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An Introduction to Stage Lighting

an introductory guide to lighting design at the ADC Theatre

Contents

Summary of Changes

1) (20/03/2022) Guide first published.

Introduction

Welcome to the ADC Theatre Lighting Guide. The aim of this guide is to explain some core ideas about lighting design and the process that lighting designers usually go through to produce the lighting design for a show. Where possible, the guide will avoid mentioning equipment that is specific to the ADC or Playroom's lighting system, and will instead talk about concepts in the abstract.

Introductory training is offered for all ADC Theatre and Corpus Playroom shows on each venue's lighting and rigging systems. Please email the Technical Manager at technical@adctheatre.com to arrange training.

This guide will be divided into sections that cover each of the main stages of bringing your lighting design from your imagination to the stage. I hope it will be useful.

If you have any thoughts on how the guide could be improved, please email them to the Technical Manager at the above address. The intention of this guide is to be useful to all newcomers to lighting design, and we would be very grateful for your feedback!

Glossary

The language of lighting design is littered with strange and often confusing terms for different things. I've provided definitions for some below in alphabetical order. Please don't feel you need to remember these offhand, but return to this section as and when it's useful.

Address – The numerical identifier (between 0 and 511) used by the DMX protocol to refer to each intelligent part of a lighting system (e.g. each dimmer or each intelligent light). Intelligent lights listen out for instructions sent to that identifier and adjust their parameters based on those instructions (e.g. change colour, adjust brightness)

Channel – The term for an individual light (or group of identically controlled lights) within a lighting desk. A channel is matched to a light through soft patching, and so when the desk controls or changes the channel, the fixture also changes.

Conventional Lantern (also, 'generic fixture', 'conventional fixture') – A lighting fixture that has a filament bulb inside and is controlled by adjusting the power supplied by a dimmer. Also referred to as a tungsten lantern. The opposite of an 'intelligent' fixture.

Dimmer – A device that can vary the amount of power supplied to a connected conventional lantern to vary its brightness, 'dimming' it (like with household dimmer light switches). The lighting desk controls the dimmer over DMX (telling it how much power to supply) and the dimmer in turn determines the brightness of its attached lanterns.

DMX (Digital Multiplex) – Used interchangeably for both the type of cable and the signal protocol used to send information to intelligent lights or dimmers (e.g. to tell them to go to a certain brightness, or turn a certain colour). (See *Patching* below.)

Focusing – The process of physically adjusting a light so it points at the right part of stage, and its beam looks right for your show (e.g. is the right shape, has softer or harder edges, etc.)

Gel – The coloured plastic sheet placed in front of conventional lanterns to change the colour of the light they produce. In the ADC all gels should be marked with a code, made up of a letter and a number. The letter marks the size of the gel (for different lanterns), the number marks the colour of the gel. Gels live in the gel trolley. In America, gels are often called 'filters'.

Hardpower – The word for power supplied to lights that does not run through a dimmer, so is not variable (like normal mains power). Used to power intelligent fixtures.

Intelligent Fixture (often 'LED fixture') – A lighting fixture that receives its instructions from the lighting desk directly, rather than being supplied variable power from a dimmer. Usually these use LEDs rather than tungsten lamps to produce light, so can often change the colour of the light they produce. The opposite of a 'conventional' lantern.

Lamp – Confusingly refers only to the bulb in a conventional fixture.

Light – Colloquially used to refer to any piece of light-producing theatrical equipment, regardless of type. Also used to refer to the light beam produced by said equipment. Because of this ambiguity, *lantern* and *fixture* are considered more "proper" terminology, but in reality, it doesn't matter much.

Lighting Desk – A computer that sends instructions to dimmers and intelligent fixtures to tell them how much light to produce, and what colour. Most modern desks can remember lighting states in playbacks (often called cues or submasters), and recall them during a show.

Lighting Fixture (or, 'Fixture') – The term for any individual piece of light-producing theatrical equipment.

Lighting Rig (or 'the Rig')– The collective term for every lighting fixture rigged for a production.

Patching – The process of ensuring the desk can control lights overstage. Comes in two stages: hard patching – physically plugging the right cables into the right lights and connecting them correctly at the patch bay; and soft patching – telling the lighting desk which channels correspond to which lights.

Plotting (or Programming) – Recording lighting states into the desk as cues or submasters so they can be recalled during a show.

Powercon – A cable with a grey connector on one end, and a blue connector on the other. Used in the patchbay to connect circuits, and over stage to run hardpower to intelligent fixtures.

Practical – A prop or piece of set that produces light. E.g. a table lamp, fairy lights, or a physical streetlamp.

Rigging – The process of putting the right lights in the right places and securing them so they don't fall.

SOCA cable – A single fat cable capable of transporting 6 circuits independently. Functionally 6 TRS cables in one. Very useful for running lots of circuits to a flown counterweight bar.

Special – The opposite of a wash. Lighting used to achieve a particular noticeable effect, and is usually used selectively for 'special' moments in a production. A hard-edged spotlight, the silhouette of a window against a wall, or a pool of orange light from a street lamp could all be called specials.

TRS / 15A – The name for the cables usually used to transport power from a patchable socket to a lantern onstage. These are mainly used to transport power from dimmers to conventional lanterns.

Universe (or DMX Universe) – There is a cap on the total number of addresses that can be sent down one DMX cable at a time (512 addresses). Modern lighting rigs often exceed this amount, so need to send multiple batches of 512 addresses to their rig. Each separate batch (and therefore separate cable) is called a 'Universe' as lights on one cable do not receive the instructions for lights on another. Lighting desks can, however, control multiple universes at once. At the ADC Theatre we use two universes.

Wash – Lighting that generally illuminates a large area, often with soft edges. The fixtures used to produce this effect are also often called 'the wash'. When a wash comes from over the auditorium, lighting performers from the 'front', it is called **'front wash'.**

Stages of the Lighting Design Process

Lighting Design generally splits into five stages. I will list them here, and go into more detail on each in their section below.

1) **Planning** –the design work that happens in advance of the designer starting to rig any lights. This process is very personal, but should result in the production of a rig plan, a cue list, and a cue script.
2) **Rigging** – the process of putting the right lights in the right places, securing them so they don't fall, and plugging them into power sockets.
3) **Patching** – a two-part process with the aim of ensuring the lighting desk has control of all its lights. Requires both **hard patching** – physically connecting the right lights to the right dimmer or hardpower circuit using cabling; and **soft patching** – telling the lighting desk how to communicate with each light.
4) **Focusing** - The process of physically adjusting a light so it points at the right part of stage, and its beam looks right for your show (e.g. is the right shape, has softer or harder edges, etc.)
5) **Plotting (a.k.a. Programming)** – Creating lighting states and recording them into the desk as cues so they can be recalled during a show.

This guide will now go into more detail on each of these sections.

Differences in Lighting Designing for Mainshows and Lateshows

Please note that while *planning* and *plotting* will be needed for every show, *rigging*, *patching* and *focusing* are only needed if you are adding additional lights to the rig. This is often not necessary for ADC or Playroom Lateshows as they can use the rig already put in place by their Mainshow.

Lateshows are welcome to rig additional lights if they do not interfere with the Mainshow's rig, and have the lanterns, dimmers, and time spare to rig them.

