

holes in architecture

by

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This is to certify that the Master's thesis of

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iv
ABSTRACT	v
INTRODUCTION	1
COSOMOLOGY WITHIN ARCHITECTURE	5
ARCHITECTURAL ANIMATION	7
PROJECTIVE GEOMETRY WITHIN A POINT OF VIEW	9
CONCLUSION	11
APPENDIX: DESIGN COMPONENT: ARCHITECTURE, ANIMATION, IMAGES,WORDS	13
BIBILOGRAPHY	14
Web sites	15
Software	16

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ABSTRACT

This thesis begins with two 18th century architectural projects by Giambattista Piranesi : the *Pianta di ampio magnifico collegio*, a plan of an imaginary center of learning, and *I Carceri* (The Prisons) a series of etchings depicting interior architectural spaces that have been referred to as dark, fantastic, and the product of a madman by some, of genius by others. Proceeding from these projects as vehicles for exploration and invention, the thesis, through a series of graphic investigations, addresses the notions of time and space in architecture. The investigation proceeds through seven layers of such ideas, which are interwoven through the process and residue of the architectural project; but which are dissected and presented as isolated from one another in the written portion of the thesis. The layers are: cosmology (and architecture's traditional relation to it), projective geometry, contemporary digital animation, the nature of surface in architecture, and the constructed nature of history as it encounters the construction of architecture itself. The resulting project is represented by a combination of traditional architectural drawing and modeling along with digital modeling through animation software (Maya).

INTRODUCTION

This thesis seeks to explore new ways in which to travel, view, understand, and experience space in a constructed virtual world. (The computer “walk-through” and “fly-by,” virtual journeys through simulated physical buildings represented in cyberspace, are obsolete.) The thesis is built upon an interweaving of several layers or strands of thought which, for purposes of clarity, will be considered separately in this text.

The project begins with a consideration of the work of the eighteenth century Italian architect Giovanni Battista Piranesi, best known for his presentations of ancient Rome through a series of detailed etchings in the *Vedute di Roma* (Views of Rome). This thesis looks at Piranesi’s *Pianta di ampio magnifico Collegio* of 1742 and the set of fantastic etchings in two states separated by several years, *I Carceri* (The Prisons).

Piranesi was accused by the *Academie de France* of not being capable of producing a proper plan and replied with a drawing, the *Collegio*. This 2-dimensional plan is a section constructed around a nucleus, which is the center, bodies of knowledge and dream like structures that begin to reveal passages within and to another universes. It depicts an ideal place of learning in which all bodies of knowledge are taught within the same building; it is a physical emblem of interdisciplinarity.

The centrality of the composition, with its successive and independent rings, projects outward from the composition, with its successive and independent rings projects outward from the circular space of the grand staircase subdivided into eight flights, which, among the organisms “that are in search of their own role” within the concentric structures, is, significantly, one of the mirror spaces.¹

The *Carceri* represent another Piranesian world. The first stage set of twelve plates, dating from 1749 to 1760, depict a series of three-dimensional prison-like spaces. These plates refer to structure, ornament, interior and exterior, materiality,

¹ Tafuri, Manfredo. *The Sphere and the Labyrinth Avant-Gardes and Architecture from Piranesi to the 1970s*. Translated by Pellgrino d’ Acierno and Robert Connolly. TheMIT Press: Cambridge, Massachusetts London, England. 1990.

and most especially dizzying spaces and fantastic multiple perspectives in which humans are dwarfed by the spaces they inhabit.

