Audio Visual Setups for Exhibitions
Media Players, Projectors and Connectivity

Museums & Galleries of NSW

A guide to selecting and using media players and projection systems in museum and gallery settings. Covers key considerations such as compatibility, file formats, and reliable playback to ensure seamless digital exhibition delivery.

Video Codecs

A video codec is a technology used to compress and decompress digital video files to make them smaller and more manageable for storage and display. “Codec” stands for **“coder-decoder”** or **“compressor-decompressor”**. When a video is recorded or created, it contains a massive amount of data that needs to be reduced in size for practical use, such as streaming or playing from a USB drive. A codec works by removing unnecessary or redundant data, making the file smaller without (ideally) affecting the quality too much. The compressed file is then decoded by the same codec for playback. Commonly used video codecs include **H.264, H.265 (HEVC),** and **VP9**.

Codec vs. Container

The terms **codec** and **container** are often confused but serve different purposes. A codec compresses the video or audio file, making it smaller, whereas a **container** is a “wrapper” that holds all the media components (video, audio, subtitles, metadata, etc.) together. Think of the container as the box that contains the video and audio together so it’s in one file.

For example, **MP4** is a very common container format that can hold video, audio, and other data. Inside the MP4 container, the video might be compressed with the **H.264** codec, while the audio could be compressed with something like **AAC (Advanced Audio Codec).**

MP4: The Most Compatible Format

The **MP4** container format is arguably the most versatile and widely supported format across devices and platforms. Its popularity stems from the fact that it supports many codecs (most commonly, **H.264** for video and **AAC** for audio) while maintaining a relatively small file size with good video quality. MP4 files can store video, audio, subtitles, and metadata in one compact package, making it an ideal choice for online video streaming, smartphones, and editing software.

Because **MP4** is compatible with almost every modern device – from smart TVs and game consoles to smartphones and web browsers – it’s often the go-to choice when you want a video to be playable across different platforms. Other containers like **MKV** or **MOV** might offer more advanced features or higher quality in some cases, but MP4 strikes the best balance between compatibility, quality, and file size, making it a universal format for most everyday video needs.

Video Cables

Over the years, various connection types such as **VGA, DVI, RCA,** and **component cables** were used to connect media players to display devices like TVs and projectors. However, over the last 15 years, **HDMI** has indeed emerged as the dominant and most widely adopted standard for connecting media players, game consoles, and other devices to modern displays.

HDMI (High-Definition Multimedia Interface) cables are designed to simplify the connection between media players and display devices like TVs, projectors, and monitors. What makes HDMI so convenient is that it can carry both high-quality video and audio signals over a single cable, reducing the need for multiple cords. This means you don’t have to worry about connecting separate audio and video cables, as HDMI handles everything in one streamlined connection. It’s a plug-and-play solution, requiring no additional setup or configuration, making it the go-to choice for most modern home entertainment systems.

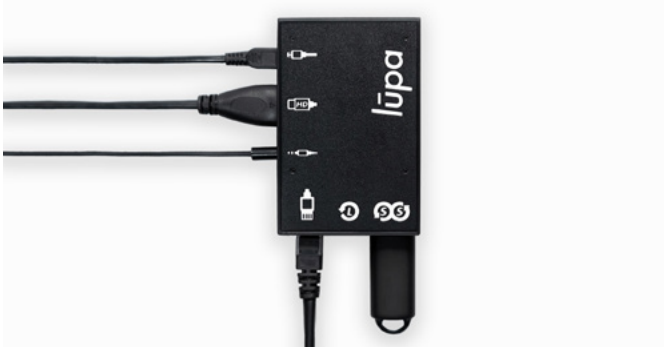
In addition to being simple, HDMI cables support high-definition video resolutions (such as 1080p and 4K) and multi-channel audio formats like Dolby Digital, all while ensuring minimal loss of quality. With just one HDMI cable, you can connect devices like Blu-ray players, game consoles, or streaming boxes directly to your TV or projector, creating a clean, hassle-free setup. It’s the most widely used port today for a reason – it offers the perfect balance of simplicity, quality, and convenience, making it the best choice for those looking for an easy, all-in-one connection solution.

Media Players

Choosing a media player

Media players are often used by galleries to display video works. There are many advantages to using a media player including automatic playback, looping and synchronisation. The cost of media players and the expertise needed to set them up varies widely. It is important to take these factors into consideration when deciding on a model to buy. A number of options commonly used in galleries are outlined below.

Lūpa Media Player



Lūpa is a media player that is designed specifically for the gallery sector as a simplistic, powerful and affordable option for displaying media works. The player is powered by Raspberry Pi, but arrives as a complete package that can be used straight out of the box with no setup required. Simply load your media file onto a USB and plug it in to the port corresponding with the playback mode you require. There are two modes, Loop and Sync:

- In Loop mode, Lūpa finds your video file on the USB inserted in the *loop* port and plays it continuously until the unit is switched off.
- In Sync mode, connect two or more Lūpa's to a network switch/router via the Ethernet port. When the USB is inserted into the sync port Lūpa will automatically find other players connected via the network cable and play back the video in sync with the other players. There is no limit to the amount of Lūpas that can be synced, as long as all Lūpas are connected via network cables, they will remain in sync until switched off.

