

Digital Imaging in Singapore

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Abstract - Contemporary painting is not taking advantage of integrating traditional painting methods and art materials with available visual effects industry software and digital devices to create high impact artwork. Usually outcome of digital artwork is a dull digital print that lacks physical presence.

Implementing the latest technologies in image creation this research project will attempt to document emotive spaces and impressions of Singapore to build illusions of three-dimensional creative vision; moving forward to using this imagery as a resource for more creative work that will comprised of an exploration of manipulated surfaces and mixed media structures in site specific settings.

Keywords: Abstract expressionism, 3D Pre-Visualization, Art and Technology, Digital Animation, Stereoscopy, Maya Paint Effects.

1 INTRODUCTION

The objective of this project is to further elaborate on current research¹ undertaken at School of Art Design and Media exploring digital and traditional image making methodology and generating large scale imagery using existing visual effect tools for integrating them in site specific settings around Singapore. With an emphasis on exploring the limitations of the digital medium, rich beautiful visuals are created by combining algorithmic paint strokes and abstract expressionism.

We seek to bring these artworks into internal and external spaces by integrating them with multi-dimensional physical structures. The aim of purposing the artwork in large scale constructs transforms the existing space into another, creating a sense of awe and to engulf the viewer in a totally new environment, with different imagery generating different feelings, emotions and thoughts through colours, form, material and construct of these artworks. Viewers should not be limited to experiencing the artwork from a distance, be it a canvas on a gallery wall or an image on the computer screen. Rather, the viewer interacts with the manipulated environment which becomes the art itself.

¹ Conradi Chavez, Ina Academic Research Fund (AcRF) TIER 1 Grant Number: RG105/07 Project Title: *Digital Imaging in Singapore: The Integration of digital imagery with traditional art media and techniques for site specific architectural, urban and landscape settings of Singapore*

This fusion of Art and Technology is visualized through the realistic reconstruction of 3-Dimensional sets and photo space manipulation. Actual construction of large scale physical structures can prove to be extremely costly, hence the importance of digital pre-visualizations as a precursor to actual construction. From which, the flexibility of the digital medium allows us to accurately explore multiple versions and variations of space/artwork/lighting combinations. Other than large scale structures, the digital imagery are repurposed and conceptualized in different possible mediums such as digital animation and stereoscopic 3D images.

The results are realistic 3D visualizations that depict the extent and possibilities in which such digitally created imageries can be dynamically employed within the existing environments around Singapore and repurposed in different digital mediums with the intention of using technology to push traditional artwork beyond its norm into a sea of possibilities.

2 AIMS / OBJECTIVES

This project aims to explore, develop, document and prepare the creative integration of digitally generated abstract artworks in both internal and external spaces around Singapore. My role focuses more on the task of developing 3D pre-visualizations to realistically depict the relationship between the art and space.

3 LITERATURE REVIEW / BACKGROUND

Works and structures made by artists/architects provided the artistic and technical inspiration to this research. A selected few are noted here.

Richard Serra – Serra often constructs site-specific installations, frequently on a scale that dwarfs the observer. An exploration on his works shows us that the construction and display of extremely large and heavy constructs is very much possible. Steel is usually his choice of material, bending and warping them to form structures that stretch several tall meters and weighing up to hundreds of tons. *The Matter*



Figure 1: Richard Serra, *The Matter of Time*, 2005

of Time (fig.1) and the Tilted Arc are among this works that provided inspiration for structural art forms in this research. Richard Serra's approach also supplements our idea of oneness between art and environment. As quoted from the artist, "My sculptures are not objects for the viewer to stop and stare at. The historical purpose of placing sculpture on a pedestal was to establish a separation between the sculpture and the viewer. I am interested in creating a behavioural space in which the viewer interacts with the sculpture in its context."²

Christo and Jeanne Claude

Their works is visually impressive as a result of its scale, one of which is of great interest is *Running Fence* (fig.2), made from a large stretch of fabric that that extends 5.5 meters high, and 39.4 kilometres long.³ Fabric is the material of choice in many of their constructs and experimented with both polypropylene and nylon. It opens the possibility of large scale structures constructed with fabric, which became an option in this research.