Lighting Designing at the Corpus Playroom

The Corpus Playroom is a far simpler space than the ADC, particularly with reference to its lighting capabilities. Much of this document either does not apply, or is not required knowledge for lighting at the Playroom. Having said that, the following sections may still be of use or interest (page numbers omitted, check in the contents above for details):

- **1. Planning** > All
- **2. Rigging** > All
- **3. Patching** > Hard Patching Conventional Lanterns
- **4. Focusing** > All
- **5. Plotting** >
  - Making a state
  - Types of Playback
  - Cue Lists
- **Types of Fixture** > Profiles and Fresnels
- **A Few Principles of Lighting Design**

1. Planning

The planning phase is the most personal stage of lighting design, and varies a lot between designers. Some designers like to draw out coloured sketches of how different scenes will look, some like to draw out diagrams of where lights will go and which will be active in different scenes, some like to calculate beam angles from certain lights to the stage to determine exactly what will be lit. Most will work closely with their script to plan when lighting changes occur and what the play calls for. Some like to use computer software to assist their planning, some prefer pen and paper.

All this is to say there is no right or wrong way to plan your design. I will talk at the end of this guide about a few lighting design principles that can help you approach thinking about your lighting design, but how you plan is up to you.

However, the planning phase should always result in the following three things:

1) **A rig plan** – a diagram showing each light in your rig, where it is going to be rigged, what type of light it is, what channel the lighting desk will refer to it as, and often what colour it is gelled and where it will be focused (often details like this are written in front of the barrel of the light).

   Often rig plans are drawn over stage plans, so the location of the light onstage is obvious, but some designers prefer summary plans that roughly show where lights go relative to each other, but not to the stage as a whole.

2) **A cue list** – a list, often a spreadsheet, that contains information about each cue. This is a massive help with coordinating with other technical departments and the stage management team, and will save you a lot of time in the plotting phase. Here is some useful information to include:
   a. Cue number
   b. Cue prompt – the line in the script or event onstage that triggers this cue
   c. A description of the state recorded in the cue (e.g. 'Susan's flat – warm interior', or 'Thunder clap – stage right sidelight at full')
   d. A fade time – how long it should take to transition from the last cue to this one
3) **A cue script** – a script (normally single sided) with each cue marked next to where they happen in the script. This is often created by the deputy stage manager based off the lighting designer's cue list during a paper tech for ADC shows, but is usually created by the lighting designer for Playroom shows. This is the document that you follow while the performance is taking place that tells you when to press 'Go' to change to the next cue. <u>Make a copy! Don't lose it!</u>

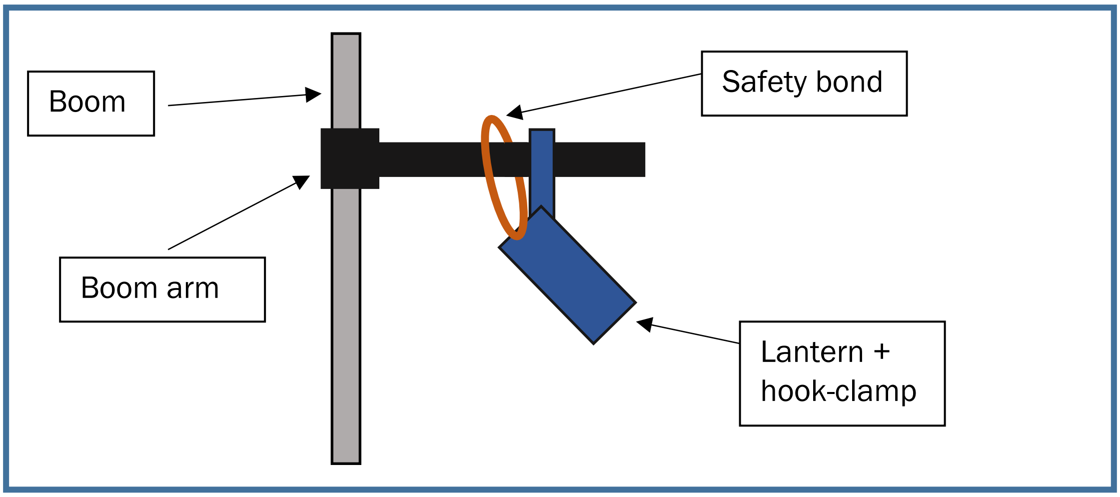
2. Rigging

The aim of rigging is simple – to get the right lights to the locations specified in the rig plan. However, there are several things to think about:

- **Rigging Lanterns and Rigging Positions**

  Lights usually attach onto horizontal metal poles (referred to as rigging positions) using a hook-clamp, and are then additionally secured to their rigging position using a safety bond (often called a secondary, or safety chain). In normal operation, the hook-clamp should hold the light in place. The safety bond is there as a secondary point of attachment – if the hook clamp fails, the light will be caught by the safety bond before it has a chance to fall on anyone. All lights must be rigged using safety bonds.

  Where a rigging position is a vertical pole (as with the perches and proscenium booms), boom arms should be used that clamp onto them to provide a horizontal pole for rigging.



There are several standard rigging positions that shows can use, these are:

1) **Auditorium Bridges** – located over the auditorium, these are great places to rig your frontwash (light that will generally light the stage, particularly to catch actors' faces). There are two bridges, bridge 1 (closer to the stage) and bridge 2 (further from the stage)
2) **Counterweight Bars** – most lighting rigs will be rigged on counterweights as they offer a lot of flexibility in rigging location and height. There are 20 counterweight bars that run across the stage, from stage left to stage right. Each can have lights rigged on it. However, set pieces and cloths often use counterweight bars as well, so you need to coordinate with your Technical Director which bars can be used for lighting, and which for set. As conventional lanterns get very hot, they should never be placed on adjacent counterweights to any flown cloths.
3) **Auditorium Ladders** – located on either side of the auditorium, these are not climbable ladders, but instead are a grid of scaffolding bars that you can rig lights off. They are often used for getting side light onto the forestage.
4) **Perches** – On either side of the forestage there are two doors called the juliettes. Above these are two raised alcoves that face each other across the forestage. These are the perches, and are a good place to hide lanterns that will be used for forestage sidelight or lighting actors downstage.

5) **Proscenium Booms** (often abbreviated to 'pros booms') – Located on the upstage side of the proscenium arch, the pros booms are vertical poles that provide an easy place to put sidelight for downstage and midstage.
6) **Rear of Auditorium Bar** – At the back of the auditorium there is a lighting bar. Due to its distance from stage it is usually less useful than other rigging positions. However, it is occasionally useful for rare effects.

These standard rigging positions are always present, but your show may also rig additional non-standard rigging positions as part of your get-in. See the **TR Standard Practice Guide** (available at www.adctheatre.com/guides) for information on this.

- ## Cabling

It is usually useful to plug in all your lanterns as you rig them, to avoid having to go up and do it again later. The ADC has several types of cables used in lighting.

	Power Cables	
1	13A TRS Familiar to most people as standard UK mains cable (notable for its rectangular pins), 13A TRS is rated to withstand up to 13A of current. In most cases this is sufficient for powering most lanterns, but to prevent confusion, it is rarely used in lighting design.	
2	15A TRS Essentially 13A TRS's older sibling (differentiated by its round pins). It is rated to withstand up to 15A of current, and is the cable type usually used in the UK for conventional lanterns as it prevents confusion with non-theatrical electrical appliances.	
3	Powercon Recognisable by its blue and grey plug connector type, powercon is usually used to power intelligent fixtures. At the ADC and Playroom we also use it for patch leads to connect dimmers to circuits.	
4	Socapex (often called 'Soca') A fat cable capable of transporting 6 circuits independently. Functionally 6 TRS cables in one. Very useful for running lots of circuits to a flown counterweight bar. Can carry both dimmable power and hardpower on the same cable (but not on the same circuit within that cable).	

