



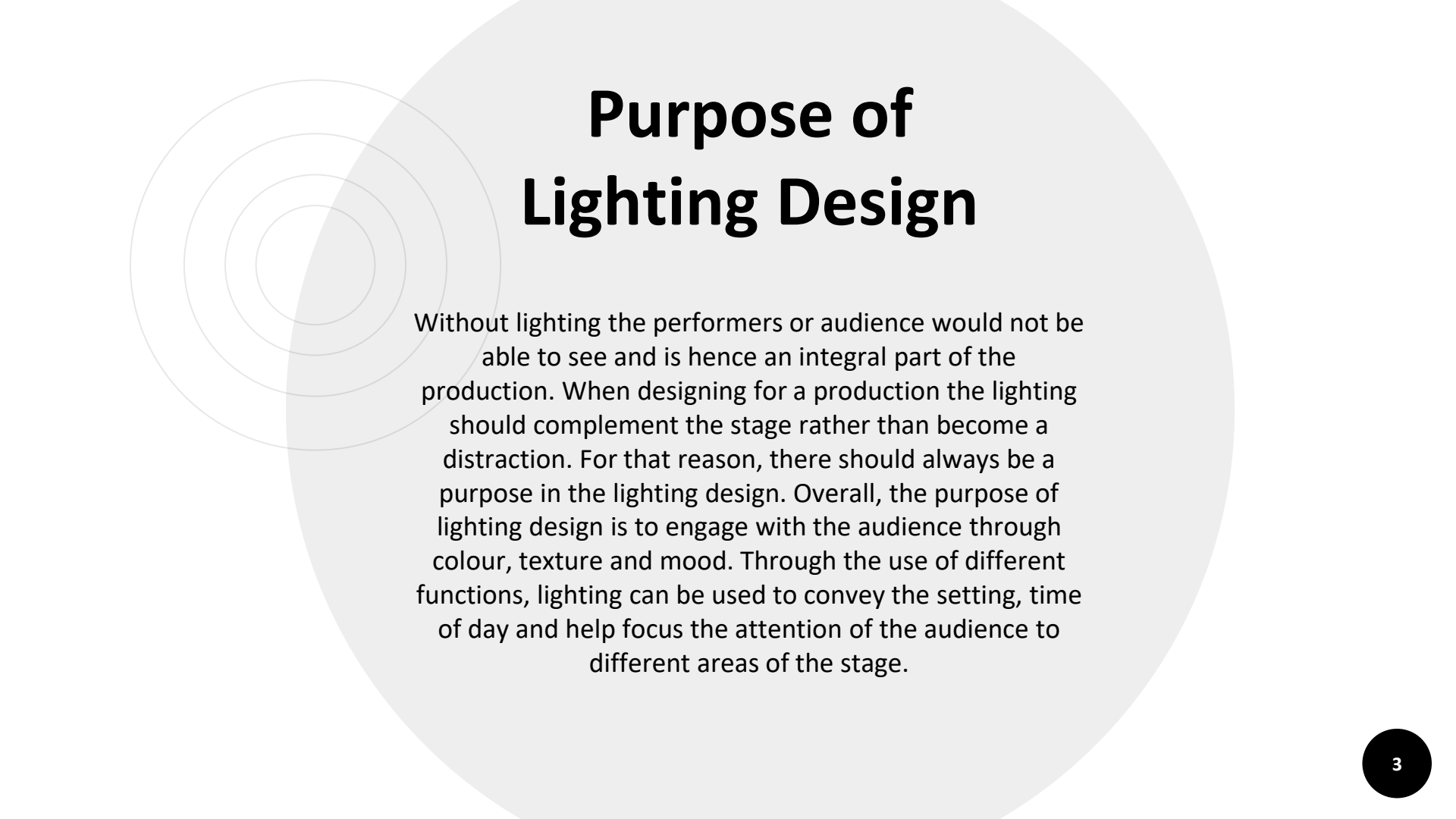
Production Technology

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Health and Safety

The purpose of Health and Safety at work is to protect those in the workplace (Benstead, 2019). Particularly within theatre, to create a safe working environment it is important to become aware of hazards and dangers that might occur to yourself or on a particular show.





Purpose of Lighting Design

Without lighting the performers or audience would not be able to see and is hence an integral part of the production. When designing for a production the lighting should complement the stage rather than become a distraction. For that reason, there should always be a purpose in the lighting design. Overall, the purpose of lighting design is to engage with the audience through colour, texture and mood. Through the use of different functions, lighting can be used to convey the setting, time of day and help focus the attention of the audience to different areas of the stage.

Functions of Stage Light

The four key functions of stage light are the following:



1. Visibility

Staging light allows for visibility of the stage and helps direct the audience's attention to something (Onstage Systems, 2019).

2. Composition

Composition plays a key role in my methodology as Set Designer as it will allow for important props or sets to be visible to the audience.

3. Mood

Lighting helps to change the mood of the audience. This is accomplished through changing colour and direction of light.

4. Selective Focus

Through using high or low intensities of light, selective focus can force the audience to look where is desired (Wikibooks, 2018).

What Does a Lighting Designer Do?

The key things a lighting designer will do is:

- Read scripts and attend rehearsals.
- Coordinate with a director and production staff.
- Perform and communicate design ideas through mood boards.
- Create a lighting plan.
- Write cues for a show.
- Coordinate implementation through the Chief LX.

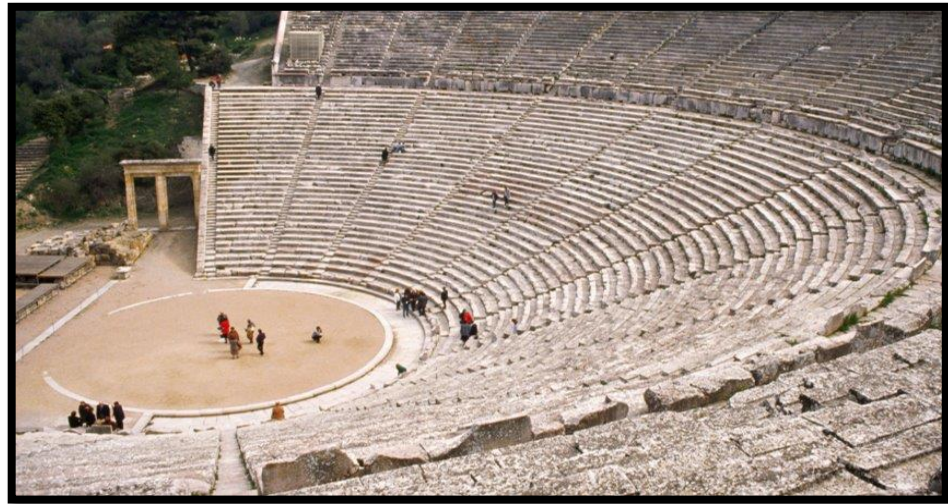
The design process involves:

- Reading the script.
- Talking to the director about potential ideas.
- Re-read the script whilst looking for lighting clues.
- Listen to any music provided.
- Discuss final ideas with director and repeat the process until perfect.

History of Lighting in Theatres

Greek and Rome Theatron

Lighting within theatre started within the Greek theatron during the 6th and 5th century CE. Although it was built in the open air, the Greeks positioned them in a particular way so that in the afternoon the sunlight would come from behind the audience and light the performing area. Similarly, the Roman theatres were also outdoors but included a coloured awning that would cover the spectators, this allowed the glare of the sun to be less harsh. (Holmes, *et al.*, 2015)



Commedia Dell'arte

During the 16th century, candles were introduced in Italian court theatres. Italian architect Sebastian Serlio was one of the first to talk about using candles in theatres. Colour was also introduced during this period as Amber, red and blue water in a flask would be placed in front of the candles to achieve different coloured lights. Numerous candles were required to light a stage and were placed in chandeliers or footlights above the audience, this caused many problems as hot wax would drip on people and due to the heat, it caused people to faint in the theatre.



Limelight

Limelight, the first theatrical spotlight, was invented by Thomas Drummond in 1816. This light consisted of a block of calcium oxide heated to incandescence in jets of burning oxygen and hydrogen. Furthermore, limelight provides a soft yet brightly lit light that can be directed and focused on actors. Due to the intensity of the light, it was most useful for spotlighting and simulation effects like sunlight and moonlight. The biggest disadvantage of limelight was that each light required constant attention from an operator, who had to keep adjusting the block of calcium oxide as it burned (Britannica, 2012). More importantly during the end of the 18th century, Scottish engineer William Murdock developed a more practical method of distilling gas from coal. The first successful transformation of gas lighting for the stage was demonstrated in the Lyceum Theatre, London (Gillette, et al., 2015).

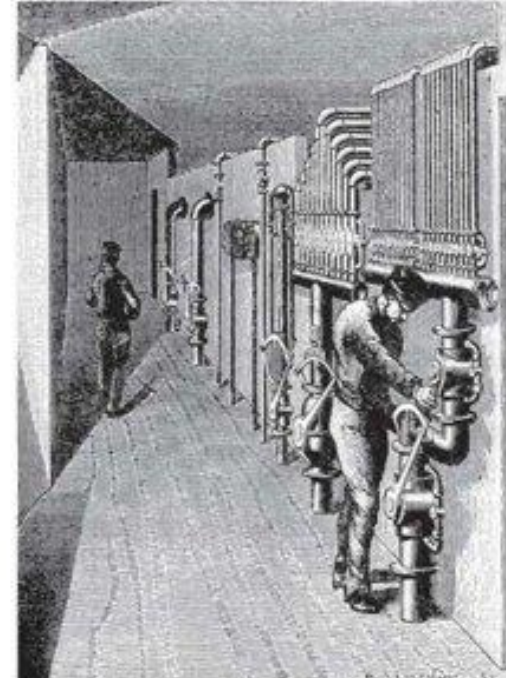
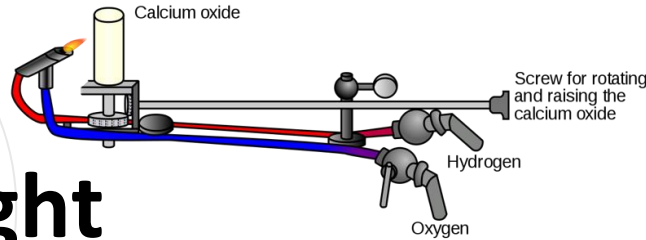
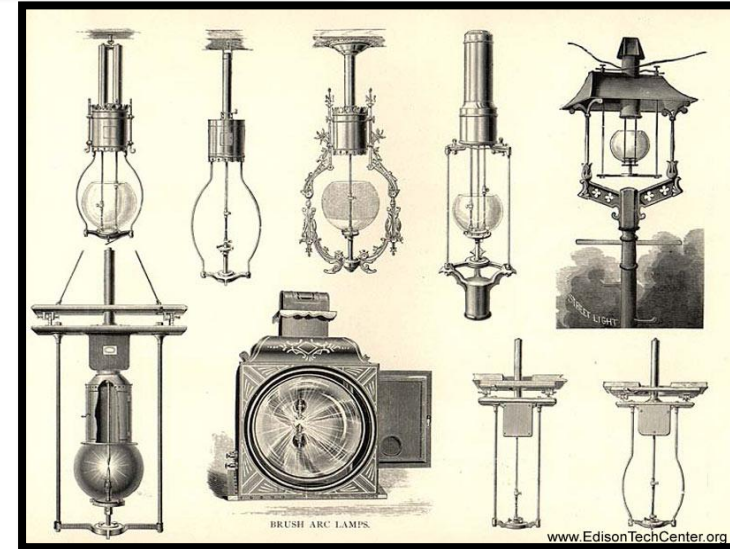
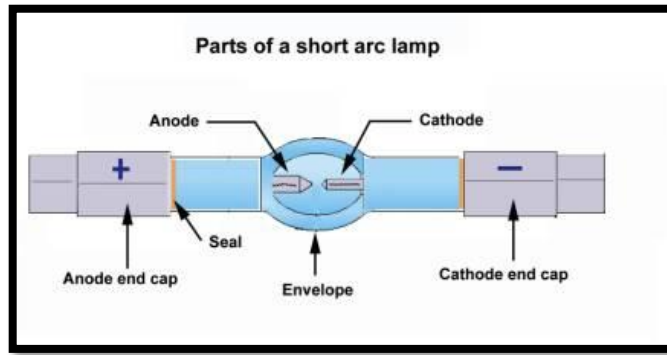


Fig 66. "Jeu d'orgue" at the Paris Opera. Charles Nodding, *Le Nouvel Opéra*, (Paris, 1875).

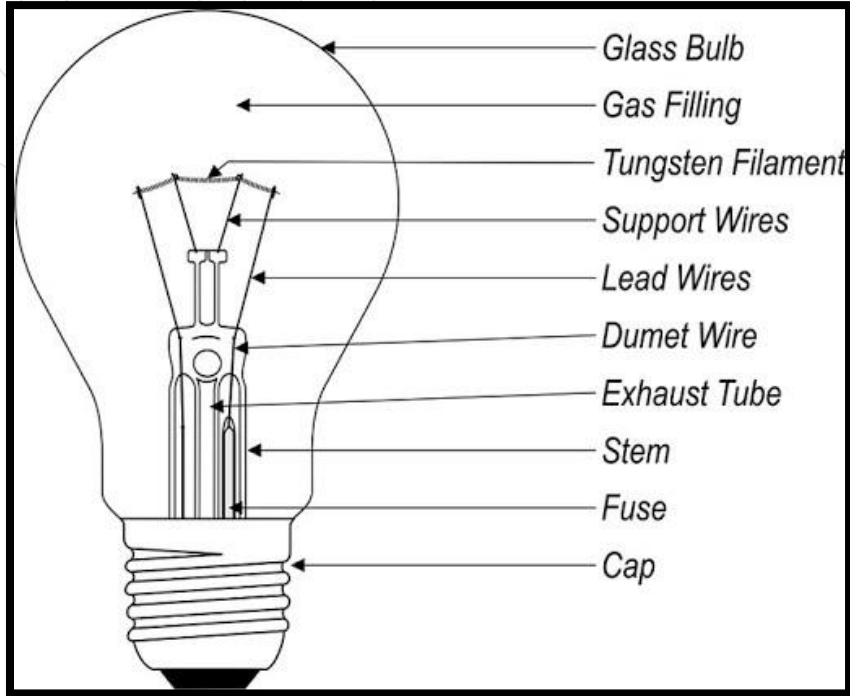
Theatre Lighting in the Age of Gas 123

Carbon Arc Lamp

The carbon arc lamp became the first most used electric light and the first commercially successful electric lamp. The light is created through a spark or electric arc between two carbon rods. Originally, the first carbon was made from charcoal. During high temperatures of the arc, around 3600°C , carbon substances become vaporized which creates a highly luminous light. Distance of the carbon rods is particularly important as if the gap is too big the arc will flicker and extinguish quicker, whilst if the gap is too narrow it will produce less light. Although, it produces a very bright light there are many dangers, the main danger being a fire hazard. Many theatres that used carbon arc lamps were burnt due to the result of excessive heat and sparks that emitted from the lamp.