Figure 2: Christo, *Running Fence*, 1976

Jennifer Steinkamp - Steinkamp is an installation artist who works with video and new media in order to explore ideas about architectural space, motion, and perception. A look into her works shows her trend of using abstract digital projection to transform the architectural space around, providing the viewer with a unique experience. The installations are not merely visual but she works with musicians to produce audio that sync with the images, to provide a full sensorial experience. Her style and approach was part of the inspiration in our production of digital animation 'Dreams' (pg4).



Figure 3: Jennifer Steinkamp, *Information About Comets*, 1996

4 METHODOLOGY

The process of creation, implementation and pre-visualization of the artworks in different spaces were made using similar methodologies. Hence I shall refer to *Elixir of Redness in ADM gallery* as an example to illustrate the development process. This process can be divided into 3 main portions: **Artwork creation**, **Pre-visualization** and **Preparation for print**.

4.1 Artwork creation – Maya Paint Effects

The various artworks were generated using Maya⁴ Paint Effects⁵ with the use of custom brushes and 2-Dimensional textures. With a wide array of algorithmic values available the possibilities and variety of image creation is limitless. Various colours, shape and form, depth and composition can be manipulated within Maya to generate different kinds of unique imagery.

Original Artwork *Elixir of Redness from the Natural Systems Series* (fig.4) was created by Asst Prof Ina Conradi Chavez. This is based on a Paint Effects preset brush, "gloppy.mel" which was re-textured using a custom image and with multiple adjustments made to the brush values to change its appearance. The resulting custom brush is used to "paint" in 3D space and rearranged to create an aesthetic composition.



Figure 4: *Elixir of Redness from Natural Systems Series*

Using the existing *Elixir of Redness* Maya file, my task was to compose an image for the purpose of an art installation in NTU's ADM gallery. For this task, I went with 2 layers of panoramic composition, suitable for the length and width of the gallery. For *Elixir of Redness front* (fig.5), the brushes were taken apart and rearranged in 3D space to simulate an illusion of depth. The strokes that were made to appear further away was downscaled and the closer ones where enlarged. A second, more neutral composition, *Elixir of Redness back* (fig.6), was created by cropping the lower third portion of the original composition.



Figure 5: *Elixir of Redness front*

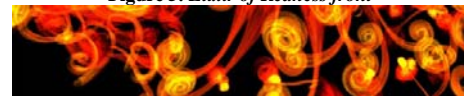


Figure 6: *Elixir of Redness back*

² Richard Serra, Sculpture
Source: MoMA, No. 38 (Winter, 1986), p. 5

³ Christo and Jeanne-Claude. *Running Fence*
<<http://christojeanneclaude.net/rf.shtml>>

⁴ Autodesk® Maya® software is an integrated 3D modelling, animation, visual effects, and rendering solution. usa.autodesk.com

⁵ Maya Paint Effects provides paint technology for creating natural detail on 2D images (including textures) or 3D objects attached to polygonal and NURBS surfaces. usa.autodesk.com

During the working process, low resolution renders have to be made periodically to observe the progress and changes made to the brushes as it cannot be fully previewed real time within Maya's viewport (fig.7). The strokes appears in the forms of lines which serve as a reference of its position and trajectory as opposed to an accurate representation of the final product.

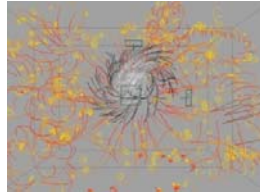


Figure 7: Elixir of Redness as seen from Maya's Viewport

Due to software limitations, images generated with Maya paint effects is incompatible with Mental Ray renderer, and hence cannot benefit from lighting solutions such as Global Illumination⁶ & Final gathering⁸. Trials have been done to convert paint effects generation into polygonal mesh to allow mental ray rendering, this process however leads to a loss of its original attributes and with render time increasing several fold while the output pales in comparison to the original. Thus at this point of time, this method is deemed impractical.

4.2 Pre-visualization – Maya, Photoshop

Pre-visualization of artwork in both internal and external spaces is explored through the construction of 3-dimensional sets and photo space manipulation. Realistic pre-visualizations are achieved with 3D package Maya and integrated renderer Mental Ray⁶, utilizing advanced lighting solutions and materials to achieve close to life renders.

