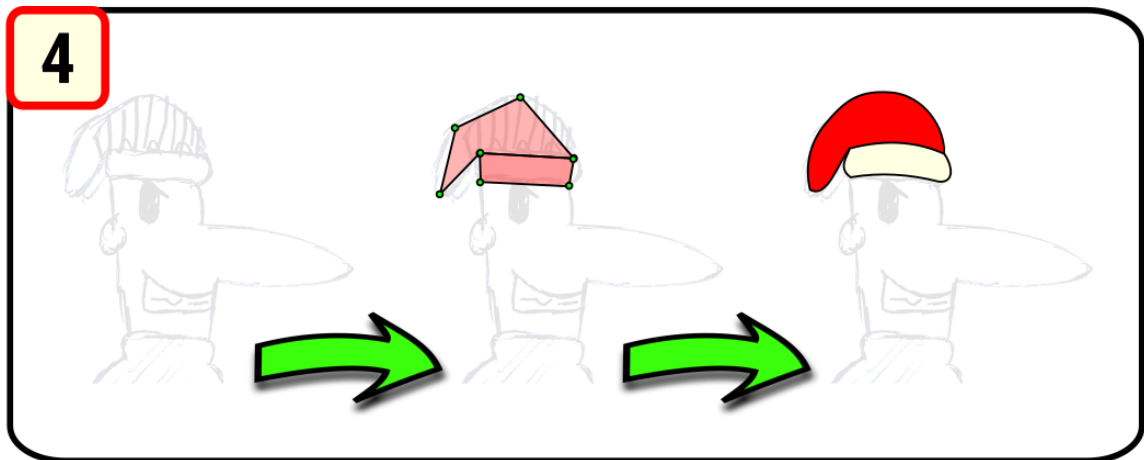
- Select the imported image by clicking on the **Select Tool** and then clicking on the image. You should see a dotted box around the image.




- b. Select **Filters >> Fill and Transparency >> Opacity** from the menu.
- c. Set **Global Opacity** to **0.1** and click on the **Apply** button.

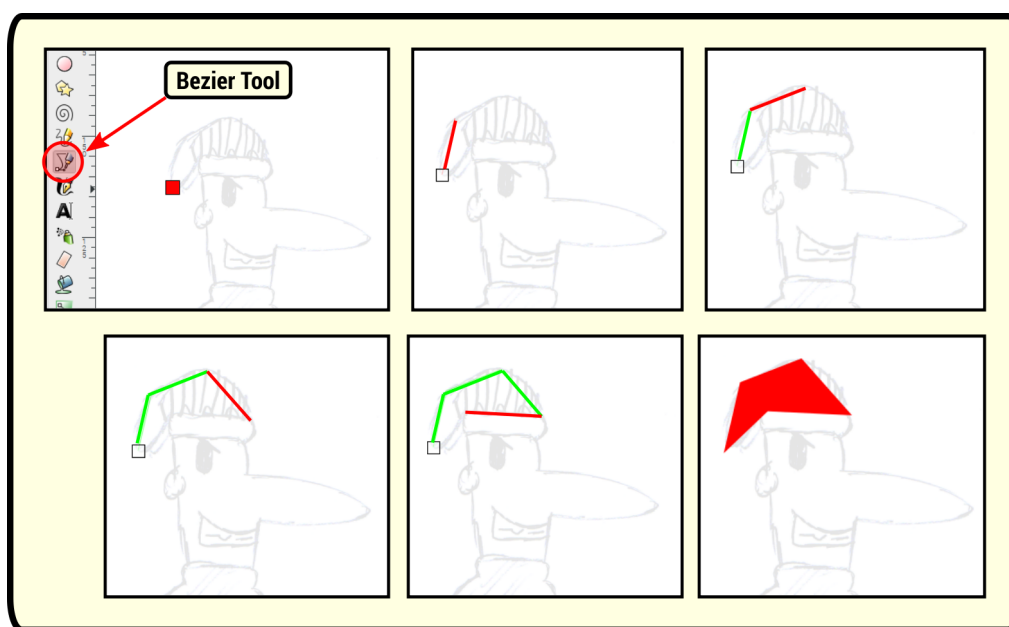
Pro Tip: The closer to 0 your opacity value is, the fainter your image will be. For other images you may need a higher or lower value to achieve a similar effect.


