



SCENIC CONSTRUCTION

Work Booklet

By George White 2004232

Aims and Objectives

Aims

- To develop students' knowledge and understanding of carpentry and metal working within set making.
- To develop students' abilities to apply knowledge and understanding through practical tests.
- To introduce students to the basic methodology of workshop practice considered essential to good working practice in accordance to H&S.

Objectives

- Display basic knowledge and understanding of scenic construction.
- Operate hand and machine tools commonly used in scenic construction in line with Health and Safety procedures.
- Display practical knowledge and understanding of the applications of CAD through the generation of technical drawings and ground plans in order to construct scenic units.

Task 1 - Tools

Rail Saw – These types of saws use circle discs and a rail to cut straight lines through long pieces of wood. I find a rail saw easy to use and very useful when making a variety of different types of stage flats. When using a rail saw you must wear protective goggles and always keep your hands away from the blades.



Drills – There are many different types of drills with many different types of uses such as drilling holes and inserting screws. Drills are very easy to use and are also very useful. There are many cool features that drills come with for example, a torch for dark situations or a magnet to make it easier to align screws.

Jig Saw – This type of tool is a free hand saw which helps cut curves and hard to cut angles on pieces of wood. The saw can be changed to suit the material or the type of cut style you want. Its quite easy to use and like the drill it comes with extra features, for example, a torch which makes it easier to use.



Wood Planer – This tool is used to smoothen pieces of wood to get rid of any rough patches on the woods surface. It also helps narrow long pieces of wood that are just a touch out of measurement. This type of tool is quite easy to use but you always need to keep an eye on what you're cutting because you don't want to take too much wood off.

Chop Saw – A chop saw is a very large disc saw that can cut long, thin, pieces of wood. The chop saw is a very dangerous tool but is built with a lot of safety features, for example, there is a safety guard which retracts whenever the saw is pulled down to cut wood. The base can change angles to change the degrees you would like your wood cut. This machine is very easy to use all you have to do is align your piece of wood up with the saw, pull down, and it will cut.



Staple Gun – A staple gun is a hand held tool that uses intense air to shoot out staples. The tool is connected to a large air canister which contains a large amount of air which is supplied to the staple gun. Some staple guns come with a very useful safety feature, if there's no pressure being applied on the tip of the gun then the trigger won't fire out any staples. Pressure must be applied in order for the staple to come out. This tool is used a lot to make stage flats and other sets and scenery. This tool is very easy to use and isn't that dangerous to use.

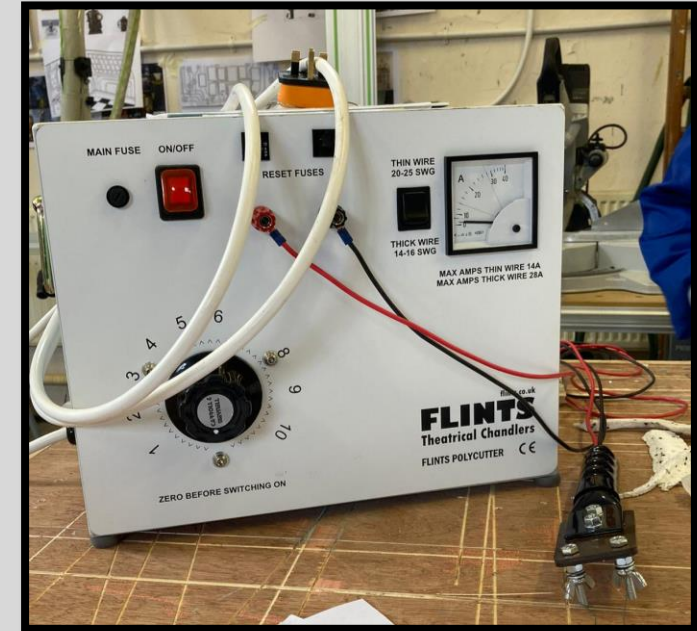


Hand Sander – This tool has many different uses, for example, it is used to remove any rough areas on the surface of wood and also remove small inaccuracies in measurements. The hand sander uses a vibrating mechanism with a sheet or sand paper attached to it. Depending what type of finish you want on a product will determine what type of sand paper you use. To use this tool you need a steady hand and always pay attention to how much you're sanding off as you don't want to take too much off.

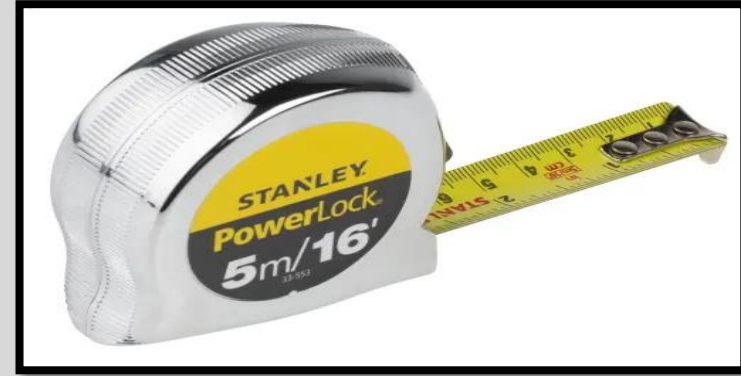
Welder – This tool is used for joining metals together. Recently I had the opportunity to help create a piece of set made from metal with the use of welding. We were designing a broken bird cage type chandelier that would be raised above the stage. It was very interesting to watch how something like that was made and from watching I could probably have a go at welding myself and do a successful job. However welding is a very dangerous tool to use, due to the metals heating together it can give off a cancerous fume that could be lethal therefore a special type of vacuumed mask must be worn. Another thing that makes this mask special is that it has a lens that will protect your eyes from the brightness of the torch welding the metals together.