Accurate Spatial reconstruction of the selected locale is essential in aiding in planning and visualization of the artwork in space. The space/artwork relationship has to pass both aesthetic and practical considerations. Prior to building the space in 3D, floor plans (fig.9) were obtained to provide accurate data and detailed measurements and photographs as reference to ensure precise architectural reconstruction. Various materials such as the parquet flooring, stone pillars, marble tiles are also gathered via photographs. (fig.8)



Figure 8: Photographic references of ADM Gallery⁷

Based on the collected references and floor plans, a basic preliminary model is constructed in Maya using real world measurements and units while a default light set up is used to temporarily illuminate the scene.

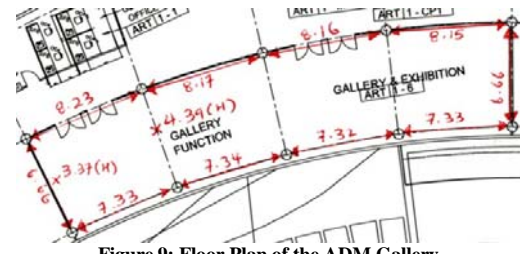


Figure 9: Floor Plan of the ADM Gallery

Following which, the secondary models such as the light fixtures, air conditioning ducts and glass panels are modelled and duplicated as needed within the scene. Polygon count is kept at an optimum to ensure a good quality/render speed balance.

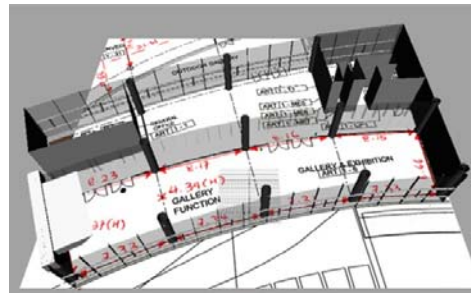


Figure 10: Preliminary Model

After the modelling phase, surface textures were created in Adobe Photoshop based on photographic references. These textures are then mapped onto the 3D surfaces via Mental Ray specific shader, *MIA_material* (*Mental Images Architectural*) a hard surface shader which interaction with light based on real physics.⁸ The material is tweaked to provide similar properties to their real life counterparts, such as the glossiness, reflectivity and surface roughness of the material. For example, matte surfaces such as the painted gallery walls would have high diffuse, low specular and glossiness values, while the metallic surfaces would have higher reflectivity and specular to reflect its surroundings. The shader for the glass panels is adjusted to a refraction value of 1.5, to simulate physical properties of real glass.

Simultaneously, a lighting setup utilizing Maya's Mental Ray Renderer is used to recreate real world lighting and to correctly portray the properties of the materials within the scene. Two large area lights that generate Global illumination⁹ photons are placed at the spans of both stretch windows to simulate the light rays during daytime (fig.11). Ray tracing¹⁰ is used to calculate the path of light rays to create realistic shadows, while Final

⁸ More information at TOI-pedia http://toi.bk.tudelft.nl/toi-pedia/index.php?title=Rendering_Mental_Ray:_mia_material

⁹ **Global illumination** takes into account not only the subsequent cases in which light rays from the same source are reflected by other surfaces in the scene, whether reflective or non reflective. http://en.wikipedia.org/wiki/Global_illumination

¹⁰ **Ray tracing** is a method for calculating the path of light waves or particles through a system. [http://en.wikipedia.org/wiki/Ray_tracing_\(graphics\)>](http://en.wikipedia.org/wiki/Ray_tracing_(graphics)>)

⁶ Mental ray® renderer is a high-performance rendering engine with advanced photorealistic lighting features. usa.autodesk.com

⁷ Photographs were taken by Quek Jia Liang

gathering¹¹ is thrown in the scene to simulate the effects of occlusion.

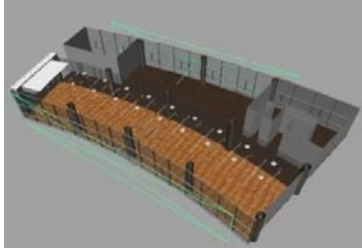


Figure 11: Light setup – Area lights are highlighted in green



Figure 12 & 13: Progress of the lighting.

Based on the preliminary render, lighting values such as intensity, light samples, shadow rays, GI photons, is adjusted as required and subsequently rendered again. For example, if the surface displays graininess, the light samples increased to reduce the grain and smoothen the surface. Light-spots on the other hand are usually characteristics of a low number of global illumination photons. Increasing these values however, would lead to a longer render time and hence an optimum quality/speed balance has to be achieved. This process of checking and adjusting is repeated several times until the desired result is achieved.