It is important to have your video/sound file and USB prepared properly for use with Lūpa. Lūpa supports the industry standard codec H.264 MP4. The official website provides export presets for all major video editing software that can be downloaded to ensure the video is optimised for use with Lūpa when exported. You can also use media conversion software such as Adobe Media Encoder to convert your video to H.264 MP4 or supply an artist with the export presets to ensure they provide the file in a compatible format. Lūpa can output in high definition through the HDMI port or in standard definition through its analogue port, for use with older monitors such as CRTs.

Lūpa supports exFAT USB formats, allowing you to play a video file of any length or size. The official website provides instructions on how to prepare your USB for use with Lūpa. Lūpa will only play the most recent file that was copied on to your USB. If you want to loop multiple videos on one screen, you will need to combine the videos into one file.

Lūpa also supports stereo audio and digital audio. Stereo audio can be played through the 3.5mm analogue port and digital audio including surround sound through the HDMI port. Export presets are available through the official website to help you format the audio properly.

Seamless, quick installation has been built into the design of Lūpa. The unit is powered through a micro USB cable, which is supplied with the player. It can be plugged directly into the USB port on your screen or projector, reducing the amount of visible cords coming from your display. This also means Lūpa can be turned on and off along with the display. Alternatively, it can be plugged in to a power socket if needed and left running 24/7. Magnets have been embedded into the case allowing Lūpa to attach to any metal surface behind your display.

Lūpa also has the capacity to accommodate more advanced settings. Through the official website, you can use the 'advanced settings system' to change the resolution and refresh rate, adjust over-scanning, adjust default audio volume and turn on standard definition to play through the analogue port. You input the advanced settings relevant to the playback of your media file, download the settings file and save it onto the USB drive along with your video. Any Lūpa the USB is plugged into will automatically read your adjustments and apply them.

Whilst Lūpa was designed in a way that avoids the need to update software, if an update is ever required, Lūpa is committed to supplying the software update free of charge.

As of October 2024, Lūpa retails for $329 per unit. This includes everything required to use the player straight out of the box.

Advantages

- Automatic playback, looping and syncing possible with minimal technical knowledge
- No limit to the amount of players that can be synced, making it suitable for works with 2+ channels
- On screen troubleshooting – indicates issue and prompts you how to fix it
- Affordable and no extra costs as everything required for playback is included in purchase of unit
- Magnets in case make installation easy and discreet
- If powered through monitor/projector, player will switch on and off with TV, simplifying opening and closing procedures in the gallery
- Supports stereo and surround sound
- Advanced settings can be customised and programmed via the website and easily installed on the player
- No video file size restriction, supports exFAT format USB
- Very helpful website with numerous resources to assist in operation

Disadvantages

- Will not play multiple video files saved on a USB in a loop. However, if you need to loop a playlist of videos, this is easily solved by combining all videos into one file. Player is exFat compatible, allowing playback of any file size.

Brightsign

Brightsigns are media players purpose-built for commercial digital signage. This means they are incredibly robust and reliable, as they are designed to play 24hrs, 7 days a week. Brightsigns have been adopted by galleries because of their reliability and their ability to synch videos. This means Brightsigns can be used for 2+ channel works.

Brightsigns can play a single channel video automatically on loop without programming. Simply save your media file onto an SD card, insert it into your Brightsign, plug into a monitor and power source and your video will play automatically on loop.

Synching videos with BrightSigns

BrightSigns can be programmed to synchronise playback of videos, allowing galleries to present multi-channel works. Synchronisation occurs automatically when the units are powered on and, if programmed correctly, will remain tight all day. You need a BrightSign for each channel of the work (ie. each monitor/projector needs its own BrightSign). The BrightSigns are then connected via a network switch/router, which allows the BrightSigns to ‘speak’ to each other. You can outsource the programming. However, BrightSign offers free PC software, BrightAuthor, which can be downloaded from their website and used to create a synchronised project. The BrightSign support page has published a video tutorial on ‘Interactive Synchronised Video Projects’, which takes you through the steps of setting up your BrightSigns for multichannel synched works.

BrightSigns are significantly more expensive than other media player options. As of October 2024, a new unit starts at around $710.00 (for an **BrightSign LS425**). However, they are more reliable and more versatile. BrightSign is also committed to offering updated firmware and

software for all previous models (their 'legacy players') as well as new models, allowing a longer lifespan for your player. When purchasing, ensure the BrightSign includes ports you are likely to need (ie. HDMI, AUX etc.). Newer models do not have VGA ports. Birghtsign also have higher end models that support 4k video resolution.

BrightSign also offers instructive videos on setting up your player through their official webpage. It is essential to watch this before setup.

Note: You need to have Brightsigns from the same product line in order to synch (ie. HD, XD). For example, an HD BrightSign (ie. HD223) will not synch with an XD BrightSign (ie. XD234). However, you can synch across models within the same product line, for example an HD223 will synch with an HD220.

Advantages

- Automatic playback and looping possible without programming using SD card for single channel works or multichannel works that do not require synching
- Can be drilled into the wall behind TV using wall mount holes on casing
- Synching possible with programming
- Very reliable
- Long lifespan
- BrightSign provides free, user friendly software and video tutorials on their official webpage

Disadvantages

- Expensive
- Technical knowledge required to set up for synchronisation
- May incur additional costs if need to outsource programming
- Not as discreet, can be quite visible behind TV

Raspberry Pi

A Raspberry Pi is a small computer that was designed as an affordable option for experimenting with computer programming. They can be used in innumerable ways including robotics and, most relevant to museums and galleries, as media players.

