Chapter Three

The Projection praxis for Play productions
Prelude

According to Pamela Howard, Scenography is the art of creating performance environments; it can be composed of sound, light, clothing, performance, structure and space. In this context, this chapter describes, the art of creating performance environments, which composed with media projections, termed as projection scenography. The visual element of media projections contributes to establishing an atmosphere and mood for theatrical presentation, like light, set and costume.

Create projection environments for play production was a challenging process. The media projection designer must analyse play script and interpret, create a significant design to fulfil specific objects and functions of play world, analyse performance space, selecting the equipment and produce an ideal projection environment for performance.

Technology has huge impact on the stage scenography. The performance environments has been always modified and elaborated by new modes of technology. Designers and technicians are experimented for new ways of expressions with technology as like, candle light, lime light, gas light and arc light. The pioneered stage innovations and stage devices facilitated instantaneous and miracle set changes. The twenty first digital technologies offer enormous tools to explore the new ways of

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2 This term widely used in continental Europe. See the web page, retrieved on 10 August 2012, at, http://theatredesigner.wordpress.com/articles/theatre-design-scenography/what-is-scenography/
expression in performance design. Contemporary theatre designers unambiguously who crossed the digital divide was utilizing digital projectors, computers, software and hardware tools as part of the creation of projection environments for play productions. Artistic aspects of media projection design were discussed in the preceding chapter. This chapter illustrates the technical aspects of media projection design. It will elaborate the construction part of the media projection design.

Image Projections in the theatre were nearly as old as theatre itself, but recent technological advances have made it easier to use—and misuse. In the introduction of his book Graham Walne commented that, the intention of projection scenography, …strike simultaneous excitement and terror into the hearts of theatre people. Excitement because, Projected scenery has a unique quality which, done properly, contributes its own dimension to the production; and terror because of few people really understand how it works… (Walne viii)

Media Projection was a potential solution to an effect which no other department can deliver in play production. This chapter will make you to calculate everything beforehand. To avoid as much experimentation at the field and avoid risks.

**Implements**

Technical design has a vital role in implementation of the artistic media projection design. The technical implements are classified into three distinct units, input unit, output unit and communications unit between input and output system.

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Constructed media projection content according to the artistic design for play production will convey through the technical projection design. Aiming the projector
to desired surface, connecting to a laptop or DVD player, by clicking remote or mouse button playing the content in a particular sequence. The simple projection system setup for a play production practiced by most of the theatre practitioners even today. Actually, it’s not an easy task as we spoke. That means the effort for technical projection design not lesser than other technical aspects of the design of the play production.

The projector and projection surfaces were essential parts in the process of delivering media projection content in play production. Media stations and control consoles are vital in distribution of media projection content. Laying communication between these input and output system was a skilful task. The projection designer must able to create a technical projection design along with an artistic projection design to complete the task of media projection design for play production.

**Output Unit**

The output unit will explain elaborately on projector and projection surfaces. The designer’s must familiar with this equipment before procuring for play production. Usually Production Company hires the projection equipment, very rarely purchase the equipment’s. The Indian theatre practitioners are improvised with available projectors to fulfil production needs. In these three cases the basic issues were that, selecting a projector for theatre play production. All multimedia projectors, which may avail at home, office, institution can capable to fulfil the needs of the production. Certainly not. So, the projection designer has to consider specific features of projectors for theatre play performance.

**Projector**

Projector is an output device that produces a still or moving image in light. The image produced by projector is made of light. The projector contain three
important elements – light source, image generator and lens. Determine the correct lens for the projection is vital component in design. The digital multimedia projector receives the data signal and projects the corresponding images on a projection surface using a lens system. Entertainment and Education sector very commonly engaging this device for shows, presentation, training and so on. The projector for play production must have specific minimum requirements which have discussed below.

The skilful projection designer will select the projector which can match with physical characteristics of the performance space. Selecting the projector according to the specifications of space was easier than constructing the space according to the equipment.

**Brightness**

The light output of projectors is typically measured in Lumens. A standardized procedure for testing projectors has been established by the American National Standards Institute. The ANSI lumen measurement is more accurate than other measurement techniques used in the projection industry. The higher ANSI Lumens indicate the highest brightness level of the projector.

Home projectors and office projectors are working great in idle dark room environments. Here we have enough control of room lighting. In a play production, the media projections existed along with brighter lighting environments. The lighting fixture of play produces influence the brightness of the projected media images. Projector illumination sometimes influences the lighting design with its’ reflective lighting on space. The size of the projected image, projection content and distance between projection surface and projector will affect the brightness of the projector.

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To decide the required brightness of projector for play production, we have to measure the amount of brightness surrounded by projection surface, size of media projection image and what we will project.

Up to 1000 Lumens category projectors are well suited for home cinema applications in dark room. 1000 Lumens to 2000 Lumens category projectors are used as an educational aid for training and teaching. 2000 Lumens to 3000 Lumens category projectors are used in large conference rooms in brighter ambient lighting environments. More than 3000 Lumens category projectors are used for public presentations. Play production rehearsals can be conducted with these category projectors. But technical and performance purpose 5000 Lumens is above category projectors are recommended for better results.

Colour brightness of projector has to be checked to avoid weak colours on stage. Every one square foot size of projection image required 20 Lumens of brightness to achieve good visibility of media projections in performance. The 4:3 aspect ratio media image occupies 16 feet x 12 feet = 192 feet, it means 192 feet x 20 Lumens = 3840 Lumens. It means minimum 3000 Lumens projector for play rehearsals and 6000 Lumens as twice of required brightness for technical and play performance was required. Depending upon budget and resources available, it was recommended that 5000 Lumens projectors are ideal for media projections in Indian play productions.

**Resolution**

The resolution is the number of pixels that makes up an image or the number of pixels inside the image. The larger number of pixels produces sharper images. If a
picture is made of 800 columns of pixels and 600 rows of pixels (4:3), that means total 4,80,000 pixels making up the whole image.\textsuperscript{7}

The latest projectors are capable to project various resolutions. Higher resolution projectors are best for image projection. But while selecting the projector for play production we have to consider the source image resolution. The source image resolution should match with the output of projector image resolution. The process of converting different input resolutions to the projector native resolution called scaling. Scaling always cause a loss of picture quality. It is not sharp and detailed. It will happen when the projector has lower resolution or higher resolution than the source. So, the projection designers select the projector depending upon the source resolution of media projections. To avoid scaling of source images, set the native resolution of the projector as source signal output resolution.

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<td>4,80,000</td>
<td>Home entertainment</td>
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<tr>
<td>XGA</td>
<td>1024</td>
<td>768</td>
<td>7,86,000</td>
<td>Entertainment &amp; Education</td>
</tr>
<tr>
<td>WXGA</td>
<td>1280</td>
<td>800</td>
<td>10,24,000</td>
<td>Ideal for Play Production</td>
</tr>
<tr>
<td>HD (1080p)</td>
<td>1920</td>
<td>1080</td>
<td>20,73,000</td>
<td>Full HD Projections</td>
</tr>
</tbody>
</table>

The above table will illustrate some of the essential resolution formats of multimedia projectors. The media projection content for a play production in a form of DVD standard resolution select the projector with SVGA native resolution was a wise choice. It will reduce the production expenditures for projection equipment. The WXGA native resolution projector was recommended for media projections in play production. This can able to handle High definition video (720p) formats also.

\textsuperscript{7} See Projector resolution, retrieved on 16 august 2012, at http://purple-cat.co.uk/guides/how_to_choose_a_projector.html#secondaryfactors
Aspect ratio

Square and rectangle are the two types of image shapes we can recognise in projected media images. The ratio between the widths to its height of an image called as aspect ratio. Based on the ability of aspect ratio projectors are divided into 4:3 like traditional television screen and 16:9 widescreen HD television screens.

The most of the multimedia projector is capable to deal both aspect ratios automatically; even though manual selection the projector aspect ratio depending upon the source image aspect ratio was advised. Aesthetical composition of images and live performance will demand the designer to choose appropriate aspect ratios in specific sequences. So the designer has to finalise source image aspect ratio prior to technical design. The familiar aspect ratios of the television screen and wide screen cinema screens are one of the prime influence reasons to assess the media projections in theatre performances are like as cinematic theatre performances. It badly influenced the perception of theatre audience regarding media projections in play productions. To break the monotonous aspect ratios of images the researcher experimented with projection mapping and successes in it. Projection mapping was discussed elaborately in the techniques section of this chapter.