Hot Wire - This machine is used to cut soft materials like polystyrene. It's a metal wire that can be heated up to extreme temperature which will then allow you to easily glide and cut through polystyrene with ease. It has an adjustable dial on the machine so that you can change what temperature you'd like the wire to be. However depending on the thickness of the wire will determine how hot the wire can go. If you have a really thin wire and blast it all the way up to ten then the wire will just melt and fall. This machine must be used with protective fire proof gloves and goggles so that you can prevent yourself from getting burnt.



Tape measure – A tape measure is used for measuring and marking out pieces of wood. This is a very common tool which every set designer should have. Tape measures have two different types of measurements on them. Those measurements are Inches and Centre meters. Some tape measure also come with the measurement of feet. Designers normally use the measurement millimetres but centre meters are easily to convert.



Goggles – Goggles are another tool that designers use for safety reasons. When chopping wood pieces of saw dust tend to blow all over the place and it could possible go into someone's eye, therefore goggles are there to protect peoples eyes for getting saw dust in them.

Pencil – A pencil is used to mark out measurements needed so you know where to cut.



Try Square - A try square is a tool that helps determine whether a wood joint is square and at the correct angle of 90 degrees. It also help to check if a piece of wood is straight and flat.

Fastener Tools

Hex Bolts – A hex bolt is a type of screw that has a hex cap. These bolts can be used with a nut or in a tapped hole.

Wood Screw – These types of screws have very large threads and a smooth shank that will enable two pieces of wood to be pulled together and kept tightly in place. Used in a lot of soft materials such as wood.

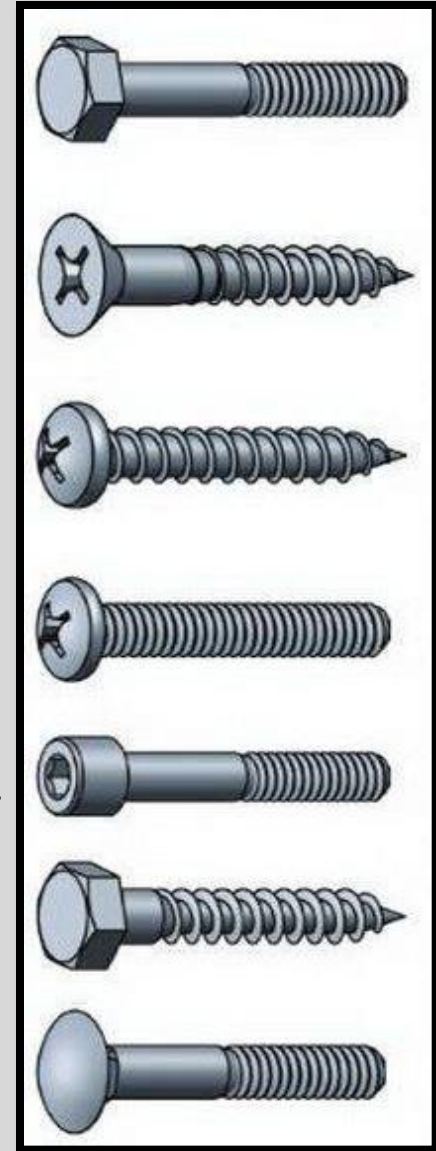
Sheet and Metal Screws – These types of screws have very sharp points and threads that are designed to drive directly into a tough sheet of metal. They can also be used in plastics and woods.

Machine Screws – These types of screws are completely threaded making it a very sturdy screw to use when creating sets.

Socket Screws - These are machine type screw which have an internal hex socket.

Lag Bolts – These screws are large wood screws with hex heads. They are normally used for wood construction and a lot of landscaping.

Carriage Screws – These types of screws have a smooth domed head with a square section underneath. This pulls the material in which prevents it from spinning during the installation process.



Source -

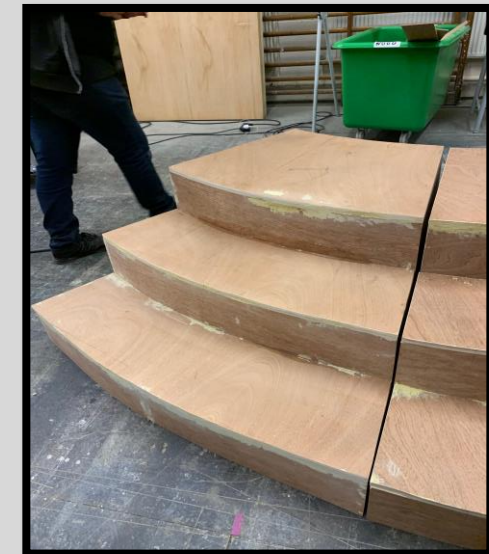
<https://moodle.uwtsd.ac.uk/mod/resource/view.php?id=154222>

Task 2 - Theatre Treads

- There are many different ways to build theatre treads. Depending on what the customer has asked for will determine the size of the treads, the width, the amount of steps on the treads and the overall design of them.
- The function of a tread is to help actors get on and off stage with ease. There are a lot of safety regulations that need to be met when making treads, for example, the treads need to be perfectly balanced and level with the floor, if the tread isn't level then it will rock side to side which can cause an injury if someone was to use it.
- Another safety regulation that need to be met is the weight distribution of the tread, if the tread cant a persons weight then the wood will snap therefore causing another injury.
- **Critical angles** – The critical angle is a 50 degree angle. The normal angle for a step is between 50-30 degrees.
- Depending on the design of the treads will determine whether handrails will be constructed or not. Hand rails are a very useful safety feature as the allow stability and balance to the person using the treads. Treads are used for quick use of getting on and off of the stage, sometimes a handrail could get in the way especially id there is a big prop that needs to come on and off of the stage, or even a big costume that could get caught on the railing.