The operating system for the computer is housed on a micro SD card, which is inserted into the back of the Raspberry Pi. Open source software is available online to set up your Pi as a media player. Because the Raspberry Pi was created for educational purposes, the official Raspberry Pi Foundation website is the most useful source for software downloads and tutorials.

Raspberry Pis are most useful to museums and galleries when they are programmed to play a video from a USB automatically on loop. You can outsource this programming or download open source software online and write it onto an SD card yourself (ensure the source is trustworthy). MP4 Museum was developed for this purpose and is freely available online.

Once the looping software is programmed and inserted into the Pi, all you need to do is save your video/sound file onto a USB, insert it into the Raspberry Pi and plug it into a monitor/projector/speaker to play. You can connect to a speaker through AUX for sound files or connect to a monitor/screen through HDMI for video files. If you are using an older style of TV without an HDMI port, you can play through the AUX port on the Pi with an AUX to RCA cable (ensure the RCA cable has three plugs, red, white and yellow for video).

Raspberry Pis can overheat and are easily corrupted if they are unplugged multiple times because the Pi has no formal way of shutting

down. This means that they can have a short life span if they are playing 24hrs a day for long periods of time.

As of October 2024, Raspberry Pi 5 is the latest model. Older models such as the Raspberry Pi 3 are still available to purchase and max out at a HD resolution. You can purchase Pi's in 'kits' that include a case, power supply, SD card and HDMI cable, all of which are essential.

Advantages

- Automatic playback possible with programming
- Looping possible with programming
- Discreet
- Relatively cost effective
- Pre-programmed disc images exist – some technical knowledge still required to set up (see below)
- HDMI and AUX ports

Disadvantages

- Potentially short lifespan (easily corrupted)
- Temperamental – programming can become outdated and functionality can be compromised
- Technical knowledge required to set up before it is 'plug and play' ready
- May incur additional costs if need to outsource programming
- Cannot be synced, only appropriate for single channel media works

Writing a disk image to an SD card

Looping software comes in the form of a disc image (a copy of the structure and contents of a storage device). A programmer may be able to create a disc image for you that you can use multiple times. If you keep the disc image on your computer you can write it to any number of SD cards. Alternatively, if you download an open source disc image from the internet, you will need to know how to write it to an SD card for use in your Raspberry Pi.

1. Download Disk Imager software to your computer ie. Win32 Disk Imager (a free Windows tool for writing images to SD cards/ **Note**: If your workplace computer requires administrator permission to install software, this may also impact the functionality of the disk imager software (See **I get an error message when trying to write to my SD card** below).
2. Insert your micro SD card into your computer. **Note:** if your computer does not have an inbuilt SD card reader, you may need to purchase a card reader that plugs in via USB. You will also need to insert the micro SD card into a Micro SD card adaptor as most card readers only take standard sized SD cards
3. Open the Disk Imager software
4. Select your SD card from the 'device' or 'drive' option
5. Select the disc image file from your computer
6. Select 'Write'. **Note:** Ensure your SD card is empty before writing. You can reformat the card to erase all data. Writing will also erase all previous data on the card.
7. Insert micro SD card into Raspberry Pi
8. Once USB is inserted and Raspberry Pi is plugged into screen and power, the video should automatically play on loop

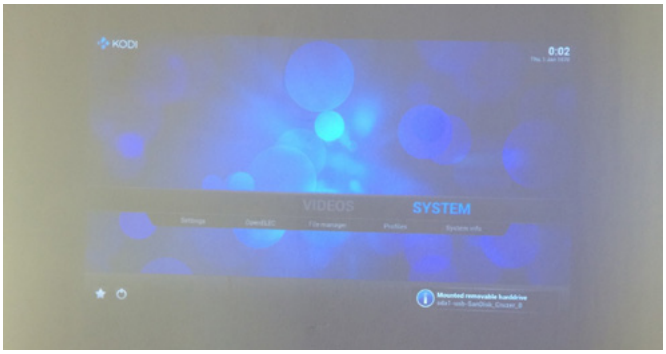
Having issues with your Raspberry Pi?

Before panicking, unplug the Pi from the projector/ monitor and from the power and re-plug in the following order:

- Projector/monitor power cable to power
- USB to Raspberry Pi
- HDMI cable to projector/monitor - **select correct HDMI source on projector/monitor**
- HDMI cable to Raspberry Pi
- Power cord to Raspberry Pi
- Give a few seconds to start up

Issue: Video file doesn't play automatically (based off the KODI operating system):

- If the Raspberry Pi is showing a desktop/media centre type screen (see image below) plug a computer mouse into one of the USB sockets of the Pi and try to navigate the screen to find the media file that is stored on the inserted USB. **Note:** this will need to be done every time the Raspberry Pi is powered back on. The Pi will no longer play automatically, it is therefore only a temporary fix, especially for projectors that are out of reach.
- If the video does not play automatically the micro SD card will need to be re-programmed. The micro SD card needs to be re-formatted and then a fresh video looping disk image needs to be written onto the card.
- If the video does not loop correctly (ie. an icon is showing in-between the end of video and beginning of video – sometimes a large rainbow icon that spins) the micro SD card will need to be re-formatted, see above. If a fresh disc image is written onto an SD card and the video still doesn't play properly, you may need new looping software.



Issue: Small square rainbow icon in top corner of display

- This icon appears when the power source to the Raspberry Pi is not strong enough. A new power cord with a higher power output (ie. 5V 2.5A – power supply for Raspberry Pi 3) will need to be sourced for the icon to disappear.