The researcher recommends that, widescreen aspect ratio can used to fill more space with media projections, to limit the spread of media projection on stage space
use 4:3 aspect ratio. The 16:9 aspect ratio projectors can capable to switch over between two ratios automatically. Projection mapping can be done in both aspect ratios. So the wide screen aspect ratio projector was ideal for theatre play productions, where the viewers are large in number of different directions.

**Throw ratio**

The distance between the projector and the image on screen called projector’s throw distance. Because the image thrown up to the distance of the screen. The throw distance will determine the size of the projected image on the surface. A common standard for projector throw distances is one foot (30.5 cm) of projection screen width to every two feet (61 cm) between the projector’s lenses and screen.8

In projection design the designer has to mention the size of image projection. The size of the image determines the mounting position of the projector. Projectors are available in long throw, short throw and ultra-short throw rations. Rear projection design requires short throw projectors, it can give the desired size of image in shorter distances, where the depth of the back stage was less. Long throw projectors are used in frontal projection design. Ultra throws projectors are used rarely for both rear and front projections. Depending upon the design strategies and physical dimensions of the performance space the designer has to select or alter the projected specifications.

![Figure 3.2: Projector Throw ratio](image_url)

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8 See the article throw distance and Throw ratios explained at www.bambooav.com
The throw ratio of projectors can derive by dividing the projector distance by the width of the image being projected.

\[ \text{Width (Image)} \times \text{Throw ratio (Projector)} = \text{Throw distance (Mounting)} \]

Throw ratios are varied from projector to projector and specified on the projector manual. For example, the desired size of the image on screen was 10 feet wide. The projector throw ratio specified by the projector manufacturer was 1.8:1. It means that for every one foot width of the screen image requires 1.8 feet distance away from the screen. So to obtain 10 feet width of the image on screen the projector has to mount 18 feet (10 feet \times 1.8 feet) distance from the screen.

The researcher cautioned that; verify the throw ratio of the projector and mounting positions in order to obtain the desired size of projected images on the surface. Normal projectors are equipped with fixed lens set within a range of throw ratios. Interchangeable lens system projectors give great command on projector distances. But it was expensive than others.

**Technology**

Selecting the projector based on the technology was a challenging task. The technology of projector means the mechanism of projector uses internally to compose images. LCD (Liquid Crystal technology) and DLP (Digital Light processing Technology) are the most prevailing display technologies in projectors. Apart from these LCOS technology projectors are also available, but it will expensive than the other.

The requirement of colour accuracy will choose the appropriate technology in the projector. The LCD technology constructed based on slide projector technology. The light pass through the same sized opaque LCD panels. The pixels in the LCD
form an image based on the input signal. The emitted light travels through these panels and expands the image through the lens and directs the light towards the viewing surface. 3 LCD panel system uses Dichroic mirrors to break the emitted white light into red, green and blue. Each of these colours of light pass through its own LCD panels and then recombined by a prism before being projected on screen.

The LCD projectors produce more accurate colours, sharper image, and brighter image than DLP Projectors. Contrast is one of the main disadvantages of LCD projectors; it cannot produce complete black images. Sharper image of LCD projectors leads to pixilation of an image, it will cause for screen door effect. In theatre performances the screen door effect will not much influence the overall image, because the viewing distance is longer than desired. These projectors are bigger in size and have more weight than DLP projectors. The occurrence of Image degradation caused by long-term use of LCD panels and it’s lead to overall contrast is reduced. Dead pixels can become a problem of LCD projectors. It will affect the appearance of projected image.

The DLP technology projectors uses and optical semiconductor known as DLP chip. The DLP chip has a rectangular array of two million hinge-mounted microscopic mirrors. These mirrors reflect the light of digital image through the lens towards projection surface. The emitted light passes through a colour wheel before reaching Micro Mirrored chip. The colour wheel filtered the light as red, green and blue. A single DLP projection chip can able to create approximately 16.7 million colours. Comparatively the colour saturation and brightness were lesser than LCD technology enabled Projectors. It was compact in size and cheaper than LCD projectors in cost.
Most of the projection equipment rental companies are supplying DLP projector for Theatre Play production. Actually the Brighter 3 LCD projectors are recommended for Theatre Play Performances. DLP projectors are well suited for home cinema applications. Because of higher contrast ratios, lesser in weight and price DLP projectors are patronised in theatre performances. The 3 Chip DLP projectors improve colour brightness and working satisfactory in Theatre play production environments. The researcher recommends that 3LCD projectors or 3-Chip DLP projectors are recommended for Public performances and single chip DLP projectors for regular rehearsals except technical rehearsals.

**Contrast ratio**

The ratio of luminous between white level and black level on the screen at the same time called contrast ratio. The high contrast ratio projectors produce subtle colour details. The largest amount of contrast ratio is advised when ambient light is more to see proper image. The DLP projectors have highest contrast ratios then LCD projectors.

**Weight**

Weight of the projector was not a big problem when you’re going to fix it on the ceiling of a theatre permanently. But it was not the case with us. Because of experimentation with a projector in play production, certainly it will not to be fixed in single static position at a time. If the production company touring with the production the transportation of the projector should take very much care. Sometime the projector may be hung from the ceiling or keeping on delicate objects, the weight of projector come for consideration. Some of the experimental production employs moving projectors. So, the weight of the projector was an unavoidable factor linked to features of the projector. The more powerful projectors are bigger in size and more in weight.
Depending upon model and brand the weight will vary from projector to projector. The designer selects the projector by considering the mounting position and angle along with its weight.

**Features**

Apart from major specification, some of the essential features of projector have to be considered while deciding on a projector for play production.

**Lens Shift:** The positional adjustment of the lens inside the projector termed as a lens shift feature of the projector. This feature will enable us to shift the entire image frame without causing distortion and changing the mounting position. The lens shift can be vertical or horizontal without tilt up or down and turn left and right. The lens shift feature will help the designer to recognise the placement of the projected image on stage without changing the physical location of the projector. Tilting the projector has a risk factor in accidents like, damage the projection lamp or dropped from the mount.

The researcher observed and struggled to tilt up and tilt down the projection image when working without lens shift featured projectors. Books and cardboards are used for tilt up and tilt down the projector along with the image. The horizontal and vertical lens shift depending upon model of projector executed by the manual or motorised operation.

**Keystone:** The projected image will get different widths when it was not perpendicular to the projection surface. Correcting this image distortion was called keystone correction. Keystone correction will alter the image itself. The keystone correction will degrade the image quality then lens shift image correction. When the front face of the projector not placed parallel to the screen surface the trapezoidal image needs horizontal keystone correction. When the projector tilted upward or
downwards at projection screen the trapezoidal image needs vertical keystone correction.⁹

![Keystone Correction Diagram]

**Figure 3.3: Keystone Correction**

The researcher opined that lens shift feature will make the projection designer work little bit easier than a normal keystone feature projector. Placing the projector parallel to projection surface will avoid keystone correction issue.

**Zoom:**

Zoom feature will help the designer to enlarge and reduce the projected image to desired size without changing the projection distance. Every projector has built with two types of zooms as Optical zoom and Digital zoom. The zoom function can be operated either manual or motorised. Optical zoom allows the projector to enlarge the size of the projected image by extending the lens. The more optical zoom projector has greater flexibility in positioning the projector at various locations without altering the image quality.

In other hand, digital zoom function by cropping the image and then enlarging the pixels to increasing the size of the projected picture. Using digital zoom leads to pixilation and reduce the quality of projected image. So, the researcher opined that digital zoom features should disable while using the zoom feature of a projector.

⁹ See the article keystone correction at http://www.bambooav.com/keystone-correction-explained.html
Accessories

The projector accessories are also vital components in the process of mounting and positioning in the performance space.

**Mounts:** Projector mounts are the important things kept away the projector from accidental crashes on the ground. Improper mounting of the projectors cause the lamp failure and unstable images on the stage. According to the design the projector installed for hanging mounts or stand mounts. The ready-made mounts are not suitable for all productions. The desired height and dimensions of projector mounts and stands has to be built by designer well in advance. Possibly at the time of technical rehearsals the production company has to make a projector mount suitable for their needs. It should be carried along with the projection equipment’s. It's very difficult to obtain a proper projector mounts in desired specification in a limited period of time.

The projector may be owned by a company or from the rental agency whatever it may from, developing a strong and stable mounts was one the additional responsibility of the designer. Because a slight change in the mounting position of the projector will impact on the calibration in projection mapping.

**Cables:** The multimedia projectors are capable to process different types of signals in the formation of projection image. The type of input signal will determine the type of cable has to be used. The projectors connect to the input devices through the wired cables optionally wireless mode also. Broadly the input signals can divide into analog video signals and digital data signals.