I had never made treads before so I was really looking forward to learning about how to make them as well as gaining the experience I needed to make them again. Considering that normal treads are basic stars the designs for the treads we're going to make are going to be significantly harder. We had to take into consideration the angle of which our treads were going to be due to the fact that they were being made for a curved stage. We started off by measuring and marking out sizes on 15mm thick plywood. Once all of the pieces were cut out we started to put them together. We used wood glue and screws to secure them in place as well as using a staple gun. To help the attach to one another we inserted some support beams inside of the to help keep their shape and to make them more sturdy and durable. At first there was a bit of a rocking motion when someone would stand on the treads so to over come this we rearranged the treads until they were all flush and the bottom of the treads were level with the floor. When making treads like these its always good to use wood that hasn't been warped as it can lead to some measurements being off and you will notice a slight bend in the wood. I would like to have another go at making treads like these so that I can test myself if I can still remember how to make them correctly.



Different Types of Flats

Book Flat – This is where two flats are hinged together on a vertical edge which will enable them to be free standing. These types of flats are normally used as a backing for doorways or windows. Braces and weights are normally used to help the flats maintain balance if they should get knocked or pushed.

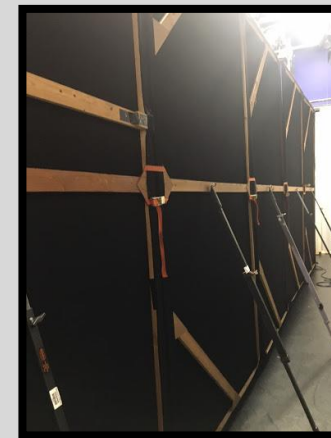
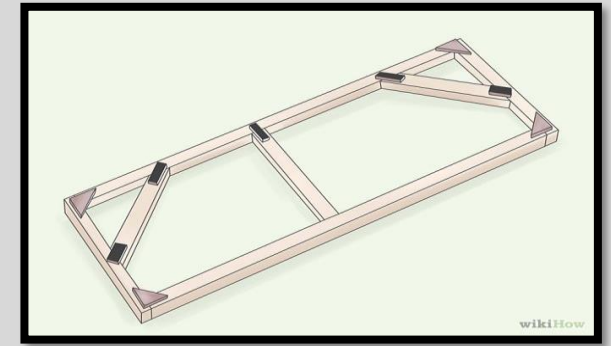
Broadway Flat – This is a very commonly used flat normally in theatre productions. These types of flats are a lot lighter in weight and are very compact in storage.

French Flat – This consists of a number of flats fixed together with battens. These types of flats are normally flown into place usually with French braces.

Hollywood Flat - A Hollywood flat is normally made from timber and the covered with a plywood skin. These types of flats are normally used for film and tv. The woods thicker edge allows the flat extra stability and clamping adjacent can be easily done, this also makes the flat look more like a screen on camera.

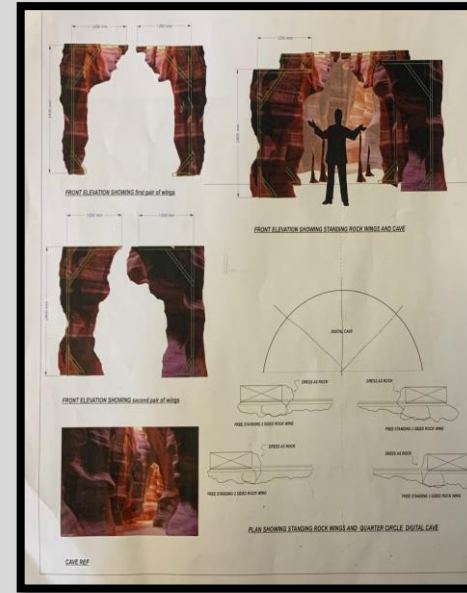
Source: <http://www.theatrecrafts.com/pages/home/topics/scenic-stage-design/flats-types-methods/>

Now a days majority of flats being produced and mainly made out of wood. Variety of different types of timber, plywood, MDF are used when constructing flats. Plastics have also been introduced to increase production of flats. Polycarbonate sheets are a lot lighter and a lot easier to work with than traditional canvas flats. Designers want a more realistic set and that can be achieved by using plastics and woods. **Source -** https://www.youtube.com/watch?v=xmSvA7_IpBI



Flats I Made

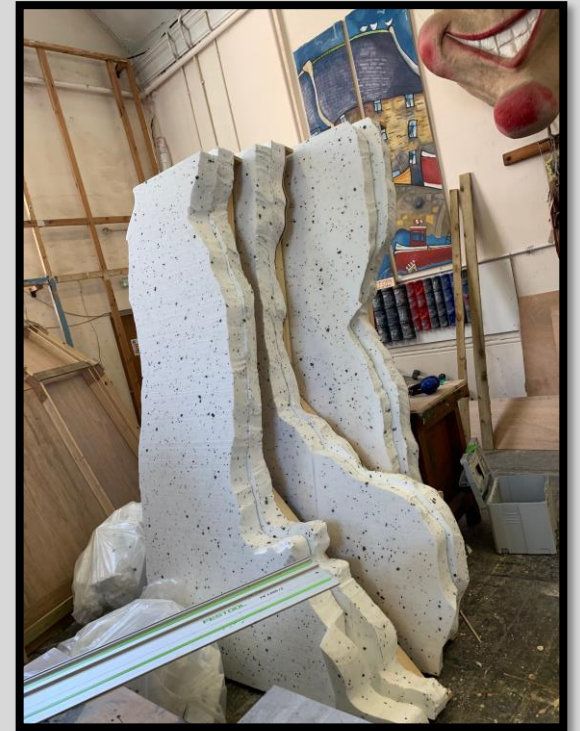
We were given a sheet of paper at the beginning of the lecture and on it was the design plans for a piece of scenery. The scene that we were going to construct was a cave, the set would contain 4 flats (2 on each side) and a huge arch which would act as the cave itself. We started by writing down the dimensions of each flat and then went straight to building. We used pieces of two by ones and started marking out the measurements. To cut these pieces of wood we used the chop saw. The chop saw enabled us to cut the pieces of wood to their exact measurements. We used Glue, screws and a drill to attach the pieces of wood together. By using glue and screws the joints will be very hard to break or detached. Once these pieces of wood were cut we then started work on the shape of the flat. The frame of the flats, if constructed correctly, would fit the design of the top pieces of wood. There are a lot of curves on this piece so to cut them we used a jig saw. We used an over head projector to project the design of the flats onto a piece of 3mm plywood. This helps give an estimate sketch of the flats curves. Now all of our pieces were cut we started putting them together. We used a staple gun and glue to secure the pieces together. The flats were half way complete all that was needed to do now was to attached the polystyrene to the flats.