5. Trace around the hat



In this step we will learn how to use the **Bezier Tool** to create an arbitrary shape with a number of straight edges and then use the **Path Tool** to “stretch” those edges to fit a curved area.

1. Click on the **Bezier Tool** . You can find this in the panel down the left hand edge of the screen. Left-click on the pointed end of the hat and trace around the top area of the hat with straight line segments by left-clicking on the corners or turning points of the hat. To close the shape, left-click over the starting point again.

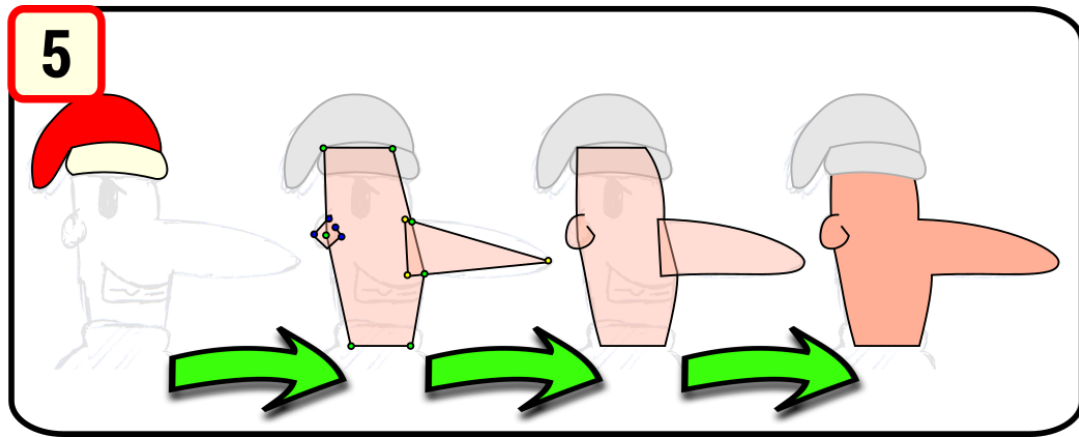


2. Click on the **Path Tool** . You can find this in the panel down the left hand edge of the screen. Click on our shape and then move the mouse over over one of its edges. Click and hold the left mouse button to “pick up” that edge. Drag the mouse out to meet the edge of the area that we are tracing. You should see the edge of your shape stretch with the movement of the mouse, like a rubber band. When the edge of your shape coincides with the edge of the area behind it, release the mouse button. Stretch all edges of your shape in this manner so that it closely matches the shape of the hat. Set the colour to red and the stroke to 0.5 pixels and black.

Pro Tip: You don't have to be exact. You can use this process as an opportunity to remove imperfections from your drawing and improve it while tracing around it.

3. Repeat the above process to create the brim of the hat. If needed, refer to the image at the top of this section as a guide. Set the colour to white and the stroke to 0.5 pixels and black.