Issue: I am having trouble copying my video onto a USB for playback

USBs can have a number of different formats. The most universally supported format for media players is FAT and FAT-32. For instance, if you are using the MP4 Museum looper software on a Raspberry Pi, your USB needs to be formatted as FAT in order to play. Unfortunately, FAT and FAT-32 have a 4GB file limit. This means that even if you have an 8GB USB stick, the largest file you will be able to transfer on to the USB stick at a time is 4GB. If your video is greater than 4GB, even if you have an empty 8GB USB, you will get an error message telling you the file is too big. Take this into consideration if you have a large video file.

If your video file is large because you have combined multiple videos into the one file for ease of playback, you can transfer each file onto the USB separately, as long as each one is less than 4GB. If you are using MP4 Museum looper software, the videos will playback in the order you copied them to the USB. Therefore, it is best to copy one at a time in the order you wish them to playback.

Mac mini

Mac Mini is a 20cm^2 computer desktop unit, which functions as a normal desktop computer when connected to a monitor. Because it has the full functionality of a computer, it is very versatile. It is possible to set up automatic playback and looping on the computer so your media plays when the unit is turned on. You can even schedule the computer to turn on at a specified time of day, removing the need for gallery staff to turn it on in the morning (keep in mind the monitor will still need to be switched on as it is powered separately to the Mac Mini).

Script can be written in 'Script Editor' on the Mac Mini to create an application that prompts the computer to automatically play and loop a video on start up. Alternatively, Quicktime and computer settings can be adjusted to achieve the same result.

Using Script Editor

1. Save your media file onto the Desktop.
2. Find the Application Script Editor in Finder on the Mac Mini and open it.
3. Copy the following text into the text frame of Script Editor:
    - tell application “QuickTime Player”
    - open “movie path”
    - set looping of document 1 to true
    - present document 1
    - end tell
4. Replace the text in between the quotation marks (movie path) with the file path of your media file. **Note:** You can copy the file path by right clicking on the file in finder, holding down ‘Option’ and selecting ‘Copy’ from the dropdown menu. Paste in between quotation marks in the script.
5. Run your script to test that it works.
6. Export your script as an application
7. Go to *System Preferences* and select ‘Accounts’ or ‘Users’ from the menu
8. Select ‘Login items’ and add your exported application to the list
9. Make sure the box next to your application is ticked and save changes
10. Ensure your computer logs in to the account automatically on start up
11. When the computer is turned on the application will start the video playing automatically after the computer has logged in to the desktop.

Scheduling computer to switch on

If you want to program the computer to switch on and shut down by itself at the same time every day, follow these steps:

1. Open *System Preferences* and select ‘Energy Saver’
2. Select ‘Schedule’
3. Select ‘Start up or wake’ checkbox and fill out days and times to suit your opening hours
4. Select ‘Sleep, restart or shutdown’ checkbox and select ‘Shutdown’, fill out days and times to suit your opening hours.

If you have programmed the computer for automatic playback, your computer should now turn on in the morning and automatically play the video on loop until it shuts down in the evening.

Use a keyboard

Alternatively, if you would like to manually start up the video each day you can use a wireless keyboard. A wireless keyboard with trackpad is ideal as you can use both keyboard commands and navigate with the mouse. Most wireless keyboards will connect to the Mac Mini through a USB receiver that plugs in to the USB port. Ensure looping is turned on when you play the video.

Mac Minis start at around $750 for 500GB storage and a 1.4GHz Processor.

Multi-channel videos

Because Mac Mini’s have at least two display ports (thunderbolt display and HDMI) it is possible to play a multi-channel work through the one computer as you can connect a projector to each port. Free 3D video player software, such as Bino3d, can be used to set up a multi display presentation.

Advantages

- Automatic playback and looping possible with some degree of technical knowledge
- Very versatile and can be used for more complex media artworks as well (ie. interactive installations etc.)
- Synching possible through additional software (two channel only)
- Very reliable
- Long lifespan
- Can schedule computer to switch on and off each day to cut down on set up time

Disadvantages

- Expensive
- Technical knowledge required to set up automatic playback and synchronisation
- May incur additional costs if need to outsource programming
- Not as discreet as other options, but attractive
- Manual start up is relatively time consuming if auto playback is not set up
- Extra cost of keyboard
- Extra cost for QuickTime Pro (dependent on playback option)

WDTV / Laser Media Player

Commercial media players such as WDTV and the Laser Smart Media Player can be used in a gallery setting to play media work. However, they are designed for use in the home and lack seamless playback options that are achievable with Raspberry Pis, BrightSigns and Mac Minis.

Media plays through USBs on these players and minimal programming is required. However, when starting up the TV/Player in the morning, gallery staff will need to navigate the menu on the player to find the media file and play. Most of these players have a 'loop' setting that can be turned on to keep the video playing throughout the day. However, they tend to show symbols or video titles on the screen as the video loops. WDTVs can be set up to 'auto play' a selected file on the USB to minimise navigation through menus. However, it can be temperamental.

These players are becoming more and more obsolete and harder to purchase as homes move towards streaming devices such as Chromecast, Apple TVs and Smart TVs to watch their media content. These companies are increasingly incorporating streaming functions to the players, thus their prices have not reduced as much as would be expected. They generally cost between $150-$200.