What first strikes us is that the *Prisons* bear very little resemblance to traditional images of a prison. In every age, the nightmare of incarceration chiefly consists in confinement, in being shut up in a dungeon which already has the dimensions of a grave. *Tu in questa tomba...* It also involves physical misery, ordure, vermin, rats swarming in the darkness—all the hideous décor of the *in-space* and the *oubliette* which so obsessed the Romantic imagination. To these lugubriously permanent characteristics, our age will add the cold functionalism of its model prisons, the sinister banality of concentration-camp barracks which conceal the modern forms of torture and death, the mocking hygiene of the shower rooms of Belsen, the image of human crowds penned in the abattoirs of the first half of the twentieth century and in those the future holds in store.²

The fourteen-second stage plates comprise etched-over versions of the twelve first stage plates plus two additional etchings. The second stage etchings were produced between 1761 and 1778. The second stage, *Carceri* suggests brutality and pain through torturous devices; gears, chains, spikes and ropes. The second stage *Carceri* is the focus of this thesis. These above and below grade spaces are also fabricated on a series of dream logic structures where space, time, structure, perspective and questions of point-of-view begin to emerge.

Everything in these *Prisons* suggests that Piranesi had attempted in a lucid state to rationalize images which had perhaps lost the manifest meaning they possessed in his delirium, to justify their title by adding to these transcendental dungeons and dizzying torture chambers some unimpeachable detail of real dungeons and actual tortures—in short, to replace on the level of concepts and comprehensible emotions of the waking state, darker but also less unexpected, what had initially been the prodigious hallucination of an architect, the dream of a builder drunk on pure volumes, pure space.³

The *Carceri* etchings represent a three-dimensional space with plans and sections for us to imagine, while the *Collegio* is the reverse: a two-dimensional representation of what we would see if the building left for us to imagine were sliced in a direction parallel to the ground surface.

A close examination reveals that the “building” represented by this single drawing is not an enclosure of stone and wood and plaster but rather a much more intricate and difficult construction.⁴

² Yourcenar, Marguerite. *The Dark Brain of Piranesi*. Translated by Richard Howard in Collaboration with the Author. Farrar Straus Giroux: New York. 1980. p108-109

³ Yourcenar, Marguerite. *The Dark Brain of Piranesi*. Translated by Richard Howard in Collaboration with the Author. Farrar Straus Giroux: New York. 1980

Bloomer, Jennifer. *Architecture and Text: Scrypts of Joyce and Piranesi*. Yale University Press. New Haven and London. 1993.

The plan encompasses an architectural program of what we might consider to be a boarding school (M), living quarters (Q), library (N), galleries (O), theater (S), church (G), horse stable (R) and other associated spaces to teach and learn.

- G. *Church with sacristy and bell towers*
- M. *The high school*
- N. *Library*
- O. *One picture gallery or gallery*
- R. *Riding school with horse stalls*
- S. *Theater with dressing rooms and rooms for fencing, for dancing, and other things.*⁵

Within this vast body of knowledge and porticoes with orders of Corinthian columns, is a place that is not yet defined or explored. It is a space that is sometimes considered as dead space or void. These voids could be considered as secret rooms or passageways into the plan or possibly a fourth dimension. This space is typically a representation that is defined by a technique architects call POCHÉ'. What connects these two architecturally defined universes, besides the possibility that they might be construed as a representation of the same building, is the *poché*. *Poché* refers to the darkened parts of an architectural plan or section, which represent solid material cut through by the imaginary slicing plane; thus columns and walls are represented through *poché*. Poche' is defined as contain, hold, embody, carry, or a *semantic void created by an excess of visual noise*⁶ and my passageway out of this drawing. By connecting the two projects by *poché*, it serves as a viewing device from one to another and through this thesis. Through the medium of the *poché* will be explored issues of travel, surfaces, viewpoints, points of view, and architectural projection. These dark spaces, or holes, are the site of my investigations between these two pieces of work, the *Pianta di ampio magnifico Collegio* and *Carceri*.

⁵ Partial translation of Collegio text done by Jennifer Bloomer Iowa State University.

⁶Tafari, Manfredo. *The Sphere and the Labyrinth Avant-Gardes and Architecture from Piranesi to the 1970s*. Translated by Pellgrino d' Acierno and Robert Connolly. The MIT Press: Cambridge, Massachusetts London, England. 1990.

Within these wormhole like spaces, space and time become diffused and different passages and interpretations take shape.