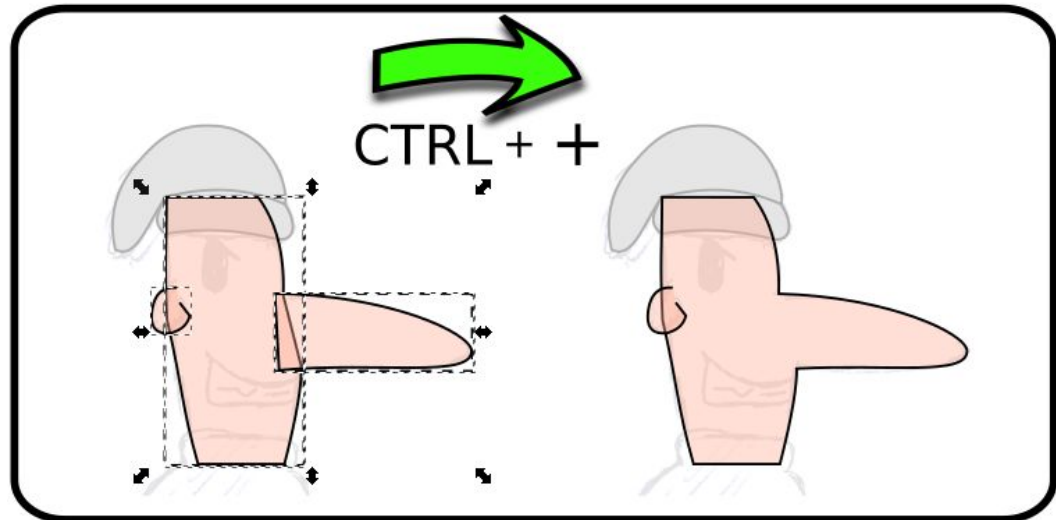
6. Create the head and ear



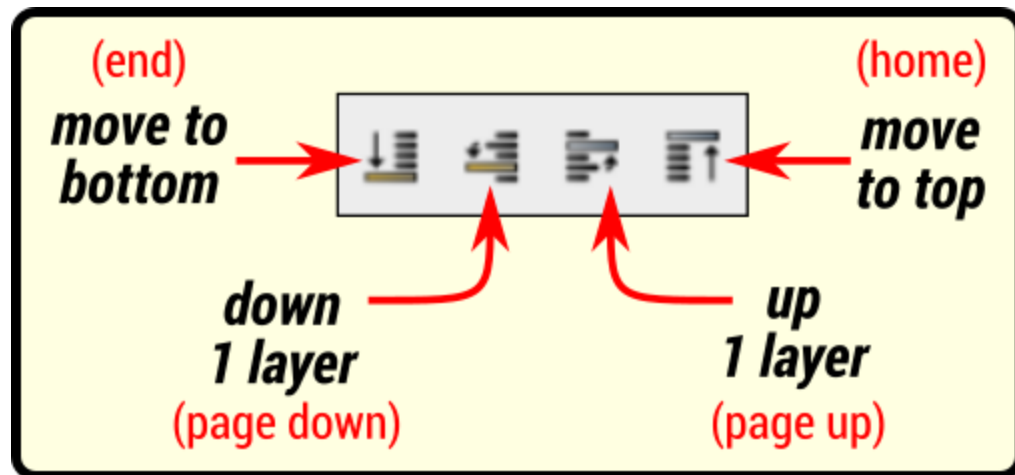
In this step we will learn how to merge two shapes into one using the **Path Union** function and hide overlaps by raising and lowering shapes on the “stack”.

- Create two separate shapes for the head and nose with the **Bezier Tool**. If you need to, refer to the image above for guidance on where might be best to place the vertices (corners) of your shapes. Set the fill colour to red (255), green (175) and blue (150) and the stroke to 0.5 pixels thick and black.
- For speed and simplicity, the edges of the head and hat do not have to match. Simply draw the head overlapping the brim of the hat. We'll hide this overlap later.
- The ear isn't a closed shape. When creating the ear, left-click on the final vertex and then right-click to tell Inkscape that you're done with that shape. Set its colour and stroke the same as the head.
- Using the **Path Tool**, stretch the shapes to fit the head, nose and ear of the character.
- Select both the head and the nose by left-clicking on the head followed by the nose while pressing the **SHIFT** key on the keyboard. With dotted selection

boxes and arrows marking the boundary around both objects (as shown on the left below), select **Path >> Union** from the menu (**CTRL++** is a keyboard shortcut for this). This will merge the two shapes into one (as shown on the right below).