Advantages

- Automatic playback and looping may be possible depending on make/model and settings – minimal technical knowledge needed to set up
- Relatively discreet
- No reprogramming required to use for a new project
- Relatively inexpensive

Disadvantages

- If auto playback cannot be set up, time consuming to get media to play in morning
- Icons and symbols can be seen on display when looping etc.
- Synchronisation not possible
- Increasingly hard to find from Australian retailers

USB to TV

Using your TV as a media player is the most cost effective option as the only additional equipment you need to purchase is a USB. It is similar to using a commercial media player such as a WDTV (see above) as the TV will have an inbuilt media player that functions in a similar way. However, the settings can be limited. Automatic playback is generally not possible. Staff will have to navigate to the media centre of the TV with the remote to get the file playing. In addition, as with the WDTV, icons, symbols and titles can show up on the screen as the video plays/loops. Synching is not possible for multichannel works. Despite these drawbacks, it is a simple, cheap option to display media work in a gallery space.

You can check if your TV supports playback of files from a USB drive but checking the specification in the manual for the TV. This will tell you which types of files can be played from the TV's internal media player.

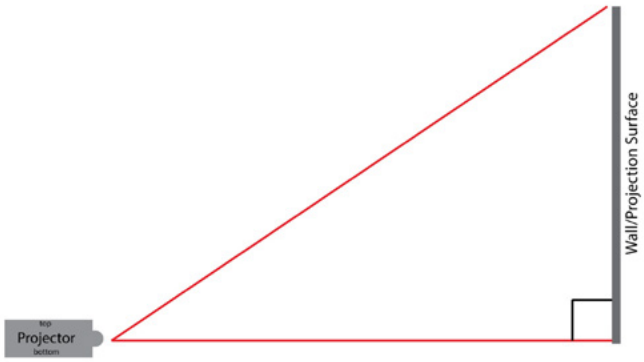
Projectors

Installation

Essential knowledge

Projector throw angle – Generally projectors project their image at a 90 degree angle to the wall. For example, when a projector is placed on a desk it projects its image in two directions: directly forward (horizontally) but also upward. The projection angle creates a triangular shape, where the base represents the distance from the projector to the wall, and the height corresponds to how high the image appears on the wall.

In simple terms, projectors don't just shoot the image straight out but also upwards, which is why the image appears higher on the wall even when the projector is sitting on a flat surface like a desk. The diagram below captures this with the red line showing the trajectory of the image, reaching the wall at a certain height.



This concept is important to understand when installing projectors, particularly for exhibitions. If we wanted to install a projector in the ceiling so it's out of the way for our audience, we would need to flip the projector upside down so the image is now being projected downwards so the image is in the correct spot on our projection surface. When you mount to the ceiling the image will appear upside down; projectors have a setting in their menus that can flip the image upside down also so the image appears the correct way up when installing in the ceiling.

Throw distance – The distance between the projector and the image on the screen is called the throw. The throw of a projector is based on a relationship between the type of lens the projector has and the distance you are projecting from.

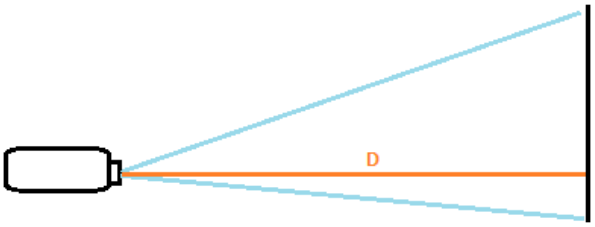
There are 'Long Throw' projectors that project images from far distances, like in a space where the projector is installed far away from the projection surface i.e. a large theatre. 'Short Throw' projectors can project an image from very short distances from the projection surface when you don't have a lot of distance between where the projector is installed to the projection surface.

The **'Throw ratio'** is an important measurement to understand when installing projectors and will allow you to calculate how large of an image you can project from when installing a projector from certain distances away from the projection surface. This will tell you how far away the projector needs to sit from the wall or how wide the image will be according to where the projector is positioned.

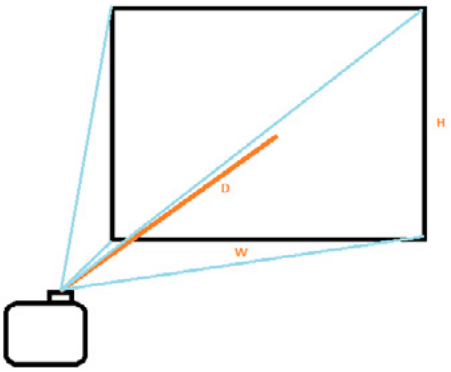
The throw ratio is represented as a single number and is the relationship between the *distance of the projector* and its relationship to *width of the projected image* (D/W). For example the lens of a Short Throw projectors will represent its throw ratio as a smaller number, generally in the range of 0.5 to 1.2. Long throw projectors will have a higher number, generally in the range of 1.5 to 5. Standard lenses generally sit in between these two extremes and are the most versatile projectors you can use.

Additionally, projectors will generally have a 'zoom' lens meaning the throw ratio can be changed by physically turning the lens on the projector, like a photography zoom lens. These projector lenses will represent their throw ratio as a range of two numbers, for instance a standard lens may have a zoom range of '1.2 – 1.7' indicating that the lens can change its ratio between these two numbers.

Example: If a projector has a throw ratio of 2.0 (2/1) this means that when the projector is 2m away from the wall, the screen will be 1m wide.