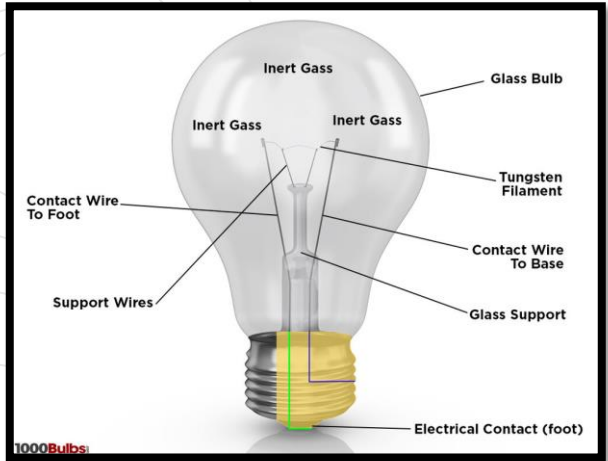


Incandescent Light



The incandescent light is typically used today and is classed as your classic light bulb for interior lighting. Light is produced by heating a wire filament to a certain temperature. The metal wire is surrounded by a translucent glass bulb as shown in the image, it is then filled with an inert gas or evacuated. With an affordable price range and lots of availability, incandescent lights are fairly good especially with their range of voltages, light outputs and currents. A downside of using these lights are their efficiency, as 90% of the energy goes into generating heat.

Tungsten Light



The use of a tungsten light could be a creative choice, especially with its warm tone. An example of this is from The HAIR UK tour, which they used a predominately tungsten rig in order to reflect the period which it's set in.

As of today, you will find nearly all theatres use a tungsten lamp. Tungsten halogen lamps are filled with halogen gases such as iodine or bromine, compared to the use of inert gases in incandescent lamp. When a current passes through the filament of a tungsten bulb, the natural high resistance of tungsten causes the filament to produce an orange light. Due to the constant reheating of the metal, it will slowly evaporate, and the wire will slowly get thinner to the point where it will snap. One of the biggest problems with the tungsten bulb is that it's energy inefficient.

LED

LED stands for "Light Emitting Diode". LED is a device that emits light when a current flows through it. It is said that when electrons move through the semiconductor material, they will lose energy due to the structure of the material. The energy losses happen through jumps which the energy is then released as light. An exact amount of energy will determine the colour of the light. Therefore, each LED will give off light in a specific colour due to the amount of electron jumps (Salzberg and Kupperman, 2018).



LED

Yearly Operating Cost - **\$1.94**

Energy Usage - **9w**

Brightness (Lumens) - **800**

Bulb Lifetime - **25,000 Hours**

\$162
Lifetime Savings
over an
incandescent
with the same
brightness

Energy efficient

Sustainable practices are becoming more important within theatre therefore switching to LEDs is important.

Smooth dimming,
reliable and bright.



Allow for a variety of colours to be produced without having to use lots of filament lanterns with gel.

Profile Spotlight

This light fixture is excellent for producing a small pool of light and has a good light throw distance. In addition, the lenses can be focussed to create hard or soft edges through using shutters. Shutters are a piece of metal attached on the nose of the light that cuts off some light to create corridor shapes. In addition, gobos can be projected onto these lights to create texture, shape and form. The beam angle can vary from 6 deg which creates a tight spotlight, in comparison to a 50 deg which allows for a soft gobo wash. (Sayer, R. 2007).

For a small to medium sized venue use 500W to 1000W. Whilst larger theatres use up to 2500W profile spotlights

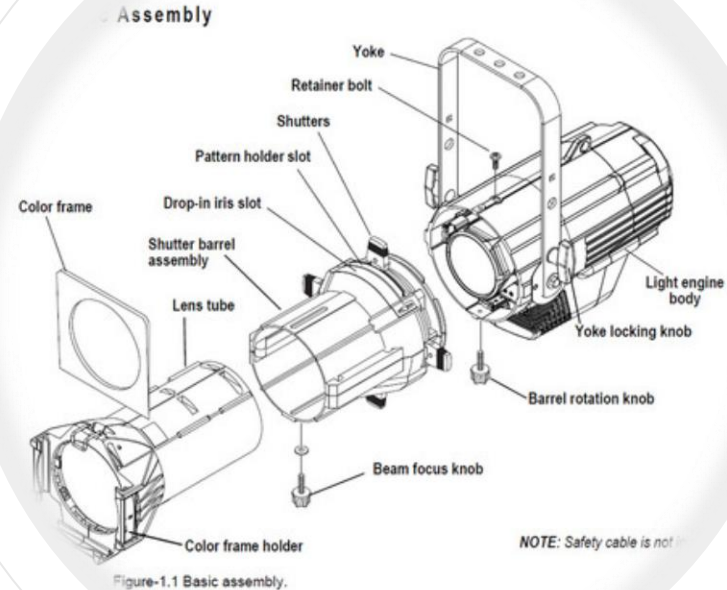


Mostly used for 'specials'.

Source Four Light



Mostly used as a directional spotlight, a source four light is the most versatile conventional fixture as it can be adjusted to have a short or long throw distance. Furthermore, the source four light fixture has good lamp focus, a rotating barrel and a shutter. Due to its cast aluminium construction with a bulb in the back of the fixture, it allows for heat to easily escape out of the back making it much safer.



Fresnel Light

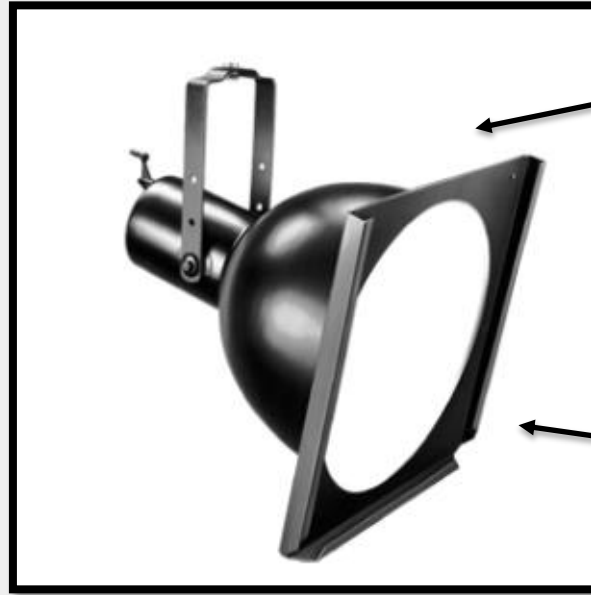
A Fresnel lens is available in diameter sizes of 6", 10", and 12". Due to the steps in the grooves, it creates a soft light but only at a short distance throw, this light is best for front (fill light) and back light. To elaborate, a Fresnel light has a stepped lens that can be adjusted by moving the lamp forward and back inside the light. Due to their variety of power outputs and soft edge light, this 500W light is functional for smaller theatre venues.

The best placement for these lights are nearest to the stage, this contrasts to profile spotlights which can be placed further away.



Covers medium to large areas.

Scoop Light



160 focusing scoop that produces a beam diameter of 13.5 to 20.7 feet.

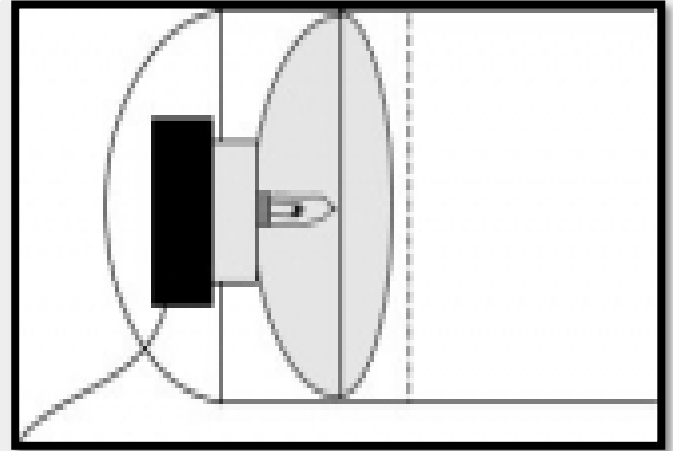
Tungsten Halogen lamps with high colour temperature.

The purpose of a scoop light is to be a multi-purpose reflector floodlight that's lightweight. Due to its small scale, it is ideal for set hallways and window backings where colour blending, and smooth washes of light is required.

Parcan Light



First introduced in the late 1960s, the parcan light soon became popular due to its low cost, weight and ease of focussing (Theatre crafts, n.d). Furthermore, the light is most known for being a fill light, the Parcan light is best for filling a space with light due to it being non directional. Comparing both the fresnel light and parcan light, the parcan uses a LED bulb instead of a halogen bulb (Thedjshop, n.d). A LED bulb allows for a lower power consumption whilst still producing a powerful beam of light.



Intelligent Lighting



Intelligent or moving lights refer to stage lighting that has automated abilities. Comparing to traditional lighting, these have the ability to move the lights and direction of the heads. Intelligent lights have mechanical abilities run by a programmer which can adjust colour, tilt, shutters and attach gobos (Stage Electrics, 2016).

Strip Lighting



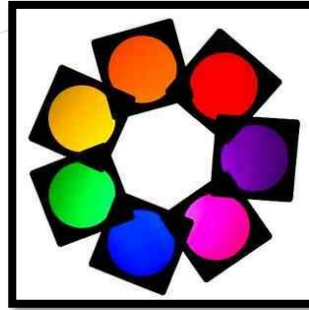
A strip light consists of 3 or 5 circuit lights which projects different colors individually or together and are either hung or stationary. Glass gels called roundels, can be placed onto the lighting in colours of red, blue or green only. Depending on the lighting design, the whole strip light can be controlled as one unit or as individual cells.

Light Accessories

Gobo holder



Colour gel



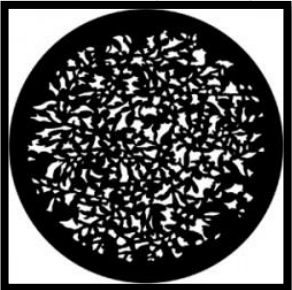
Top hat



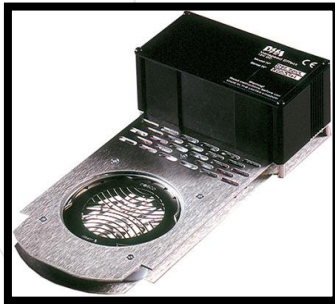
Barn doors



Gobo



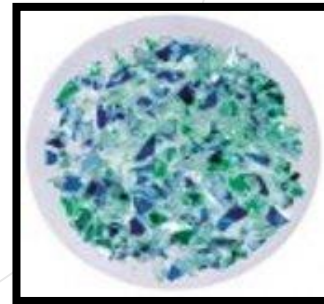
Gel frame



Iris



Glass gobo



Principles of illumination

There are numerous methods of lighting a theatre stage, however they all are based on the principles of illumination. Having certain control of functions such as intensity, distribution, colour and movement allows you to create a good lighting design.

Key Points

- There must be enough light to perceive colour, texture and details of the stage and sets.
- Too much light on the wrong thing should be avoided.
- Objects of prime interest must be clearly distinct and brighter than the background against which they are seen.

By creating a technical plan first it allows you to define the acting area and where to distribute light fixtures for the desired visibility. When using colour to support the shape and form of the acting area and actors, it is important to use colour correction when lighting an actors face.



Front Light



See movement
of body

good visibility

lack of
shape

objects look
flat

Top Light

grounds the performer

Showing form

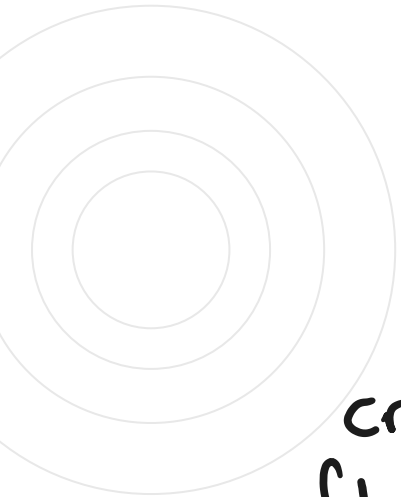
can be used as a wash light
to colour stage



good illumination

Shadow on face

Side Light

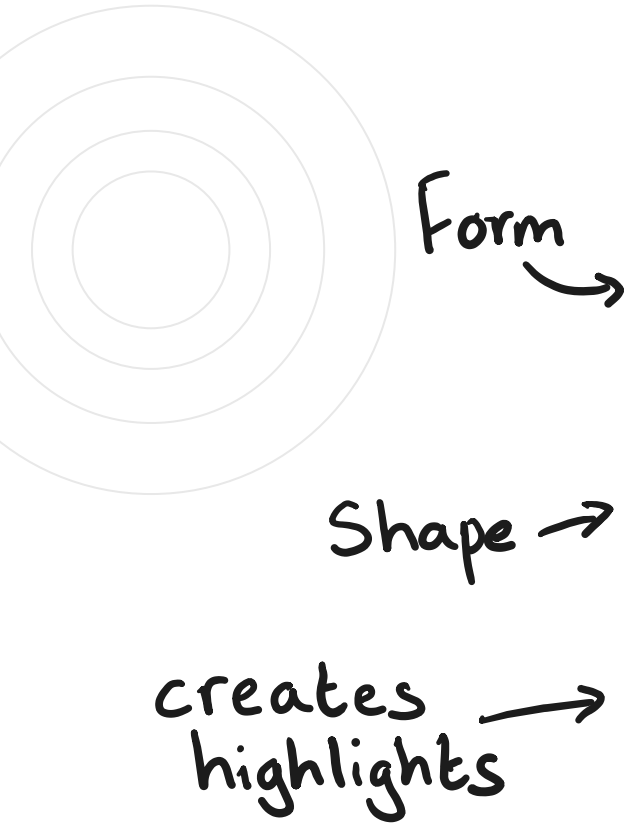


creates
fluidity →



← Sculpts
body

Backlight



← can be directly behind or at an angle

← perspective

Silhouette



mysterious
↙

↗
have to be cautious
of audience - light in eyes

Floor Light

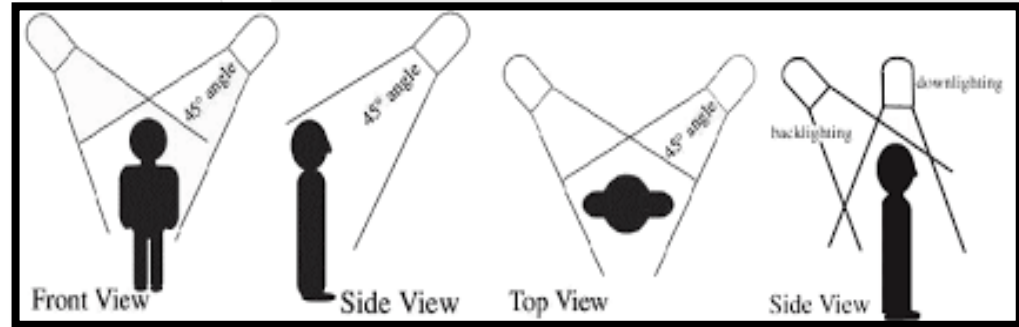
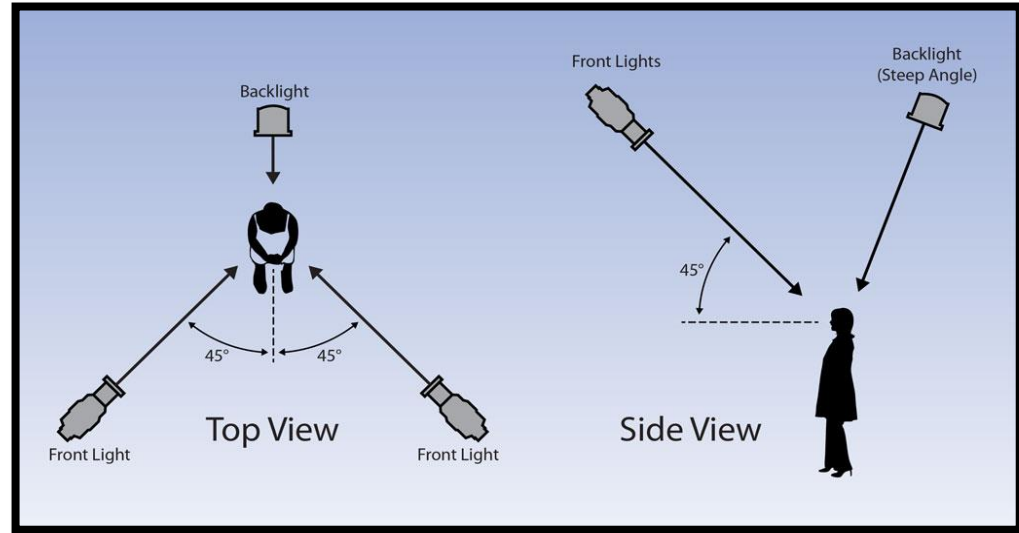


↙
magic

uplifting ↗

Stanley McCandless

During the early 20th century, DR Stanley McCandless, a design professor, published *A Method of Lighting the Stage*. Within the book, it discusses lighting designs using only key light and has been used as a reference for many lighting designers. McCandless idea is based on a system of diagonal front lights arranged at a 45° from the subject and 45° above the subject. This arrangement ensures that there is enough visibility and to create realistic lighting on stage.