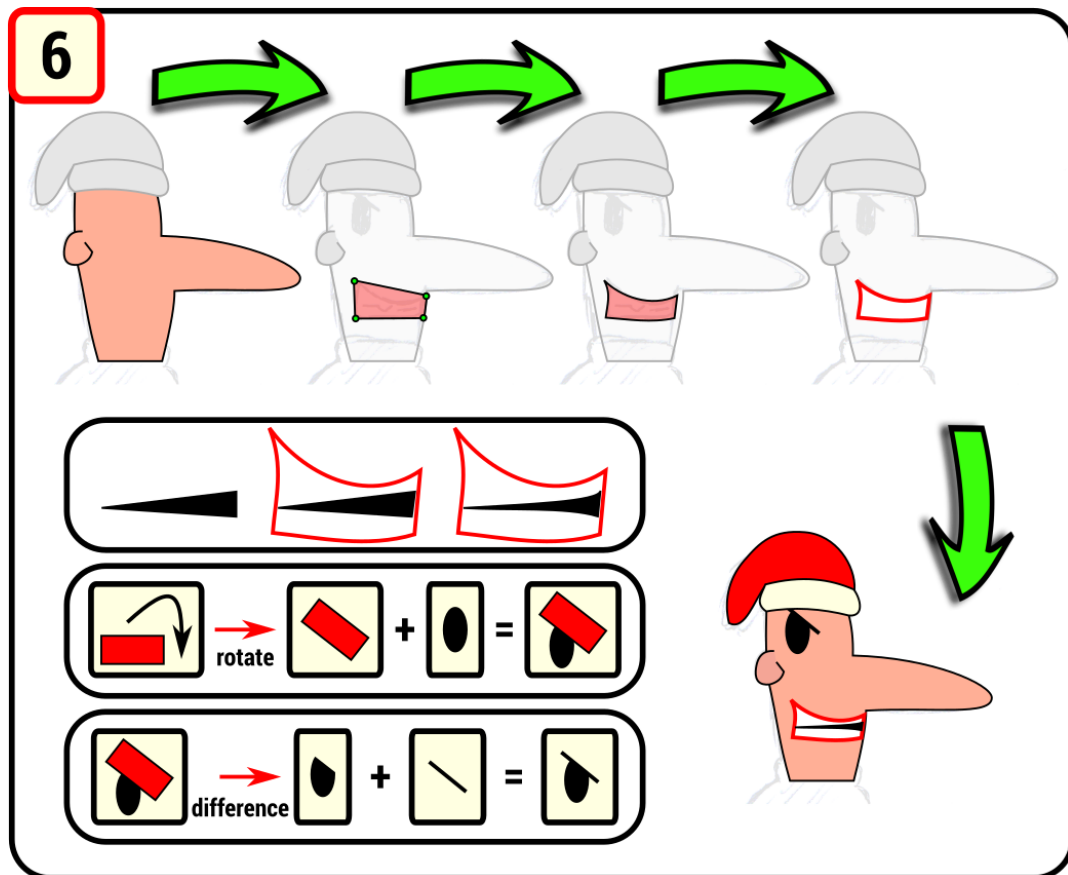
- f. To hide the overlap between the forehead and the brim of the hat, we will need to use the **Raise/Lower Tool**. You can find this under the menu at the top of the screen.



Select the head by clicking on the **Select Tool** and left-clicking on the head. A dashed box will appear around the head to confirm that it is selected. Click on the *down 1 layer* icon in the **Raise/Lower Tool**. Repeat this until the top of the head disappears behind the brim of the hat.

- g. Select the ear by clicking on the **Select Tool** and left-clicking on the ear. Place the ear on top of the head by clicking on the *move to top* icon in the **Raise/Lower Tool**.

7. Add facial features




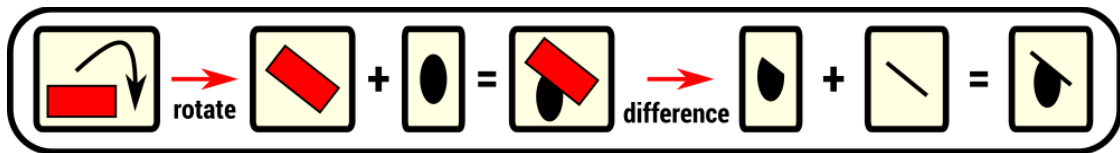
In this step we will learn how to **Rotate** an object and use the **Path Difference** function to remove the portion of a shape which intersects with another shape.

a. Creating the mouth

- Trace around the mouth using the **Bezier Tool**.
- Set its fill (teeth) to white and its stroke (lips) to 0.5 pixels and red.
- Adjust the shape of the mouth using the **Path Tool**.
- Create the gap between teeth in a similar manner with the **Bezier Tool** and **Path Tool**.
- Set its fill and stroke to black.