Flats I Made

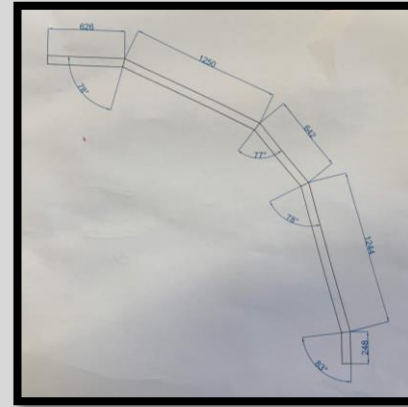
We had just received a delivery of polystyrene which we are going to use as the cave walls. Referring back to the plans the cave walls need to be curved and look layered. The cave walls we need to copy looks like its been eroded away from years of wind and sand slowly curing the rocks and making them look smooth. To recreate this look we are going to shape the polystyrene using a hot wire. We used the polystyrene we didn't need to make small bolder looking pieces of set. We stacked the polystyrene on top of one another and glued them together by using a certain type of glue. We used the same glue to attach the polystyrene to the flats. To get the curved edges onto the polystyrene we traced the outline of the flat with a black marker. We then used a hot wire to carve the polystyrenes curved shape and the stacked them on top of one another using that same glue. The benefits of using a hot wire is that it can be shape in whatever way you'd like to help create intricate shapes. A technique like this was used by sculpture studios. They created a polystyrene brick wall that's stretched over 30ft long. Wire brushes and sand paper will help make the polystyrene smoother and look more realistic. **Source -**

<https://www.youtube.com/watch?v=PzVDEqrJoil>



The Cave

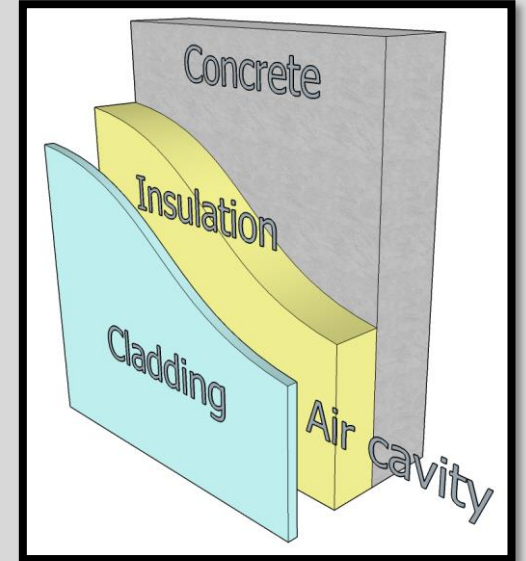
At first glance this seemed like a very difficult design to create, but going over the design a few times things started making sense. Because the pieces of wood are made out of two by ones the would be cut on the chop saw. To attach the pieces of wood together they would need to be cut at specific angles. Due to the size of the angle we were unable to cut them on the chop saw so we figured out a way that we could. It was pretty simple, we took the angle away from 90 degrees and then used the answer as the angle we needed to cut on the chop saw. Once all the pieces of wood were cut we then glued them together and used larger staples and stapled them together. To ensure that they would stay stapled together we placed 5mm ply wood on the joints and then stapled those to the joints. Because these pieces of wood aren't flush with the arch we used a router to cut the excess wood off. Now we had the arches ready we needed to started putting them together. We used three by ones to join the arches together by gluing and screwing them together. Our next step was to use 5mm ply wood and cut out the accurate size pieces that would be stapled to the arches. As soon as all of the arches are complete we are going to do the same thing that we did with the flats, we are going to stick polystyrene to the cave walls and carve them so that they look like authentic cave walls.



Study Task 3

Cladding - this is the application of a material secured on top of another to provide a flat layer. Its used to provide a degree of thermal insulation and weather resistance.

- There are a variety of different materials that can be used for cladding, for example, different types of wood, metal, brick, lumber, and concrete, as well as some IFR (Inherently Flame Retardant) cloth.
- Hardboard is a very cheap option which is normally used for cladding. It's a very flexible material but unfortunately not very durable and is very heavy and hard to move around.
- Plywood is your more expensive material which is use for cladding, but it's a lot more durable than Hardboard and a lot lighter too making it easier to move on and off the stage.
- Cladding can be used for all kinds of things for example, it can wrap around an entire building or just cover a specific area.
- Its purpose is to protect structures for external forces such as weather. It can also provide insulation and noise control. This can be done by installing materials such as polystyrene or acoustic insulation to stop noise from traveling through.



