What is Projection Mapping?

Using High-Lumens Projectors for Greater Audience Engagement

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Executive Summary

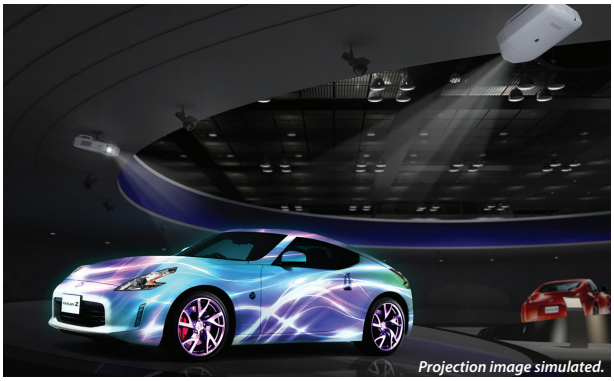
What is Projection Mapping?

Projection mapping is the projection of video, animation, and other colorful displays onto three-dimensional surfaces within venues, such as sports stadiums, night clubs, and concert halls. Once available for only big-budget productions, recent advances in projector technology deliver affordable, bright, high-quality, high-lumens projection that is within the reach of virtually any venue owner or manager.

Disney pioneered the use of projection on three dimensional objects in its Haunted Mansion display at Disneyland in 1969 [1]. Plaster busts of the "deceased" came to life, talking and singing to amazed onlookers. However, the high-cost of producing these effects kept the technology out of the mainstream until the advent of more affordable high-lumens projectors.

Unlike other light show technologies, projection mapping offers venues wide-spread creativity in using light in small or large environments. Driven by a new, affordable generation of projectors, mapping can completely cover not just flat walls and traditional projection screens but also irregular shapes, objects, and even entire building facades. These projectors are not your typical boardroom AV devices. Among the many capabilities of projection mapping are:

- Affordable, high definition projection of images, including video and animation
- Synchronization of projected images with high-quality sound
- Portable placement of projectors
- Stacking and linear linking of projectors for panoramic and large-scale, seamlessly blended images
- Innovative and easy-to-use software for creating and driving original projection mapping immersions



Projection mapping permeates nearly every public event, including trade shows and product introductions.

For nightclub owners, sports producers, and corporate/private event managers, projection mapping draws customers and entertains clients. For this reason, many Las Vegas nightclubs invest heavily in AV technology, including projection mapping, to pack their dance floors [2]. Now, with the latest generation of liquid crystal display (3LCD) projectors and off-the-shelf software, most clubs and other venues can deliver electrifying motion, immersion, and action into virtually any setting.

Projection mapping now permeates several public events—from product launches to concert halls. Wherever producers want to bring excitement to the next level, projection mapping plays a key role in emotionally engaging audiences, increasing the "wow" factor, and promoting greater attendance and attention.

Here's how projection mapping takes light to a whole new level:

Immersion: Projection can map an entire venue, enveloping the audience in an image and color-rich environment that transforms the ordinary into the extraordinary.

Impact: Story, flowing images and animation can create a greater emotional impact than static slide shows or music alone.

Motivation: Greater emotional impact leads to motivation—whether it's to get up and dance, consider a product purchase, or join the crowd in cheering on a sports team.

Setting tone: Light influences mood. Projection mapping can extend the mood-altering properties of light into a more focused and shared experience.

So where is projection mapping gaining the greatest traction? Anywhere that producers or owners want to motivate and energize their customers and audiences.

Part I:

Light Shapes Human Emotions

Recent neurological research has shown a direct correlation to light and hormonal activity in the human brain. Lighting, or lack of it, can actually trigger hormonal and other electrical impulses. Seasonal Affective Disorder (SAD) is perhaps the best known direct correlation to the absence of natural sunlight and emotional response [3]. Patients with SAD exhibit prolonged depression during the long, cloudy periods of winter.

More recent studies have found that blue light—especially the type emanated from electronic devices—can ward off sleep. The pineal gland in the brain normally releases melatonin, the brain's "sleeping pill," a few hours before a person's regular sleep pattern. Exposure to blue light, however, postpones or diminishes the brain's production of melatonin [4].