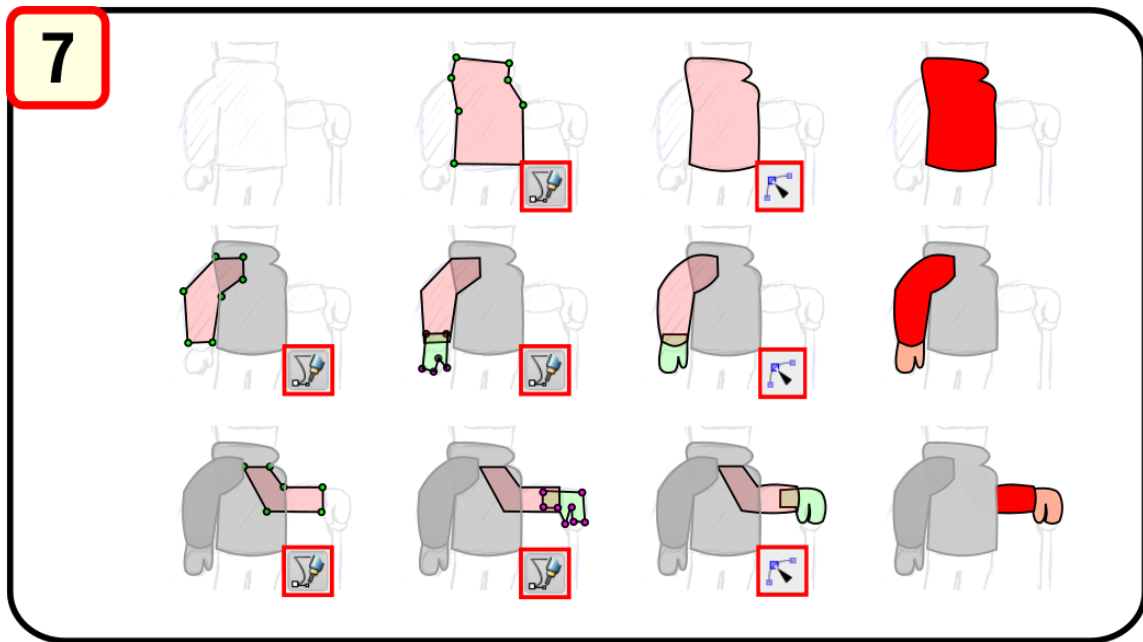
b. Creating the eye

- i. Using the **Ellipse Tool** , left-click and drag the mouse on the screen to create an ellipse the size and shape of the eyeball.
- ii. Create a rectangle the same way using the **Rectangle Tool**.
- iii. Open the **Transform Tool** by selecting **Object >> Transform** from the menu. Click on the **Rotate** tab, enter -30 in the **Angle** field and click on the **Apply** button.
- iv. Move the rectangle partially over the top right corner of the ellipse by left-clicking and dragging it into place. Move the rectangle in front of the ellipse by moving it to the top of the stack. With the shift key held down, click on both the ellipse and rectangle to select them both and select **Path >> Difference** from the menu.
- v. Using the **Bezier Tool**, create a line for the eyebrow. Set its stroke to black. Select & drag the line into place over the cropped corner of the ellipse



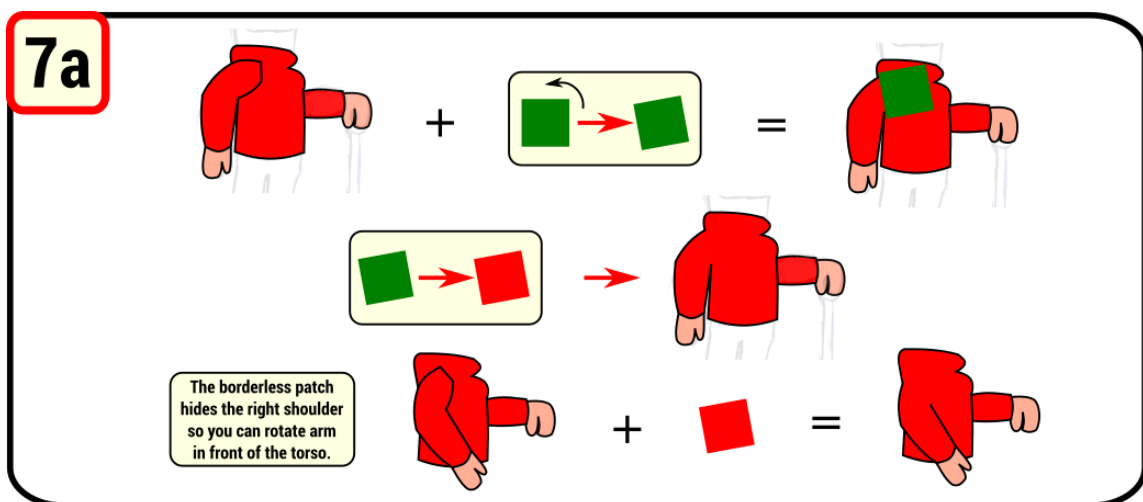
8. Create the torso

Follow the same process as you did for the head, using the **Bezier Tool** and **Path Tool** to create the torso, arms and hands. Make the torso and arms red and the hands the same colour as the head. Set all strokes to 0.5 pixels and black.