	There are adapters that convert one Socapex cable into 6 15A TRS cables (and vice versa), each numbered so you know which is which.	
5	**Trucon** A later revision of powercon, used to provide power to some more recent intelligent fixtures. We only have two lights that use it – our two followspots, so it can usually be ignored.	
	Signal Cables	
1	**DMX Cable** DMX is the cable we use to run signal to lights. It is notable for being much thinner than power cable, and having 5 pins. This is the only cable used of running signal at both the ADC and Playroom. Warning – DMX 5-pin cables are easily confused with microphone XLR cables, which look the same, but have three pins. Note – DMX 3-pin cables exist, but we do not use them at the ADC. If you hire equipment, you may have to consider whether you also need to hire 3-pin DMX cables, or extra adapters.	

Adapters exist at the ADC between all mains power cable types, but in most situations, you should be able to plug a light into a nearby socket with only one cable.

- ## Gels

Conventional lanterns are unable to change the colour of the light they produce, so to ensure a lantern is producing the right colour, you need to use gels (often called 'filters' in the US). Gels are thin pieces of coloured heat-resistant plastic that change the colour of the light that passes through them. They are located in the gel trolley in the OP Quad, and are usually cut to size for the right light. The colour of a gel should be marked on it in chinagraph pencil with a number corresponding to its colour in the Lee colour scheme (see here for more detail https://www.leefilters.com/lighting/colour-list.html). Please note the ADC does not stock all colours of gel – the gels we do stock are specified here https://www.adctheatre.com/production/consumables/.

Different lanterns take different gel sizes, which are demarcated with letters. If there are not the right gels available, you can cut them using a special guillotine located in the OP Quad which has templates for different sizes of gels. The ADC's Lantern List (available at www.adctheatre.com/technical) specifies what size each gel takes.

It is a good idea to put gels into lanterns before rigging your lights! This will save you a lot of time during your focus.

- ## Masking

While some productions like their lighting fixtures to be visible to the audience, most productions will want to conceal most of their fixtures from audience view. This process is called masking, and involves the rigging of flown ‘borders’ (short stage cloths) on bars downstage of lighting bars to block view of the lighting bars behind.

At the ADC borders are often flown by the set team during the main get-in, but it is important for the lighting designer and set team to decide where they will be rigged before the get-in begins. Often when all counterweights have been used up, hemps are used instead to fly masking.

3. Patching

The goal of patching is to ensure that all lights can be controlled by the lighting desk. There are two sides to it: **hard patching** – physically plugging the right cables into the right lights and connecting them correctly at the patch bay; and **soft patching** – telling the lighting desk which channels correspond to which lights. (The 'hard' and 'soft' terminology here is used in the same way as in 'hardware' and 'software'.) As they are substantially different I will explain them in separate sections, but troubleshooting an issue often involves thinking about both.

Hard Patching

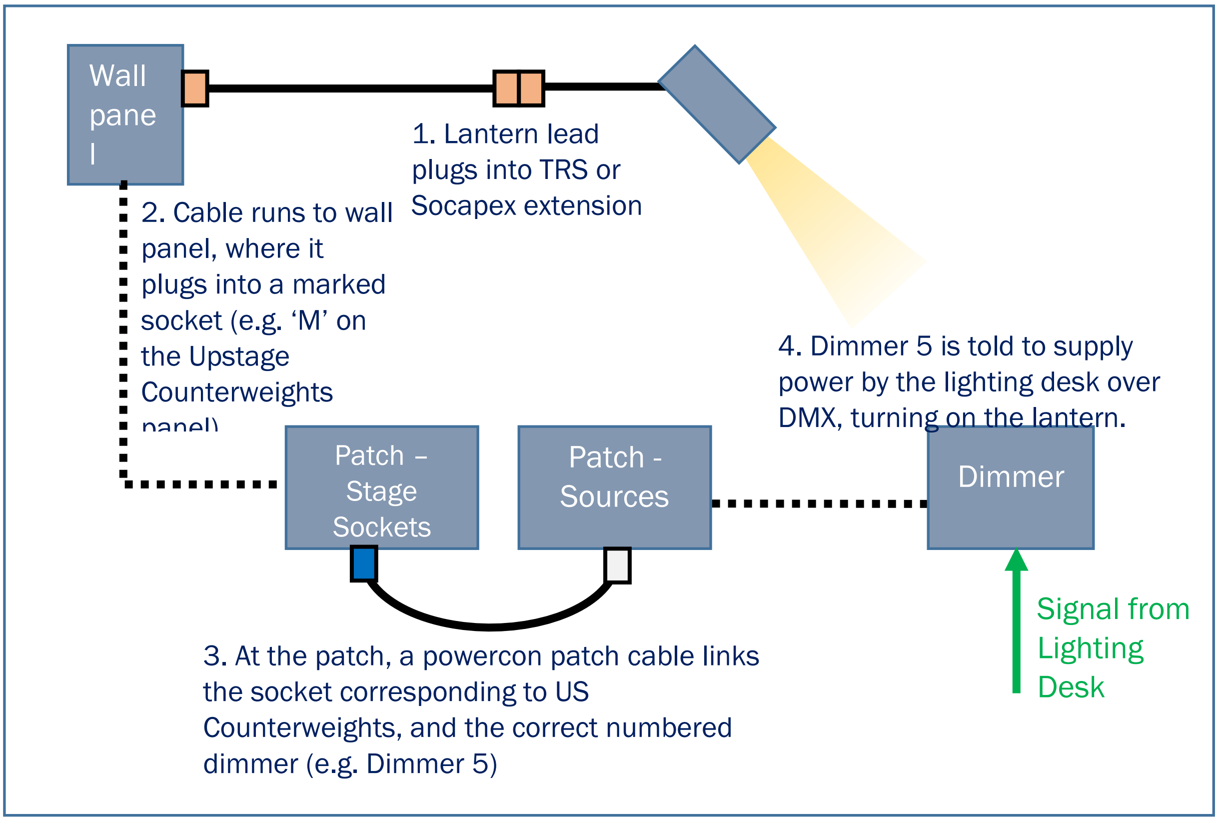
Hard patching is a very different process for conventional and intelligent lanterns, so I will treat them separately here.

- **Hard Patching Conventional Lanterns**

  A conventional lantern is simply a casing around a tungsten bulb, that connects back to a dimmer that supplies it with power. The more power the dimmer sends it, the brighter the lantern.

  This simplicity means that there is only one question to consider when hard patching a conventional lantern – is the lantern connected to the right dimmer?

  Patching a conventional lantern will usually work as follows:



If a lantern does not turn on, one of four things has happened:

1. The circuit between the dimmer and lantern is broken somewhere (e.g. dimmer 5 is patched to US counterweights 'N' not 'M' at the patch). This is just something to double check.
2. The desk is not turning on the dimmer (this is likely to be a soft patch issue – see below for more information).
3. The lamp in the lantern has blown. Swap out the lantern for another identical working one if you have one, otherwise ask management for a new lamp.
4. The dimmer has tripped (i.e. the fuse has blown) – often happens when a lamp blows. This can be fixed by resetting a switch at the dimmer pack.

In any case, the easiest way to check that issue is not an open circuit is to connect the grey end of the powercon cable into hardpower at the patch. This will bypass the dimmer and check if the cable is continuous between the patch and lantern.