From early sketches, the idea was for *Elixir of Redness* to float in the gallery space with an illusion of its large saturated strokes swirling in space. In order to eliminate image background, alpha channels created in Photoshop was used to create a transparency mask in Maya. *Elixir of Redness front* and *Elixir of Redness back* is split into 7 panels each for a more realistic and manageable size at such a large scale. The panels are then imported into the Maya scene and mapped onto a tempered glass material measuring 160cm x 227cm. These are arranged in 2 rows along the length of the gallery with overlapping to create a sense of depth. Following which, minor lighting adjustments are made to compensate for the addition to the scene. For example, the ray trace depth is increased as there is more transparent material for light to pass through.

4.3 Preparation for print

With a single panel at 160cm x 227cm, at 300dpi the resolution would equate to 18899 x 26780 pixels. A normal method of rendering was not possible due to its extreme size, would exceed the limitations of Maya. Thus a batch render script is created in notepad to

¹¹ Final gathering add realism to local reflection models by taking into account attenuation of light due to occlusion.
<http://en.wikipedia.org/wiki/Ambient_occlusion>

instruct Maya to slice up the render into multiple smaller tiles; these individual tiles would then be composited with Adobe Photoshop later. However, due to unknown reasons the image tiles would render out pure black. After several trials we experimented with a render management software, *Render pal*, which was could slice and render the images successfully from which we could composite in Photoshop. During rendering, another issue became apparent. At a large scale, pixilation (*fig.14*) on the brush became visible. Attempts to solve this issue took several days as it is uncertain what was the cause of the pixilation. Rechecking the brush values and the texture yield no clues. It is with a stroke of luck that an extremely slight colour variation, not detectable by the human eye (difference of k=1) was revealed in the texture's alpha channel when selected with Photoshop's *Magic wand* selection tool. This pixilation corresponds to the pixilation also seen on the *Elixir of Redness* and was fixed by changing the K:1 values to K:0 (pure white).

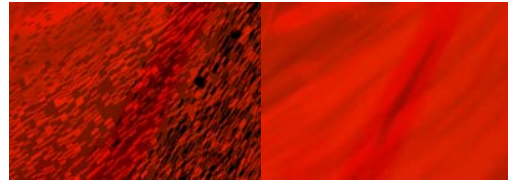


Figure 14: Close up Original (left) Fixed (right)

5 RESULTS

5.1 Digital Pre-Visualizations (In Chronological order)

ADM Gallery

Elixir of Redness in NTU's ADM Gallery was among the first pre-visualization proposals, from which a few possible variations were experimented with. *Elixir of Gold*, from the same series of works on 'Natural Systems', was purposed as a possible alternative for the gallery space (*fig.16*). Plans for actual construction at the time of the proposal remained indeterminate due to the gallery's lack of proper ceiling supports to suspend the panels.



Figure 15: *Natural Systems: Elixir of Redness* 3D rendering
Fourteen panels, material tempered glass



Figure 16: *Natural Systems: Elixir of Gold*, 3D rendering

Inspired by Richard Serra's *The Matter of Time* and the *Tilted Arc*, an ambitious idea was visualized using 14 large scale free standing panels (2.27m x 1.6m each) placed in an open public space in Singapore. Due to the complexity of the environment, actual panoramic photographs¹² were used instead, with 3D structures composited over to match the lighting and angle.



Figure 17: *Natural Systems: Elixir of Redness*; Tempered glass; size variable, 14 panels; each panel W 160 cm X H 227cm. Manufacturing: exposed U-channel with *conceal* ground mounting.

Post Museum Exhibition "Internal External"

This is an example of a pre-visualization image created prior to an actual exhibition "Internal External" at Post-museum during 13 Feb – 8 Mar 2009. The exhibition consists of 3 sets of artwork in 9 panels @ 2.4m x 1.2m. Many variations were made during the pre-visualization stage before arriving at the final layout (fig.18) which was referenced for the actual exhibit (fig.19).



Figure 18: *Internal External*, Digital prototype



Figure 19: (Actual exhibition photograph) Feb 13 2009
Media: digitally generated still images on UV VUTEK® QS2000 back lit polycarbonate; installation composition's space size variable, size of each panel 227cm x 100 cm. Total nine panels

¹² Photographs were taken by Quek Jia Liang.