**Composite Video cable** – The most common way of transmitting video data happens through composite video cable. All projectors have composite video jack at input section. It was first used for colour televisions later continued to LCD and DLP
projectors. This cable can only transfer Standard Deification quality images not suitable for transmitting High Definition quality images. The SD images are also not that much sharper than Component Video Images.

In composite cable, Yellow cable is used for transferring video signal, the red and white cables are used for transfer left and right stereo audio signal. The signal quality degradation depends on the make of RCA cables. The High qualities RCA (Radio Corporation of America) cables are recommended for Play productions, which can be able to transfer the analog signal minimum 50 metres to maximum 100 meters.

**Component Video Cable** - the component video cables can transmit the better video signal than single composite video cable. It will enhance the picture quality. The three Red, Blue and green cables are labelled as Y, Pb , Pr and connected to the component input jacks. If the projector using the analog video signals engaging the component cable instead of single composite cable was advisable to enhance the quality images on stage. Component cables have an ability to transfer high definition video signals also.

**RCA Cable Joiner** – the RCA cable joiner can use to connect two different lengths of Composite or Component cables to extend the length of the whole. In play production practices we are encountering the problem of cable length. Every performance space has its own physical dimensions; the cable lengths are varying space to space. These joiners will help the projection crew to extend the video signal to desired length. Always keeping some of the RCA joiners along with the Production Kit was recommended.

**DVI Cable** – the Digital Video Interface cables are designed for connecting Computers to LCD monitors. But some of the projectors built with DVI interfaces.
DVI cables are used to transmit High Definition data signals from computer to projectors. The DVI cable only carries Video signals not like HDMI cables.

**VGA Cable** – Video Graphic Array cables are most commonly used to connect a projector and computer for play productions. The cables can extend by connecting VGA joiners.

**HDMI Cable** – High Definition Multimedia Cables (HDMI) are highest quality cable to transmit digital data from computer to projector. The cable was costly then the other cables. More than 10 meters length cables are not affordable for production practices. Instead of these cable USB and RJ 45 connector LAN cables are recommended for connecting the projector to the computer input system.

Apart from the physical cables, the projectors can connect the input systems through wireless modes also. To connect projector in wireless mode the projector should have a wireless connectivity option as add-on or inbuilt. The wireless feature enables the projector to connect laptops directly without and physical cable communication. The system of wireless connectivity application will vary from projector manufacturer to model. So to know more details regarding this the researcher suggested that refer the projector manual, which was procured for the production.

Researcher opined that the wireless connectivity projection system suitable for static image presentations, higher network speed enable to present motion images also, even though wired connectivity was the ideal solution for play productions without disturbance. Some of the theatre auditoriums are equipped with wireless network jammers to prevent mobile phone usage and other VIP security purposes. Among the above different types of cables, the researcher recommends that, three coloured component cable for analog video, VGA cable for Digital Video Signal and
RJ 45 LAN cable for network computers. Please ensure that the projector should have the appropriate input ports.

**Shutters:** Projector shutters are the important accessories than any other for theatre play production. The projectors are not unable to project completely black at the time of black outs. The emitted light from projector may distract the aesthetics of production design. Switching off and on the projector is not possible always. Manual covering the projector light will always not possible. Most of the projectors hung at different heights in the performance space. The DMX based Projection shutters are very convenient to block the unnecessary emitted light from the projectors. It can be controlled through DMX console. These shutters enhance the aesthetics of production design.

The DMX based projector Shutters are little bit expensive. So the DIY (Do It Yourself) community illustrates the Making of Projector shutters with unusable CD Drives. The CD drive door can be controlled through a circuit. Really it’s working and the researcher also used for his play production practices.

**Maintenance**

To maximise Projector efficiency in performance and keep it running smoothly, it need regular maintenance. The projector operator has responsibility to ensure its maintenance. The projector should always turn on five minutes before intended use. The lamp mode should be kept in normal mode. The air filter should clean after every use. This will enhance the life of the projector lamp. Ensure that the projector should be turned off, before cleaning the air filter. Referring the user manual for regular maintenance of projector is advised.

Before switch off the main power supply, the projector should be turned off through remote control or projector power switch. It was recommended that, don’t cut
the power in projector lamp cool down period. To avoid damage of the lamp, allow minimum ten minute interval between turn off and turn on. During the rehearsals, if we are not using projector more than thirty minutes to keep the projector in standby mode for the duration. But, don’t forget to turn it on before five minutes to cue. In performance time if no longer using the projector after a specific task, try to turn it off remotely. In performance standby mode was not recommended. DMX Projector gates or Manual shutters recommend to cut the light emitted by the projector. Keep always the user manual throughout the production based on the model of projector as a safety measure.

When the projectors are turned on, don’t cover the projector with any material. Allow minimum two feet of free space nearby the projector to allow ventilation for heat dispersion. Don’t mount the projector in high temperature environments, like near to flood light or heavy stage lights. The more heat environment can damage internal circuits of projector and projector lamp, the Smokey environments can spoil Projector optics and the moisture environment can harm screen image quality. Use small vacuum cleaner, which was used for laptops and computers to clean the air filters.

Use always a proper projector mounts for installation in rehearsals and play performance show. Use the proper packing box for transportation or projector from the performance space for production space. The photographic camera lens cleaner solution and dry cloth can use to clean lens of the projector. Operating the projector in economy mode for regular rehearsals will recommend. It will stretch to the maximum lamp life for any media projector. Always use security chain lock for projector, which was linked with projector mount to prevent projector theft in the absence of the projection people in public spaces.
Projection Surfaces

Projected image need something for the light to hit and reflect, then only the audience see the images. Because, light is invisible until it hits something and is reflected. Projection surfaces are a vital component in projection system, after the projector. The projectors are aimed towards projection surfaces and throw the media images upon it. The reflected images of light perceived by the audience sensory system. The role of projection screens or surfaces in projection design needs an in-depth study by projection designer.

History: The primitive evidences explain that, the first projection surfaces are not man-made. According to Matt Gatton Paleo theory experiments, the cave walls are surviving as projection surfaces for Paleo camera inverted image projections. The cavemen are perceived the nature projection of light in their dwellings, and it leads to the origin of Cave Art.

Around 360 B.C in China, projecting images of cut-out figures onto screens made from thin cloth and it was lit behind from the screen. The rear shadow projection techniques are found during the Sung dynasty period. We can notice these shadow play performances using cloth screens in India, Indonesia, Turkey and Greece. This shadow puppet forms introduced the use of projection screens to the audience, long before the arrival of cinema screens.

Using camera Obscura the inverted images of the outside images collected on the inside walls of camera Obscura chambers. The inner chamber surfaces are aided as projection surfaces. Based on Leonardo Da Vinci descriptions, historians assumed that, very often the actors performing outside the room, the performance was projected through camera Obscura chamber’s and presented it for spectators’ entertainment.
Phantasmagoria performances are used multiple projection screens and multiple magic lantern projectors for their shows. The screens are made with fabric and different sizes. The rear projection techniques are widely practiced to produce astonishment and frightened experiences for spectators. The handheld projection equipment’s are moving behind the projection screens in order to create the illusion of motion.

Birth of cinema in 1895 contributed to development projection screens and experimentation. A series of projection screen manufacturers are emerged in early 20th century, through the saying ‘improve the visual experience’. The stretched projection screens in the cinema theatres are resembling the invisible fourth wall of traditional proscenium theatre’s architectural aspect. The invention of sound pictures raised the necessity of perforated projection screens in cinema theatres.

**Projection Screens**

Any surface will receive the light. We only see objects because light is reflected from a surface into our eye. The purpose built screens are specially designed to maximize this reflection, and in specific directions relative to the angle at which we are viewed. The fabric screen, stage architecture and scenic objects are used as projection surfaces for theatre play production. Reflective and Translucent material projection screens are widely available for theatre productions. The projection screens are distributed into highly reflective and high contrast screens. Reflective acrylic goos are available to paint scenic objects and stage walls to convert the desired surfaces as to the projection surface.

High Grey contrast projection screen was recommended for stage play productions. These screens are rich in enhancing the depth of black levels in the projected media image. This type of projection screens can able provide 180 degree
view angle. Matt White projection screens are used for all presentation needs in daily usage. It can reflect the brightness levels as better than Grey contrast projection screens. Even though, it was not recommending for theatre use. Because, the ambient light picked from the projection surface diffuses the projection image quality. The white projection surfaces will looks alienated in the total composition of the stage picture. The low ambient light conditions also, the reflected projector light spilled around and bring visibility for them.

Optical projection screens can also use for front and rear projections in theatre. Normally it was recommended for use in high ambient lighting environments. It was more expensive than the White matt and Grey projection screens. The optical lens system of the projection screen works to focus and concentrate the image before it is reflected back toward the spectators.