- **Hard Patching Intelligent Lanterns**

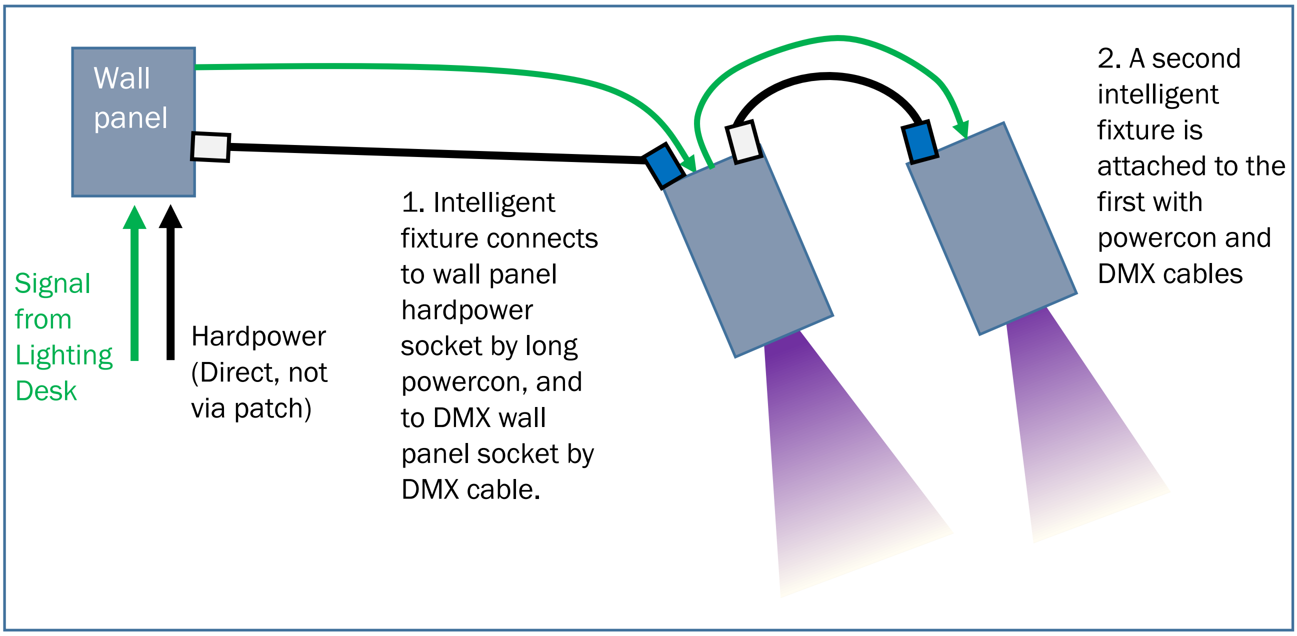
Intelligent fixtures are less complicated to rig, and only rarely have hard patch issues, but are prone to having soft patch issues (see below).

Intelligent fixtures, unlike conventionals, <u>should **never** be connected to a dimmer.</u> Every intelligent fixture contains a mini-computer, which can be badly damaged by changes in supply voltage. Instead, like a computer, all intelligent fixtures should receive constant mains power (known as **hardpower** in a lighting context), and are controlled not by changing the amount of power provided to them, but by sending instructions to them over a **signal** cable.

For this reason, all intelligent fixtures need two cables to function: a **power cable** (usually powercon) plugged into hardpower, and a signal cable (DMX 5 pin) that connects back to the lighting desk.

Additionally, because all intelligent fixtures receive the same power and the same signal information, you can **daisy chain** power and signal between different LED fixtures, only needing to plug into the wall in one place.

In many places around the theatre these sockets are available directly, without needing to go via the patch. For example:



Running hardpower through 15A sockets

It is possible, however, to connect any circuit that could be connected to a dimmer to hardpower instead by connecting the grey end of the power cable into a hardpower circuit instead of a dimmer circuit. This means power can be, and often is, supplied to intelligent fixtures from the 15A sockets on wall panels. This can be useful for extending the reach of a cable, or reducing the number of cables to a bar (if hardpower is run through Socapex), or simply getting power to a place where there are no local direct hardpower circuits (e.g. the perches or auditorium ladder rigging positions).

DMX

For all practical purposes, all onstage DMX sockets are identical, and there is no patching needed for them. Signal runs directly to them from a DMX splitter, but as every cable contains a complete copy of the relevant data, it doesn't matter which wall panel DMX socket a DMX cable is plugged into.

Soft Patching

Soft patching is essentially the process of telling your lighting desk how to communicate with your intelligent fixtures and dimmers. I'll go into this in more detail below, but for people who want the sparknotes:

- **Step by Step – how to soft patch a fixture at the ADC Theatre**
  1. Open the **'patch'** window on the lighting desk you are using (on Eos, press the 'Patch | Address' button twice).
  2. Get the light's **address**.
     - For conventional fixtures – this will be the number of the dimmer the fixture is connected to.
     - For intelligent fixtures, the address can be found from the back of the light – it's usually displayed as a three-digit number on a screen, or as a three-digit number on a sticker.
  3. Work out what **DMX Universe** your light is in.
     - At the ADC, if your light is a conventional fixture plugged into a dimmer then it is in **Universe 1**. If it is an intelligent fixture then it is in **Universe 2**.
  4. **Pick a channel number** (the number you call the light in the lighting desk), and **assign the channel to the address** in the right universe (1 or 2).
     - on Eos, make sure you're in 'patch', then: type the channel number, then [@], then the universe number, then a '/', then the address number, then [Enter].
     - E.g. "Chan 3 Address 2/205"
     - (If your light is in universe 1, you don't need to bother with the '2/' - the desk will by default assume it's in universe 1 if you don't specify.)
  5. Set the channel to the right **fixture profile**.
     - For conventional fixtures this can be left as 'Dimmer'
     - For intelligent fixtures this will need to be manually set - on EOS this is done by tapping the 'Type' column, then tapping the name of the fixture in the window at the bottom left of the screen, or if it's not displayed there, searching for it using the search tool at the bottom left.
  6. **Done!** The light should now be controllable from the desk.

- **Intelligent Fixtures, Addresses, and an explanation of DMX**

Intelligent fixtures spend their time taking orders sent to them via DMX. DMX (lighting signal) is made up of a stream of bytes of data (numbers ranging from 0 to 255), and every fixture receives all the data for every fixture on their *DMX universe* (more on what this is later). A fixture listens to this stream and attempts to filter out the bit of it that is relevant to that fixture.

For example, a dimmer is only interested in how much power to supply to its circuit. This means it is listening out for a number between 0 (0% power) and 255 (100% power), but it receives 512 numbers, each between 0 and 255. How does it know which of the 512 numbers to listen to?

The answer is that every fixture is listening out for a number in a specific location in the DMX chain. This location is called the fixture's **address.** For example, our dimmer might be set to address 2, so it listens only to the 3th number in the chain (as computers start counting from 0):

Address	0	1	2	3	4	5	6
Value	10	0	255	120	100	0	60

Here the dimmer would know to give its circuit full power (255 out of 255), and it turns its attached conventional lantern on at full.

Now dimmers only need one parameter – intensity – but some fixtures need information on more than one parameter. These fixtures may need an intensity, but also a value for red, green, and blue (so that they can mix them together to change colour). In this case the fixture listens out for a range of addresses in a known order. For example, let's say our dimmer was instead a basic colour changing intelligent fixture set to address 2 that listens out for Intensity, then Red, then Green, then Blue. The fixture would filter the DMX chain like this:

Address	0	1	2	3	4	5	6
Value	10	0	255	100	100	0	60

In this case the fixture would set itself to full brightness, and to a yellow colour (acquired by mixing red and green light).

Now, we could say this fixture is listening to the range of addresses 2-5, but that doesn't tell us which number corresponds to which parameter, so it is important that the lighting desk knows what the fixture is expecting to hear in advance – intensity first, then red, green, and blue. This order is known as a **fixture profile** and tells the fixture, and the lighting desk talking to it, how many addresses the fixture is listening out for, and which parameter corresponds to which address.

- ### Lighting Desks and Channels

  The lighting desk, on the other hand, thinks in terms of **channels**. A channel has a number of parameters that can be altered, usually its intensity (brightness) and its colour. These are bound up with each other, so the desk knows that intensity and brightness belong to the same channel. Since the desk knows that these go together, you can select a colour on a colour picker on a touchscreen, and the desk will automatically work out what values to give to red, green, and blue.