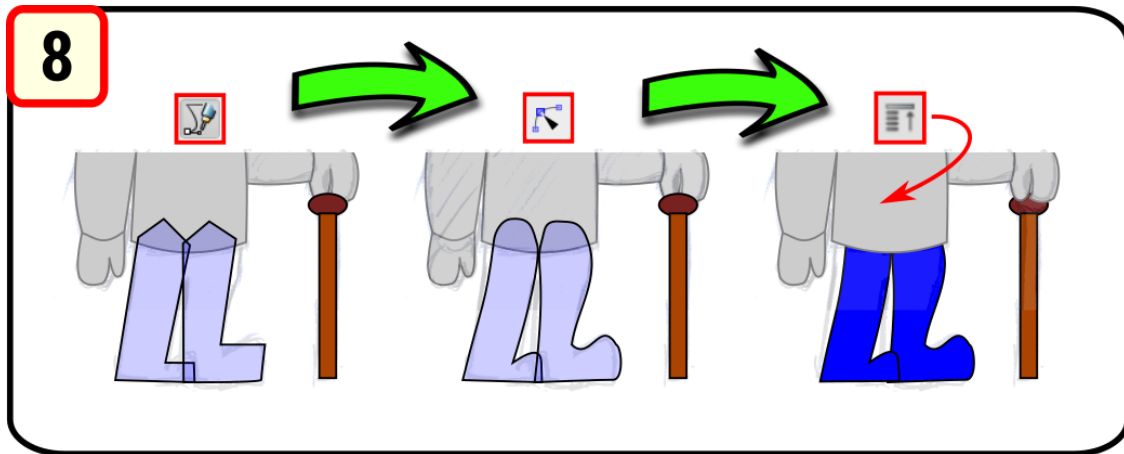


When animating this character we would like to be able to rotate the character's right arm (around the shoulder joint) in front of the torso. Let's hide the top of that arm from view. We can do this as follows:

- create a square patch with no border
- Rotate it anti-clockwise so the edge lines up with the contour of the torso.
- Place the square over the shoulder joint
- Give it the same fill and stroke settings as the torso.



9. Create the legs and walking stick

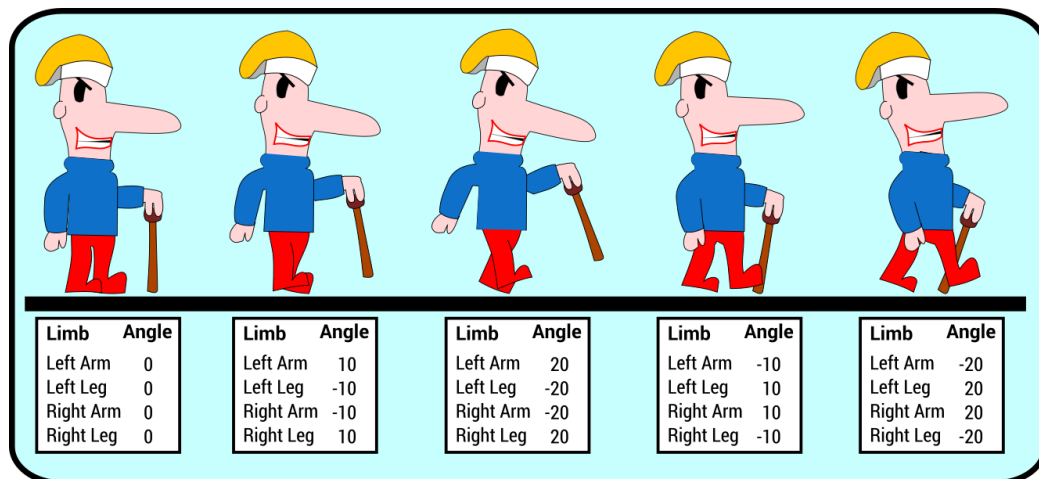


Following the same process as you did for the head, using the **Bezier Tool** and **Path Tool** to create the legs. Make them blue with a black stroke of 0.5 pixels width. Note that the top of these legs overlaps with the torso.