Colour

Colour is used within lighting design to enhance elements of the stage set, to convey an environment or to create emotion. In order to create coloured lighting, it involves adding or subtracting from visible wavelengths of colour (Stage Electrics, 2016). RGB LED lights allow you to mix colours using red green and blue LEDs, this process is called additive colour theory. (Stage Electrics, 2016)

Colour has the ability to influence an audience emotionally and physically. An example being, warm colours such as red, yellow and orange can create emotions ranging from comfort and warmth to anger. On the other hand, cool colours such as green, blue and purple can enhance calm yet sad feelings. Using this technique in theatre can help an audience empathise with an actor/character.



Colour Task

“Choose a colour that represents you on your first day at University, you today and your future self.”

Start: Using white to represent my innocence and blank state of a new beginning.

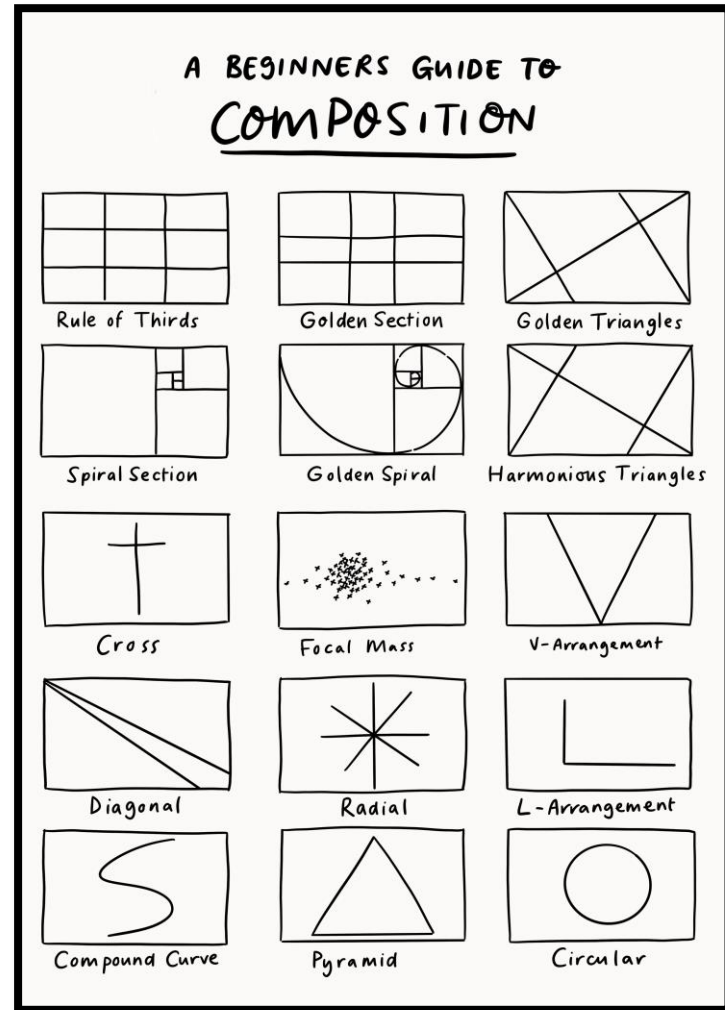
Middle: Harsh transition to represent the sudden isolation. Would use a gobo to create the shadows of the windows. The windows and colour red representing a sense of feeling trapped.

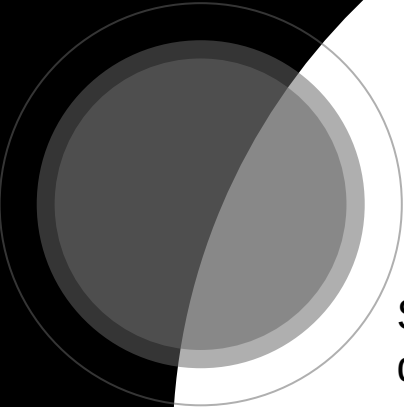
End: Using a backlit light with red gel to represent the past and a front white light to showcase power, strength and being successful.

Composition

Types of composition used within lighting design:

- Depth Perception
- Texture
- Shape
- Flow
- Pattern light and the human form
- Line and direction
- Balance
- Positive and negative space

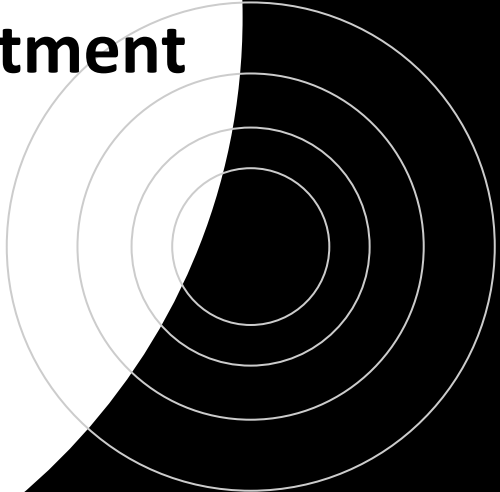




Sound Design

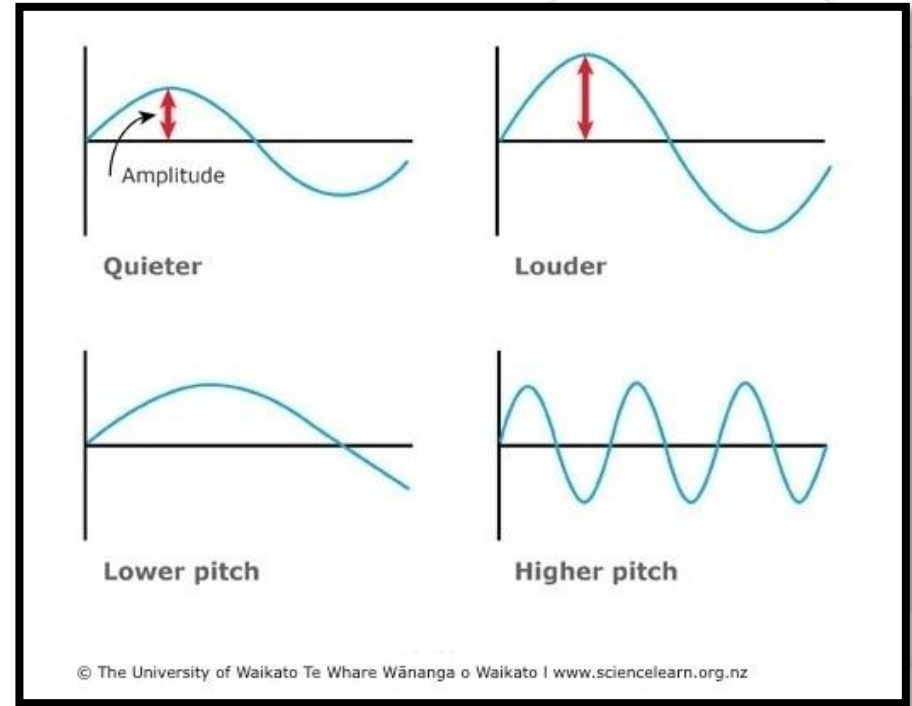
Sound Design is the process of recording, developing or producing audio for theatre.

Job Roles in the Sound Department

1. Sound Designer
 - 1a. Associate Designer
 2. Production Sound Engineer
 3. Sound Number 1 (mixer)
 4. Sound Number 2,3,4 etc.
 5. Operator
 - 6 Crew/Riggers.
- 

What Is Sound?

Sound is created through vibrations in the air that then travel outwards then to your ears. We struggle to hear quiet sounds as they don't cause much change within the air pressure or produce much vibrations. Volume describes the amount of air that is moving. A frequency is how fast and often vibrations change per second. It is known that our ears can hear from 20hz to 20,000hz.



The Phonograph



Thomas Edison invented the Phonograph in 1877. It was designed to record and play back a message. Audio was printed onto a tin-foil cylinder which the indentations were then interpreted by the phonograph to create a recorded sound (MansWorldIndia, n.d).

The Turntable



Compared to the phonograph, the turntable made in 1887 was the first audio device to plat flat discs, initially made from rubber, instead of a cylinder disc. (MansWorldIndia, n.d). The process involved using a needle to trace grooves onto a cylinder. (Roberts, 2019).

CD Players



First released in 1982 the CD Players were a new digital audio disc that is compact. Inside a CD player is a laser beam and a small electronic light detector. The laser will then flash onto the under side of the CD and bounce off the pits and land patterns. (Woodford, 2020).

The Process of Making Sound

Microphones:



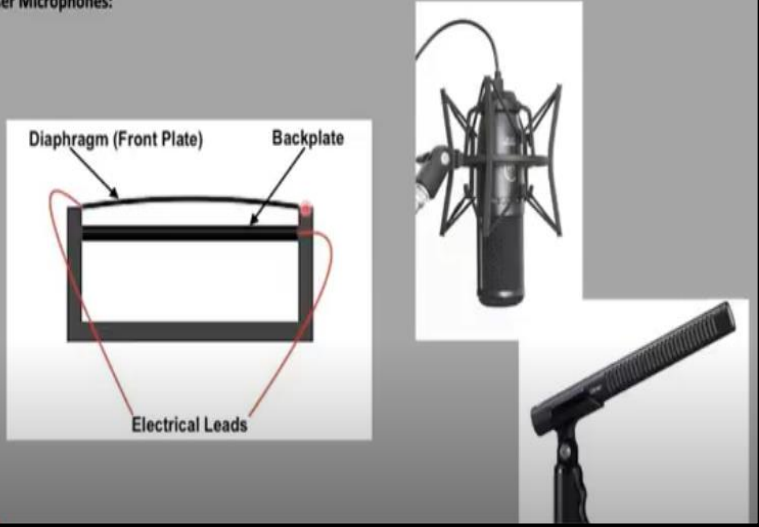
1. Source

The first step when creating sound is to find a source of electricity. This could either be a microphone or computer. When looking at all these microphones, although they look different, they all essentially have one job which is to take sound and convert it into electricity. With microphones it is hard to tell by the look what type it is, the two main types of microphones are dynamic and condenser.

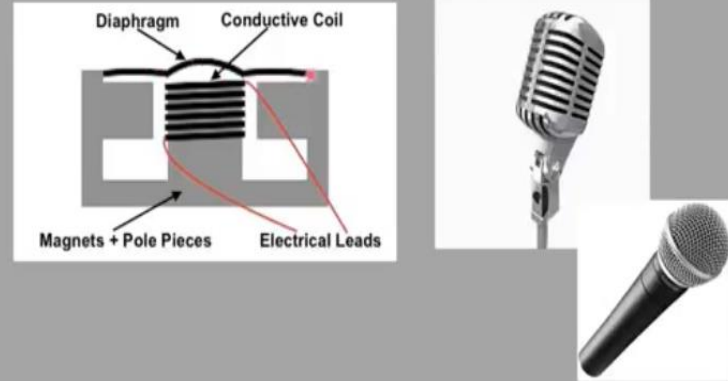
Dynamic VS Condenser

Both microphones have a diaphragm which is so thin that the vibrations in the air cause it to vibrate. Therefore, as the diaphragm vibrates it moves a coil of wire with a magnet which creates a small amount of electricity. To compare, a condenser microphone generates electricity in a different way. It is made up of a capacitor with one plate that wobbles back and forth thus creating electricity. The biggest difference is that a condenser microphone needs electricity to work, which is why a mixing desk will have a phantom power button that sends 48V of electricity through the same cable it's plugged in.

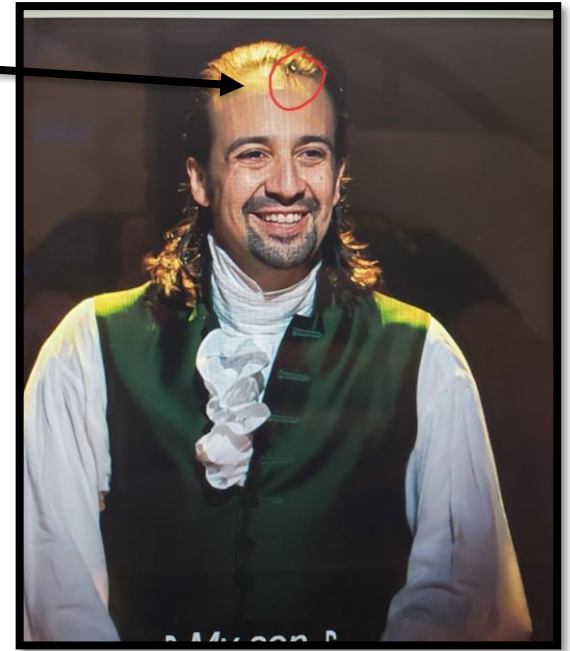
Condenser Microphones:



Dynamic Microphones:



Within Hamilton, key members of the cast wore two mics incase if one breaks, they can continue with the show.



Placement of Microphones

Depending where the placement of your microphone is will determine the quality of sound you achieve. For example, a radio microphone placed of the head of an actor will make the sound appear more natural. Within theatre, to avoid vibrations from the movement of the face or bones a headset microphone could be used as it isn't attached directly on the face. The belt pack for a microphone may ruin the visuals of a costume and therefore the use and placement of mics can be a creative decision.

In regards to radio mics, they need to be made sure that they are safe and comfortable for the actor as they are made from metal. Due to radio mics breaking easily a radio mic clearance will be checked after every break, and the show will not start until the sound crew are happy with the mics.



Radio Licensing

Before continuing, you must ensure to have the correct radio license which is controlled by the PMSE Dept of OFCOM. Looking at the photo below, any frequency used in the orange boxes will require you to pay the government. Channel 38 however, is license free and most theatre will have bought and use this license. Lastly, channel 70 is free for all but is not used for professional use.