  As you can imagine this makes programming with channels a lot easier than editing the red, green, and blue values sent to lighting fixtures via DMX manually.

- ### Soft Patching in Practice

  The job of soft patching, then, is to make it so the desk knows how to convert channels to addresses, so you can programme entirely with channels and never worry about what's going on under the hood.

  In most modern lighting desks, a patched channel will be made up of three components:

  1. The channel number (e.g. Channel 1)
  2. The corresponding address (the first address the fixture will listen for, e.g. Address 2 above)
  3. The fixture profile being used.

  For example, our dimmer (on channel 5) and colour changing light (on channel 6) might look something like:

Channel	Address	Fixture Profile
5	2	Dimmer
6	2	Intensity, RGB

Soft patching is just the process of filling in this table with the channels and addresses you need to control during your show.

- DMX Universes

  There is one last complication with DMX. Since DMX can only carry 512 values down one cable, big lighting rigs often need more than one cable's worth of DMX information. To do this, they run multiple cables from their lighting desk, each one carrying a unique set of DMX values, and going to a different set of fixtures. These cables, and the fixtures on them, are said to be in different **DMX universes**.

  All that that means is that there can be multiple fixtures at the same address in different universes (e.g. a light at Address 15 in Universe 1 and Address 15 in Universe 2). When we patch a channel to a fixture at the lighting desk, we need to tell it which universe that fixture is in, so the information can be routed down the right cable, and to the right light.

  The syntax for doing this on **EOS** (the ADC's lighting desk software) is to write the universe number, followed by a forward slash, followed by the address number. For example, if our colour changing light was on Universe 2, but our dimmer was on Universe 1, our patch table would look like:

Channel	Address	Fixture Profile
5	2	Dimmer
6	2/2	Intensity, RGB

  From a channel and show plotting perspective, this would work exactly the same, Channel 6 would control the light, and there would be no difference in operation, but under the hood the patch would be sending the info to the right place.

  In the ADC Theatre, all intelligent fixtures that you plug a DMX cable into are on Universe 2. All others (e.g. the permanently installed dimmers and the houselights) are on Universe 1. **When in doubt – if it's a dimmer, Universe 1, if it's not, Universe 2.**

- Troubleshooting Soft Patching Errors

  Unsurprisingly, given how faffy the whole soft patching system is, there are a few regular errors that crop up.

  The ADC has a pre-set DMX patch (labelled on each fixture) that should never clash. So hopefully errors where you have to be able to access the fixture should be rare.

  1) Help! My intelligent fixture is not responding to the desk!

    - **Step 1: Does it have power?** Press a button on the back of the light and see if its screen lights up.
      - If no power, troubleshoot hard patching of power. (See **Hard Patching** above)

- **Step 2: Is it set to the right address?** Look on the screen at the back of the light and check the address listed is the same address as the channel is set to on the desk. Also check if the address matches the number on the label attached to the fixture.
  - If it's not, correct the error in the patch, or on the fixture, and try again.
- **Step 3: Are you in the right universe?** Check on the desk, that if it's a dimmer it's patched to Universe 1, and if it's something you have plugged a DMX cable into, it's patched to Universe 2.
  - If it's in the wrong universe, correct and try again.
- If none of the above helps, seek out management for technical support.

2) **Help! My intelligent fixture is flickering!**
- **Step 1: Is the fixture terminated?** DMX needs to be terminated to prevent signal echoing back and forth along the signal wire, confusing lights. Some fixtures self-terminate, but many do not. Terminators are small black caps that plug into the 'through' DMX port of the last light in a chain to prevent the signal echo.
- **Step 2: Does the intelligent fixture have a number value in its strobe parameter?** Go to live table view on Eos, and check if the fixture has a number (even a 0) in the strobe column.
  - If it does, select that fixture, select the 'Shutter Strobe' parameter, and set it to EMPTY (e.g. Channel 5 Shutter Strobe @ [ENTER]), and see if that fixes the problem.
- **Step 3: Is there any other channel that overlaps with the fixture's addresses?** It's possible another channel's intensity or colour parameter is overlapping the fixture's strobe channel. Check on patch whether there are any other channels patched to addresses soon after the offending light (Hint: pressing 'Format' while in patch switches the table to be ordered by Address not Channel, making it easier to check)
  - If there is, check if the fixture is actually set to that address, and correct the error in patch or on the fixture, and try again.
- If none of the above helps, seek out management for technical support.

4. Focusing

In a nice change from Patching, Focusing is pretty intuitive. Focusing is the process of ensuring the light produced by each lantern or fixture hits the right part of stage in the right way.

This usually requires going up a ladder to physically change where the light is pointing, and how it produces its *light beam*. The end result, the position and set-up the light ends up in for the show, is called its **focus**.

Focusing is generally very intuitive – you essentially just fiddle with the light until it looks right, then move on to the next one. However, to give an idea of the kinds of things you'll be changing I'll run through the main ones here:

- **Direction** – the direction the lantern faces changes what its light beam hits. A lantern can usually rotate in two axes, horizontally and vertically.
    - To rotate horizontally you swivelling its yoke around its hook clamp.
    - To rotate vertically you usually release a brake where the yoke connects into the lantern body, adjust it to the right angle, then apply the brake again.
- **Beam Shape** – Many lights allow you to shape the beam by blocking off parts of the light beam, allowing you to create straight edges instead of circles, or prevent light hitting a part of the stage. This is usually accomplished using **shutters**—metal panels that slide in and out of the side of the light—on *profiles*, and **barn doors**—metal flaps at the front of the lantern—on most other lights.
- **Beam Angle** – The angle between the two edges of the beam's as it leaves the lantern. If the angle is large, the beam is wider, hitting more stage but less brightly as the light is dispersed. If the angle is small, the beam is thinner, hitting less stage more brightly as the light is concentrated. Most lights have fixed beam angles, but some allow them to be adjusted, usually by adjusting knobs on the barrel of the light.
- **Beam Softness** – All light beams can have harder or softer edges. A hard edge on a beam looks like a traditional spotlight, with a hard border separating the lit area and the dark area. A soft edge instead has a gradient at its edges, blurring light and dark areas together. Some lights (particularly *profiles*) allow you to adjust how hard or soft their beams are by adjusting knobs on the barrel of the light.
- **Colour** – While not strictly a part of focusing, if you haven't got the right gels in your conventional lanterns, now is the time to do it!

Usually during a lighting focus you need someone on the desk to turn each light on, and someone up a ladder or in the Genie (a mobile work at height platform – basically a cherry picker) to focus the light. In Cambridge, some lighting designers prefer to see what the light will look like from the desk, others prefer to have focus the light themselves to have full control over it – it's a personal preference. In the professional world a lighting designer very rarely focuses lights themselves.

5. Plotting (a.k.a. Programming)

By the time you sit down to plot a show, every fixture you are using should be rigged and focused correctly. Plotting is the process of recording which fixtures should be on at any point in the show, how brightly, and (if they are LED) what colour they should display.

While you can do all of this sat at the desk, do not underestimate how long it will take. The process scales by how many cues you need to plot, and often can take several hours.

- ### Making A State

  The first step in plotting is to make a state. A **lighting state** is a static way that the stage looks. Most desks allow you to alter the intensity of fixtures using either *faders* (sliders that adjust intensity) or *console commands* (that tell lights to go to a certain percentage brightness). The colour of LED fixtures can usually be changed using a touchscreen colour selector.

  Adjust the intensities and colours of different fixtures until they look how you want them, and that's a lighting state. Next you need to record it so you can play it back later.

- ### Types of Playback

  Ways of playing back lighting states later, are, imaginatively, called 'playbacks'. There are two main types: **cues**, and **submasters**. Both record states, but differ in how they recall them.