Light Excites

Meanwhile, studies at the University of Toronto have determined that bright lights intensify emotions. Participants in the study were exposed to various light levels when judging a variety of sensations—such as taste, word choices, and fictional characters. High light levels correlated to heightened responses.

Researchers concluded that marketers should make certain that light levels are high when literally spotlighting potentially emotional product purchases, such as jewelry. Dim light is relaxing—the perfect venue for a romantic dinner. Bright light excites the brain on many levels.

Attracted to the Light: From Lime to Projection

One of the first theatrical lights, which burned calcium oxide (quicklime).

It's no wonder then that we're attracted to light on many levels and that light has the proven potential to influence our mood and behavior. For these reasons, public venues have used lighting for great effect throughout the ages, from the first lime lights that illuminated early theatrical productions to the multimedia extravaganzas of popular music performances today.

Clubs in the Roaring 20s competed for customers with lavish dancefloors sporting light-diffracting chandeliers and mirrors. In the 1960s black lights and morphing, amoebae-shaped light shows pulsed to the sound of psychedelic music.

The 1970s brought *Saturday Night Fever* and a raft of nightclubs sporting disco balls and multicolored panel dancefloors that blinked to the beat of dance music.

> ***[Researchers] asked participants to rate a wide range of things—the spiciness of chicken-wing sauce, the aggressiveness of a fictional character, how attractive someone was, their feelings about specific words, and the taste of two juices—under different lighting conditions.***
>
> ***The results: under bright lights emotions are felt more intensely. In the brighter room participants wanted spicier chicken wing sauce, thought the fictional character was more aggressive, found the women more attractive, felt better about positive words and worse about negative words, and drank more of the "favourable" juice and less of the "unfavourable" juice***
>
> Source: University of Toronto News.

Flashing disco dance floor panels synchronized to music, circa 1970.

Laser light shows have become common in clubs, sports arenas, and especially concert halls.

Laser lights were next on stage in the late 1980s and 90s to excite crowds from dance clubs to sports arenas, piercing the air with crisscrossing, multi-colored beams. During the Super Bowl XLIV half-time show, *The Who* staged the largest outdoor concert production incorporating laser lights. That display was broadcast to over 100 million viewers. Since then, even smaller night clubs have installed laser lights to draw crowds [5].

Part II:

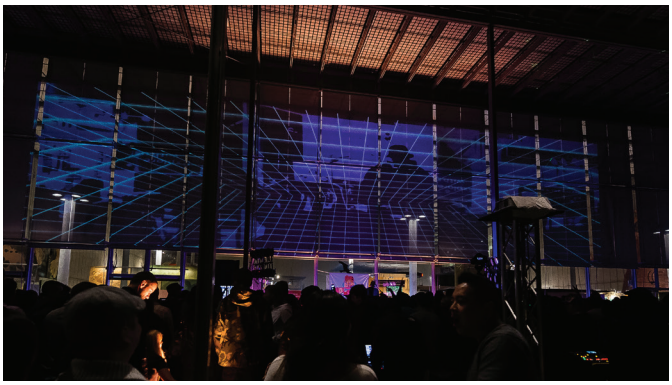
Light + Story = Greater Emotional Engagement

Projection mapping is a natural progression in audience engagement through the use of light. Lasers, dancefloors, and other lighting techniques still have their place. But projection mapping can paint entire visual stories and create immersive environments – delivering even additional impact combined with stagecraft lighting effects.

While we are all affected and energized by light, storytelling and imagery are also a captivating way to excite crowds, tell a product story, or bring an additional creative dimension to a concert performance. Stories and images provided by large, immersive projected displays add an energy and emotional connection.

On the Dance Floor and in the Concert Hall

Projection mapping has revolutionized dance floors, concerts, and live events. Carrie Underwood, during the 55th Grammy Awards, performed live as her dress, as a projection mapping surface, transformed into butterflies, roses, and other brilliant images as she sang "Two Black Cadillacs."



Panoramic videos added to backdrops, floors and even the ceilings of clubs and concert halls draw and engage audiences. The latest projectors easily sync to pre-recorded and live music through sound boards.
Courtesy of Mike Rosati, Mike Rosati Photography www.rosatiphotos.com.