Spectrum is shared with TV Broadcast :

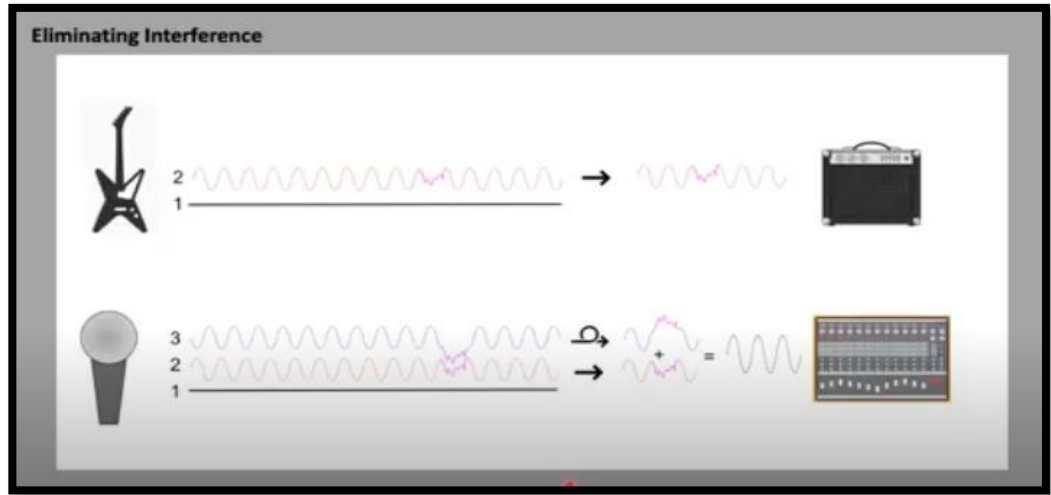
21	22	23	24	25	26	27	28	29	30
470-478	478-486	486-494	494-502	502-510	510-518	518-526	526-534	534-542	542-550
31	32	33	34	35	36	37		38	
550-558	558-566	566-574	574-582	582-590	590-598	598-606		606-614	
39	40	41	42	43	44	45	46	47	48
614-622	622-630	630-638	638-646	646-654	654-662	662-670	670-678	678-686	686-694
49	50	51	52	53	54	55	56	57	58
694-702	702-710	710-718	718-726	726-734	734-742	742-750	750-758	758-766	766-774
59	60		70						
774-782	782-790		863-865						

Yearly Shared license – TV38 (and TV70)

Per site license - Single Frequency or whole TV Channel (8MHz wide)

2. Mixer

A mixing desk is an electronic device that combines, mixes and changes the level of audio signals. There are two types of mixing desks: analog and digital and both are commonly used and easy to understand. A sound operators' role during a show would be to push the buttons on the mixer to play the sound effects at the right time.

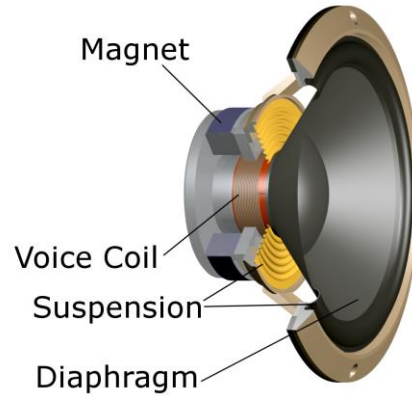


Microphones will be accepted by mixing desks due to outputting at mic level and everything else outputs at a line level which also works with mixing desks. However, electric and base guitars don't fall into this category, so in order for them to be accepted by a mixing desk signals need to be taken and turned into a standard signal. A D.I Box (Direct Input) is used as a converter to fix this issue, it outputs a standard signal and then balances the signal.

3. Amplifier



An amplifier is an electronic device that turns low voltage signals from the source equipment into a signal with enough gain to be used on speakers. This device will take a signal and make it louder, which would then be connected to a speaker to be heard.



4. Speakers



Speakers work by converting electricity energy into mechanical energy. A current will be sent through a voice coil that produces an electric field attached to the speaker. (Landr, 2017).

Recording Own Sound Effects

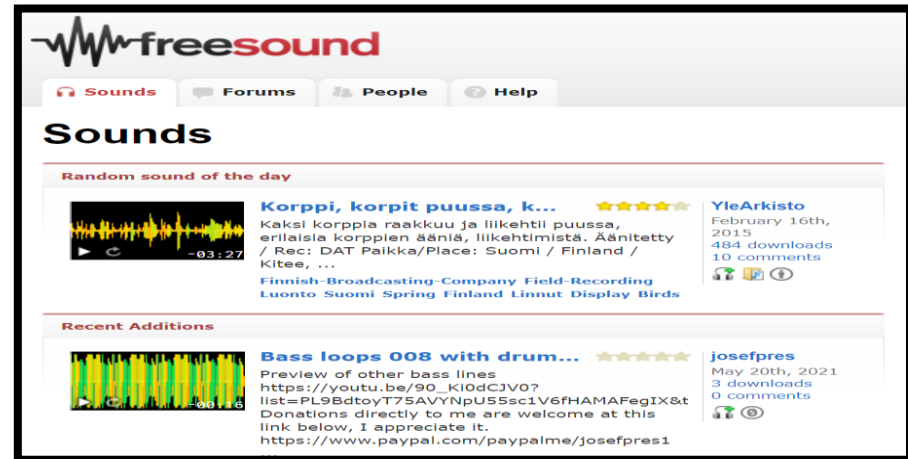
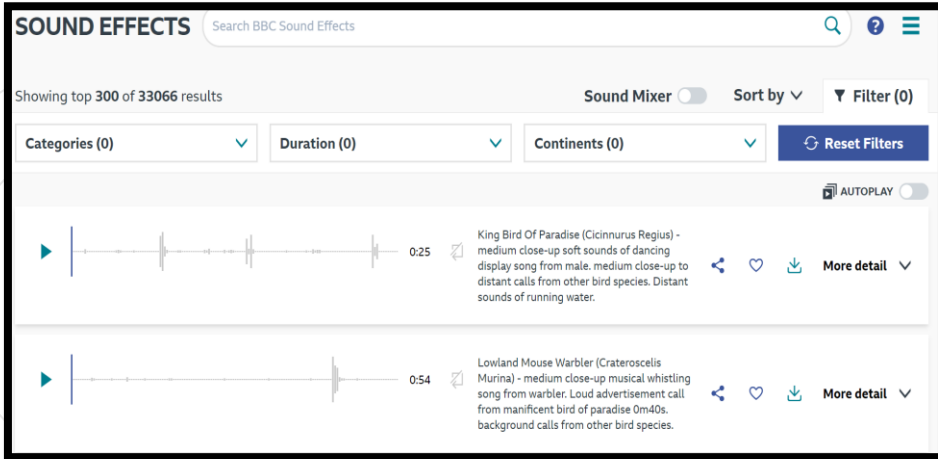
- By recording your own sound effects, you will always get what you desire, unique sounds and is much cheaper. To create your own basic sounds, all that is needed is a mobile phone. However, when making your own you will have to think about the sound you're trying to record, as if it's loud or very quiet it might need special equipment. The environment is a huge aspect when recording sound and you will need to consider wind noise.
- Microphones work by picking up vibrations in the air and are very sensitive to wind. In addition, vibrations from your hand can also cause unnecessary noise. To solve this issue a suspension such as a shock mount can be used.



Recording Outside

When recording outside in the UK, you will always be able to hear man-made noises such as cars, planes, traffic and more. When only one minute of sound effects is needed, it is advised to at least record 10 minutes worth. Due to things going wrong or background noises it is easier to edit it down to one minute. To remember where you have recorded, making notes or talking into the microphone at the start of the audio is good for future reference.





Using Stock Sounds

Due to budget, it might be easier and cheaper to use stock sounds or sound effect libraries. There are many different ways of obtaining sounds, such as buying a whole collection of a specific sound effect or using free websites like the BBC sound effects library. A downside of using famous sound libraries like the BBC is that the sounds could have been used a lot in the past. The Wilhelm scream is an example of a sound being repeated often within films. If a sound has been recorded by yourself, legally you own it, whilst if you are using sound from someone else you will require permission which is the same with the free sound effects libraries.

Sound Team Scheduling

Sound Rig: Place the speakers in desired location and physically build the system in the space.

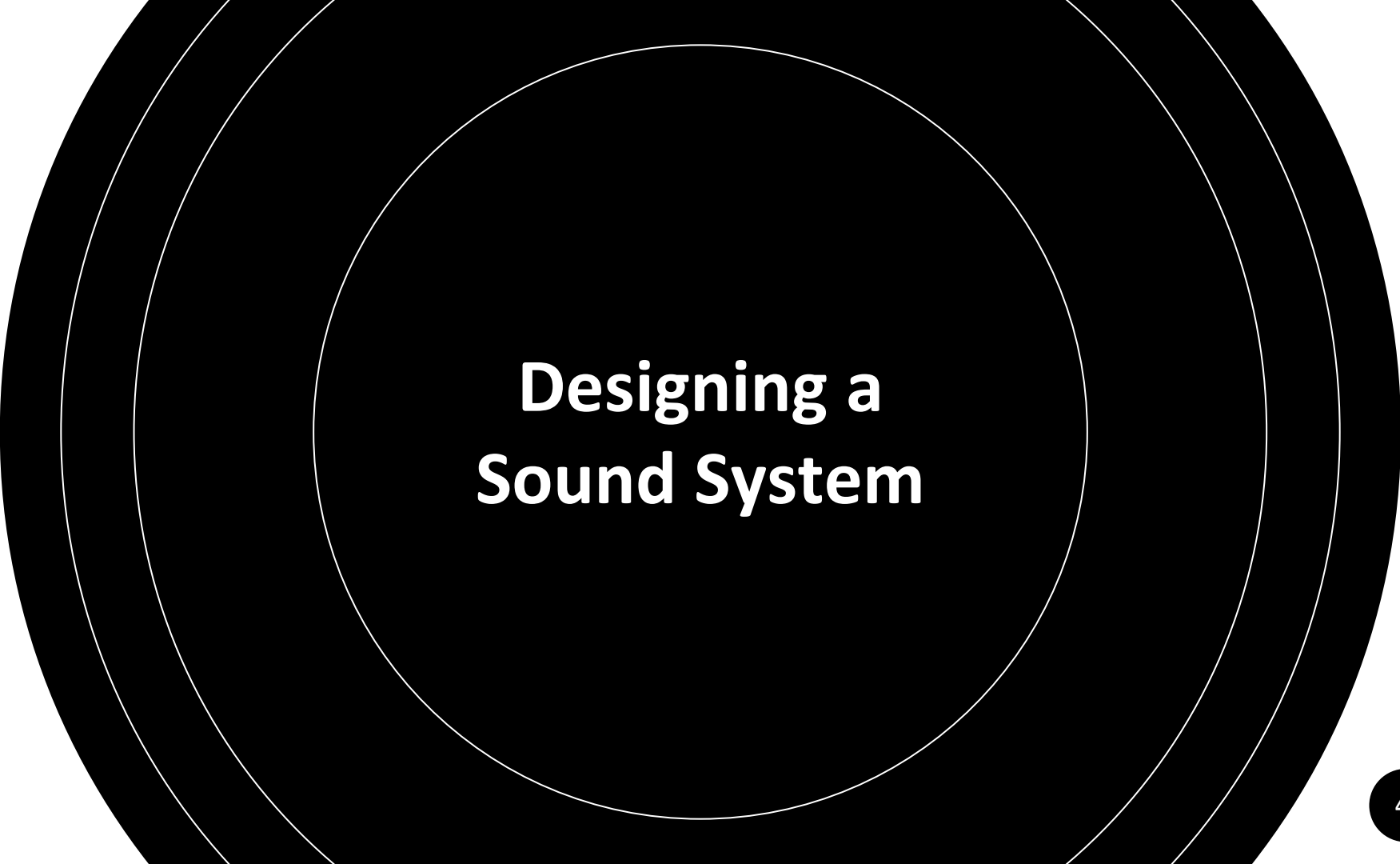
Quiet Time: This is the most important part. The speakers will need to be focused and pointed in the direction that covers where you need. The delay times should be figured out. A laser measure can be used to measure the distance and then be converted into time (sound travel time). This process involves listening carefully. It is important to make sure that the sound system is recreating all the frequencies you need it. If you can hear the sound coming from the stage and can hear all the frequencies in all places and it's a similar volume front to back and left to right a correct sound system has been accomplished.

Sound Check: This is different to quiet time. Sound check is when you get the microphones involved and the actors who will use them. A sound check for the band is important as well so they can hear the music and themselves playing. The cast will have the microphones fitted and then checked to see if it sounds good or needs correcting.

Sound Plot: If the show has a lot of sound effects, these will need to be rehearsed with the director.

Tech rehearsals with everyone: All checks must happen before the tech rehearsal.

Sitzprobe: Exclusive to musicals, a sitzprobe is a play and sing through for the cast and band but is typically not completed in the auditorium.



Designing a Sound System



A sound system for theatre can be as simple as a single speaker however as venues get bigger it will require more speakers.

The mixing desk is the most crucial part of the sound system. The size of the mixing desk will be determined by the number of inputs and sources that need to be mixed together for the show.

Many theatres will require a large channel count of radio microphones. The benefits of using radio microphones is that it creates louder sounds and doesn't require actors to push their voices out to the back of the audience. This is especially important as the audience need to hear the same consistent sounds. The placement of microphones and speakers can be a creative decision but if the speakers don't deliver it will be wasted time and money.



The type of show will determine the volume, for example a play with only sound effects won't be as loud as a musical. In regards to understanding volume within speakers, it is important to remember that watts is not a measurement of volume, as two speakers could have the same watts but one could be louder than the other.

Speaker Specifications

Enclosure Type	Two-way passive, reflex loaded
Components	1 x 6.5" (165mm) neodymium LF drive unit 1 x 1" (25mm) exit neodymium HF drive unit
Dimensions (HxWxD), mm/(ins)	368 (14.5) x 195 (7.7) x 208 (8.2)
Net/Shipping Weight	7/8kg (15.4/17.6lbs)
Frequency Response	50Hz - 20kHz ±3dB
Nominal Dispersion	90° x 60°, rotatable (-6dB points)
Maximum SPL	116dB continuous, 124dB peak
Loudspeakers per amplifier	DQ6: 4 per channel, DQ10: 4 per channel, DQ20: 4 per channel
Power Handling	200W RMS, 400W program
Nominal Impedance	8 ohms

Normal dispersion is a general idea that suggests the throw distance of a speaker, therefore in the example above this speaker will have a throw sound from the front at 90° horizontal and 60° vertical.

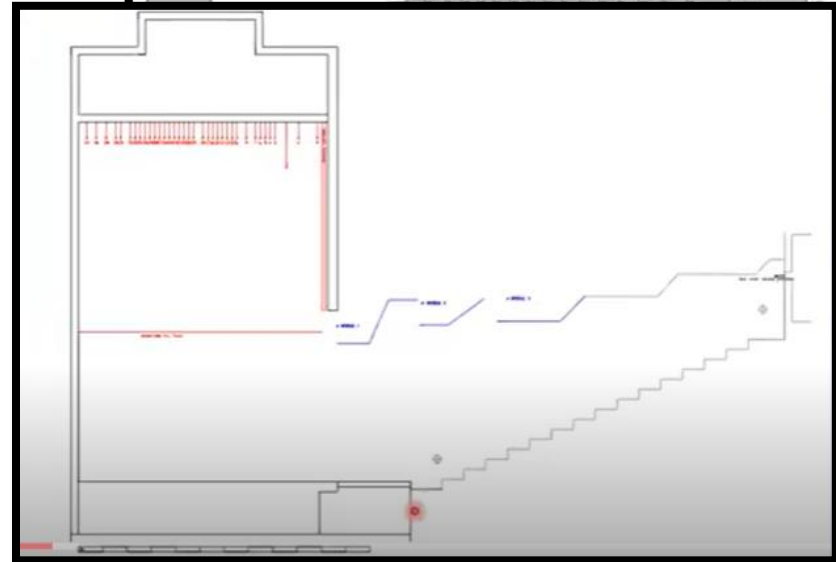
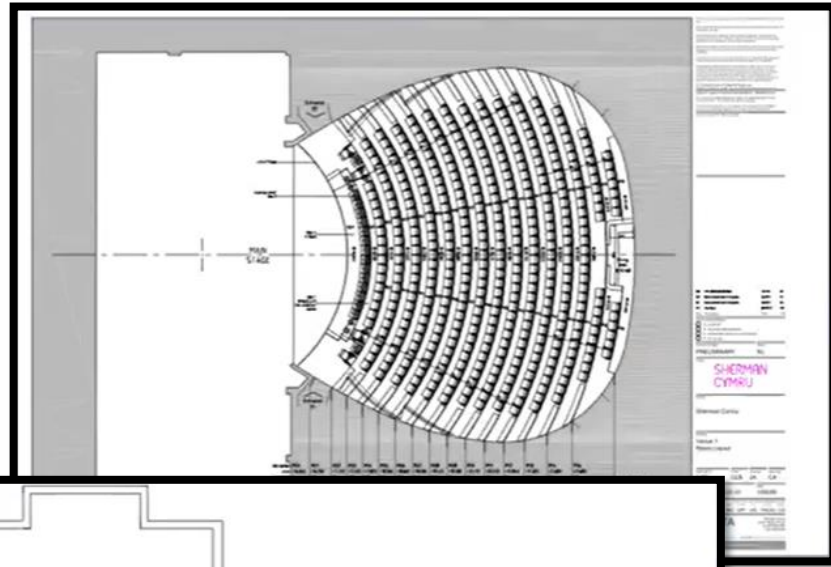
Enclosure Type	Infinite baffle, coaxial
Components	Coaxial 4" (100mm) LF 0.85" (21.5mm) exit HF
Dimensions (HxWxD), mm/ins	150 (5.9) x 120 (4.7) x 130 (5.1)
Net/Shipping Weight	1.6kg (3.5lbs)
Frequency Response	50Hz - 20kHz ±3dB
Nominal Dispersion	80° conical (-6dB points)
Maximum SPL	110dB continuous, 116dB peak
Loudspeakers per amplifier	DQ6: 6 per channel, DQ10: 6 per channel, DQ20: 6 per channel
Power Handling	125W RMS, 250W peak
Nominal Impedance	12 ohms

In comparison, this specific speaker only has an 80° degree sound throw from all around.