Study Task 4 – Benefits of using metal

Metals have a variety of different properties that can be used a lot when making props or sets for theatre and film. Metals are a very strong material, they are heat resistant and are very cost effective. They can last a very long time and will only rust if they aren't taken care of correctly. Metal is also very versatile, it can be welded, soldered and moulded. However there are a few downsides to using metals, for example, there are a lot of design limitations. When designing it's always important to consider what properties a metal has as not all metals are malleable. Metal is also significantly heavier than wood so carrying it on and off the stage it's going to be a huge challenge that's why metal is only used in small amounts for sets and sometimes used for props. Metal has been used in all kinds of shows for example:

Wicked – The Oz Head

In the musical Wicked they use a variety of different metals to help create and operate the giant Oz head. The Oz head was designed by Bob Flanagan and he took inspiration for his design from both the book and the movie. He also took inspiration from the original design of the tin man from the Wizard of Oz movie. He made plenty of designs and around 7 – 8 models of the different designed Oz heads. The Oz head has many cool features, like it has both lighting and smoke effects which can be controlled behind the scenes. The way that the Oz head is operated is very unique, for example, to operate its mouth movement it uses a bike brake, the eyes on this machine can blink and the eye brows are able to move up and down by using a drum pedal. The design of the Oz head was to be scary so the designer Bob Flanagan used LED lights for the eyes to make the head even scarier.

Source - <https://www.youtube.com/watch?v=I0atKUyMp6I>



Using Metal

I had never really worked with metal before but luckily I got the opportunity to help Dave with the third years production. They had asked us to make a metal gazebo that looked old and broken. We had a look around the workshop and managed to find some long metal poles that were perfect for the task. At first we were very confused on how make the poles circular so we did some tests. We started my drawing a circle onto a table, and the splitting it in half twice and screwing screws at each point on the circle. The first attempt didn't exactly go to plan as the metal pole looked more like a square than a circle. The next idea was to screw screws all away around the circle and then to hold it in place screw in other screws on the other side of the pole to make it secure and take the shape of the circle. The poles were hard to attach so we decided to weld the end together and that enabled the poles to keep the circular shape. We repeated this method twice and ended up with two very large metal hoola-hoops. Luckily Dave had ordered special pieces for this set, he had ordered metal, Swirly, decorative things that we would use to attach the two metal poles together. Once again we used welding to join the metals together, but we had to remember the fact that the third years wanted the gazebo to look old and broken so we attached the swirly things to the poles in all kind of positions to give it the broken look. I really enjoyed working with metal and I would like the opportunity to work with it again, especially now I kind of have an idea on welding.



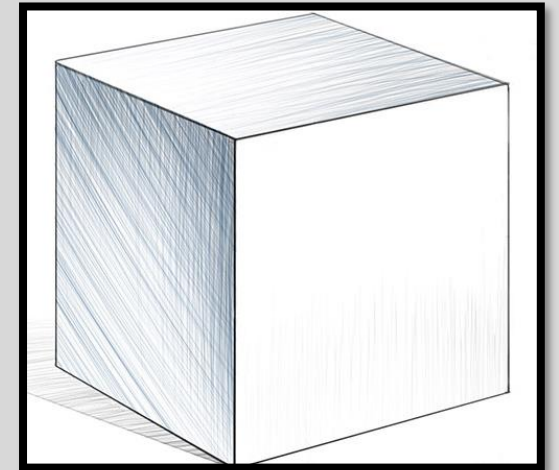
Perspective Drawing

One Point Perspective - this is a drawing method that shows how things can appear to get smaller the further they go away, eventually converging towards a 'vanishing point'. It's an easier way of drawing objects on a flat piece of paper.

Vanishing Point – a point at which something disappears or ceases to exist.

Horizon Line – this is the point where the earth meets the sky. It's always at eye level – no more and no less.

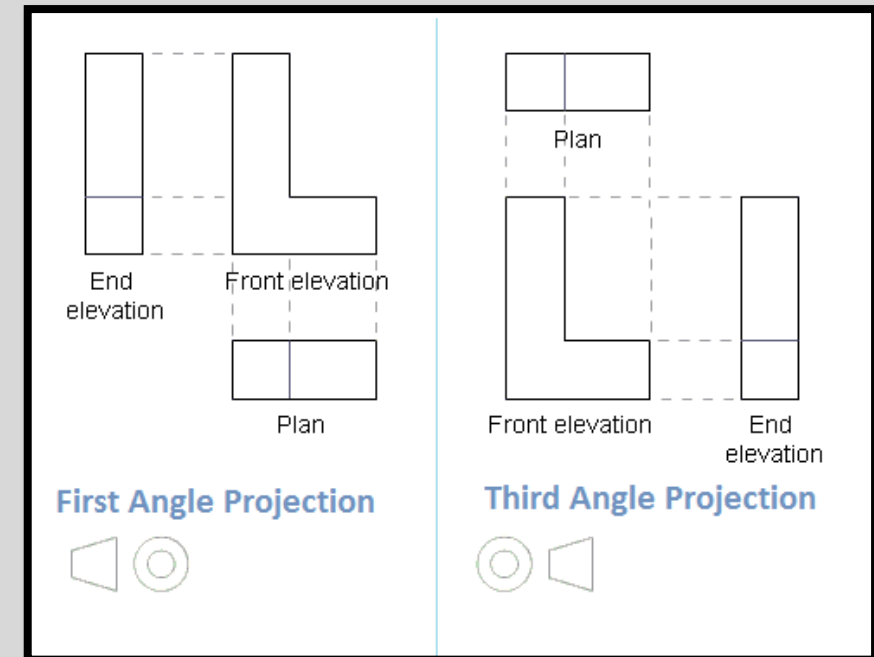
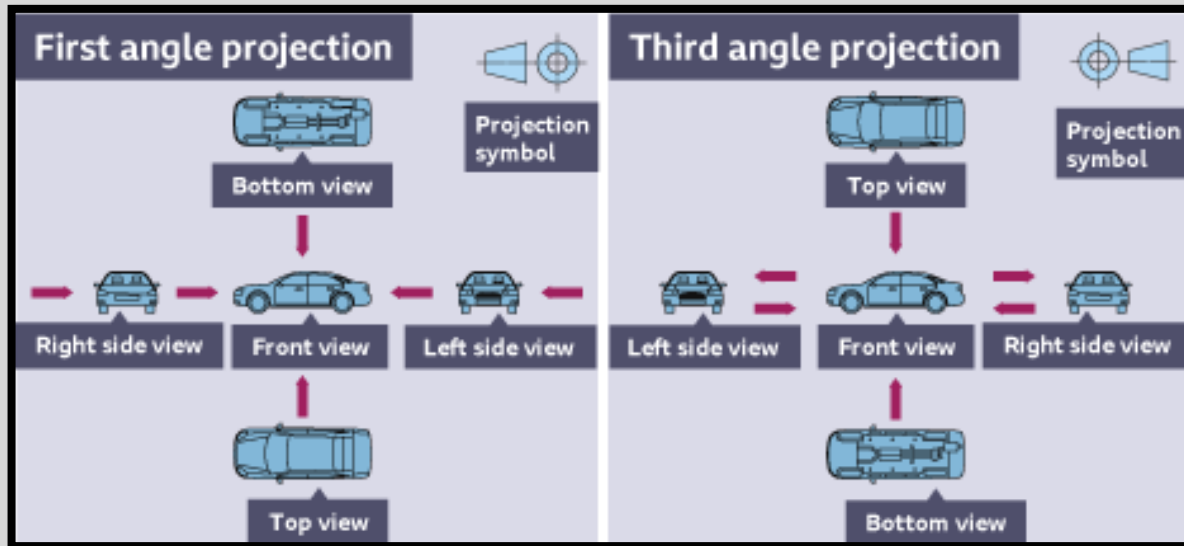
- Eye level and line of sight are completely different.
- Most designers use pencils as a scale reference, for example, how many thumbs are above your eye level.
- As you can see on the right there is a cube, if you can draw this cube you can practically draw any perspective.