COSOMOLOGY WITHIN ARCHITECTURE

The making of architecture is an ancient tradition. In most cultures, it is more than simply the construction of shelter for humans; architecture is that activity of humans, which reflects and celebrates our relationship with the universe, as it is known. In ancient cultures in Africa and Central America, for example, architecture was painstakingly built as a connection between life on earth and the world of the gods.

Architects of the Italian Renaissance sought detailed and definite connections between the work of God, as they understood it – the universe – and the highest work of God's best creature. As God was to the universe, so man was to architecture. They theorized the key to this connection in mathematics: in the numbers of proportions found in Greek musical harmonies, which seemed to reflect proportions found in nature, an idea first remarked by Plato many centuries before. From this body of thought comes the idea of the "golden section," a ratio derived geometrically, but which is found throughout the natural world. The golden section, as well as other ideas based on the idea of the creator-architect as a reflection of God-the-creator, continues to be used by designers to this day. The work of architects such as Guarini and Borromini reflects the baroque obsession to synthesize perceived phenomena and a geometrical theory.

Newtonian physics influenced the architecture of the eighteenth and nineteenth centuries, and Einsteinian physics played a large role in the development of the theories of early-to-mid twentieth century architecture. Fractal theory and chaos theory has played their parts in contributing to architectural discourse in the late twentieth century.

This thesis project seeks to explore the possibility of a relation between certain ideas of late twentieth century theoretical physics and contemporary digital architecture. The physicist Lee Smolin's idea of the universe as a self-organizing system, much like a large city, suggests the complex, mutating possibilities of a digital architecture, for example. Brian Green's topological model of the wormhole, "

a tube-like region of space connecting one region of the universe to the another," is compelling for a contemporary architecture that, because of the capabilities of the computer, no longer relies on Euclidean geometry as a primary tool of representation and invention.

ARCHITECTURAL ANIMATION

The idea of an animated architecture, an architecture in motion, historically has been limited: to parts of buildings, such as the wheels of mills and industry; to building/human combinations, such as the "tortoise" war machine described in 44 AD by Vitruvius in his *Ten Books on Architecture*; and to the machine-inspired architecture of the modern movements at the beginning of the twentieth century. With the advent of the computer as a design tool, the architectural "fly through," which presents a design as if one were flying through the building on a magic carpet, came to exemplify the relation of architecture and animation. Formalist experimentation in design in the late twentieth century has focused on a variety of approaches. These include such buildings as: Frank Gehry's Guggenheim Museum in Bilbao, Spain, with its blend of form, material, and surface suggesting fluidity; the experiments of Greg Lynn FORM, in which building designs are invented out of the frozen animation of other forms (a use of animation software to produce forms shaped like and called "blobs," but which differ from conventional buildings only in form); and Stephen Perrella's notion of "hypersurface architecture," This is the combination of both architectural material and images projected upon the architectural surface (or membrane, or substrate) so that neither the materiality of the building surface nor the image projected on it is dominant.

Hypersurface is a reconsideration of often dichotomous relationships existing in the environment. These binaries include: image/form, inside/outside, structure/ornament, ground/edifice and so forth; not as separate and hence static entities but as transversally-constituted fabrics of planes of immanence. Hypersurfaces are generated in the problematic relationships that occur when binary categories of the Real and the Unreal, for instance, are insufficient today because each is infused within the other.⁷

In hypersurface, the surface is animated through light, shadow, material, and texture. In much the same way as a Baroque surface is animated. This idea brings

⁷ Perrella, Stephen. *Hypersurface Theory: Architecture <> Culture*, Architectural Design, VCH Publishers New York Inc.

to question, the technologies and ideas of the seventeen-century architecture's and the present.

PROJECTIVE GEOMETRY WITHIN A POINT OF VIEW

Project geometry was noticed in early renaissance paintings, where renaissance painters began to recognize that the eye isn't just distorting things in random chaotic ways; but in fact parallel lines do intersect and circles can become ellipses due to mathematics and computer animation software. This geometry of perception is considered to be projective geometry.