Throw distance



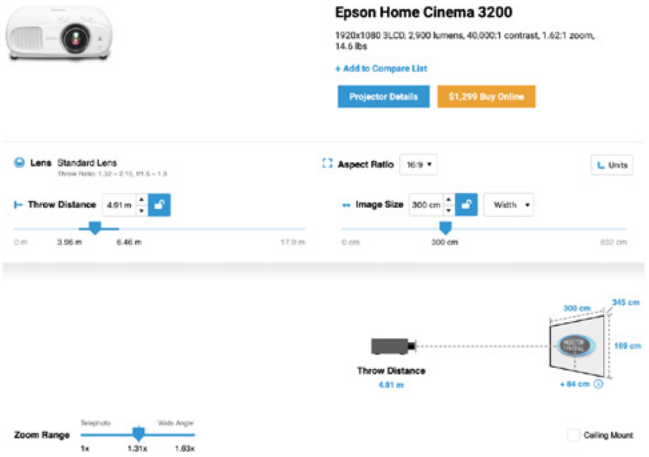
Throw ratio = D/W

You can consult your projector's manual or the manufacturer/retailer's website to find the throw ratio of your projector or simply measure it yourself.

There are also useful calculators on the internet such as projectorcentral.com where you can select the model of your projector and it will use the throw ratio to calculate optimum distances for installation. Projector calculators like these are extremely useful when planning for an exhibition as you can calculate the space you need to install the projector to get a certain size of screen, based on the projector you may be using or thinking of purchasing.

Example: Below is an example of projectorcentral.com projection calculator. In this example, the slider on the right under 'image size' has been moved to match our desired projection width of three meters. The calculator therefore shows under 'throw distance' that we need to install the projector at a distance of 4.91 meters in order to achieve this three metre screen size.

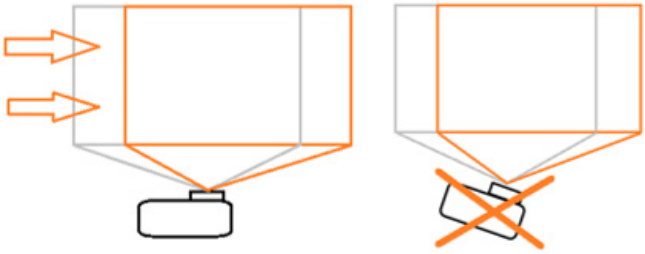
The Epson projector in this example has a lens where the zoom can be adjusted, and this slider is represented under the 'zoom range'. If we were to move this slider towards the 'wide angle' side (a lower throw ratio number) we would be able to install this projector closer to the wall and achieve the 3 metre width we desire - the new position on the projector could be only 3.96 meters from the wall saving almost a meter of space.



Follow these steps when determining the placement of your projector:

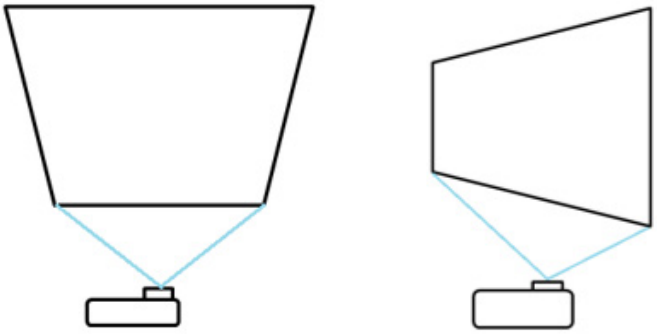
1. Physical considerations: the physical placement of the projector should be the first consideration. Try to minimise the angle that the projector needs to be tilted to project on the wall/screen. Also take into consideration the throw distance/ratio of the projector. Accessories can be used to assist in perfecting the physical position of the projector:
   - **Ceiling mounts** – Ceiling mounts are additional accessories that allow you to avoid installing the projector in a position where visitor's heads will disrupt the path of light and provides a cleaner look in the gallery space. If the gallery has high ceilings, you may need to invest in an extension pole as the closer a projector is to being perpendicular to the wall/ screen, the better. You want to minimise the angle the projector points downwards as much as possible for the best image. Use a Projector Distance Calculator on the internet to determine how far the projector can come down from the ceiling to achieve the screen size you require.
   - **Shelves** – A more affordable option is to place the projector on a shelf high on the opposite wall or on a moveable wall (throw distance permitting). You must ensure that the projector is flipped upside down if you wish to place it on a shelf, based on the information above in the projector throw angle section.

2. Technical considerations
    - **Projection modes** – some projectors have multiple projection modes that allow you to be flexible with the placement of your projector.
        a. The standard setting allows you to project directly onto the wall/screen.
        b. If you are projecting from a ceiling mount, the projector unit will be flipped with the bottom facing the ceiling. When ceiling mounted, the image needs to be flipped vertically so you can project from the upside down position.
        c. Some projectors have a setting that allows you to project onto a translucent screen from behind. This projection mode flips the image horizontally so it is correct when viewing from the front of the screen
        d. Some projectors will have a setting that allows you to project onto a translucent screen from behind, ceiling mounted. The image is flipped both vertically and horizontally.
    - **Lens shift** – lens shift is a feature that allows the lens within the projector to move vertically or horizontally within the housing unit. This will allow you to position the projector off-centre without needing to tilt it on an angle to hit the wall (see diagram). This allows greater flexibility in placement, especially when using ceiling mounts. Lens shift is preferable to using keystone correction, as keystone correction can compromise the quality of the projected image. Read the projector's operational manual to learn how to use lens shift on your specific model, for some models it is done manually with dials, and with others, digitally through the remote. It is not a feature on all projectors. If you are buying a projector consider one that has this useful feature.