  A **cue** remembers a lighting state and stores it within a **cue list**. Each cue has a number, and the cue list plays back in order—cue 1, then cue 2, then cue 3—moving forwards through the list, with different speeds of fades set on each cue to control how quickly it transitions between the states.

  Cues are fantastic for theatre, as they work really well in environments when you know exactly what will happen when in your show, allowing you to do all the set up in advance, and just press 'Go' to move between cues on the night.

  A **submaster** records a single state, but you control how much of it is recalled using a *fader* (a slider on the lighting desk). The levels recorded in a submaster are recalled proportionally to the level of the fader. When the fader is at 50%, 50% of the values in the submaster are recalled, and the lights will go to 50% of their intensity level in the recorded state. This makes a submaster very good for controlling groups of lights, or mixing together different lighting ideas quickly.

  Usually submasters are best in either very technically simple shows (as they are quicker to set-up than cues, allowing more rehearsal time), or shows where the show changes each night, like improv shows, where the rigid structure of cues is poorly suited.

- ### Cue Lists

  As mentioned above, cues record states in a list, and playback by recalling those states sequentially in a given order. A cue list is usually viewed in a table, and usually looks something like this (numbers usually refer to seconds):

	Fade Time				
Cue No.	Intensity In	Intensity Out	Colour	Label	Follow/Hang
1	5	5	0	S1 – the house	
2	0	0	0	Black out	
3	3	3	0	S2 – the living room, night	
4	20	20	20	Sunrise red	H10
-> 4.1	40	40	40	Sunrise orange	F30
-> 5	10	10	10	Living room, day	

Breaking this down, each cue has:

- **A cue number** – usually an integer, but you can insert additional cues in at decimal points – these are called 'point cues', and are useful if you get stuck.
- **Fade times** – the time it takes to transition from the last cue into this one. Usually this is for the cue as a whole, but many desks let you change the speed at which different parameters fade – for example you could change colour at a different speed to intensity, or change the intensity of fixtures getting brighter at a different speed to fixtures getting dimmer ('Intensity In' vs 'Intensity Out').
- **Label** – A field to write a brief text description of the cue.
- **Follow/Hang** – a tag that allows this cue to trigger the next cue after a delay.
    - **Follow** starts a timer of fixed duration when the cue is entered (when the 'Go' button is pressed) and when that timer hits zero, triggers the next cue.
    - **Hang** does the same as follow, but starts its timer after the cue has finished transitioning in, instead of as it starts transitioning.
    - E.g. cue 4 above has a fade time of 20s, and then a hang of 10s that counts down after the fade time, so cue 4.1 will trigger 30s after cue 4 starts.
      On the other hand, cue 4.1 has a fade time of 40s, and follow of 30s, that counts down at the same time as the fade, so cue 5 will trigger 30s after cue 4 starts, and 10s before cue 4 has finished transitioning.

There are a couple of other parameters that can be added to cues, but they depend on the how the lighting desk is recording cues.

- **Cue systems: thinking with Tracking**

Lighting desks can record cues in one of two ways: they can record every piece of information about every fixture into every cue, or only record the changes between cues.

The first system is very simple, but allows less flexibility than the second, as all fixtures receive their instructions together, and fade at the same speeds – the Zero88 Jester at the Corpus Playroom works on this system.

This second system is known as **tracking**, and is what most modern lighting desks, including the ADC Theatre's Gio@5, use. It allows more detailed programming for different fixtures.

Tracking systems usually use a colour code to describe what kind of change has been recorded into a cue:

- Blue – the value has increased (the sky is **up** and is **blue**)
- Green – the value has decreased (grass is **down** and is **green**)
- Magenta – No change recorded. The number visible is at that value because it was at that value on the previous cue.

Both tracking and non-tracking systems actually behave very similarly when you're first recording cues, it's when you want to edit cues that it's more difficult.

Say you are lighting a scene in a living room, where an actor turns on a table lamp, then another, and afterwards the stage goes to a blackout. Looking at the intensity values stored inside the cue, it might look something like this:

Cue	Label	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8
1	Living room	60	60	60	60	0	0	0	0
2	Lamp 1 on	60	60	60	60	0	0	80	0
3	Lamp 2 on	60	60	60	60	0	0	80	80
4	Black out	0	0	0	0	0	0	0	0

Then suppose you decided you wanted Channel 5 to be on at 40% throughout the scene. If you were in a non-tracking system you would have to change cues 1 through 3, rerecording them with Channel 5 at 40%.

Now imagine it was in a tracking system:

Cue	Label	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8
1	Living room	60	60	60	60	0	0	0	0
2	Lamp 1 on	60	60	60	60	0	0	80	0
3	Lamp 2 on	60	60	60	60	0	0	80	80
4	Black out	0	0	0	0	0	0	0	0

Because Cue 2 does not contain a change for Channel 5, and just allows to stay at the same level as in Cue 1, if you change the level in Cue 1, it will carry forwards into Cue 2 (and on into Cue 3, which also doesn't record a change):

Cue	Label	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8
1	Living room	60	60	60	60	40	0	0	0
2	Lamp 1 on	60	60	60	60	40	0	80	0
3	Lamp 2 on	60	60	60	60	40	0	80	80
4	Black out	0	0	0	0	40	0	0	0

This saves programming time, particularly if you have many cues in that scene.

However, as you can see from Channel 5's intensity in Cue 4, it also creates a potential problem. Because Cue 4 only records changes, and when it was first recorded there was no change on Channel 5 between Cue 3 and 4 (in both it was at 0), when Channel 5 was set to 40%, there is no instruction to tell it to black out, and the light stays on at 40% in the Cue 4 blackout.

One way to fix this is to add an instruction in Cue 4 to turn Channel 5 to 0. However, this only works retrospectively, and only works for Channel 5.

The better fix is to use a **block cue.** A block cue is a cue that remembers exactly its values, and automatically adds instructions to set Channels back to those values if needed.

To make a cue a block cue on Eos, you use the command "[Cue] [Number] [Block]", and a 'B' will appear beside it in the cue list to confirm it is a block cue. To make a block cue a normal cue, simply apply the command to the same cue again.

Values controlled by a block cue are normally displayed in white. The example scenario with a block cue, immediately after updating Cue 1 to set Channel 5 to 40%, would look like this:

Cue	Label	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8
1	Living room	60	60	60	60	40	0	0	0
2	Lamp 1 on	60	60	60	60	40	0	80	0
3	Lamp 2 on	60	60	60	60	40	0	80	80
4	Black out (BLOCK)	0	0	0	0	0	0	0	0

Cue 4 has automatically added a green "go to 0" instruction on Channel 5, and Channel 6 is marked as white, and ready to add the same instruction if Channel 6 is updated in an earlier cue.

- **Submasters**

  A submaster stores a state and recalls it proportionally to the level of the submaster. For example, here is a table of a submaster containing a state, and then recalling it at different percentages:

	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6	Ch 7	Ch 8	Ch 9
Initial State	0	50	100	100	50	25	0	0	0
Sub at 0	0	0	0	0	0	0	0	0	0
Sub at 10	0	5	10	10	5	3	0	0	0
Sub at 50	0	25	50	50	25	13	0	0	0
Sub at 100	0	50	100	100	50	25	0	0	0

Submasters are usually mapped onto faders - physical sliders on a lighting desk that can vary between 0 and 100%. Often faders have a button at the bottom that can do something (usually it just sets the submaster to 100% while it's pressed).

This means that submasters can be controlled in a very quick, hands-on way, perfect for improv, or any time you want to directly control lights during a show. Submasters are also very quick to set up compared to cues.

However, as submasters have no concept of time (they only record one state), you need to manually operate them during a show, setting them to a level live for every scene, which makes operating a show off them harder.