Task 5 - First and Third Angle Orthography

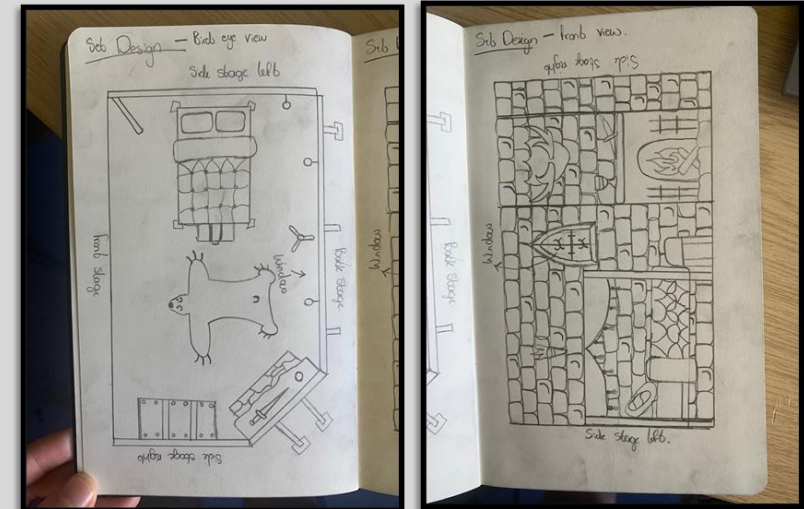
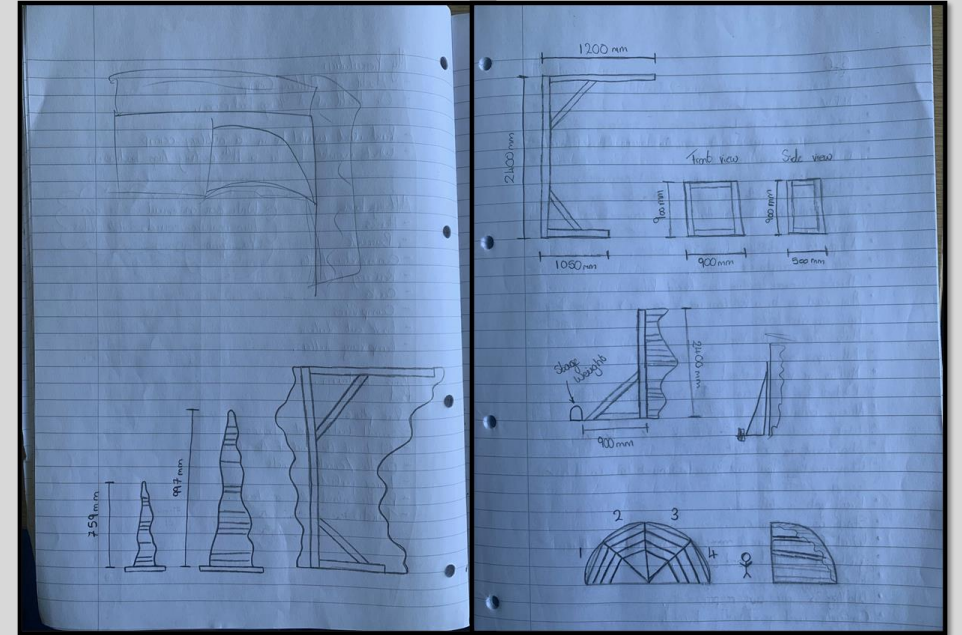
First and Third angle orthography are the two main types of orthographic drawings. There are hardly any difference between the two drawing techniques apart from the fact that the projection is in the position of the plans. Third angle orthography is what people would see from the right and how they would be drawn where as first angle orthography is what people would see from the right and drawn onto the left. **Source (image too) -**

<https://www.bbc.co.uk/bitesize/guides/z6jkw6f/revision/6#:~:text=The%20difference%20between%20first%20and, and%20drawn%20on%20the%20left.>