Esplanade



Figure 20: A 3D visualization for exhibit *Elixir of Redness*, Concourse Space in Esplanade. Translucent fabric was substrate proposed to create a sense of warmth and depth through layering.

GALLERYGALLERY EX (Japan)

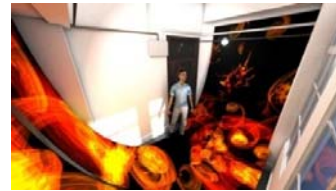


Figure 21: Proposal for exhibit in Japan at Kyoto International Contemporary Textile Art Center, 18 Jul - 1 Aug 2009

5.2 Digital Animation

Inspired by an earlier collaborative work titled "Boundaries", "Dreams" is a work that combines the abstract imagery with experimental animation. The result is kaleidoscopic journey into an exploration of both image and sound. It was also screened as part of the *Internal External* exhibition. Both a DVD and full HD version of this animation was produced.

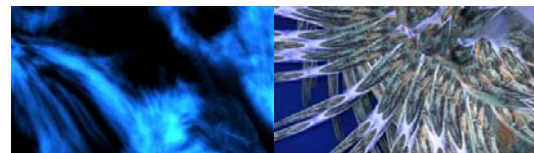


Figure 22: Screen captures from "Dreams" 1080p25

5.3 Stereoscopic Imagery (experimental)

Small scale tests have been done to develop stereoscopic¹³ images using the existing artworks from the *Natural System Series*.

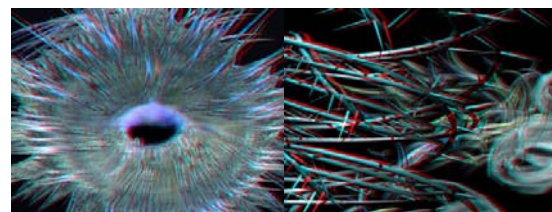


Figure 23: Stereoscopic *Natural Systems*

¹³ Stereoscopy, stereoscopic imaging or 3-D (three-dimensional) imaging is any technique capable of recording three-dimensional visual information or creating the illusion of depth in an image.

6 DISCUSSION

The paint effects creations have shown the flexibility of digital art which can be purposed in different formats, compositions, medium. By taking the same artworks and repurposing them, we have successfully created animation, physical installations and stereoscopic imagery. 3D pre-visualizations constructed with Maya has served useful in proposals not only because they visual appealing but conveys the idea much more accurately than any sketch or technical drawing can. It appeals to the casual viewer yet remains technically accurate, good enough for architects or engineers. The development of accurate spatial reconstruction in 3D has proved to be very useful, aiding in the drafting, planning, proposal and construction stages.

However, the use of 3D rendered visualizations has its limitations. Although structurally accurate, some discrepancies of lighting and material surfaces can be observed. This is due to the fact that there are countless physical factors in real life that is difficult to completely emulate in a digital setting. In certain cases, where we pre-visualize complex exterior settings, the method of using a photograph with the pre-rendered artwork composed over it is preferred as it would be too complex to accurately recreate a large scale outdoor scene in full 3D (fig.17).

From our results thus far, these digital reconstructions have proved more than sufficient in projecting an image of the art and space. The use of digital reconstruction of existing space opens many possibilities to its uses. It could be integrated as real-time web gallery, 3Dimensional tour maps, or even implemented within an interactive video game environment. 3D stereoscopic yielded positive results that opened more ideas, such as large scale stereoscopic art in spaces where printed artworks goes beyond flat images to create the illusion of 3D. It could also be implemented within experimental animation to create a 3D film.

7 CONCLUSIONS

This research has certainly solidified the use of digital pre-visualizations, accomplishing a large number of images within a relatively short time frame. Delving into experimental animation and stereoscopic images has also generated positive results. From an idea, to a render, to a successful exhibition, we have managed to achieve the original aims of the research. To implement large scale images in public settings, transforming and merging both art and space in order to create a unique environment for the viewers and participants. Many ideas yet remain as visuals due to the limited time and resources. However, I am confident of the viability of bringing all these pre-visualizations to life.

Still, true interactivity with the audience remains limited as these artworks still remains as static structures or linear animation. What lies ahead is the potential to

transform these artworks as truly interactive pieces that interface and interact with the viewers in real time.

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