- **Using Cues and Submasters Together**

  You can also use both cues and submasters together in a show. Usually the desk works out how to combine two playbacks that both have data for the same channel by using either **highest takes priority (HTP)**, where higher values are displayed instead of lower values, or less commonly **lowest takes priority (LTP)**, where the lower value is displayed instead.

A show could therefore mainly use cues, but use submasters for certain effects that are fiddly to programme into a cue stack (for example lightning flashes, or a bulb flickering, or lights that pulse in time with live music).

Submasters are also commonly used for controlling DMX fixtures that are not lights, like **haze** and **smoke machines**, which are better controlled manually by the lighting designer rather than automatically in cues, as the amount of extra haze needed in a scene may vary from one performance to the next.

- Effects

  An **effect** usually refers to a repeating continuous lighting change (for example a light pulsing on and off repeatedly, or a light mimicking fire glowing, or a light changing through a rainbow of colours before returning to the same place) that can be stored inside a cue, allowing the cue to store dynamic lighting. There are lots of different types of effects, and as lighting desks tend to handle them very differently so I will not go into them in detail here. I would recommend researching the lighting desk you plan to use to find out how they work.

- Blind Mode

  Many modern desks have a mode called 'Blind mode' (as opposed to 'Live mode'). In 'Live' any changes you make occur to the stage immediately – lights will turn on – and you need to deliberately record them into memory. 'Blind' allows you to access the memory directly, like a spreadsheet, and read and edit the information in cues you are not currently looking at.

  This has two principle uses: to fix a cue during a show without having to bring up that cue; to troubleshoot tracking issues, or get an overview for what a single channel is doing in multiple cues.

  I would recommend taking a look into it – it is a useful tool, but when programming you will spend most of your time in 'Live'.

Types of Fixture

- ### Profile

RJ 614sx Conventional Profile

Source 4 Lustr S2 Intelligent Profile

The most complex and versatile light in the LD's arsenal. Also usually the heaviest and most expensive (aside from moving lights). Profiles have multiple lenses that can be moved up and down a lens tube, allowing a wide range of optical control – beams can vary from a soft wash to a sharp spotlight, and some profiles allow you to change the beam angle of the light (making the area it hits onstage larger or smaller).

Additionally because profiles have such tight optics, they can focus the energy of their light source on a small section of the stage, allowing more brightness onstage for the same light output from the light-source. This is particularly useful when lighting the stage from far away, as a profile can be much further from the stage and achieve the same brightness compared to another fixture.

Profiles can be identified by their length (they are proportionally longer than other fixtures), and by the fact they use shutters not barn doors to shape their beam. Shutters are only visible as handles on either side of the lens tube.

Profiles are usually used as specials due to versatility, or as frontwash when rigged far from stage (e.g. on a lighting bridge or the front of an auditorium gallery in a large theatre).

Profiles are also the only fixture type that can use gobos – small metal stencils that allow a silhouette to be projected onto stage.

In essence profiles can serve almost any lighting purpose, but you are normally limited in how many profiles you have available so treat them as a limited resource, and use them where they will best serve your design.

- **Followspot**

RJ Roxie (CW v2) Followspot

Essentially a bright profile on a swivel stand. The followspot is designed for one purpose – to follow actors and light them as they move around the stage. They are in every way your classic spotlight. They usually have controls for how bright they are, what colour they are gelled to, and an iris to control how wide their beam is. Unlike a profile, they usually do not have shutters and cannot use gobos.

- **Fresnel**

CCT Starlette Fresnel

CCT Minuette Fresnel (much smaller)

(Pronounced Freh-nel – the 's' is silent) Fresnels have a lens made up of concentric rings that create a soft beam that is brighter at the centre and fades to dim at the edges. This is great for creating soft washes of light, so are usually used for washes from any angle. They are also usually lighter and smaller than profiles, which make them easier to fly, or fit into a crowded grid. Most fresnels allow for some optical adjustments using knobs on the sides of the lantern, but have nowhere near the variation of a profile.

- **Pebble Convex (PC)**

Have a different lens design to a Fresnel, producing a beam with a slightly harder edge, but are otherwise very similar and fairly interchangeable.

- **PAR**

PAR64 Lantern (a.k.a. 'Parcan')

Colorsource PAR Intelligent Fixture (a.k.a 'CSP')

PAR stands for parabolic aluminized reflector. Usually referred to affectionately as a Parcan (a nickname derived from the fact they look like oversized tin cans). The full sized Parcan is officially called a PAR64. It consists of a large lamp with built in lens, followed by a cylinder of black metal that contains and somewhat shapes the beam. The optics of Parcans cannot be adjusted at all. You just point them in a direction and gel them.

In the days before colour-changing LEDs, Parcans were used a lot for adding coloured top, back, and side light (since you could rig many in different colours). Nowadays LED PARs are generally used for this purpose (see the 'CSP' above), allowing designers to rig fewer as one light can produce many colours.

Tungsten parcans now have few uses, though are often used as 'blinders' (lights pointing at the audience to "blind" them) or in 'parcan walls' (onstage rigs of multiple parcans that point towards the audience and can run different patterns or effects) since they are cheap and plentiful.

- **Birdie**

PAR16 Lantern (a.k.a. 'Birdie')

A small PAR fixture, usually used for footlights or for fitting a small light in a set. The name derived from a golf pun – the "birdie" is a size smaller (one less) than the "PAR". Birdies otherwise are identical to PARs in their advantages and limitations.

- Flood

Strand Coda Conventional Floodlight

Altman Spectra CYC 200 Intelligent Cyc Flood

Flood lights, similar to PARs, cannot adjust their optics, they can only be pointed in different directions. However, unlike PARs there is very little to contain a flood's beam, so it tends to flood light over everything evenly in the direction it faces. This is very useful for evenly lighting cloths, leading to the floodlight's common use as a 'cyc flood' – a flood intended for lighting large cyc cloths and backdrops onstage. Outside of this use case, floods are not usually useful in stage lighting design.

- Strobe Lights

Strobe lights are, as the name suggests, lights that are able to turn on and off at a high frequency, to create strobe effects. Usually the fixtures themselves look very similar to floods, but will have a means of controlling the speed at which they strobe, usually over DMX. Be aware most LED lights also have a 'shutter strobe' parameter that allows them to also strobe, though they will often not be as bright as a dedicated strobe fixture.

Strobe lights can be dangerous to people with photosensitive epilepsy, so it is critical that you inform ADC Management as soon as you know you are planning to use strobe effects so they can warn customers the production will contain flashing lights. Usually this is done in Section 2 of the show risk assessment. Strobe lights should never be used at a frequency of higher than 5Hz at the ADC or Corpus Playroom, and the period of time they are used for should be kept to a minimum.

- Moving Lights

Moving lights, or 'movers', are fixtures built with the ability to rotate in three dimensions. They usually contain either a profile or Fresnel, but are unique in that their focus is determined in soft patch, rather than by physically going up to focus with a ladder. This makes moving lights incredibly versatile. However, they come with some drawbacks. They are heavy, very expensive, prone to breaking down (as they have moving components), and usually perform specific functions worse than a light dedicated for that purpose. Additionally, most moving lights have loud fans, or are audible when moving, which can be very distracting. They tend to take up a lot of DMX addresses, usually take longer to plot with, and are prone to a wide range of plotting errors as they are more technically complex. We do not have any moving lights at the ADC Theatre, though you are likely to encounter them if you ever work in other professional venues, or the Edinburgh Fringe.

A Few Principles of Lighting Design

As mentioned before, lighting design is very personal, and there is no right way to approach it. Different shows have different demands, and different lighting designers have different artistic styles.

Having said that, there are some general principles of good lighting design that are worth being aware of, if only to know when you're breaking them. I'll mention a few below. If you feel there are any that are notably missing, please send suggestions to technical@adctheatre.com.