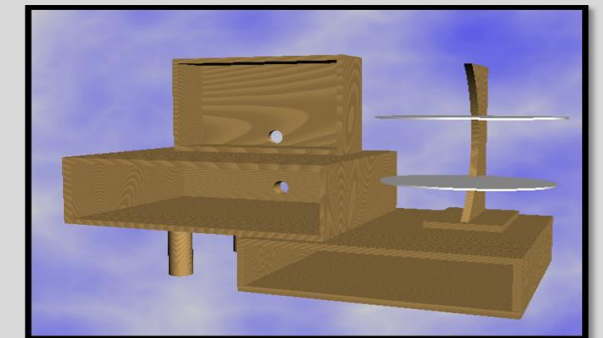
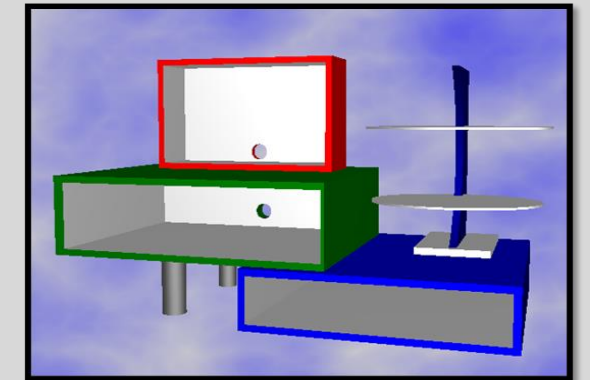
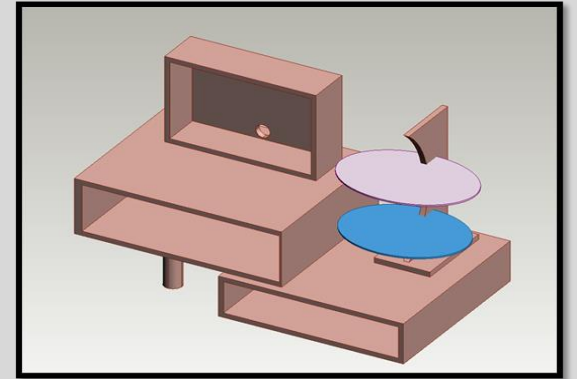
Scenic Drawings

- Scenic drawings act as instructions for set designers when designing sets and stages.
- Many scenic drawings use the measurement millimetres
- Scenic drawings are 2D drawings that show a basic layout of the desired product viewing different angles.
- There are a variety of different products that can be made for different types of stages.
- However before the sets can be made a series of prototypes must be made to ensure that



CAD (Computer Aided Design)

Back in High school I used to use a CAD software very frequently. I used the software called Pro Desk top. This software had a variety of different features that allowed me to create my designs in 3D. There are a variety of benefits that designers can use when using CAD. CAD is incredibly accurate when it comes to dimensions, you can draw shapes by using the various tools given to you and input the correct measurements on the design and the software will allow you to see if the measurements will be correct. I used CAD for designing Products back in high school so I haven't really had the chance to use it for scenic construction. However the same principles will apply, just because I'm not designing a product doesn't mean I won't be able to use Pro desk top for set designs. As I already know how to operate pro desk top I will for sure be using it when I enter the industry and a set designer and throughout my university experience. During one of our lectures we were introduced to a new CAD software called Auto CAD. Auto CAD is an industry standard software which is used by a variety of different designers in the industry. Its free to download and can draw fine lines and technical hand drawings on your computer. After view the lecture AutoCAD seems pretty simple to use however I'm pretty sure I will need a lot of practice before I can get familiar with the software. I haven't been able to access AutoCAD on my computer so I am going to conduct some research on how I can install it and practice using the software so that I am familiar with how to operate it and how I can use the variety of tools to be able to create complex technical drawings.



Task 6 - What are Revolves?

Revolves are a moving piece of scenery used on stage. Revolves can be hired however they are very expensive. Revolves can be adapted to fit any production and any stage. A revolve is a device that can change or shift sets in one position, it can basically spin a set 360 degree, for example, the rotating swamp in Shrek the musical. Revolves can be computer operated and programmed to move in specific ways. However they work better on a flat stage as they can they move without any limitations

Revolves can have a massive impact on a production. Thinking of different ways to interoperate a revolve in a set is incredible, its an effect that can really captivate the audience and get them thinking 'how did they do that?' Shrek the musical uses three revolves which they can program and change the direction they are rotating in. another example in Shrek is the princesses Castle. This piece of set can rise out of the ground and go back into the ground thanks to the use of revolves. I hope to use revolves in a set that I am designing one day as I think that they are a genius way of captivating the audience and they have such a massive range of functions which I hope to understand and use. **Source -**