The image quality of the projection depends upon the distribution of light within it. The projection screen gain indicates the surfaces reflectivity nature. The high gain surfaces reflect more light towards the audience. Sometimes it will distract the audience vision in low ambient environments. High gain ration surfaces will have less view angle. Only those people sitting in front the surfaces can get good visibility of the image.

Acrylic projection paints can turn any paintable surface to the projection surface. The researcher was highly recommended that, the painted projection surfaces will easily migrate into the stage pictures and, unidentified by the novice audience as a projection screen. Hanging screens exclusively for projections in stage plays can be avoided by using acrylic painted projection surfaces. Any surface in the stage environment has a good visibility to an audience can be transformed as projection
surface. The risk of projection screens mounting was eliminated from practice through this practice.

The researcher strongly anticipated that, the audience can immerse deeply with the media projections on integrated projection surfaces than alienated projection surfaces. The drawback with the painted surfaces was that, we have to do front projection only. The acrylic rear projection screens also available to use in theatre play production. It can synchronise with the painted surfaces of the stage objects.

**Photometry**

Measuring the amount of light involved in stage is called Photometry. The amount of light falling on projection surface, the amount of ambient light around the projection surface and the amount of reflective light from the projection surface can be measured through the photometric equipment. These values can define the amount of light required for projection and the amount of light spill has to be reduced.

**Input Unit**

The media content input and distribution mechanism was developed along with the technologies. The earlier projection system consists the media content mechanism as integral part of the projection system. The slide projector, Overhead Projector, gobo projector and film projectors are the prevailed projection systems earlier to Media projector. Invention of Cathode ray Tube technologies changes the projection distribution technologies or Projection system. The CRT based Video projectors are gaining video input signal form a Video Record player and these equipment’s are connected with a Video signal cable.

Still most of the Projection practices in Indian Theatre productions employing a Video Player (DVD) connected to a Media Projector. The media content in the player was controlled through the remote controllers. The projectionist can play,
pause, stop and jump between tracks. The abilities of the projection input equipment are limited. To create a unique media experience through projections in play productions, we have to know the more media input systems for projection structure. Here, the researcher exemplified the different Input systems for Media projections; Media Servers, Application Systems, Control Systems and Interface Devices.

**Media Servers**

Media servers are dedicated computer systems to store and share various digital Media content for various Media Playback devices. Digital media is form of electronic data stored in the digital Binary form. The media servers hold Computer Generated Media images, Photographic still images, Videographic Moving Images, Audio and Music files in Digital Format. The inbuilt special application of Media server can provide access to the files to various applications and devices.

Theatre Productions are employing these media servers to share the Audio and Video media through the application systems of Audio and Video Projection systems. Some of the special applications provide the media projections content into the handheld device of Audience. Media servers required huge Hard disk space, Network Connection with sufficient bandwidth, maximum RAM and Powerful Processor. The media servers not only share the stored digital media, it can capably to stream the live Video data for broadcasting in stage productions.

**Arkaos Media Servers**

The Arkaos Pro Stage Server\(^{10}\) is the perfect solution for Theatre Media projections. The powerful Arkaos engine from Media Master Express will produce smooth hassle free visuals to the stage play production. The media image channels can be easily triggered from DMX channels and also from MIDI control desks.

\(^{10}\) Visit for more product details to [http://www.arkaospro.com/media-servers/arkaos-stage-server](http://www.arkaospro.com/media-servers/arkaos-stage-server)
The servers have one VGA/DVI/HDMI type of interface output for projector connectivity. The output has 8K resolution. We can connect a number of projectors to build-up the huge projection walls. The server has network capabilities. Through this we can access the server ever for from the performance space. Media Master Express software access the Server and trigger and deliver the media images according to the Cue list. The server can controlled through directly from a DMX lighting console, MIDI consoles, Keyboard and Art Net enabled devices.

**Hippotizer Media Server**

The Green Hippo’s Hippotizer Media server\textsuperscript{11} was also having similar features as Arkaos Stage Servers. This server also widely used for Theatre play productions in West End to Broadway. The Live mask function allows projection mapping onto intricate scenery, the automation component in this server enables the tracking of moving scenery or rotating objects. It has maximum 16 number of media layers to control. The attributes of the layers can be controlled through the DMX lighting consoles. Like a lighting design, we can assign layers to the respective of channels by soft patching.

**Playback Systems**

Media servers are designed for hassle free execution of media content for play production. But, it was very expensive to afford for a play production. The professional touring companies can deploy these gadgets into their design. Indian Theatre Productions have the potential to produce big productions.

Most of the Indian Theatre production is performing in venues without charging audience, some of the professional theatre groups are collecting entrance fees as minimum as possible. Making a theatre production in India with expectations

\textsuperscript{11} Visit for more details about this product at http://www.green-hippo.com/products/hippotizer-hd
of profits out of the shows, not yet fully dependable. In this context, spending huge amount of the money for projection design for a play production really impossible. Some of the funded projects, sponsorships make it possible. The researcher understands the context of projection design in Indian theatre play productions and recommend the given below projection application tools for the media projections. These tools are less expensive than media servers and some of the tools are freely available to use for non-profit projects. These applications are tested and experimented by the researcher in various projects and some of them in a lab environment. The theatre practitioners have a freedom to select any one of the tools to execute their projection design in affordable overheads.

**Video Projection Tool**

Video Projection Tool one of the excellent Media projection application appropriate for Theatre Play Productions. This application absolutely free for downloading from the website.\(^{12}\) This full functional application can be used for theatre media projection practices. The VPT 6 version was stable and VPT 7 was under testing stage, the stable version will become available soon.

Hegilje developed this application out a project ‘Conversation with spaces’. Through this project he explores how the audio-visual technology can be used to transform, create, expand, amplify and interpret physical spaces. VPT is a free multipurpose real-time projection software tool for Windows and Mac computers. The VPT runs under the Personal Computer system, which has Windows XP Sp3 or Windows 7 operating system, 4 GB RAM, QuickTime player 7.6 or later, an Open GL-compatible Graphic card. If the Graphic Card has 1GB Video Memory it will

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\(^{12}\) Visit to obtain a copy of the VPT 6 application at [http://hegilje.wordpress.com/vpt/](http://hegilje.wordpress.com/vpt/)
work very fine. This specification are minimum requirements to work for a theatre projection design with VPT application.

VPT can be used for projection media images on complex forms, adopt a particular space/ surface, combine recorded and live footage, for multiscreen High Definition playback, and good for interactive video installations using Arduino sensors or camera tracing ++. The researcher employed VPT 5.1 for a project called ‘Homo Sapiens’ as part of a research study of this application. Working with this application very challenging for the first time, through continues practice it became very tranquilly to work.

The projection design stresses to project two simultaneous media projections in a play, normally we employ two projectors along with two media players. If the design demand six projection surfaces simultaneously for a scene requirement, the VPT 6 application has a solution for that. 32 layers with an interactive graphic interface the application available. Each layer represents one projection surface. These layers can possible to scale, position and distort according to the design. The layers can acquire media from 8 recorded sources and two live came sources. Using mask option of the application we can crop the media image output into desired shape. The video Projection mapping technique can apply using this application. This function is similar to gobo projection through lighting equipment. Using the Enttec USB DMX Pro interface device, the DMX controlled lighting consoles can able to control each projection channel by changing its attributes. Easily we can bind the media projection executions along with the traditional lighting consoles.

The Media content format should be in QuickTime movie format and recommended apple photo JPEG 75% quality compression rate. The High Definition media footage also plays back from this application. Live text feeding sources also
inbuilt in this application. Through this direct we can project text onto the projection surfaces. Video mixing from one source to another source and cue list for one cue to another cue was an additional advantage for interactive projection design. Through this application the projection designer can visualise more innovative modes of execution of media projections through his design for theatre play production.

This application has an extensive support for OSC communication. So the projectionist need not to depend upon the lighting consoles for operating the cues. The Touch OSC application enables Android handheld devices or iOS enabled iPads can control the functions of Media projection excitation remotely. The Projection output from the application systems directly connected to the projector. If three projectors using in the design in various locations, the Matrox Triple Head-to-Go video splitter device can help to split the single output to three projectors. To learn and experimentation with this application refer the manual at application website or check YouTube video tutorials. Even if you have problems facing at work contact the author through mail, he can suggest appropriate solutions. During the project the author gave enormous support to complete my study through emails and software updates.