Using the **Ellipse Tool** and **Rectangle Tool**, create the walking stick. Choose a brown fill colour and black stroke of 0.5 pixels widths.

Using the **Stack Tool**, move the legs and walking stick behind the torso.

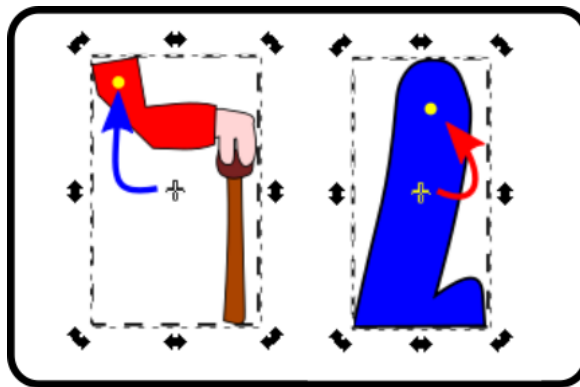
10. Create the poses



In this step you will learn how to rotate the arms and legs to create 5 different poses. When these poses are played in sequence it creates the illusion of movement, very much like a flip book animation would do.

Objects rotate around the central point by default. Our limbs don't do that - they rotate around their upper extremities (shoulders or hips). We need to move the centre of rotation.

Click on the limb twice. You will see a cross appear in the centre of that limb - this is the centre of rotation. For all arms and legs in turn, click and drag it to the locations shown in the diagram below.



To see how the limb will rotate around its joint, click on and drag one of the corner arrows. Press Control + Z to undo your last action and revert back to the original limb position once you've finished playing with the rotation.

When we walk, the direction of rotation of your arms is opposite to those of your legs. So, when your right arm swings forward, your right leg swings back. Similarly, the left and right limbs do opposite things.

Before we start to adjust our character to create poses, let's export this one. Select all of the parts of your character by clicking somewhere above the top left and dragging the selection box to below the bottom left of your character. Select File >> Export PNG Image from the menu. In the Export Tool's window that appears do the following

- click on **Selection** (this exports all selected objects)
- Click on **Export As...**
- Browse to the Desktop and name this file Character-01.png and click on **Save**.
- Back in the **Export Tool**, click on **Export** to Export your character graphic.

Let's now create our first pose.

- a. Select the **Object >> Transform** menu item to bring up the **Transform Tool**.
- b. Select the **Rotate** tab.

LEFT LEG

- c. Select the left leg of your character
- d. Type **-10** into the **Angle** box of the **Transform Tool** and click on **Apply**.

LEFT ARM

- e. Select the left arm and, while pressing the **SHIFT** key, select the left hand and the walking stick.
- f. Group all these objects together by typing **Control + G** on the keyboard. This allows you to move all these items as if they were one item.
- g. Type **10** into the **Angle** box of the **Transform Tool** and click on **Apply**.

RIGHT LEG

- h. Select the right leg of your character
- i. Type **10** into the **Angle** box of the **Transform Tool** and click on **Apply**.

RIGHT ARM

- j. Select the right arm and, while pressing the **SHIFT** key, select the right hand.
- k. Group these objects together by typing **Control + G** on the keyboard.
- l. Type **-10** into the **Angle** box of the **Transform Tool** and click on **Apply**.

EXPORT THE POSE

- m. Repeat the process above for this pose, calling it *Character-02.png*

REVERSE AND REPEAT FOR OTHER POSES

- n. Reverse the rotations in the **Transform Tool** to return your character back to the original position (or hit **Control + Z** 4 times to roll back the last four actions (our limb rotations).
- o. You've just created the second pose from the left shown in the diagram above. Repeat steps a-n above for the remaining 3 poses in that graphic, using the angles of rotation specified under each pose in that diagram. Don't forget to export.

Well done!

You now have a set of poses that you can import into Scratch as sprite costumes.