The key realization in the development of projective geometry was that while figures deform according to the point of view, lines of sight do not deform. So rigidity is transferred from objects to the medium of their transmission, which is most easily imagined as light.⁸

In this thesis projective geometry is base around the retina, image and depth of the transformation. There are two types of homographic transformations that make up projective geometry; projections and sections of circles, lines and points. In comparison to Euclidean geometry, which has been describe as the geometry of touch; projective geometry would be describe as the geometry of vision. The optical quality of the retina is based on near and far, where the ideas of proximate vision and distant vision are ways of seeing and viewing within a point of view. Proximate vision is the organization of the whole field of vision surrounded by a cosmic chorus, where as distant vision is less passive and free flowing to let the eye travel along a line of vision, i.e the horizon. Where everything becomes background and the ocular field is homogeneous, which makes our sense of vision blurry.

The result is that what we see at a distance is hollow space as such. The content of perception is not strictly the surface in which the hollow space terminates, but rather the whole hollow space itself, from the eyeball to the wall or the horizon.⁹

It must be noticed that the development of projective geometry was in the field of mathematics where the idea of perspective and projections started to

⁸ Evans, Robin. *The Project Cast Architecture and Its Three Geometries*. The MIT Press:Cambridge, Massachusetts. London, England. 1995

⁹ Ortega Y Gasset, Jose'. *The Dehumanization of Art and Other Essays of Art Culture, and Literature*. Princeton University Press: Princeton, New Jersey. 1986.

emerge. This concept of projective geometry helped to change the *point of view* or the way of looking at things mentally, which allowed perspective to be viewed in terms of solid geometry. Henri Poincare' want to *develop the projective geometry as an automomous discipline, independent of algebraic analysis*.¹⁰ Coming to find out the projective geometry would benefit from algebraic methods, which is applied to Euclidean space and with cartesian geometry and the development of computer software, ie, CAD and animation. The idea of the computer and its X,Y and Z allows us to forget about projective geometry because it is already applied.

¹⁰ Carche, Bernard. *Extended Play*. Accessed: 2000, May 27 <http://www.objectile.com>.

CONCLUSION

This body of work is not about a final product or an image, it about research and to think critically about process, design, and architecture. I feel that this project started out being a misinterpretation of extruded models of the Collegio to help me understand what these virtual spaces could be, but coming to find that the Collegio is an endless structure of a theoretically magnification, building opun mathematics, cosmological, architectural animation, and knowledge.

APPENDIX

DESIGN COMPONENT: ARCHITECTURE, ANIMATIONS, IMAGES, WORDS

This portion of the thesis should be viewed with a computer.

Best viewed at 1280x960 pixels

To use this CD-ROM, double click on the "enter.htm" or launch your web browser and open "enter.htm, from the FILE pulldown menu within your browser.

For this CD-ROM to work properly, you need the must current versions of
Netscape
Internet Explore
Apple Quick time
Shock Wave plug-ins for Netscape and Internet explore

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Thomas, Nick C. "Basics." *Projective Geometry*. Accessed: 1999, March
<http://www.anth.org.uk/nct.path.htm>

Thomas, Nick C. "Basics." *Projective Geometry*. Accessed: 1999, March
<http://www.anth.org.uk/nct.counter.htm>

Software

Adobe Illustrator 8.0 (pc and mac)
Adobe Photoshope 5.0 (pc and mac)
Adobe Premiere 5.1 (pc and mac)
Alias|wavefront Fusion 1.1 (pc)
Alias|wavefront Maya 3.0 (pc)
Macromedia Director 7.0 (pc)
Macromedia Dreamweaver 3.0 (pc and mac)
Macromedia Fireworks 3.0 (pc)
Macromedia Flash 5.0 (pc)
Microsoft Word 2000 (pc)
Quicktime QuickTime VR Authoring Studio (mac)