**Laser cut Zoetrope pipeline**

This zoetrope has a 40x\_30cm base and a 40x40 circle top that sits on a lazy Susan baring joint with a 15x15cm circle that sits between the joint and the base. The band that wraps around it is 127.6comx 15cm and has 12 3mmx3cm slots at exactly 10.4cm intervals. The 40x40 top is made of 2 layers a laser cut 3mm MDF top and a thinker 6mm MDF circle (that can be laser cut on a bigger machine or cut on the CNC) that are sandwiched together. On the zoetrope are 12 holes for a replaceable laser cut sequence to sit In, alternatively you can also place a paper band inside it with a 12 frame sequence, the paper band will need to be marked every 10.4com for spacing, markings can be found on the laser cut top for reference when putting it in place.

I could really do with a diagram or a photo here to be able to reference what is actually quite a complicated shape to describe. Will they have seen the Zoetropes beforehand? Your keyboard is so dirty it makes me sad inside.

Materials:

1. 70x80cm\_x\_3mm MDF £1.50 from woodwork (was a bit hard to read without spacing)
2. 6mm MDF 50x50cm from woodwork
3. Lazy Susan joint <http://www.amazon.co.uk/QBL-Susan-Square-bearing-56-64x101-6x7-93/dp/B00LB0D38E/ref=sr_1_1?s=diy&ie=UTF8&qid=1430840616&sr=1-1&keywords=lazy+susan> If this is a printout that is an awful thing to do to people
4. \_Araldite or wood glue
5. 1.5mm high impact styrene <http://www.amariplastics.com/products/productviewf772.html?tid=139>
6. \_Thumb tacks
7. \_3mm pot rivets

Total:

**Step 1**

Preparing your file for the animated sequence

For this pipeline you will need to have completed the intro to lasers workshop to have access to the laser cutter, during that work shop file prep will also be explained. When using the laser cutter files/designs are made in illustrator so that the laser can follow a vector line when cutting your material. For your zoetrope you will be given a template file in which to put your designed sequence. Remember to book your laser cutting session in advance as the laser lab can become busy close to deadline times.

1. Design your 12 frame cycle animation in clear dark lines checking your frames will fit within a 10cm box and your outer line (the line you will be cutting out) flows around the edge of your image continuously. You may also find it helpful to number your frames in the same clear dark line.
2. Scan your images in and open them in illustrator then select image trace at the top of the art board.
3. Once image traced select expand, when your image has been expanded it should have blue boxes along its lines
4. One expanded select all and make the stroke weight 0.25pt, which is the thickness of the laser as it cuts Screen shots would help
5. Select all go to object at the top of the page and select ungroup
6. Select the white space between your lines and delete anything that isn’t the line you want, do this also if your line is too thick by selecting and deleting any excess colour
7. Once done select your inner lines/detail and make these green (all the same green)
8. Select all and drag your image into the template file
9. Place your image so that the bottom of it over laps the base supplied
10. Then select your outer line and the base and using either the unite option in pathfinder or the shape builder tool merge the 2 objects to become one, make this line red.
11. Once you have done this select all of your image and the box you just used, go to object and click group.
12. Repeat this process for all 12 of your frames and rename and save your template, the files for laser cutting are .ai files this will be opened in the soft wear ApS-Ethos when you come to use the laser cutter later.

**Step 2**

Using the laser space

Remember to book your laser time in advance. It is always a good idea to ask one of the laser technicians to look over you file before your session, if your file has a problem and you have to fix it during your session you will not get that time back. The technicians have time set aside in the mornings of Mondays and Tuesdays to review files, otherwise you can speak to them about booking their time if you need help or are unsure. If cutting your plastic outer band or the 6mm 2nd layer of the top of the zoetrope you will need the use of one of the bigger machines.