Lens shift

- **Keystone correction** – If your projector is positioned at an angle from the wall/ screen then it will create a trapezoidal image. Vertical keystoning occurs if the projector is tilted up or down and Horizontal keystoning occurs when the projector is placed to the side of the screen and pointed diagonally towards it. Some projectors have a Keystone correction feature that allows you to correct the image. Vertical keystone correction will compress or expand the bottom or the top edge and Horizontal keystone will compress or expand the left or right edge. There are limits to keystone correction, therefore utilise the lens shift feature as much as possible before you tilt the projector to achieve the image you require.



Keystone correction

- **Issue: I am having trouble finding a place to mount my projector directly in front of the wall, and I need to mount it off to one side.**
  Ideally, you want to avoid having your projector on an angle. However, this is not always possible and the resulting image on the wall/screen will generally be distorted. You would need to use a projector that has horizontal key stoning as explained above, meaning you can change the image to make it appear more square when you have a projector.

- **Issue: My projected image is upside down or back to front**
  - See **Projection modes** above
  - Check that the projection mode corresponds to the orientation of your projector in relation to the screen

Resolution and Aspect Ratio

Resolution refers to the number of pixels, or squares of light, that make up your image. Generally, the greater the resolution, the greater the quality of your video. Projectors have a fixed or 'native' resolution. This means that the projector will always display at this resolution, regardless of your video's resolution. Determining your projector's native resolution is important as this will determine how well your video is displayed. It is ideal if your video's resolution matches your projector's resolution. If they do not match, they will still play, but at a lesser quality. Aspect ratio is another important measurement that refers to the ratio between the height and width.

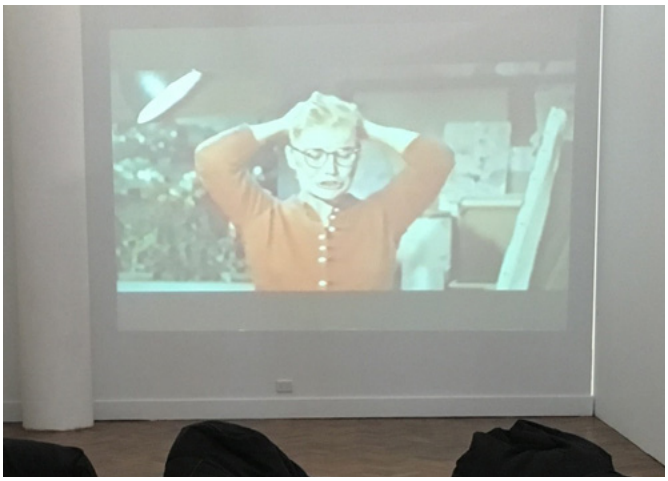
The most common resolutions/aspect ratios are:

Resolution	Aspect Ratio	Description
1920 x 1080	16:9	HDTV
1280 x 720	16:9	HDTV first iteration – will compress videos with resolution of 1920 x 1080
640 x 480	4:3	Standard definition (eg. CRT)
4096 x 2160	16:9	4K – newest release - four times the resolution of HD
1280 x 800 / 1920 x 1200	16:10	WXGA / WUXGA – a projector resolution that matches computer screen size for presentations etc. Avoid buying for the display of media work

Tip: Resolutions are generally referred to by the unit of pixels along the vertical axis (ie. 1080 HDTV or 720 HDTV)

- **Issue: I can see black bars along the edges of my video**

  Check the aspect ratio of your video and the native resolution of your projector as they may not match. This will most likely occur if you play a standard definition video (4:3) through an HD projector (16:9). This also occurs if you play an HD (16:9) video through a 16:10 projector, which is a common native resolution for projectors that are made for use in business settings. You will see black bars because a projector emits light across the whole area of its native resolution. Even when the edges are black they will still be visible as it is impossible to replicate the colour black using a light source (see image below).



- **Issue: My projection looks squashed, elongated or cropped**
  - If your image looks squashed, elongated or cropped the issue likely stems from the aspect ratio settings. If the projection is trapezoidal in shape, see **Keystone correction** above.
  - Check if your projector has a setting that automatically controls the aspect ratio of the image. When playing a video source through a projector, you are dealing with 3 aspect ratios: the aspect ratio of the original video source, the aspect ratio of the video set by the projector and the native resolution of the projector (which is fixed). Although the aspect ratio can be manually selected on the projector to match the input video, some settings may automatically adjust the aspect ratio for you. For example, some settings automatically set the aspect ratio of the projector to match the input video. Other settings will use the full projection area and maintain the aspect ratio of the original video, which may result in black bands along the top/bottom or sides or a cropped image. Some may be set to a full screen setting that displays the video across the whole projection area without maintaining the original video's ratio, which is the most likely setting to result in a cropped image from a video source. The safest option is to set the aspect ratio setting on the projector to match the input video's ratio. See above for more information on Native Resolution and issues with aspect ratios. **TIP:** The standard aspect ratio for HD videos is 16:9 and the aspect ratio for standard definition video is 4:3. The aspect ratio is generally supplied with the artwork details

- **Issue: The colour of my projection is washed out**

  There are several factors that may be interfering with the colour of your projection and numerous ways to correct it.

  There are two major factors to this, light bleed from the ambient light in the space you are in, and the colour of the surface you are projecting on.