"They can do a lot of amazing things with projectors these days," she said backstage, holding her trophy for best country solo performance. "We had a dress especially made. I said I should take that home and we can watch movies on it." Watch exerpts of her live projector-dress performance on YouTube: Technology behind the Couture.

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Morphing Public Spaces

Using multiple stacked and linked projectors, video artists can morph virtually any curved, cornered, or irregularly shaped surface, including entire building facades. These are the same techniques producers are using to enliven outdoor events, such as Lyon's "Fête des Lumières," or Festival of Lights, and the 2014 Sochi Olympics opening ceremonies.

"With stacked and linked projectors, even the largest outdoor structures can become brilliant and colorful mapping canvasses."

Energizing Fans and Audiences

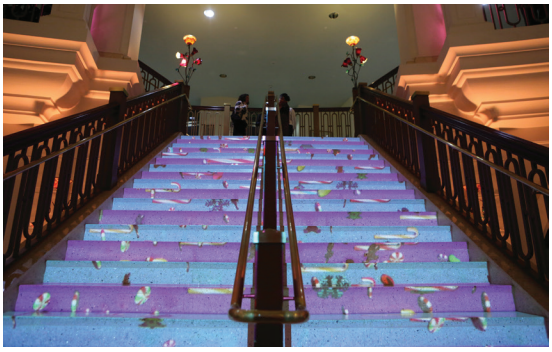
Projection mapping of stadiums boosts crowd energy during pregame and halftime shows. At Pensacola Christian College, producers there developed and staged a full-court projection mapping presentation for its basketball team for one-thirteenth of than the price quoted to them by professional production companies.

Left: The Pensacola Christian College basketball court before projection mapping.

Right: After mapping: Pre-game projection mapping pumps up the basketball crowd at Pensacola Christian College.

> ***"I heard more than one student say, 'I've seen this in the NBA, but I didn't expect it at PCC.' Nobody would expect anything like this from a small Christian college."***
>
> **– Caleb Keener, Electronics Producer, Pensacola Christian College.**

Events become unforgettable when projection mapping transforms existing, mundane structures into colorful animations. Here a cascade of candy and cookies "flow" down the stairs at a holiday charity event. [Courtesy of Danny Firpo CEO and Co-founder of All of it Now, LLC.]



Making Events Truly Eventful

From fund-raisers to product launches, projection mapping bathes familiar objects and environments in a whole new light. Animation, motion, and video draw greater attention, make events more memorable, and create a lasting, positive impression.

Part III:

Projection Mapping Essentials

Other than a creative event producer, clubs and other venues need the following to get started in projection mapping:

- Mapping software
- Computer hardware
- Multimedia content
- Projector
- Projection surface(s)

The good news is that prices have continued to fall for all the essential components for projection mapping while quality has improved, making mapping even more affordable than ever. Even reasonably priced laptop PCs and Macs have the power to render, host, and serve up video at a reasonable price-point.

Mapping Software

Look for software that will give you ample creative possibilities yet won't break the bank. The following packages fit the bill:

Resolume Arena
https://resolume.com/
(Approximately $500/license) Resolume Arena is a cross-platform (PC and Mac) software package that allows event producers and/or lighting directors to map video to any type of surface. Users can work with live HD video, pre-produced and saved content, or pipe complex renderings in real time to single or multiple projectors through a single interface. With its SMPTE Timecode, video can easily sync with your sound systems. One license covers both PCs and Macs. Spout, a PC software add-on, allows you to directly broadcast rendered video from any number of software rendering programs into Resolume Arena.

Madmapper
http://www.madmapper.com/
(Approximately $400/license) Madmapper is an Apple Mac-based projection mapping product that allows producers to use their existing Mac computers to project rendered video onto any surface. Madmapper uses the built-in capabilities of the Mac OS X Siphon framework to share video among a variety of Siphon-compatible graphics and video packages, enabling a great deal of creativity and control over how and what is projected. Input can be QuickTime files, images, or any content from compatible rendering programs.