1. Open your file in Asp-Ethos
2. Press alt and ‘r’ at the same time to centre your image
3. Go to material manager in the top drop down bars
4. In materials manager select the material to be cut (3mm MDF for the top base and animated sequence, 6mm MDF for 2nd layer of the top, 1.5mm petG or 1.5mm acrylic for your outer band)
5. Return to your image, next you will need to assign your lines to be cut or engraved to do this you can either go to top right of your page to a drop down menu select the line you wish to assign a job to then find the correct job/colour in the drop down menu or next to the drop down there is an icon the looks like an paper and pencil click on this select remove unused, then by selecting the job,( i.e. cut-through) the colour you wish to assign and set you can assign a job to the existing colours of your design.
6. **Make Sure When Using the laser space you pay attention to all health and safety precautions!** Before using the laser cutter make sure the correct extractor system is on, for the smaller machines this will be next to the computers used to send your files, for the bigger ones this is in another room and must be done by a member of staff do not use the machine without fist turning on the extraction. There are big red emergency stop buttons on all of the machines make sure you are aware of where these are depending on which machine you are using. Keep walk ways free and in the event of a fire raid the alarm and alert a member of staff do not try to put this out by yourself.
7. Place your material in the machine by lifting the lid and gently laying it on the extraction bed
8. If you can place it so the material is straight or square with the lines on the cutter bed, if you can place the material under the laser head and then very carefully place the plastic measuring block provided between the head and your material there will be a small dial on the side of the laser loosen this and allow the head of the laser to sit on the 11mm part of the block and then tighten gently, if you are not comfortable with this ask a member of staff.
9. Lower the lid
10. Make sure the machine is on by pressing the green on switch if this still doesn’t work twist the emergency stop button until it pops out and try again
11. Press the button with the image of a hand on in to turn the machine online
12. Press the button with the image of a whistle and then the button that has an arrow that looks like the enter button on a keyboard this should make a message that says ‘load media’ then using the arrow keys find the bottom left corner of your material you will be able to see the laser move as you do this and a red light will appear from the head which helps you to see where it is pointing, set the bottom left corner then do this again for the top right
13. Once done return to the computer
14. On the page under the drop down (from step **3.5**) there should be an icon of a door and an arrow if you hover over it with the mouse it should say send to cutter click this, a box will appear and give you the opportunity to review your request before it sends.
15. Once reviewed select send to cutter. If an error occurs check your material is the correct size for your file and that your request (material manager) has the correct information, otherwise seek the help of a member of staff.
16. Once your cutting is done wait for a moment for any fumes to dissipate and lift the lid.
17. Gently check your material has cut or engraved as you wanted then remove.
18. Remember to clear all unused material from the machine after use so it is available for the next person to use.

**Step 3**

Assembling the zoetrope

1. Using wood glue or araldite glue the top circles together remembering the markings need to be on the outside using bulldog clips or pegs leave these to dry then with a pencil and ruler mark the edges using the top for glue then on the bottom find the centre point by drawing it into quarters
2. Find the centre point and draw quarters on both sides of the 15x15 circle
3. Using the hand drill or pillar drill and a 3mm drill bit make 2 holes on the top engraved ‘x’ marks on the zoetrope band
4. Wrap the band around the circle top (making sure it fits tightly without distorting it, through the holes with a white pen or sharp tool mark the other end of the band for 2 more holes on the other end keep checking it will fit the circle.
5. Take the top away and with two 3mm rivets and a rivet gun (which you can borrow from fabrication) rivet the ends together. If the ends don’t come off snip them with some sharp plyers and then file down any rough edges
6. Carefully sit the circle top inside the band and with thumb tacks and a hammer nail the band to the lower layer of the circle (you can use a tiny bit of tacky wax or modelling clay to hold the tack if it is slipping away before you hit it with the hammer) do this around the edge under each slot you can add more for decoration at this point.
7. Once secure turn upside down with the bottom of the circle top facing up. And using araldite and the marks you made previously for guide glue your lazy Susan baring to the centre of your circle careful not to get glue in the mechanism
8. Once that side is dry put glue on the other side and line up your smaller 15x15 circle using the marks as guides on both the circles and press it onto the lazy Susan baring
9. Slot your 2 base parts together then using araldite run glue along the top of the newly assembled base and attach, lining up with your markings on your 15x15 circle
10. Once dry turn over and you can now slot your animated sequence into the top and you should have a working zoetrope.