**ISADORA - Troikatronix**

Mark Coniglio was the creator of this award winning, interactive Media presentation Tool. He receives prestigious Word Technology Award 2012, recognizing his visionary contribution to art and technology by The World Technology Network at New York. It has limitless potential possibilities other than any application for real-time digital media interactivity. It’s more stable than HC Gilje VPT, and more feature are there to explore enormous possibilities of artistic expression through media projections. It was coming with the paid license per system base. Intended user can obtain the full functions enabled copy from website and
practice it for ever freely, but saving the working files' option was disabled. Only licensed users can save the working files. This application has most of the solutions for all projection design needs of a theatre play production.

Isadora was one of the essential resources for Dance performances, Theatre Performances, Interactive Installations, Video effects for Post-Production and Video for Club Environments. Using Isadora was like learning by playing and experimenting. Programming capabilities of Isadora enable the projection designer to compose unique Designs for every Theatre Productions. Video Projection Tool was one step behind in this. Isadora building blocks can enable the designer to do creative improvisation than mechanised operation. 250 basic building blocks of Isadora Application can be linked in a nearly infinite number of ways. It will allow the designer to create media-intensive theatrical experiences. The media projections can be lined with the real-time performers’ action on the stage. The performer can able to control the attributes of projections, triggering the cues through the sensory hardware device, which are connected to Isadora Application System.

Isadora has easy-to-learn user interface. It has built-in real-time Video Processing Modules from free frame video plugins. The designer can create a custom control panel according to his production design needs. The online tutorials and manual will assist you to construct it. Using a fast desktop computer with multiple video adapters, the designer can project six independent images on six different surfaces. The live audio and video inputs, OSC application device and MIDI interface device can control the Media projections through this application.

Theatre performances, create dynamic, virtual sets that respond to a computer operator’s cue or a performer’s movement or sounds can be designed through this
application. Control and cue lighting, play back multi-channel audio was an add-on advantage of this application.

**QLab**

QLab is Multimedia playback-cue based application, which can only run on Mac Operating system designed for theatre productions and live entertainment. This comes with a license to use. We can’t use this application as VPT and Isadora to make innovative designs. Deferentially it was a cue based Playback device. It is not Media Creation Application for Projection. Very easy to operate with any of the crew in the play production. It can play audio cues and video cues according to the cue list.

The new version of QLab 3 equipped with new features like video blending between attached projectors for the computer system. No need to go for an expensive video splitter device, but if you are running with QLab 2 version you need Matrox TripleHead2Go for connecting more than one projector. Projection Masking was a very interesting feature added in this version.

QLab can handle complex cues from a single action than any other Playback application for media design in theatre play production. We can assign the execution of cues through the existing lighting control desk, along with the synchronised lighting cues.

**Dataton Watchout**

Dataton Watchout\(^{13}\) was a Multi-display production and playback application system. Its functions like similar to QLab. Without a requirement of any Hardware tool through this application we can scale the projection surfaces to desired measure. We can connect six projectors running with Dataton licenses connected to a projector and the ability to project 360 degree projection surfaces.

\(^{13}\) For more details about the product please visit, http://www.dataton.com/watchout
Using this application we can Built Multiple Video walls with LCD Video monitors. The capability has connecting any display device to computer systems, this application will make it display the media images on it.

The Production Computer was connected to a Network device to all the display computers. The computers connect to projectors, instead of monitors. The production computer sends the cues and scale the media projections on desired projection surfaces. Each system must have valid license to operate. Depending upon licenses we have we can increase the number of systems in the network and projectors. Most of the theatre installation projects are using this application to create an immersive environment to the live audiences. The architectural projections are taking place through this application widely.

**Arkaos GrandVJ**

Arkaos GrandVJ\(^\text{14}\) was an 8 layer cue based playback and real-time media mixing application based on windows and Mac operating system. The easy to use interface will enable moderately to execute the media projection content based on cue. Mixing like a music, the designer can manipulate various attributes of media contents and trigger it through MIDI and OSC control Devices.

**TJShow**

TJShow application designed to be run on networked environment. It was a freeware application to use show control. This will handle different device connected in a network and trigger the appropriate content according to the projection design. Through this device we can use other device connected to a networked system.

\(^{14}\) Visit the website for more details regarding this application, http://vj-dj.arkaos.net/grandvj/about
Researcher experimented with this to use a web camera of a networked computer. The handheld devices with OSC applications we can monitor and control the Show.

**Cycling 74 MAX/ MSP**

Max\(^{15}\) is a Visual programming language for multimedia, which enables the projection designer to create unique applications for Theatre Play Projection Design. The famous Video Projection Tools application written based on this Programming language by HC Gilje. This programming language is widely used by performers to create innovative performances. The creative imagination of the Artist programmer was the end of possibilities for this programming language.

**Media Players**

These Media Playback applications are dominant in Indian theatre projection practices. The VLC Media Player\(^{16}\) was becoming most popular player among the reaming media players. VLC player can handle most of Media compression formats as well as various Media Streaming protocols. This application was completely free to download and work for production. It can run on most of the Operating systems including Apple Mac’s. VLC player can play damaged, incomplete or unfinished videos, because it is a packet-based media player.

Windows Media Player\(^{17}\) was an inbuilt Media player comes along with the Microsoft Operation Systems. This application was required Media Codec package to play all Media formats. It's not popular now after growth of the VLC media Player. Apple QuickTime Media Player was the best application for Playback Media content for Projection. The QuickTime player can be opened in many windows for each media content. It reduced the projectionist work at the time of live performance.

\(^{15}\) Visit Website for more details. http://cycling74.com/products/max/
\(^{16}\) Visit the website for more information regarding this application. http://www.videolan.org/vlc/
\(^{17}\) to know more details visit, http://en.wikipedia.org/wiki/Windows_Media_Player
The desired media can be played directly by pressing the play button of the respective media player window. Most of the practitioners are not exploring the potential of QuickTime player in live performance. The researcher is advised that, QuickTime player makes the workflow smoother than any other playback media applications. If the Media content in QuickTime format its wonderful working with this player.

**Interface Controllers**

The Interface Device will interact with Application system controls in order to deliver media projections. Most of the popular Media Projection Programmes are able to communicate the given below interface device through DMX, OSC, MIDI protocols.

**DMX USB Pro**

Enttec DMX USB Pro Device\(^\text{18}\) originally developed for fulfil all computers based lighting needs. It can support all operating systems. The DMX data Output port can be used for connecting Dimmers to execute the lighting functions.

The DMX input port can be used for control various layer attributes of the media projection applications. The DMX enabled Lighting control consoles can handle the media projections. Each channel can assign for each media layer. The triggering and scaling the projected images, mixing the media images between one among another can be done through DMX consoles. This interface device transforms the art of media projection to playful event.

**TouchOSC**

Open Sound Control\(^\text{19}\) is a content format for messaging among computers, Sound Synthesizes and multimedia devices. TouchOSC is a modular OSC and MIDI

\(^{18}\) Visit the website for more Details.
control surface for iPhone, iPads and Android tablets. The TouchOSC software application has to be installed in the computer system, where the VPT or ISADORA Media Projection Application systems are running. The application should enable the OSC receive mode through TouchOSC bridge application. The handheld device can configured with the network address of the TouchOSC bridge system in wireless mode. Once the network is established the map the appropriate functions according to the OSC message. The Handheld Device interface layouts can be designed through layout editor according to the needs of Design. This the way to design own Module of Projection Control Interface for Media projection design for theatre production.

**MIDI**

MIDI controller was an abstraction of the hardware to control a performance. The slider was assigned to manipulate the values of appropriate layers of the Media Projection applications. It was hardwired to projection application system through MIDI interface cards or ENTTEC Pro Mk2 devices. The MIDI input ports enable this Midi controllers to connect the application systems. These controllers can dedicatedly use for Media projections, without linking the Lighting console systems of the Play production.

**Matrox TripleHead2Go**

Matrox TripleHead2Go was a perfect solution for scaling the Projection surfaces for theatre play production. If the designer intends to cover the complete performance space with the media projections or create an immersive environment around the audience environment, this Hardware device will work Fine. The ISADORA and VPT Projection applications are well connected with this device. Most

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20 If you want to download this application. http://hexler.net/docs/touchosc
21 For more details about this product refer the website, http://www.matrox.com/graphics/en/products/gxm/th2go/displayport/
of the Operating System will connect this device through the USB port and Display Port.

Motion Sensing

Motion Sensing is a process of detecting an object position relative to its environment. The motion sensing devices are widely used all over the world for different purposes, primly for Security applications. The researcher attempted to use the technology to integrate in play productions, to detect the objects and character movements in performance. The sensing data will helps the projection designer to trigger the media projections, scale and manipulate various attributes of media projections through application software. Here, the researcher illustrated some of the useful tools and applications suitable for motion detecting in play productions to link with media projecting design.