Planning

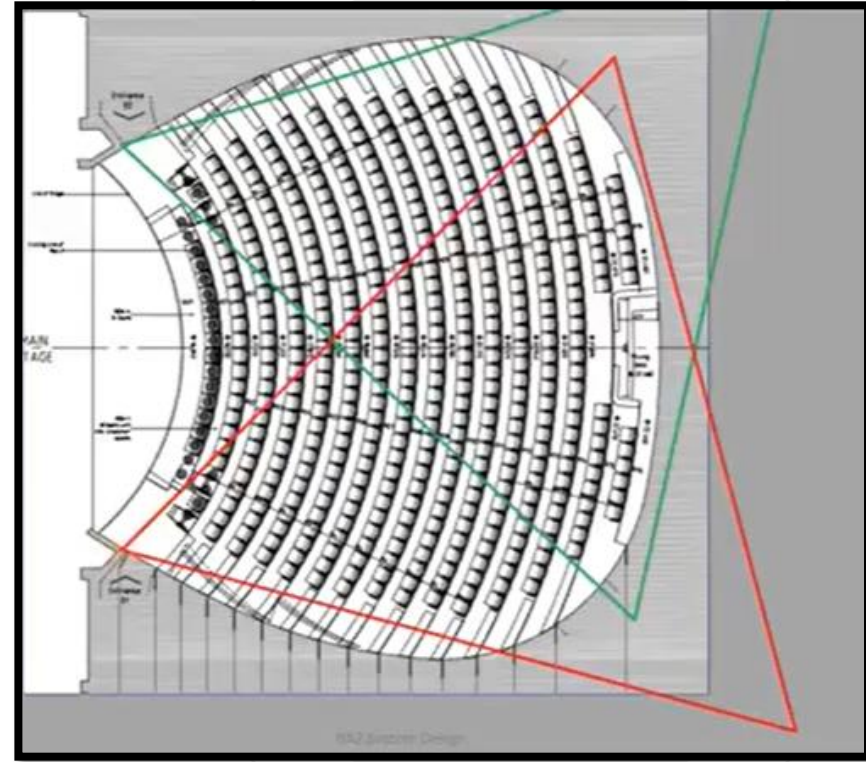
Reading and acknowledging the speaker specifications is very useful for when planning the placement of speakers. Using the information, it allows for speakers to be positioned in theatre correctly so that it will cover the audience efficiently.

Using digital plans like this will determine the angle and position the speakers need to be. A plan for the vertical angle is essential as well as it can help determine the height needed to cover in the auditorium.



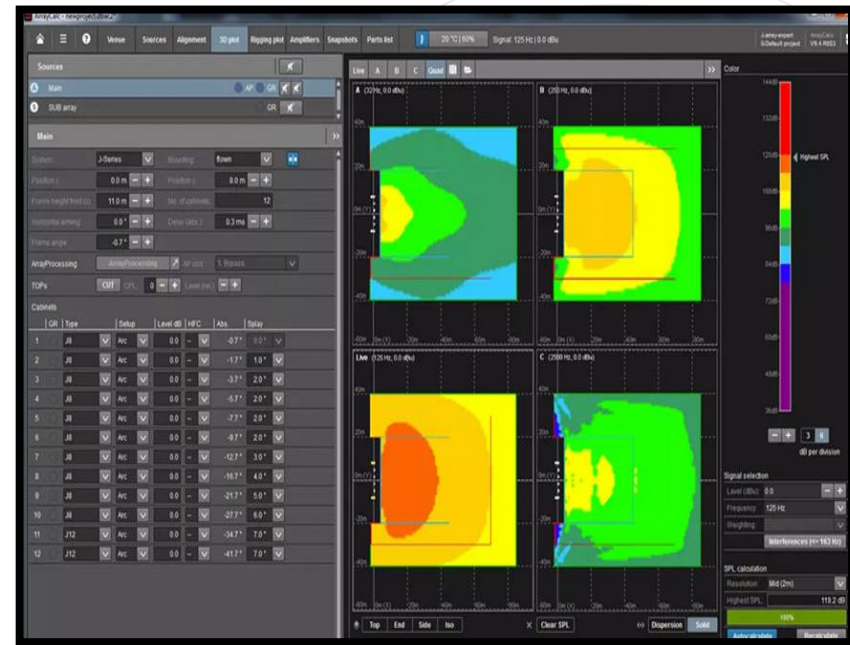
Example

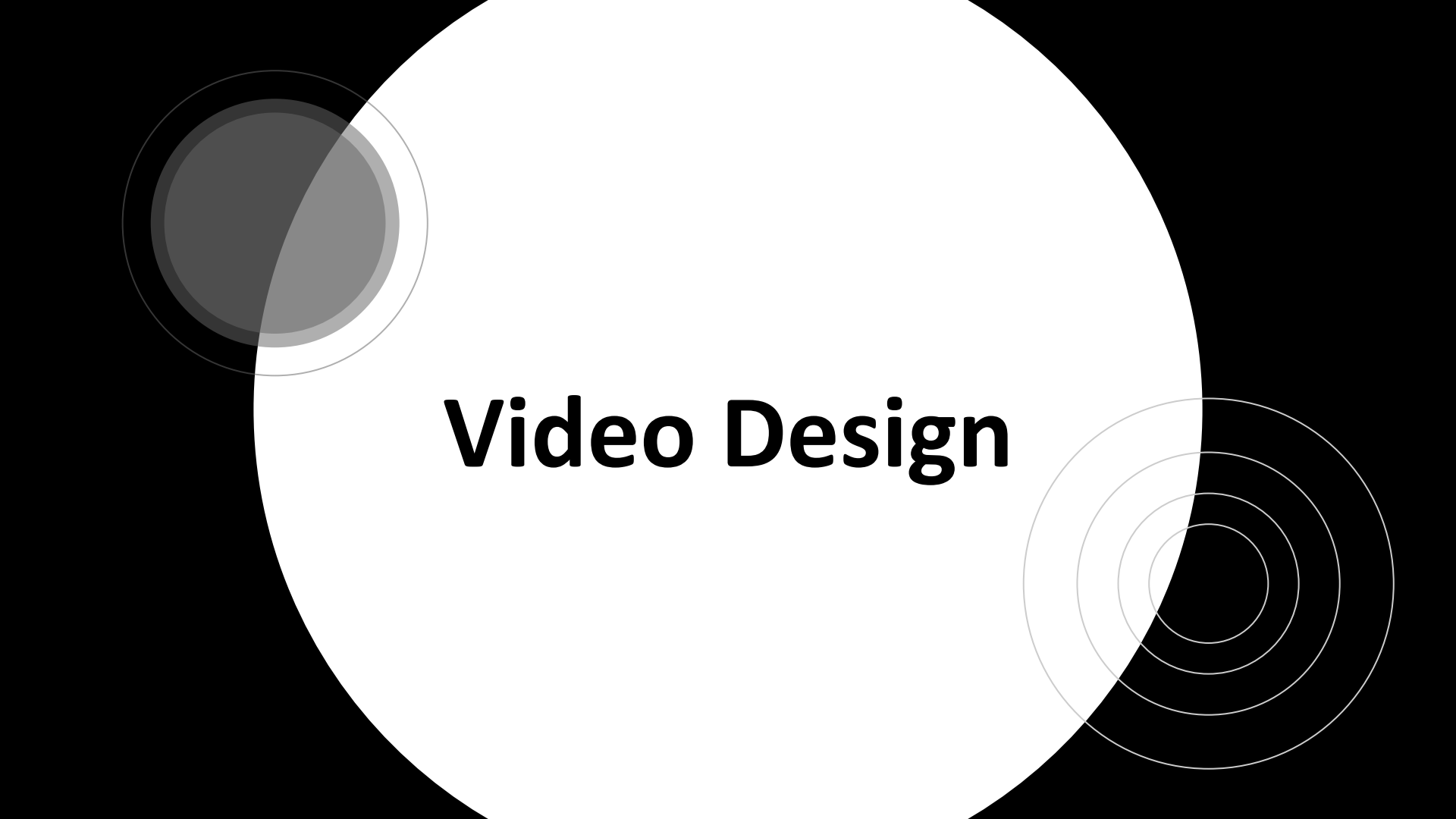
Using the Sherman Theatre as an example, their speakers are placed at 60° angle and 40° high. From looking at the image, the further you place the speakers towards the stage the more seats can be covered. There will only be a few seats that will be able to hear both speakers at an equal volume, this is where both triangles on the image cross. In contrast, the seats at the middle front won't have a speaker pointing directly at them. In order to solve this issue, additional speakers would need to be added, such as front fills that fill in sound. Delay speakers will also have to be installed.



Understanding How Sound Moves

As sound travels through the air it will lose clarity. High frequencies in particular can not travel through the air as well as low frequencies, meaning that the further away you are from sound it will become less detailed and duller. Sound is heavily dependent on the environment and simple things such as the air temperature and humidity will have an affect on how the sound travels through the air. Arraycalc is a stimulation tool that helps give an idea of how sound will react around a space. Using arraycalc will help reduce setup and tuning time when planning installations (AV-iQ, 2021).



The image features a large white circle centered on a black background. To the left of this circle, there is a smaller, semi-transparent gray circle that overlaps with the white one. To the right, there is a series of concentric white circles of varying diameters, also partially overlapping the main white circle. The text "Video Design" is centered within the large white circle in a bold, black, sans-serif font.

Video Design

What is Video Design?

Video Design or Projection Design is a term to describe the design of image media for a live performance such as theatre. In addition, it is a creative field of stagecraft that utilizes cameras, projectors, LED walls or monitors. The role of a video designer sits on par with the set designer and lighting designer. The basic production process typically involves researching, story boarding, collecting images or moving footage, editing, manipulating and compositing.



Using Projectors as a Set Designer

As a designer, I have developed an interest of using light within my work. I enjoy working with light to add texture or shape to photographs taken of my models. To develop my work, using projection could help me experiment with colour, pattern and texture. In general, using projection is a flexible way of changing scenes quickly without having to pay a designer to paint each scene.



The Magic Lantern

Invented in the 17th century, the magic lantern is the earliest form of a slide projector. The name comes from the experience of seeing images appear on the wall like magic (Magic Lantern Society, n.d). In order to create the images pictures, paintings or photographs were placed on a transparent plate, mostly made from glass. The first magic lanterns were illuminated by candles, however during the mid-19th century limelight was most used as it produced a very bright light that can be used in big venues.



Large Format Projector

Similarly, the magic lantern and the large format projector have the same principles of being able to cover large areas. On the other hand, the large format projector is more modern as the source of light is a tungsten bulb which is brighter. Comparing to a projector found in cinemas, they both have similar technology and light outputs. The large format projector still uses plates to deliver images just with a better long focal length.



Slide Projector



The slide projector has a similar concept to the rest however, we can see that the projector has been developed to be more compact and better design. To elaborate, this projector works by shining a light through specialised photograph slides. When light travels through the slide it creates an enlarged image that displays on a screen or wall. As is evident from the image above, a carousel or magazine holds different slides that when activated by a button, advance in a consecutive manner (Writer, 2020).

Overhead Projector

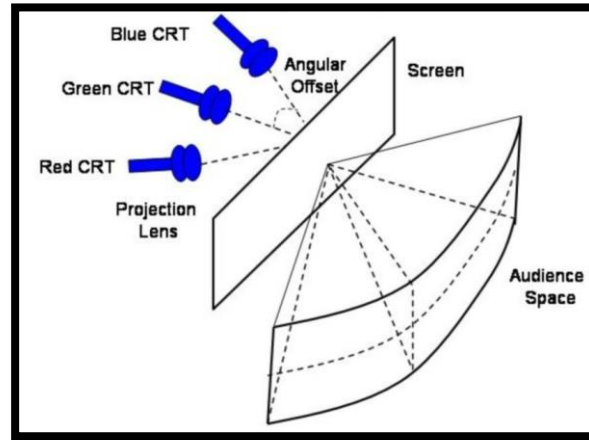


Using a converging lens and a mirror to project a wider real image on a screen or wall, the overhead projector is simple, basic, cheap and mostly used within schools (Bloomfield, 1997). Despite this, there are many limitations such as being heavy, requires electricity and a lot of preparation when creating transparent materials.

CRT Projector

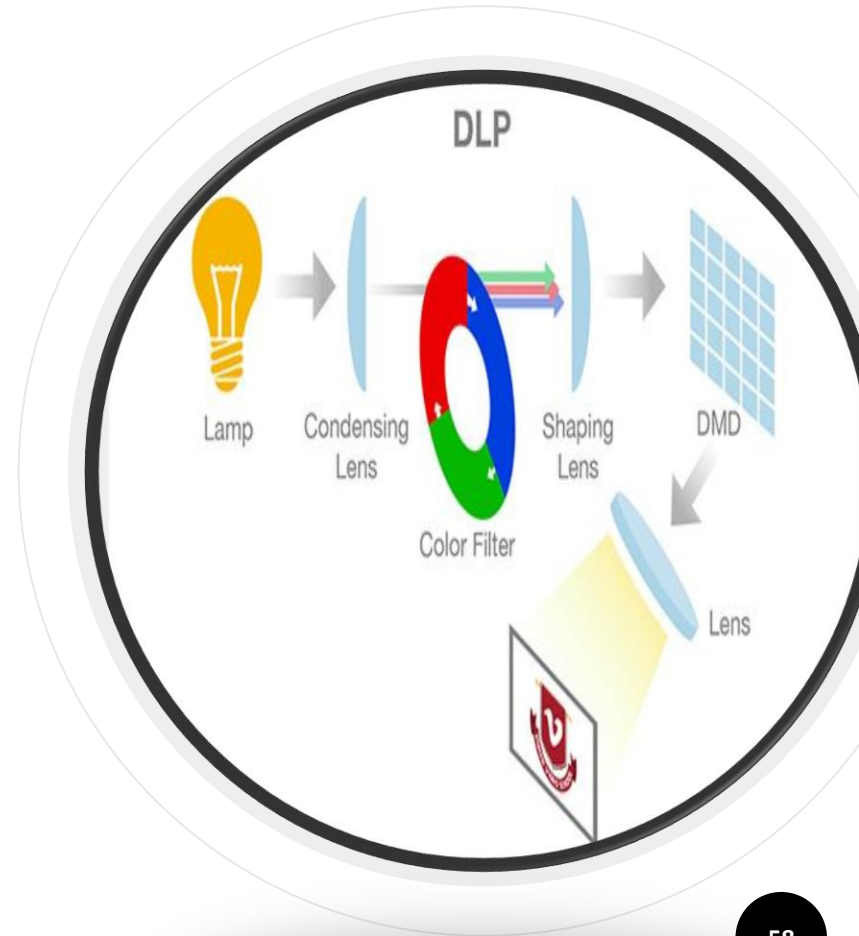
Cathode Ray Tube

A cathode ray tube is a sealed glass enclosure with electron guns fitted and an anode connection. The role of the electron guns is to fire electrons through the vacuum to create the video image (Phillips, n.d). Until now, the CTR was the first projector that used colour mixing on the screen or wall instead of inside the projector itself. Therefore, three separate images are projected onto the surface area in the colours of blue, green and red.