Both Resolume Arena and Madmapper host lively blogs and user forums where VJs, lighting directors, event producers, and club operators trade tips, tricks, and support.

Computer Hardware

Whenever working with video, the better the graphics capabilities the better. Good gaming-quality PC laptops with capable graphics cards run around $1000-1500. A MacBook Pro with a graphics card upgrade will cost approximately $2500.

Multimedia Content

For beginning producers, it is wise to start out simple: shoot video straight on for the smoothest and least complex mapping. At first, stay away from complex canvasses or surfaces. Animation—both original and rented—can be mixed easily with the mapping software previously mentioned.

Mapping surfaces

Venue owners should take a survey of their site and determine the most appropriate surfaces for projection mapping, including the following:

- Walls, floors, and ceiling panels
- Built-in projection screens and panels already on stage
- Other surfaces such as stairs or overhangs

When mapping, producers should take into account the distance from the projector to the mapped surface, and where the projector should be mounted in the most effective and least intrusive manner. For example, performers on stage prefer that lights and lighting is projected behind them rather that at them: projectors can be mounted on overhead mounts behind the performers at a stage backdrop.

Projector

Epson Powerlite Pro G Series projector.

The projector is the heart and soul of any video immersion project. Remember the earlier tips: projection that is closer and aimed dead-on or nearly so produces the clearest, most brilliant images. Epson Powerlite® Pro G Series projectors with short-throw lenses range from $3000-$6000, depending on the lumens of the model. These projectors can be chained to provide panoramic, edge-blended displays, or stacked for wider and taller immersions over a greater surface.

Advance Projection Mapping: Panoramas and Curved Surfaces

With stacked or linked projectors, producers can map larger venues, including the entire façade of a building. Linked, side-by-side projectors with edge-blending capabilities can provide wider, more panoramic displays. Meanwhile, mapping software will allow the creative projection of images onto curved surfaces and "bend" images around corners. Using these techniques producers can map everything from large floor spaces to entire buildings.

Advanced Projection Mapping: Constructing 3D Surfaces

Beyond flat walls, screens, and ceilings of the venue, projection mapping producers can experiment with projection canvasses made of paper or cloth. One of the best canvasses, however, is a material called Coroplast®, a flexible, highly reflective plastic corrugated sheet

material, available for about $10 per 4'X8' sheet. When used with its specialized cutting cloth, Corocloth, more complex 3D surfaces (canvasses) can be easily modeled, such as snowflakes, pyramids, etc. Producers are bounded only by their imagination and modelling skills. Coroplast is waterproof, more durable and flame-retardant than other canvass materials, and can be held together with simple tape or Velcro, so it can be folded up and stored easily.

Before and after mapping a complex surface.

Part IV:

Zero Sticker Shock with Epson PowerLite Pro® G 3LCD Projectors

The Epson Pro G series of 3LCD projectors offer a wide range of lumens—up to 11,000, depending on the model, and feature:

- Image blending, layering, and mapping to nearly any surface
- Easy stacking and connection of multiple projectors
- HDBaseT, HD-SDI, and HDMI connectivity

The following is an estimate for an entry-level system with all the professional bells and whistles for a mid-sized venue:

Mapping projection software	$500
PC or Mac content driver	$1000-2500
Epson PRO G projector	$3000

The total is approximately $5000. That's less than most venues would pay for a few limited-use and inflexible flat panel TVs. Now even smaller and medium-sized venues can create immersive, eye-popping visuals using off-the-shelf software. Expand as needed. Move projection where it matters. Producers, VJs, and event managers can create Impactful visual experiences previously possible in only the most high-budget scenarios.

For more information on the complete line of Epson large venue projectors, visit www.epson.com.

About Epson

Seiko Epson Corporation is a global imaging and innovation leader that is dedicated to exceeding the vision of customers worldwide through its compact, energy-saving, high-precision technologies, with a product lineup ranging from printers and 3LCD projectors for business and the home, to electronic and crystal devices. Led by the Japan-based Seiko Epson Corporation, the Epson Group comprises over 70,000 employees in 108 companies around the world, and is proud of its ongoing contributions to the global environment and the communities in which it operates.

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