The motion Sensing can be detected onstage action by the way of Passive and Active Infrared Sensors, Video cameras, Radio Frequency sensors, Microphones, Vibrations and magnetic sensing devices. The most efficient way of sensing motion on live play production was infrared sensing and Video camera. The radio frequencies and Microphones are also useful for on stage actions in a restricted space, but it will not deliver efficient results than Infrared Sensors and video cameras even in long distances.

Arduino: Arduino is single-board microcontroller designed to make process of various electronic inputs. The values of the output can be used by the various applications for numerous purposes. The programmer can write the programme on the microcontroller and get the intended values as input for the applications.

The Arduino board is very less in price, compact in size and easy to integrate into any production environment. The Multimedia Theatre productions are widely
employed these devices with various sensors. The lighting sensor, Pressure sensor, Temperature sensor, sonic sensors and motion sensors are connected to this board. The desired input levers of sensory data will trigger the intended actions through the media application.

The lighting changes will detect by lighting sensor and deliver the input values to the media projection application through the Arduino board. The desired intensity of light value of onstage will trigger media projection and manipulate the intensity of projection content. So the projection designer can link the amount of ambient illumination to required amounts of media projection illumination on the projection surface. This is like an intelligent lighting design with the combination of media projection design. The pressure sensor will detect the amount of pressure applied in specific surface and it will trigger the servo motor attached to a door. In effect the door will automatically open and close depending upon presser values given by on stage actions. The creative possibilities are infinite with this tiny hardware device with different combinations of sensors and applications programmes. The study focused only on the projection aspects, so the researcher would like to study these aspects of digital performance interfaces as a separate study in future.

**Wiimote**:

Wiimote was a gaming controller device for Nintendo’s Wii Console\(^{22}\). The primary feature of this Wii remote was motion sensing. It was the Infrared motion sensing device. It will allow the user to interact and manipulate items on screen with the user gesture recognition and point through the use of accelerometer and optical sensing technology. This handheld device can connect to console through Bluetooth network technologies.

\(^{22}\) Visit the product website for more details.  
http://www.nintendo.com/wii/what-is-wii/#/controls
The researcher found this gaming controller can useful for theatre interactive media projections. At the same time he noticed that, Michal Webber, a Media projection Designer used this device creatively for an Indian theatre performance ‘Strange Lines’ directed by Amitesh Grover. The motion of Infrared Pen held by a character captured by Wiimote and transmitted it in to the Isadora application through Bluetooth network. The media projection application according to the input values of the Wiimote, the attributes of media projections manipulate. The real-time manipulated media content was thrown on a projection surface using the Media projector.

**Kinect:** This is an optical motion sensing device by Microsoft for the Xbox 360 Gaming console. Through this game console user can interact the projection interface through gestures and aural sounds. The inbuilt web camera and microphone capture the sensory data and transmits the digital values to appropriate application programme.

Using this gaming control, the designer can track the different objects and character actions without any additional sensing device on stage. The Kinect web camera through motion tracking application can able to recognise the difference between character based on the geometric values and face recognising feature. It will enable the projection designer to track number of characters simultaneously. The basic disadvantage is that, on stage dynamic lighting changes sometimes influence the real values. In this case, Wiimote was successful to operate even in low light conditions or completely dark environments. Using Kinect input controller we will get poor results in dark stage environments.
EyesWeb & EyeCon: – EyesWeb 23 is an Open software to design and development multimodal interfaces. EyeCon is fully functional freeware up to 30 days. it can support different type of sensing devices, including the Wiimote, Kinect and Arduino circuits. It will analyse the motion sensory data and process it in desired method of design. The analysed motion digital data values are needed to be linked to Media application software to manipulate Media Projections in real-time.

Techniques

The way of implements utilisation in order to achieve desired effects may call technique. These techniques can help the designer to create numerous possibilities of creative expressions for play production uniquely. Technique is not a shortcut for a procedure. Various projection techniques are employed by the designers by using the different devices, the researcher illustrated given below.

Shadow Projection

Shadow projection techniques were derived from the traditional shadow play practices. Keeping the objects in front of the light sources the cast shadow of the object will fall behind on the surface. Theatre play productions widely use this technique to create illusion of actions and scaling the object size beyond the normal size. The distance between the light source and the object will assist to manipulate the size of shadows on the screen. These effects were executed by lighting designer with the help of scenic designer. In contemporary days, the media projectionist is combining these techniques in the creation of media projection along with shadows and digital forms.

Indian Multimedia Performance art Maker Amitesh Grover’s latest production ‘Gnomonicity’\(^24\) was a replica of earlier shadow projection techniques in an innovative expression through digital technologies. The instructions for the piece of performance was ‘Cast your shadow on the screen’. The cameras capture the viewers’ bodies and project as silhouettes through a motion sensing process onto a white screen. Through the silhouettes, the viewers can view the live imagery streaming from surveillance cameras around the world.

**3D Projection**

3D Media Projections were a method of mapping three-dimensional imagery into a two-dimensional surface. Using a visual programming tool ‘vvvv’\(^25\), most of the designers experimented with the 3D Projection on different projection surfaces. According to Elliot Woods\(^26\), 3D Projection mapping is the act of re-projecting a virtual 3D object onto its real world counterpart using a video projector. So all the features of the real object which are visible from the point of view of the projector have been projected on the surface. He was conduction workshops on these aspects to train creative technological artists.

**Projection Mapping**

Projection mapping is the technique of beaming video (with a standard video projector) onto three-dimensional objects and adjusting and masking the image so that it seems to follow the shape of the target object instead of spilling out onto the walls.\(^27\) These 2D graphics become 3D graphics when it interacts with applied

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\(^24\) Refer the art work at , http://amiteshgrover.blogspot.in/2013/01/gnomonicity.html
\(^25\) Visit the website for the more details, http://vvvv.org/
\(^26\) Visit https://github.com/elliotwoods/
surface. And then, applied surface gives messages by using audio-visual elements onto its own infrastructure to the audiences.

The Projection Mapping technique will convert irregular projection surfaces into possible projection surfaces. On stage there is no need to construct a plain white projection surface. The projection designer need not go to show cinema to audiences. Any surface through by projector light, all the surfaces are mapped according to the shape of the scene objects and project the media images. The Software applications like VPT and Isadora and many more tools able to scale the media projections according to the shape, without much distraction of the imagery. The technique earlier called as Spatial Augmented reality. The first record of projection on walls in 1969 at the time of Disneyland Open. In 1980, the installation artist Michael Naimark filmed people interacting with objects, in a living room, then projected into a room, creating the illusion as if the people interacting with the objects really there.28

Using the feature of Masking in the application, except desired projection surface blocked by a template in front the media projection content. The combination of both mask and media content projected on the surface will create an illusion of reality. These surrealistic images make the audience to get a new experience in the play world.

**Interactivity**

Interactive Media projections are clearly we can perceive in Amitesh Grover’s productions. Most of the Amitesh Grover’s Performances have interactive characteristics. This is one of the basic characteristics of multimedia theatre productions. Indian Theatre productions he explored and exploited the media potential in a higher degree. Interactivity in theatre production we can found in two ways;

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human to human communication and human to computer communication. We are aware about the human to human communication.

The human to computer communication is the way people communicating with new media. The media projections are created in the task environment. The human interaction with the task environment captured by sensing devices and it is communicated to a computer system to initiates reciprocate actions on task environment. The cycling process of these mechanisms will create an illusion of reality in the actions.

Michel Weber\textsuperscript{29} worked for ‘Strange Lines’ production along with Amitesh Grover. Webber used live cam projection on stage screen, the media images are revealed by another character wiping the surface, dramatically the live cam images revealed. The interactive projection designed by using Infrared Pen and Wiimote sensory device. The character holding the IR pen and wiping the surface, the motion was tracked by Wiimote Device, which was normally used to Gaming experience, and send the data to Isadora application. The application unravels the portion of the media like removing the mask of the projection. The real-time process of these technologies will create a unique experience for audience through this projection design.

**Immersion**

Immersion through media projections in play world, a way creating a perception of presence in non-tangible world. The faithful artistic reproduction of reality will deter main the degree of suspended belief. The greater suspension of disbelief, the greater degree of presence achieved\textsuperscript{30}. The theatre audience viewing a play with a degree of suspension of disbelief. They prepared psychologically and

\textsuperscript{29} Visit for more details, http://www.michelewebber.com/

attend the performance. If the media projection environments enhance the suspension of disbelief in the audiences' mind by reproducing the virtual reality, the audiences should get a unique immersive experience in the play world. The media projections for theatre play production are primarily designed for creating an immersion world for the characters. The interactions of character actions in the immersive projection worlds produce an enhanced experience in audience minds. Creating immersion projection worlds primarily intended for audiences, we can find in installation and performance art works.