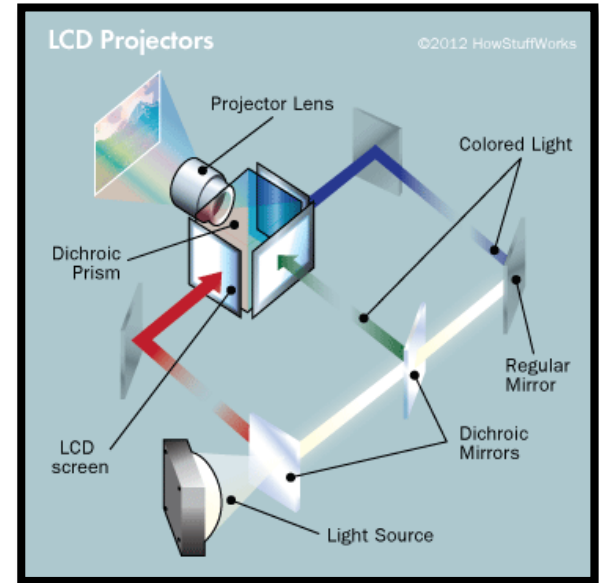
Digital light processing

DLP stands for 'Digital Light Processing' and what DLP projector means is a projector using a DLP chip to display the projector images. DLP Technology was invented by Texas Instruments. The picture in a DLP projector is produced by light reflecting off a Chip which has millions of tiny mirrors fixed on it. This chip is commonly known as a 'Digital Micromirror Device' or DMD. Each mirror in the DLP projector's DMD Chip represents one pixel in the digital image, so for example, in a HD DLP DMD chip there will be 1920x1080 or a little more than 2 million mirrors assembled on the tiny DLP DMD Chip. The DLP chip mirrors vibrates or wobbles to either reflect the light beam to the final image or reject the light falling on it. 3 chip DLP projectors can process individual beams of RGB light simultaneously and are capable of producing high quality images which are bright. Most cinema theaters use 3 chip DLP projectors to show movies.



LCD projector

LCD projectors work by using three liquid crystal panels, a lamp, a prism, and filters to create the image on the screen. The lamp provides white light that passes through a polarizing filter. Polarizing works by accepting light that is traveling on the same plane, all other light will be blocked. From the polarizing filter the light is then passed through a series of dichroic mirrors. Dichroic mirrors work by only allowing certain colors in the light spectrum to be reflected, while others pass through. The dichroic mirrors in LCD projectors separate the light into the three primary colors, green, red, and blue. These three colors are then sent to a separate LCD panel; remember there are three of them. From there the LCD panels send the light through the dichroic prism which recombines the light and sends it out the main lens in the LCD projector to the surface against which it is projected. Each LCD is only capable of controlling one color. Therefore, if you were to project a red plane against a blue sky, the green LCD would block the light from passing to the dichroic prism and out the lens.

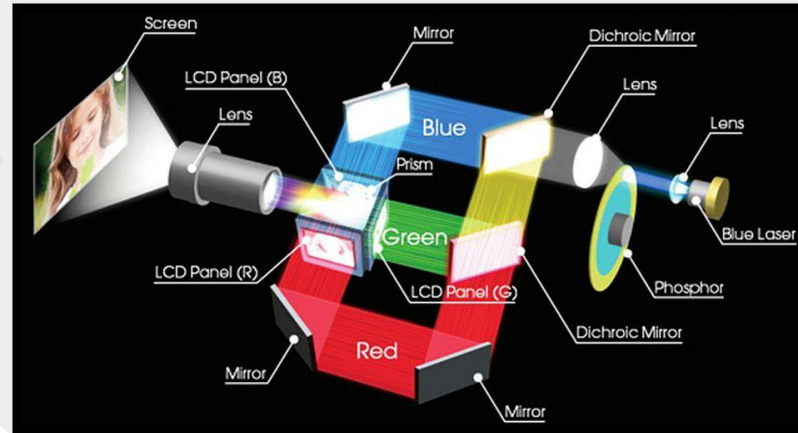


Laser projectors

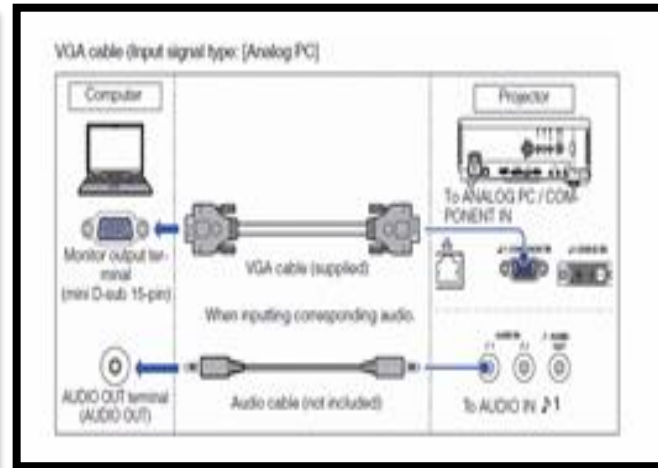
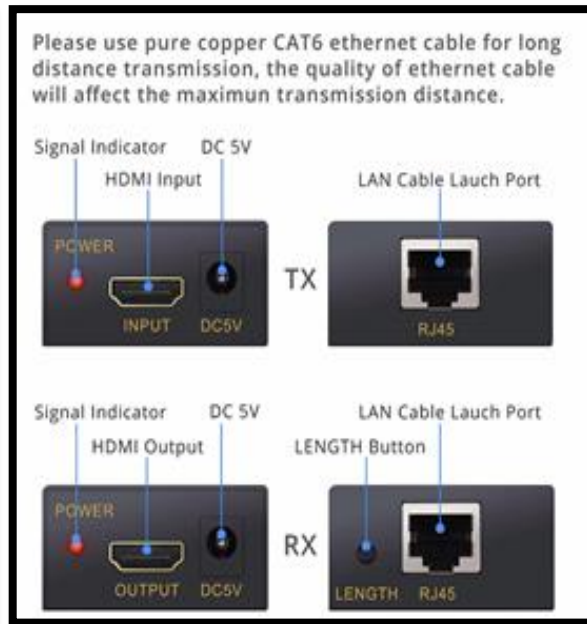
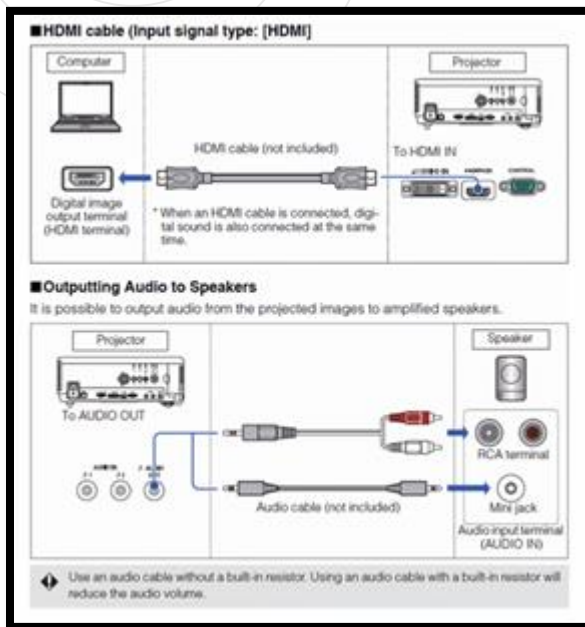
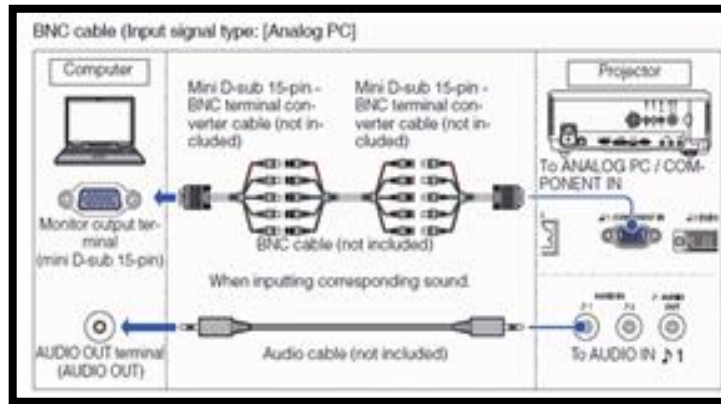
Unlike a standard projector that projects white light through a colour filter, a laser projector uses laser light in the primary colours. The benefits of using a laser projector include not being reliant on a light bulb as a laser lasts longer, has a constant light output and is energy efficient. A laser projector works by using a light source that is deflected off a chip and then magnified and focused by lenses (Matthes, 2021).

Health and Safety

Epson, a Japanese electronics company suggests that safety of the eyes when using laser projections is not a concern. Epson explains how the light complies with the class 2 safety standard due to the laser “passing through a phosphor/diffuser wheel”.



How to Plug in a Projector

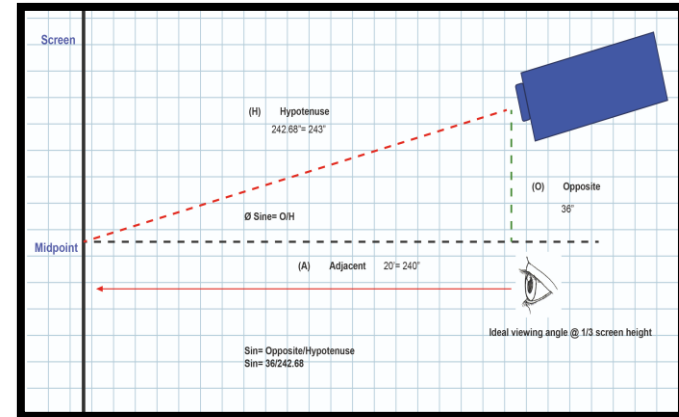


When using a HDMI cable in a distance, an extender should be used to boost the signal from up to 50 to 100 meters.

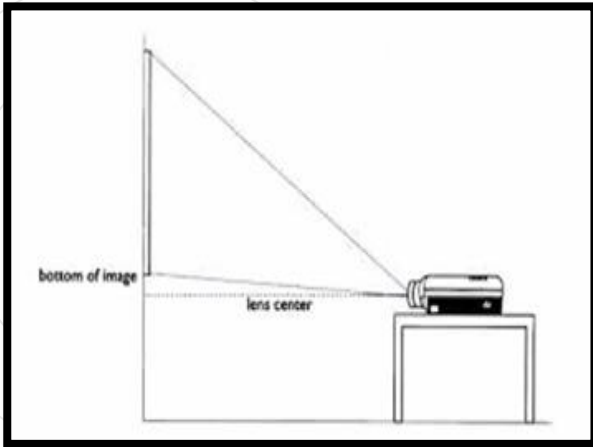
Projection Angle

The projection angle is calculated from the angle between the projection axis (or centreline), from the lens to the centre of the screen, and the perpendicular to the screen.

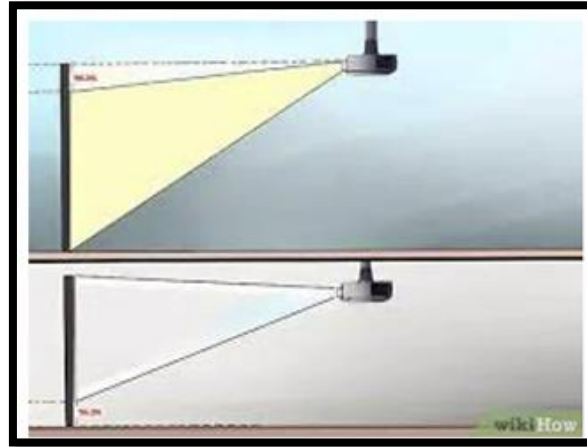
Calculating the wrong projection angle can create many issues. One issue is the keystone effect, this is created when the projected image is distorted or has a trapezium shape. The cause of this is when the projected light hits the surface from too high or low of a vertical angle (Rodgers, 2017). Many projectors have a vertical keystone corrector, which digitally manipulates the image to correct the distortion. However, when using a projector in theatre a video projector programme should be used to fix the issue instead of relying on the projector itself. Another issue faced is when a bright spot or glare appears on the image, this issue is called Hot-spotting (Rodgers, 2017). Higher gain and ambient light rejecting on surfaces is the main cause of this issue. In order to fix this problem, it's important to use a screen material and projector that are compatible with another.



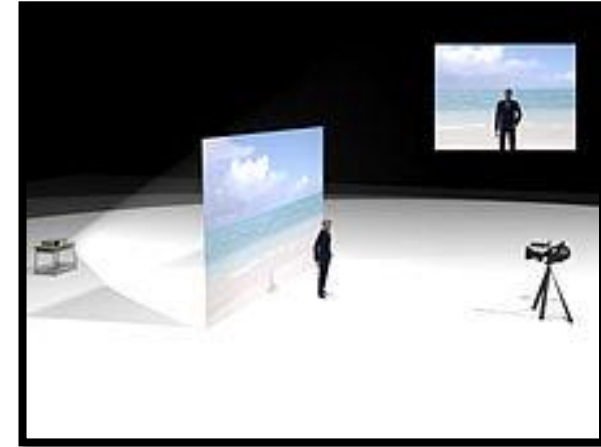
Floor mounted



Ceiling mounted



Back projection



There are numerous types of projection surfaces. Soft or textured surfaces combine scenic elements to create an overall look. When using a back projection behind a scenic element, it will create set silhouettes, although when projection is not in use there will be a constant white screen. In order to achieve a dark surface when projection has stopped a black projection screen is available. Back projection uses a BP screen to display the image. On one hand the placement allows for performers to be upstage without casting a shadow on the screen, however the brightness is affected. On the other hand, floor and ceiling mounted projections allow for a clearer image but if placed incorrectly, shadows from the actors will be shown.