- **Make sure actors faces can be seen!**

For most shows being able to see the actors' faces is key to their performance – the face is the most expressive part of an actor's body and audiences generally don't like being deprived of their expressions (the exception here is dance shows, where sidelighting the body is often more important). This is where good facelight (also known as keylight) comes in. Usually your frontwash will do a lot of the heavy lifting here.

However, good facelight isn't just about having enough light on people's faces, it's also about ensuring that the shape of the face is visible. Traditionally this is done by lighting the two sides of the actor's face in slightly different colours, usually a cool white and a warm white. This allows the three dimensions of the face to be more visible, and makes different scenes and locations feel more distinct as the balance of cold and warm facelight can vary from scene to scene. This is the idea behind why many lighting designers rig both a warm and cold front wash.

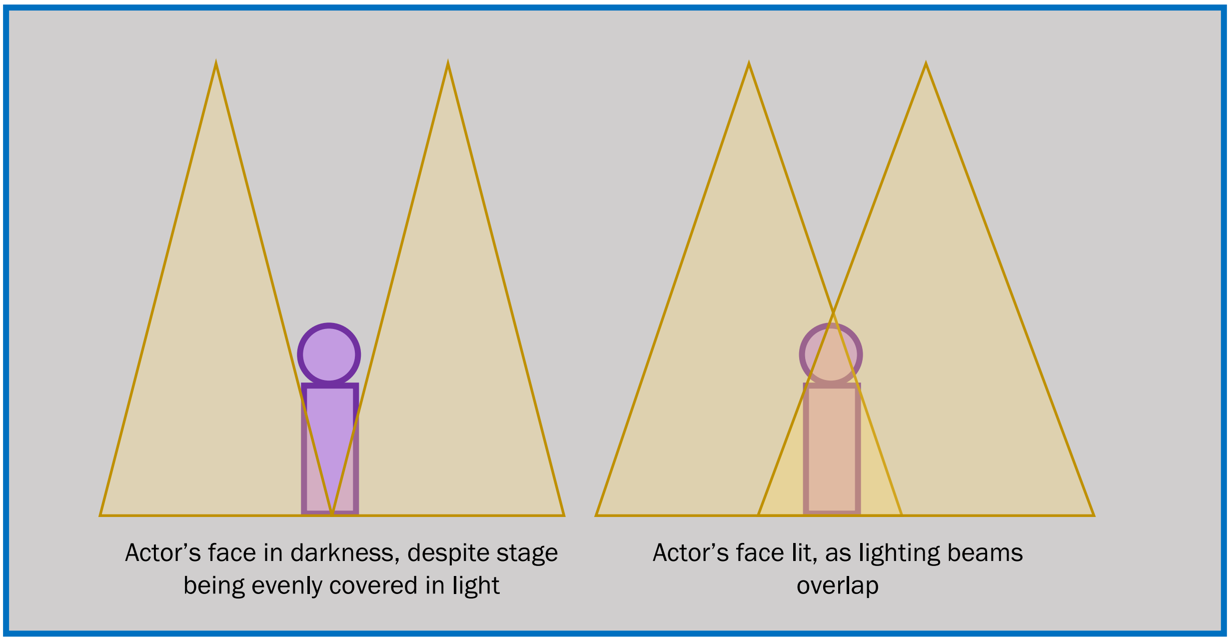
- **Only light what you need to!**

A lot of lighting is about guiding audience attention – usually the brighter an area of the stage, the more people's eyes are drawn to it. Where possible, it is always good to ensure that the main playing area (the space the main action is occurring) is brighter than the rest of the stage. This is where good focusing is crucial – you don't want a light to spill over and hit too much of the stage or your ability to draw focus to one area is reduced. You definitely don't want to light anything that isn't within the stage space (e.g. the auditorium ceiling or walls, or the audience) unless it is a very conscious artistic decision.

- **Make sure your frontwash is even!**

Audiences are sensitive to unlikely changes in brightness on an actor's face, and nothing is more jarring than an actor walking across the forestage and their face getting darker and lighter as they walk in and out of pools of light. Spend some time focusing your front wash to make sure it is as even as possible to someone walking from stage right to stage left, and downstage to upstage. Also, double check if it's still even when the tallest member of your cast walks across it. In Cambridge Theatre dim patches are colloquially called 'shafts of darkness' or 'SoDs', in contrast with shafts of light.

Remember that lights are cones, so even if the stage floor is evenly lit, the performer may not be:



- **Think about multiple angles on each location!**

One of the best ways to quickly build a rig is draw your set plan and then place an imaginary actor at different locations. Then ask yourself – where is their face light coming from? Are they being side-lit, are they being top lit? Then place lights in answer to these questions. Then once lights are placed for all the main playing spaces, start pruning down lights that are performing the same function, until you have a core rig. Then add in specials and any lights that aren't for lighting actors (e.g. for lighting set pieces).

As a general rule, the more angles you hit an actor from, the more three dimensional they will appear, the more they will pop out from the scene, and the better the state will look. Often this requires a good knowledge of each scene's blocking (where actors will be at different times). Constructing a design around where people stand at important moments really helps those moments look good, and helps you emphasise the key parts of the production as a whole.

- **Think about transitions!**

Lighting transitions can make or break a show's lighting design. Some shows call for bold transitions and effects, some for subtle changes, but almost all demand that the fade times fit the action of the show. Even sketch comedy (often a relatively lighting-agnostic genre) relies on the suddenness of a snap blackout.

When planning your design, think about how one lighting state should get to another. Mark where in the script you want the transition to start and finish, how long it should take, and whether the whole rig should fade together, or different sets of lights come on in stages.

Ultimately you will always edit transition timings during the technical and dress rehearsals, and often later across the show. Getting them just right, and in sync with the rhythms of the performance, are what really help the lighting blend in and bring out the best in the production.

- **Think about what is motivating your lights to look as they do!**

This is a bit more conceptual than the above tips, but is a good way into thinking about lighting.

When designing a lighting state, it is important to consider what factors are contributing to how it is lit. These factors are often referred to as motivations – what is motivating a light to be that colour, or to come from that angle?

In a naturalistic lighting style, a light is usually motivated by the lighting sources that would naturally be in a scene. For example, the lighting of an interior room during daytime could be motivated by how the sun's light enters the room – if there is a window on stage left, the light from that side should be a cool white to mimic daylight, while light from stage right should be warmer, mimicking the light from electric lamps that illuminate the inside of the building. Conversely, a room at night will be motivated by where the artificial lights are located. A table lamp turning on may motivate other lights in that area to produce a bright warm light to mimic the table lamp's illumination. In naturalistic lighting design, ensuring lights are motivated in a way that is consistent with the set design and script is key to selling the location, time of day, and, above all, the reality of the show's world.

In other styles, lighting may be motivated by something entirely theatrical or non-naturalistic. In musicals, often the motivation is the music itself – lights change in time with beats or choruses to emphasise the music – or perhaps the motivation is the movement of the soloists, the stage lighting up where they walk, rather than mimicking how the location would naturally look.

Ultimately motivation is an answer to a question. In most productions, it should be implicitly clear to an audience why the lighting looks or behaves as it does. When they subconsciously ask, 'Why did the lighting change, or why does it look like that?', your design's motivation gives the answer: 'Because there's a window stage left' or 'Because this is the last chorus of the act one finale and it needs to look like a showstopper'.

You can also introduce motivation where there isn't anything about lighting in the script. If you're ever lighting a state that isn't giving you anything to work with, decide on a fitting, if arbitrary, motivation – add a window; add a streetlamp; add a sunrise; decide on the time of year. It will help your lighting lift the production, and help you come up with visually interesting and distinct lighting states.