The evidence of the Spatial Immersion world can be found in ‘Sagara Kanyaka’ directed by Jyotish. M. G and Amitesh Grover’s ‘Strange Lines’ and ‘H.O.M.E’. In the play production ‘Sagara Kanyaka’, the characters are living in the immersive media projection environments. The designer constructed three sides of proscenium theatre with huge projection surfaces with the media projections. The characters living in the projected media environments almost all the duration of the play. The play world was believed by the characters and the audience. Apart from the immersive environment, the director explored the potential of media projections in several ways, in order to convey the visual narrative.

In Indian Multimedia theatre practices Amitesh Grover explored the most of the media possibilities in different ways. In the Graphic novel Production ‘Strange Lines’, the encircled media projection surfaces revealed the various extended paces of play worlds. The different living world of characters of the play brought together as single sharing play world along with the audience made it possible by innovative media projection designer. The short clips of these performances were enclosed in a DVD format along with this documentation.
Surtitling

The audience watching the foreign films are very familiar with the feature of subtitling. The subtitles are the textual versions of the dialogue or commentary on films, which usually displayed at bottom of the screen. As like, the translated or transcribed dialogues or text projected above or displayed on screen in theatre performances called surtitles. The word ‘surtite’ derived from the French language, ‘sur’ means ‘over’ or ‘on’ with the combination of English word ‘title’. The word ‘surtite’ was trademark of the Canadian opera company. Initially the Opera companies used the Surtitles to display the lyrics of the opera songs.

Most of the Indian theatre play production has their own regional languages for making performances. India has 22 official languages. Apart from that numerous local languages. Theatre performances are happening most of the native languages of their region. Theatre has a visual language to communicate live audience. However, the most of the performances are verbal based than visual. Each region's language is a foreign language for another region people. In the context, the performance of other regions is difficult to recognise the verbal conversation in the performance.

Some of the Indian theatre practitioners are attempting to cross the language boarder by employing surtitles in their performances. But it was in English, which was the second official language of India. Except educators, most of the regional people still not able to familiar to understand English as surtitles in play production. The practitioners are condense the essence of the scenes and projecting it separate projection screens. The Microsoft PowerPoint Application was used for this. Some of the practitioners are translating all the dialogues into English and projection simultaneous along with on stage dialogues.
Using the Presentation application making hundreds of slides was a difficult task for projection designers. Every performance venue the designer has to arrange all slides according to the geometrical position of the projection surfaces. The researcher intends to find a solution to surtitling application in Indian theatre play production. The researcher through his exploration he found a Belgium based company called ‘Nova-Cinema’ working on a surtitling programme. Preliminarily the application was not stable. The feature is also less for to use as Indian theatre play production. The researcher interacted with the software team and requested the distinguish features enable application. After a series of developments and versions of the application finally they produced a suitable application for suitable for Indian Theatre Play Production.

The Researcher stressing that, Indian Theatre Play productions means that, the surtitling programme can able to handle most of the Indian languages, not only English. If the surtitles in the native regional langue, it was very easy to understand the gist of the actions on stage. Here, the researcher identified a new problem that, the production team may not know the all regional languages of India. How to translate it. Finally, the researcher found a moderate solution for that, it is none other than Google Translate\(^{31}\). The production team can utilise the translation application to transcribe their native language script to the desired language. The transcribed text can be verified before the performance from the Performance space. The simple Unicode text file is more than enough to work with the Surtitling Application developed by Nova-Cinema\(^{32}\). Finally I would like to inform that, this application was absolutely free to download and no licence required for use it in Theatre performances.

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31 Visit the website for more details. http://translate.google.co.in/
32 Visit the website to obtain the copy of the application.
Projected Scenography

As we know that, scenography is the art of creating performance environments. It can compose by sound, light, clothing, performance, structure and space. Rachel Ditor, director of ‘Transit Lounge’ production used video projections for play world stage scenery. He exploited the possibilities of video projection, by using it for stage lighting also. They innovatively used bouncing projection technique to throw media images on the stage floor. In front projector they used a mirror, which was aimed towards stage floor.

Indian theatre practitioners often use the media projections instead of three dimensional setting. They prefer the projected settings, where the setting change time was very less and the budget of the product was not affordable for tangible settings. These two reasons are provoking the most of armature theatre practitioners to employ projections as part of the projected setting for play productions.

Special Effects

Using projections for Special effects was the age old practice in theatre productions. The natural effects, different locations, various incidents are documented and projected on performance space became common practice in armature theatre practitioners. Representation of locale, time, places and incidents media content added to enhance dramatic values for on stage actions through the projection practices.

Projection redundancy

Projection redundancy is a technique to provide backup media projection system, it achieved by stacking two projectors one on top of another or side by side to provide a backup image in the show. These two projectors are running simultaneously.

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aimed for same direction to the projection surface. If any projector turned off with a problem, the second projector will run the show. This projection redundancy setup is increasing the budget of the projection design. If the company able to afford for that, the designer can deploy projection redundancy mechanism in the design.

**Content Production**

The researcher illustrated above regarding, projector, projection surfaces, Hardware and software implement for media projections along with the several media projection techniques. Here, the major aspect of the total media projection design, the Media Content means the images to project discussed in detail. The aesthetics of media content, media production tools were explained under the respective headings.

**Production Tools**

Media content creation is the major task for the projection designer. The designer may use already exited media content from various sources or create an original media content for play production. Any of these choices selected by designer must need at least any one of the given below tools to make a final media content, which can able to deliver through media projection applications. Most of the media content was created through two ways; Captured and Generated. The Captured Projection Media includes the content which captured through the lens system device, Digital Photo Camera, Digital Video Camera and Digital Scanning Devices. The Generated Projection Media includes all types of Computer Generate Imagery delivered from various computer software programmes.

**Captured Media Production**

Digital imaging devices made the media production process little easier than earlier. The media creation for theatre projection has distinctly three phases; pre-production, Production and post-production. Pre-production and post-production
phases are mandatory for projection media creation either original footage or existed footage.

Pre-production phase, the designer has to sketch the visuals and evolve a story board. The story board will narrate the media content, which may be projected on stage. The story board illustrations will help the designer to demonstrate his ideas to core production. A designer has to be prepared storyboards for task wise, according to the identified tasks. The task may have still images, moving images, titles, computer generated images, and visual effects. The designer has to be prepared a task wise media content creation process. Some task may need existing footage, some task may need video production or CGI production. The detailed task wise budget proposals will enable the company to decide the necessity of task presence. Sometimes if a particular task demands more budget, the company may not approve. So the designer has to explain the various production process to produce the media content for the specific task. This section will inform the various production process of media content creation suitable for theatre play productions in Indian context.

The prime aim of media projection is to fulfil design needs / objectives with a significant function. The design objectives and functions are described in the previous chapter. According to that the designer has to be create media content. In a specific task, the projection design objective was Rain forest, where the characters are performing the actions in play world. The function of projection design was primly scenic. Using three projectors along with Matrox TripleHead2Go, the designer constructed an immersive environment for characters live-in. But, what about media content, which supposed to be projected on the constructed surfaces.

Three options exist to create media content for projection; Using Stock Imagery, Video Production, CGI production. Depending upon the financial
constraints of production designer has a choice to choose any one of the affordable method for production.

**Stock Imagery** – Royalty free stock imagery can be found in internet database. The still imagery or moving imagery both can be downloadable in the required resolution from the internet. Some of the companies are charging very less amount of specific categories of imagery. Obtain the media content from the internet and process it in to make it fit for design was a wise task. The designer usually aids this option to demonstrating the projection design to the core team at preliminary meetings. The impressive media presentation along with suggestive imagery will create a good impression on the design and removes ambiguity involved in projection design production.

The stock imagery will help the designer to reduce production budget, but the designer cannot produce a unique design. Because, the stock footage may be experienced by the audience in different spaces in different context. Once the stock imagery found in a play world, the audience attempts to recognise the imagery through their cognitive experience and relates the imagery with original contest. This process will alienate the audience and distract the strength of suspension of disbelief. The stock imagery may successes in order to fulfil the needs of design and creation of immersive environment for the characters of the play world, but not to the audience. If the production design intends to alienate the audience through the media projections, this option works well, otherwise the designer has to choose video production option for media content creation for the task. Researcher enclosed some of the stock imagery both moving and still enclosed in DVD.

**Video Production** – the video production of projection design done in two modes; the online-video production, offline-video production. The online-video production
for play production will demand expansion of the projection design team. The Videography crew presence is required for all the technical rehearsals and composting the media imagery. This online-video production will employ in projection design for live narration the offstage narrative.