<https://www.youtube.com/watch?v=68Mig6ni0vU>



Task 7 - Interesting Sets

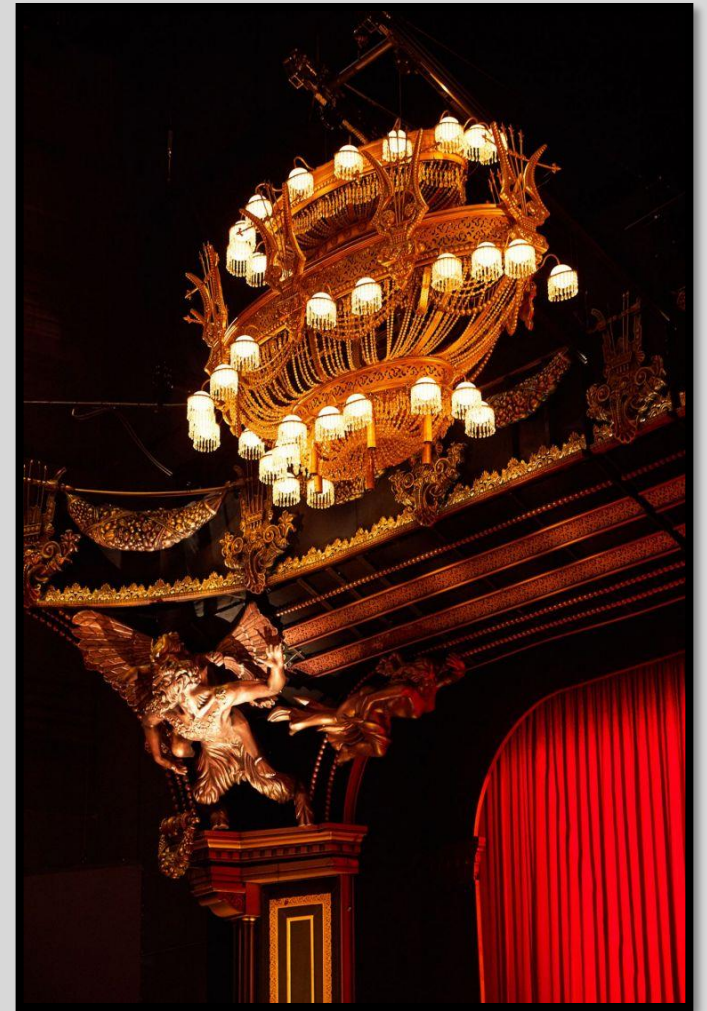
The first set I will be commenting on is the sets for the Disney plus series the Mandalorian. This is a prime example of what designing a set is like in the 21st century. They use techniques that has never been seen before. They used game engine technology to help create the perfect CGI scenes. We haven't worked with CGI in this module but its something that id like to learn and master to help me with this new generation of set design. The first of this technology was used in the live action lion king and then interoperated into the Mandalorian. Due to the Mandalorian being in space and having so many different lighting aspects or scenery it was a challenge to get these aspects right the first time as they needed the scene to be accurate as possible. The Mandalorian is the first show to use real time rendering and a live wall in camera with effects. Due to this show being owned by Disney and the fact that it's a tv show means that there is going to be a much higher budget than your average stage production. However I think that its crucial that now in the 21st century that we try and adapt the theatre to these new technologies and create masterpieces for everyone to enjoy live on stage. This will also start to bring in the argument 'man vs machine'. However there is a easy way to overcome this argument, if this type of technology gets brought into the theatre then new jobs will be required, basic training will also be required so it could give designers new job opportunity's as well as using old traditional theatre standards and methods. I found this information on the Disney plus series star wars gallery, it's a 6 part documentary series which explains how they made the Mandalorian.





Another set I am going to talk about is the set of the Lion King. This set is one of the most unique and breath-taking sets ever designed. The entire story is based around Africa and what life is like for animals living in the African planes. The designer Richard Hudson was responsible for bringing this set to life, he has managed to accomplish and a lot more. He said that in theatre it's the audiences job to fill in the blanks and give them a little but of what its like, the audience will then use their imagination and go beyond the limitations of what's actually happening on set. They use brilliant techniques that involves stage positioning and the lighting. They use special lighting techniques to make the background look like its infinite, with the assistance of the stage being 'racked' (tilted) it gives the effect of a huge amount of space past the stage, almost like looking over a cliff. Their version of pride rock is basically a massive rotating tread. Looking back at the beginning of the year the treads were quite easy to construct, however they were a lot smaller than this massive, rotating piece of scenery. I think that is incredible as it allows easy access on and off of the set and it can rotate and disappear into the stage floor without the hassle of moving it on and off stage all thanks to the use of revolves and classical treads. I would love to have the experience of helping a designer make a piece of set like this or eventually make my own. The designer has cleverly made the set look as if a real bug cat has clawed at it and it give the audience the realisation that this show is all about animals. The design of the claw marks can be seen throughout and I think it's a very ingenious way of using animals and what they do to a piece of scenery. Source - <https://www.youtube.com/watch?v=e5nZCVXUk3I>

Another set that I found really interesting is the falling chandelier in the phantom of the opera. The one used in the theatre is the original chandelier used in the very first show, the chandelier is now over 30 years old and is still used to this day. It has been designed to drop in about 7 to 8 seconds and with the assistance of motors and cables the falling motion looks more dramatic. The lights used on the chandelier work by just flicking a switch on an I phone. The entire show of the phantom of the opera is big and captivating. They use a variety of different show tricks on stage, such as the use of a trap door. The designers had put a lot of thought and effort with this set and I hope one day I will be able to create a master piece like this. By using the skills we learnt in this module I hope to improve and adapt my knowledge and understanding of how a set is designed and constructed with such professionalism. Referring back to the beginning the chandelier itself isn't made out of metal, in fact its made of various wood and plastics. But because the chandelier is so high up and doesn't really come down until that one scene the audience isn't really going to be able to tell that its not made out of metal. **Source** - https://www.youtube.com/watch?v=py_iDeCFkc



Summary

This has to be my favourite module that we have done all year. The reason why I wanted to take this course in the first place was so that I can understand and create amazing pieces of scenery which will be used in a production. Unfortunately due to covid we missed out on a fair bit of this module so I made it my goal to help out in any way possible with the other year groups. Luckily enough I was given an opportunity to help out and I spent three days straight helping create the third and second years sets and bring them too life. The jobs I was given weren't that big but I didn't care I was still happy to help out. In fact the work that I did helped out a lot as it helped speed up the production and help get both years ready for their final performances. I used the skills I had learnt from my scenic construction module to help me out and build the things needed as well as gaining new skills in welding and scenic art. I feel confident with the construction side of this module, however I would like to improve my scenic drawing and CAD work. At the beginning of the year we briefly touched upon both topic but I now feel like I need a refreshers course just to help me get the knowledge back that I learnt as the start of the year. Another thing I enjoyed in this module was the fact that I got to work with a completely new material. I had never used polystyrene before and never thought of how often it is used in set design. The material is very easy to use and can be shaped and cut into practically anything. I am for sure going to use everything that I have learnt throughout this module to get me the grades I need to pass my course and get a successful job.