1. Light bleed – try to minimise the amount of light entering the area where you are projecting. You can utilise moveable walls to block light in a space or remove/ reposition lights to reduce ambient light. If you have the budget, painting the room black lowers ambient light as well.
2. Background colour – the colour of the screen/wall you are projecting heavily impacts the resulting colour of the image.
   a. If your space has very low/no ambient light a white screen is generally the best option.
   a. If you're unable to tightly control the ambient light in your space, a grey or black wall/screen can be preferable. Darker tones tend to become washed out on white screens when ambient light is present as the ambient light is reflected back to the viewer. A grey/ black screen absorbs ambient light making the contrast more vivid.
   TIP: Use test boards to decide on a shade for your screen. Grab a few spare pieces of plywood and paint each one with a different shade of grey to create a decent spread of shades. Line them up next to each other along the wall and project your video on top. This will allow you to see which background produces the best colour in your space. A good all-purpose grey screen colour is Dulux Flooded Gum. Ensure any paint you use is low sheen.
   TIP: When painting a screen directly onto a wall follow these steps:
      1. Once you have installed the projector in the correct position, project your video onto the wall and trace the outline of the projection using painting tape. Align the inside edge of the tape with the edge of the projection
      2. Paint over the inside edge of the tape with existing wall colour to seal this edge. This will prevent any paint bleed of your grey coat
      3. Apply at least 2 coats of grey paint
      4. Peel back tape for a crisp line

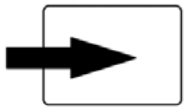
Keep in mind that you will need to sand back the taped line when deinstalling otherwise it will protrude when you paint over the screen. It will take approximately 3 coats of paint to take it back to the original wall colour.
TIP: If you are unable to paint the gallery walls, you can paint a thin sheet of MDF grey and affix to the wall. Remember to fill the screw holes so they aren't visible on the screen.

The following are other settings you can adjust to maximise the image quality of the image:

1. Colour modes – your projector may be set to a particular colour mode which automatically adjusts various colour settings to suit a particular environment (ie. low light, bright rooms etc.). Test out different colour modes to see if one matches your particular space. Avoid using 'Auto'.
2. Settings – various individual settings can be manually adjusted to improve the colour of your image. Settings may vary depending on the brand of projector, below are some general settings:
3. Brightness – lightens or darkens the overall image. Avoid changing the brightness as it digitally alters your image rather than increasing the amount of light emitted by the projector, which remains constant.
4. Contrast – adjusts the difference between light and dark areas of the image – a low contrast will cause a washed out image, however, the more you increase the contrast, the more colour detail you sacrifice as you decrease the colour spectrum being used and colour variation becomes more limited.
5. Colour saturation – Adjusts the intensity of colours in the image
6. Sharpness – Adjusts the sharpness of image details
7. Colour temperature – Sets the colour tone of the image, higher values make the image 'colder' with a blue tint and lower values make the image 'warmer', with a red tint.
    a. **Notes:** Take note of initial values when adjusting settings in case you need to restore to the original set-up
8. Other modes may affect the colour/ brightness of an image for example power consumption settings that reduce lamp brightness to conserve power and lamp life.
9. Lamp – your lamp's brightness will decrease with prolonged use. Lamps have a limited life span and need to be replaced periodically. The quality of the image may be related to the age of your lamp.
10. Lumens – is the measurement of light emitted by your projector. The higher the lumens, the more effective the projector will be in space with lots of ambient light. Generally, anything between 2800-6000 lumens is suitable for such spaces. For darker spaces, the lumens can be lower and still be effective.
11. Screen size – most projectors will have an optimal screen size (dependent on other factors such as ambient light) where the image will be its brightest. The larger the screen size, the more washed out the image will become.

- **Issue: My projection is crooked/ trapezoidal**
    - See **'Keystone correction'** above
    - If your projector is sitting on a shelf or plinth, adjust the legs of the projector to ensure it is level

- **Issue: My video is not playing through the projector**
  - Select the correct source using the control panel on the projector or remote – source is often denoted by the following symbol:



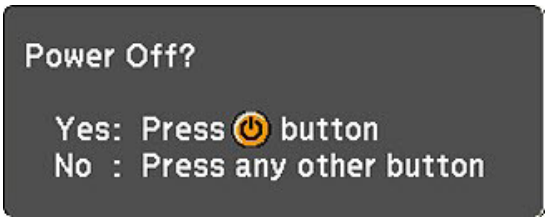
Check the port that your media/device is plugged into for a name and select the corresponding option with the controls. Most media players play through the HDMI source. Some projectors will have 2-3 HDMI ports, ensure the port number matches the source ie. 'HDMI 1'

Examples of ports on a projector

  - Make sure the media player is plugged in/switched on. Test it on a monitor you know is working (ie. a computer monitor) to eliminate the possibility that the media player is malfunctioning

- **Issue: My projector won't turn on properly when I press the 'On' button**
  - Projectors will not power on properly if they have just been turned off. Avoid switching your projector on and off in quick succession.

1. Make sure you power down the projector properly. Select the 'Off' (sometimes labelled 'Standby') button on the remote or body of the projector. Generally, a notification will pop up on the screen asking to confirm the power down. Follow the prompts to turn off the projector completely.



2. Many projectors need to be given sufficient time to cool once they have been shut down before unplugging at the wall. It is a good idea to read your projector's manual to understand any lights/prompts on the projector that may indicate it has cooled completely to aid you in unplugging at the correct time.

If the projector has been left to cool overnight and still doesn't switch on, the lamp may need to be replaced. Lamp life is limited and can run out quickly if being used all day in a gallery space. Replacement lamps can be purchased online, ensure you check the make and model of your projector to find the corresponding equipment.