The projection designer should plot the positions of the live video camera equipment, cabling diagram and delivery mechanism. Some designs may not require media processing before deliver, if the manipulation of live imagery required, before projecting on stage, the designer has to channelize the live feed to real-time projection manipulation software like Isadora or Video Projection tools. The multi-camera video production may require a video mixer along with the operator. Most of the Digital Video cameras are directly connected to production servers through fire wire. The application soft wares in media servers are capable to handle the mixing solutions for live feed in real-time.

The interactive projection design required motion sensing application software, motion sensor devices along with the regular video production team. The projection designer has the major responsibility in order to streamline the live-video production components. The motion sensing interfaces often trigger the projection cues remotely under the specific parameters composed by projection designer in projection manipulation application. The post-production for live-video productions are occurring in real-time.

The offline-video productions are largely depended on the post-production process. The efficient Videographer capture the required media content in a raw format under the specific location. Once the raw media content handovers to the designer, the task of Videographer was finished. He no longer existed in the production process. The projection designer has to work with a video editor to crop
and groom the raw media content. The video editor compose projection sequences with the different sizes of shots, which was suggested by projection designer. The video editor was a professional individual, he may not aware the requirements of play production through media projections. The designer needs to describe the context of the media projections presences on stage to video editor. It will aid the editor to understand the context and helps to produce relevant content. If in a task, the character is entering the stage of projection world or a character interacting with the projection world existed virtual character, or a character moving from live stage in virtual projection space, in all above mention sequences the projection designer need to explain the character movements based on the ground plan of the stage. According to the directions of movement plan, the editor can able to produce a synchronised movement pattern for projection world characters through his editing techniques.

The designer intends to work with the post-production process, he must know some of the post-production applications. The knowledge related to these applications make the designer understand potential possibilities of the application. Most of the video post-production application available in the consumer market will fit for the needs of post-production for theatre play media content creation. In exceptional case, the designer has to move for the more professional editing system. The popular non-linear professional digital video editing systems are Apple Final Cut Pro, Adobe Premier Pro and Avid Media Composer. Corel Video Studio Pro was a semi-professional Video editing system. Professional editing systems required huge system configurations than the semi-professional editing systems.

Depending upon the workload of the post-production for media content, the designer has a choice to hire an editing system or build and work with a semi-professional editing system. The graphical user interface of these editing applications
makes an enthusiastic within a week as a moderated video editor. If the designer really intends to work with video production editing system, the researcher advised that, learn the concept of editing and film language before sitting in front of the editing system. The Adobe Premier pro was a quit good editing system to learn quickly and work efficiently.

**Digital Photography –**

Apart from moving images, still images also used in specific sequences to express to enhance the on stage dramatic actions. The Digital Still camera device made it simpler than earlier photographic devices. Once the photograph taken by digital camera it can able to project through media station applications.

As a task of projection designer need to establish an on stage character transformed as an alien character or an old building make it as new with paintings. The projection media content designer can able to transform the photograph of the character to an alien character by applying digital photo finish techniques. As the same way a new building was transformed as the old building. The process of digital image making has numerous possibilities, which can be achieved in less time and affordable budget of the production. The major digital photo image making applications are Adobe Photo Shop, Adobe Graphic Suit, Corel draw Graphic Suit.

**Generated Media Production**

All media content are not possible to create through Captured media production. Some of the media content may be required to produce through Computer generated Imagery. The computer generated Imagery give full control over the all aspects of media content for the media projection designer. But this process requires more time and expansion in the production budget. Number media production content needs to generate the required imagery.
As a task, the projection designer needs to create a projection world character as like as monsters and aliens, the option for the designer was Computer Generated Imagery. Through costume design and make-up masks we cannot establish really alien characters in a believable way. The designer has to work with illustrator to sketch out the visual and prepare a storyboard before making the Computer modelling. Once the design approved and sanctioned appropriate budget for CGI Media making, the designer can approach reliable CGI team to construct the Media for Projection.

Among the various CGI production software applications, Autodesk Maya was a popular application. Using Maya application designer can construct Interactive 3D Applications, animations and Visual effects for play production. Autodesk 3D Studio Max and Blender was also popular 3D modelling applications. The interested Designer can obtain a copy of the Blender software from the internet and construct 3D Media content.

**Media Formats & Conversion**

The digital video camera creates a raw type image file. The files are created in an uncompressed format, which has the exact data captured by the camera. Depending upon image sensor used in the video camera different types of raw image formats exist. As like as same, depending upon editing system the created media has its own type of media format. All the raw and edited media format image files can not able to handle by all projection media applications. Each media projection application demands specific media formats required for execution of the images.

Two different concepts of digital technologies are involved in the formation of different media files. These are termed as codecs and containers. Codecs is a short form of a coder and decoder for media. It is a way of encoding video and audio into a
stream of digital data. The encoding method will determine the quality of media image. Container represents a package to hold different codecs of media. The digital stream of media content was stored and packed in a file container. The container will not influence the quality of media images. For example to understand this technology, the ‘.Mov’ file containing the ‘H.264’ data, an ‘.AVI’ file contain the ‘DivX’ Data.

The Media content output format has to be selected based on Digital Storage Space, Frames per Second, Video Bitrate, Resolution, way of distribution, required codec for media project application or media player. The various experimentations done by researcher with different media codecs and application software, he suggests that, MOV file containers with Apple QuickTime Mpeg4 codec was working efficiently. DivX media format files are come with lesser file size than any other media formats, but it will consume more processing power to transmit images.

Media info was an application software will illustrate the various attributes of the selected media file. This application will assist the designer to choose appropriate attributes for media content. The Xilisoft media converter will convert different media codecs to intended media format.

**Symbiotic Aesthetics**

Aesthetics are a philosophical concept dealing with the perception, understanding and appreciation of beauty. Media projection designer need to clarify, intensify and interpret the human experiences through media projections to the audience. In this process, we need to develop a heightened sense of vision and learn how to give such vision significant form to our audience. Applied media aesthetics help the projection designer in this challenging task. If not communicated effectively, significant vision diminishes into insignificance. The media aesthetics will explain the necessary Visual elements, which involved in the process of media content creation.
Herbert Zettl described in his book *Sight Sound Motion* about the major aesthetic image elements; Light and colour, Space, time / Motion and Sound. The associative context of media images in the presence of live stage actions will influence the audience perception, from the original existence context of Media Images. So the projection designer needs to balance the aesthetic principles of stage and Media Images. The fusion of both the aesthetical aspects will create a unique perception and interpretative contexts for the audience.

![Figure 3.44: Associative Context Example](image)

Zettl described about the influence of associative context through above image. We can perceive that the middle circle of above image (a) is smaller than (b) image. Actually, the size of the middle circle in both images are same. This example will illustrate the power of associative context of media image in stage and vice versa. The projection designer needs more attention in projection design in order to create a symbiotic design for play production.

**Light** - Lighting is a deliberate manipulation of light and shadow for a specific communication purpose (Zettl 19). In Digital Imagery the lighting aspect will achieved with pixels. As like as how the stage lighting functions similarly the light function in the media images. To create a symbiotic environment on stage through lighting, the projection designer has to study the lighting plan of the production. The lighting sources for the on stage actions make it extended into the media projection
environment the coherent lighting design will establish on stage picture. At the same time based on the media projection images lighting sources can be extended into the stage, the audience can immerse with the total stage picture without alienating by media projection. So through the coherent lighting design of the stage and Media images we can sustain audience's suspension of disbelief for longer.

The space - presence of two dimensional imagery on three dimensional stage space was an age old phenomenon. The perspective painted stage scenery curtains was prevailed since the Renaissance period in theatre play productions. The painted curtains are replaced with the advancements of technological improvements in a form of projection surfaces. The researcher would like to discuss about the object size and vector orientations of stage and media imagery.

People are alienated from reality because of the size of the objects. If a cat was in normal cat size and pencil was in pencil size, the people was treated it as a real thing. A same psychological principle also causing the audience to alienated form screen objects. The virtual presenters of the screen objects are not in the regular scale, the audience immediately recognises the difference and disagree to accept it. The researcher advised that, possibly create projection world characters in the scale of real world objects. It will certainly enhance the believability of audience. The vector orientation of the media image objects has to be synchronised with stage actions and movement patterns. At the same time possibly the character movements of on stage has a need to be synchronized with the projection world actions. These symbiotic relationships will demises the spatial boundaries of real space and virtual space. Extension of the third dimension of projection surfaces towards on stage space can create a unified play world to perform seamless actions in between virtual and real space.