Projection Placement and Surfaces

The Crucible

Projection project, collaborating with Vanina Guerinon

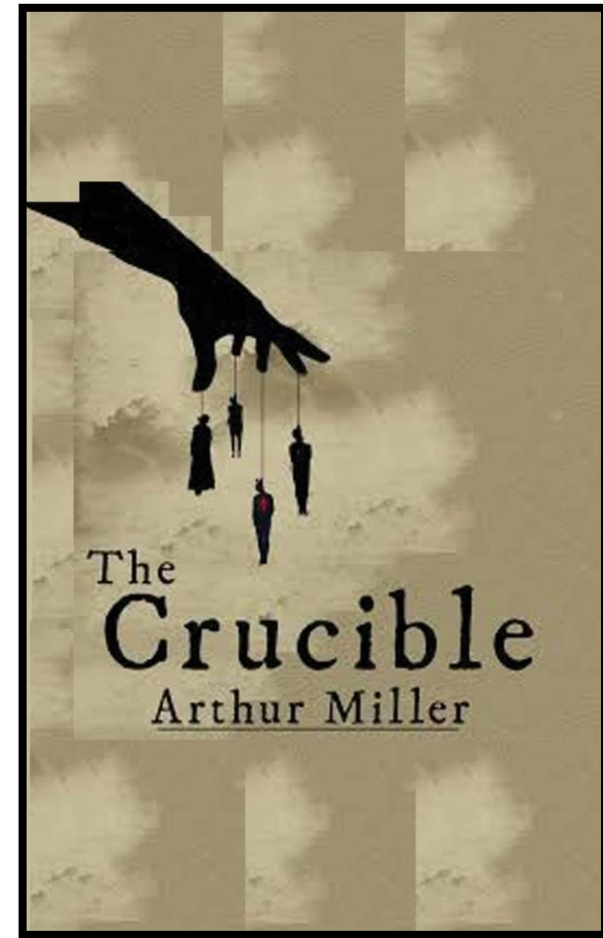
About The Crucible

Key points of The Crucible:

- Reverend Parris finds girls dancing naked in the forest around a fire who claim they were bewitched. The court investigates these allegations.
- Over a hundred of Salem's citizens are accused of witchcraft. One of them, Elizabeth Proctor, proclaims her innocence to her husband, John, who had an affair with a girl named Abigail.
- Realizing that Abigail has incited this witch hunt, John admits his adultery to save his wife, only to be convicted of devil worship. John is hanged while his pregnant wife is spared.

Inspiration

In the 1953 play *The Crucible*, playwright Arthur Miller looks at Massachusetts Bay colonists who were accused of witchcraft in 1692, it is also a metaphor for government persecution of suspected communists during the mid-20th century. Within New England, it was still very much an English colony that was founded by the Puritans who were seeking religious liberties. The play focuses on themes of tragedy, allegory and historical fiction (SparkNotes, n.d). Arthur Miller's inspiration for the play was to create a drama reflecting the mass political hysteria that happened when the US government pursued to suppress Communism within America (American Masters, 2015).





Salem Witch Trials



Summary Plot Overview

17th century

PLACE + TIME

rhythm
innocent — harmless
— naïve

somber

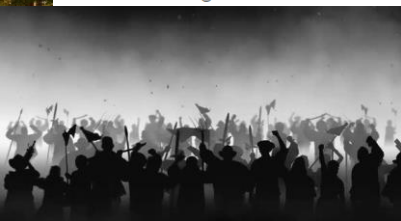
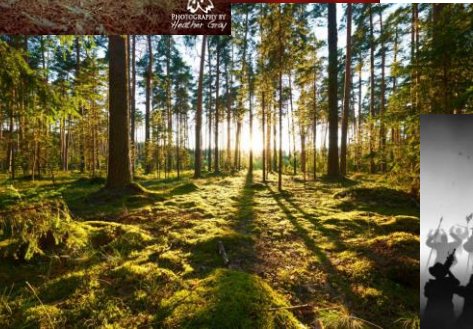
unknown

In the Puritan New England town of Salem, Massachusetts, a group of girls goes dancing in the forest with a black slave named Tituba. While dancing, they are caught by the local minister, Reverend Parris. One of the girls, Parris's daughter Betty, falls into a coma-like state. A crowd gathers in the Parris home while rumors of witchcraft fill the town. Having sent for Reverend Hale, an expert on witchcraft, Parris questions Abigail Williams, the girls' ringleader, about the events that took place in the forest. Abigail, who is Parris's niece and ward, admits to doing nothing beyond "dancing."

suspense

possessed
— devil

While Parris tries to calm the crowd that has gathered in his home, Abigail talks to some of the other girls, telling them not to admit to anything. John Proctor, a local farmer, then enters and talks to Abigail alone. Unbeknownst to anyone else in the town, while working in Proctor's home the previous year she engaged in an affair with him, which led to her being fired by his wife, Elizabeth. Abigail still desires Proctor, but he fends her off and tells her to end her foolishness with the girls.



in pain, shock

mystery →

Betty wakes up and begins screaming. Much of the crowd rushes upstairs and gathers in her bedroom, arguing over whether she is bewitched. A separate argument between Proctor, Parris, the argumentative Giles Corey, and the wealthy Thomas Putnam soon ensues. This dispute centers on money and land deeds, and it suggests that deep fault lines run through the Salem community. As the men argue, Reverend Hale arrives and examines Betty, while Proctor departs. Hale quizzes Abigail about the girls' activities in the forest, grows suspicious of her behavior, and demands to speak to Tituba. After Parris and Hale interrogate her for a brief time, Tituba confesses to communings with the devil, and she hysterically accuses various townsfolk of consorting with the devil. Suddenly, Abigail joins her, confessing to having seen the devil conspiring and cavorting with other townspeople. Betty joins them in naming witches, and the crowd is thrown into an uproar.



← blaming others
|
power hungry

love and
sense of security →

authority

A week later, alone in their farmhouse outside of town, John and Elizabeth Proctor discuss the ongoing trials and the escalating number of townsfolk who have been accused of being witches. Elizabeth urges her husband to denounce Abigail as a fraud; he refuses, and she becomes jealous, accusing him of still harboring feelings for her. Mary Warren, their servant and one of Abigail's circle, returns from Salem with news that Elizabeth has been accused of witchcraft but the court did not pursue the accusation. Mary is sent up to bed, and John and Elizabeth continue their argument, only to be interrupted by a visit from Reverend Hale. While they discuss matters, Giles Corey and Francis Nurse come to the Proctor home with news that their wives have been arrested. Officers of the court suddenly arrive and arrest Elizabeth. After they have taken her, Proctor browbeats Mary, insisting that she must go to Salem and expose Abigail and the other girls as frauds.

evil

being responsible

important

suspicious
being cautious

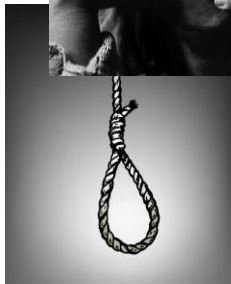
The next day, Proctor brings Mary to court and tells Judge Danforth that she will testify that the girls are lying. Danforth is suspicious of Proctor's motives and tells Proctor, truthfully, that Elizabeth is pregnant and will be spared for a time. Proctor persists in his charge, convincing Danforth to allow Mary to testify. Mary tells the court that the girls are lying. When the girls are brought in, they turn the tables by accusing Mary of bewitching them. Furious, Proctor confesses his affair with Abigail and accuses her of being motivated by jealousy of his wife. To test Proctor's claim, Danforth summons Elizabeth and asks her if Proctor has been unfaithful to her. Despite her natural honesty, she lies to protect Proctor's honor, and Danforth denounces Proctor as a liar. Meanwhile, Abigail and the girls again pretend that Mary is bewitching them, and Mary breaks down and accuses Proctor of being a witch. Proctor rages against her and against the court. He is arrested, and Hale quits the proceedings.

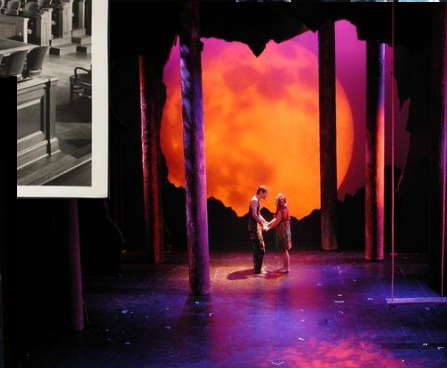
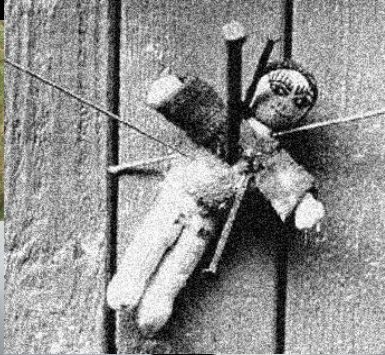
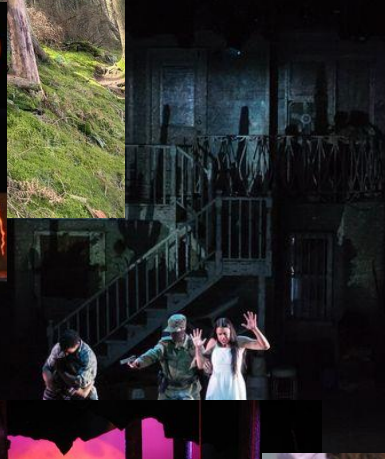
one persons
word against
another

rumours, uneasy

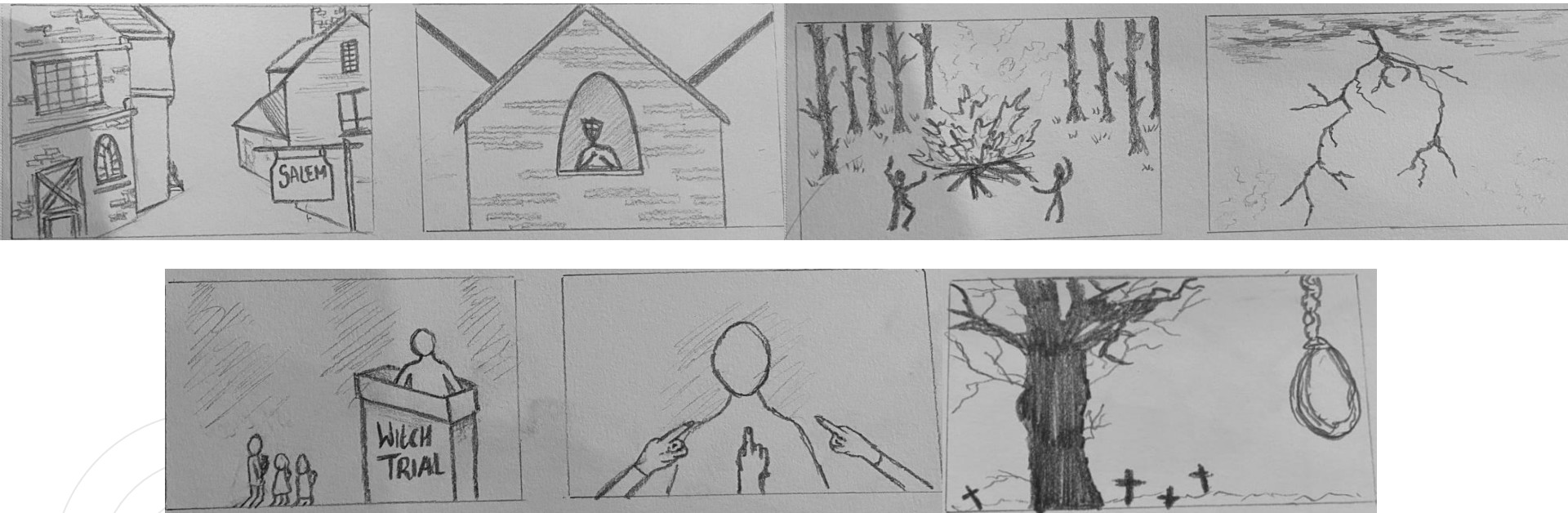
September

The summer passes and autumn arrives. The witch trials have caused unrest in neighboring towns, and Danforth grows nervous. Abigail has run away, taking all of Parris's money with her. Hale, who has lost faith in the court, begs the accused witches to confess falsely in order to save their lives, but they refuse. Danforth, however, has an idea: he asks Elizabeth to talk John into confessing, and she agrees. Conflicted, but desiring to live, John agrees to confess, and the officers of the court rejoice. But he refuses to incriminate anyone else, and when the court insists that the confession must be made public, Proctor grows angry, tears it up, and retracts his admission of guilt. Despite Hale's desperate pleas, Proctor goes to the gallows with the others, and the witch trials reach their awful conclusion.





Storyboard



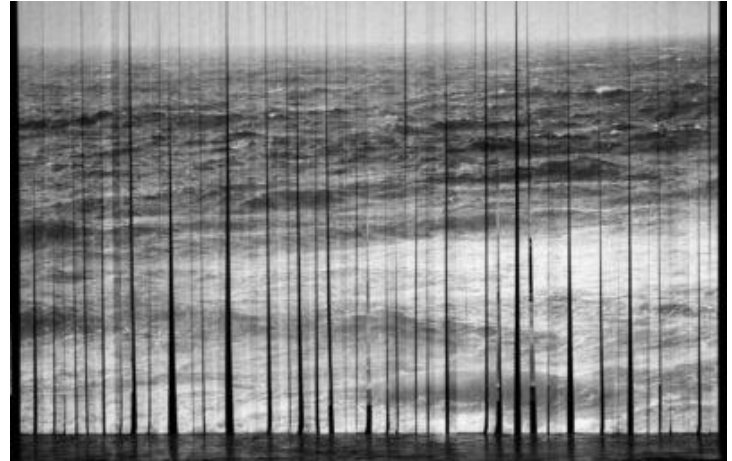


Derek Kreckler

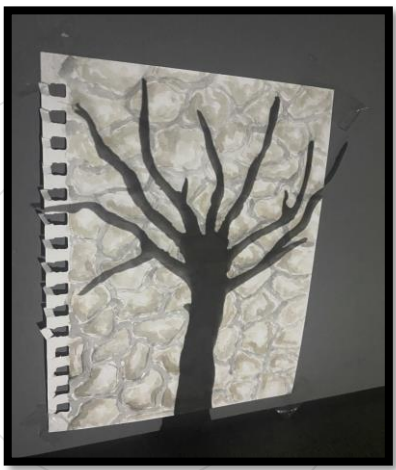
Derek Kreckler's Littoral piece looks at a moving image of water that has been fractured. The inspiration comes from watching the breeze blowing through a blind. Kreckler explores visual art, photography and installation art. The reason I like Kreckler's work is due to the way he plays with light and form to create a sensory experience that conveys emotions of relentlessness. I would like to explore further the relationship with environment within The Crucible.

My Response

Focusing on the theme of nature, I used a model tree to 'project' onto paper. By cutting strips of paper I was able to create a similar look to Kreckler's piece, if I were to use fabric it would have been easier to create the movement I wanted. When the paper moves it creates an eerie and hostile feeling which I feel represents The Crucible. However, I believe parts of the story would not suit the space and therefore I will not be continuing with this idea.



Littoral,
2014



Using watercolour, I painted a texture similar to a stone wall. I like the look of the shadows displayed on the material however I believe if coloured images were projected it would be hard to see detail.

Projecting on different media



Taking inspiration from the panelling of the Salem Witch House which is the last standing structure with direct ties to the Salem witch trials. I believe this design is simple but if I matched the colour of the house it would be hard to see the projections.

STEPHAN MAZUREK



Stephan Mazurek is an award winning Director of Photography, who created the video projections for Luis Alfaro's Mojada, produced at thePublic Theatre. Personally, I like the composition Mazurek has used to represent two contrasting images, being a bright blue sky with fields in comparison to a run-down rustic house. The idea of using a house to project images relating to the story is an idea that I would like to explore further as I believe the way Mazurek has achieved this conveys a powerful message and due to the position and placement of the actors, I believe a ceiling mounted projector would have been used.

My Response

I have used my own models to recreate Mazurek's work based on The Crucible. I do not own a projector, therefore I have used Photoshop and turned the opacity down in order to see the house details. This gives me an idea of how it might look and after discussing with my teammate Vanina we agree to carry on with this idea.





Es Devlin

Wire- Flag: Burning

Es Devlin is an artist and stage designer, who is known for creating large-scale performative sculptures and environments using music, language and light.

This particular set intrigues me a lot. It consists of four large mirrored cubes with lighting and projections, each individual member was placed in a box and would separately be lit during their time.

I like that all boxes tell a different part of a story using the song/lyrics, which is something I would like to take inspiration with my projection.



1692 houses

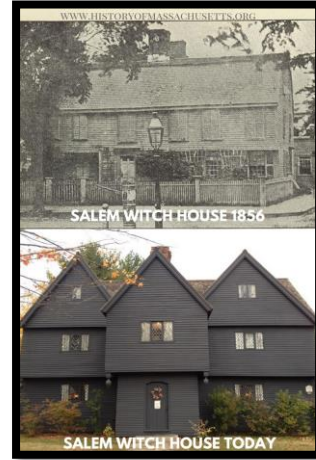
← projection mapping?



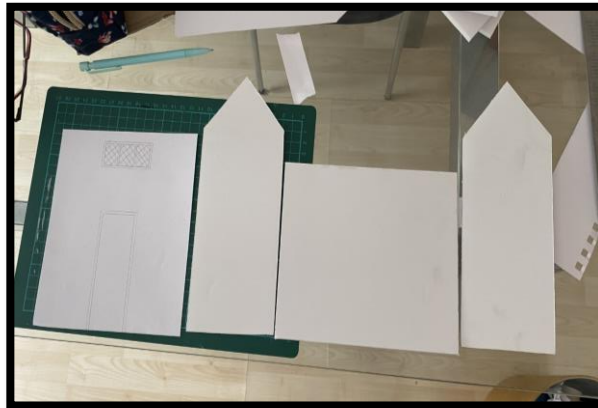
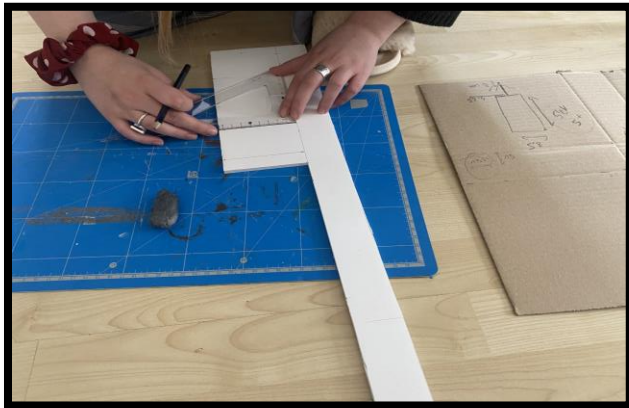
We have decided to create three houses inspired by the Salem Witch House, and project each house individually to tell a different part of the play.

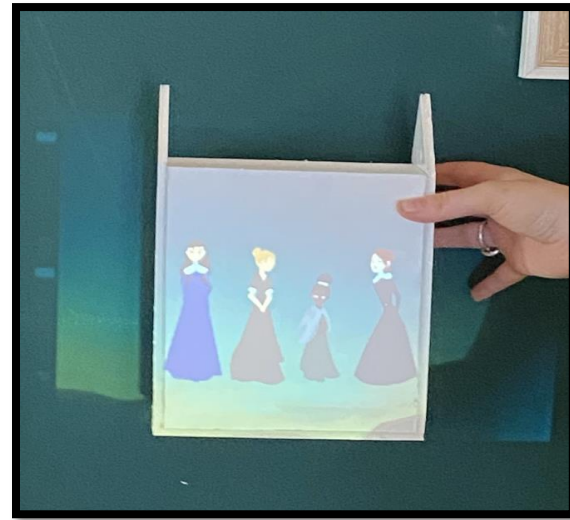
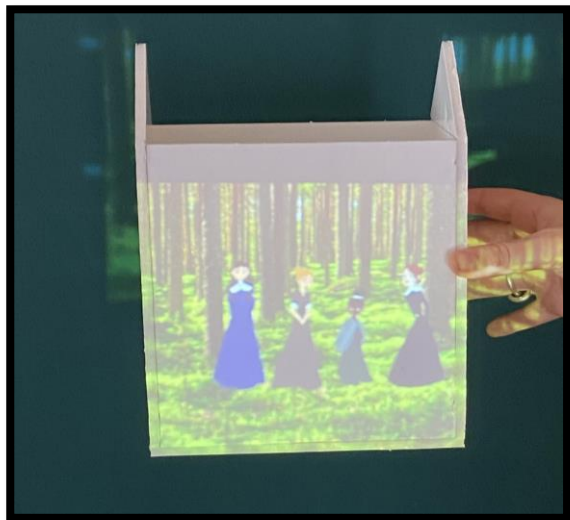
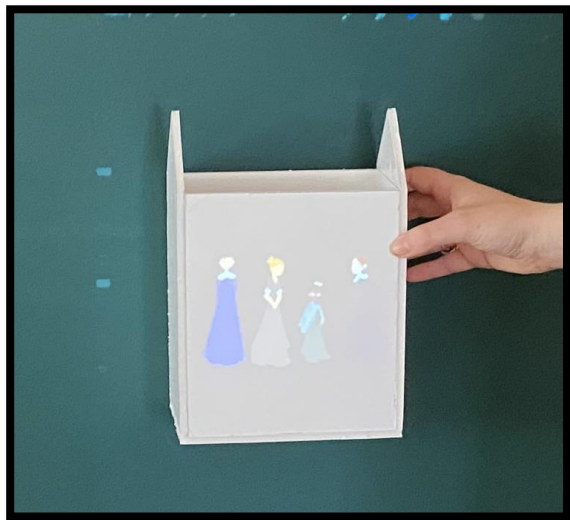
different projection on each house

← tell a different story



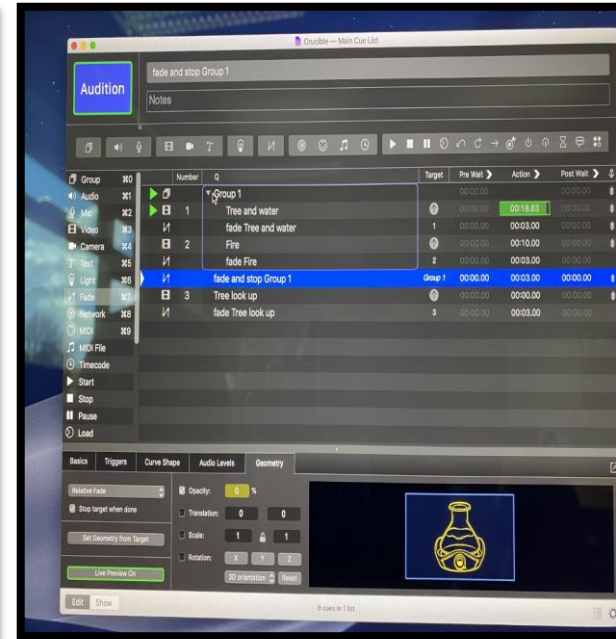
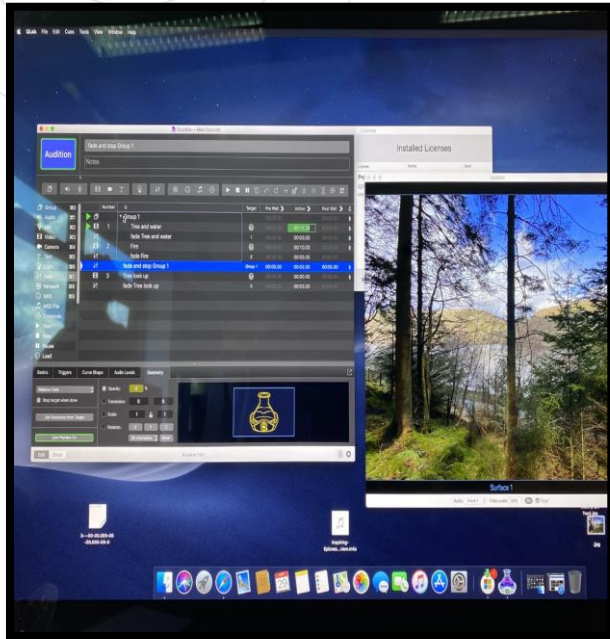
For our first prototype we used foamboard and created a basic house structure. We were still unsure whether to carve windows and doors yet. On the other hand, we have decided to keep the houses white as it will be easier to project onto.





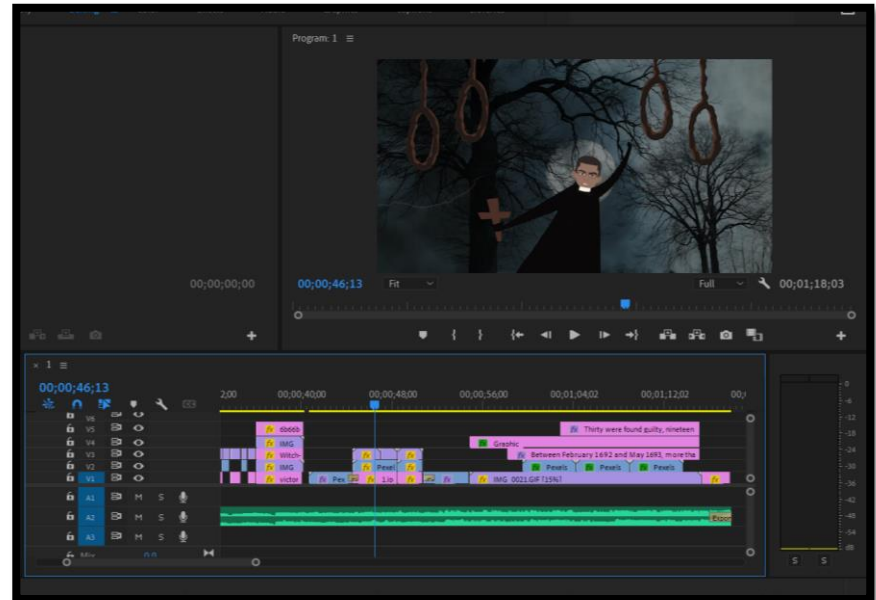
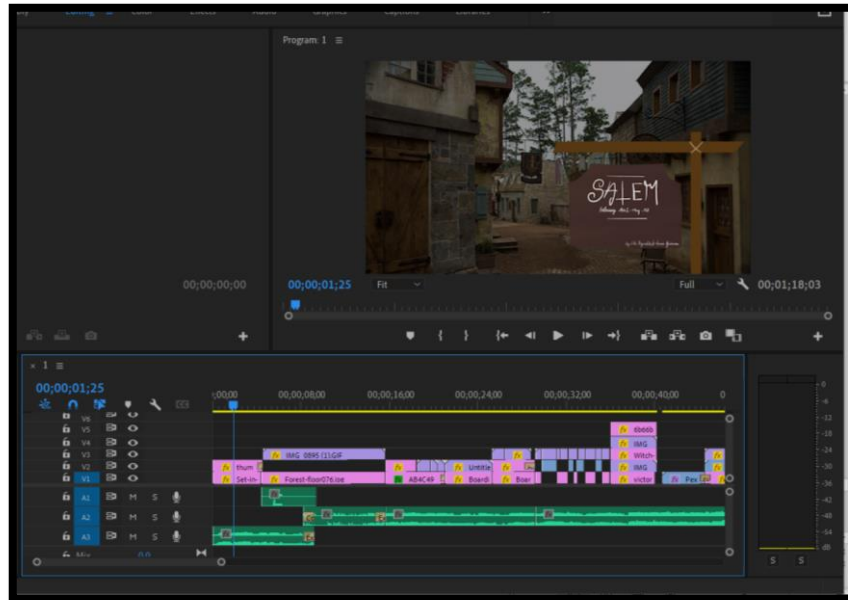
QLab

I had one lesson where I was able to experiment with QLab. I created a very simple video where I overlaid an image of a forest with a flame. I found it somewhat easy using QLab for basic transitions such as fading in and out. One thing I liked about QLab was having control over when an image or video would be displayed on screen, this would be especially useful for projecting on 3 different houses.

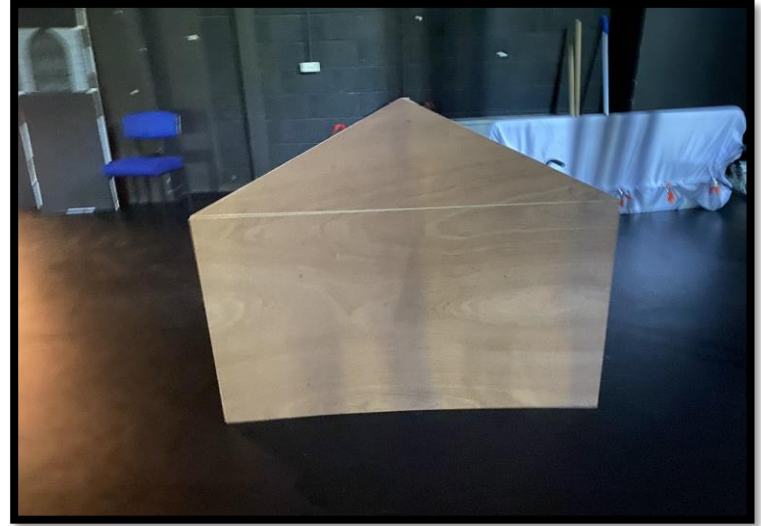
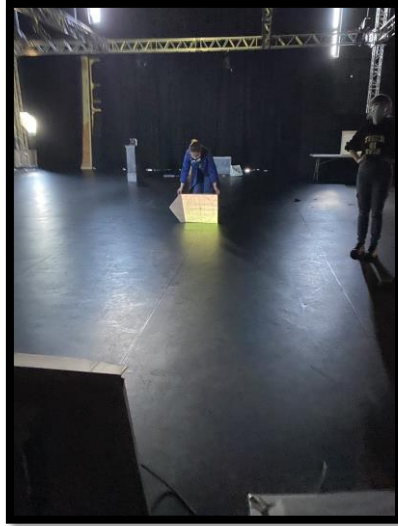


Editing the Projection

Originally, the editing for the projection was supposed to be done using the software Qlab. However, I do not own and was unable to get access to a Mac computer. This meant I had to problem solve and decided to use Adobe Premier Pro, a software I have never used before. At first I found it extremely difficult to understand how to layer videos and add effects, but being a quick learner I was able to practice and pick up a basic knowledge of the tools available. I enjoyed using premiere pro as it automatically plays the montage and has more tools to manipulate and edit the videos. Considering my skill level and software that was available to me, I believe I did well in creating a piece that focuses on the tragic story of the Salem witch trials through the use of lighting and atmospheric backgrounds.



Problem Solving



After practicing projecting on our white card model, we soon realized that it was too small to project onto. Therefore, we created another house structure out of plywood. Unfortunately, this model was also too small and to improve we knew that the house would need to be wider in order to fit the whole screen/video.

Above was the last house model we made that was big enough to project on, which was roughly 1500mm wide. Luckily, we were able to check that our model worked but next time I believe taking notes of the screen dimensions of the video would help.

Finished Piece



Evaluation

What went well?	What hindered?	Even better if I..	Key learnings for future.
• Working with Vanina to create a finished piece that looked good and played smooth during presentation. • I was able to learn the design principles of using lighting and projection, which will benefit me in future.	• Not being able to use Qlab for the final piece and having to use a different application that I have a limited knowledge of. • Did not fulfil the original design for final piece, next time ensure to plan ahead.	• Managed my workload better, especially when completing two workbooks at the same time. • Created own unique sound effects within my surroundings.	• Consider buying a Mac especially as it is industry standard – not only will this help with University work but also for career. • Fully understand how colour theory can convey different emotions and ideas.

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