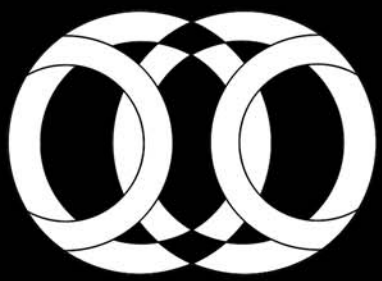

Corcoran College of Art and Design

10 December 2008

WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY DARLENE M. MOLNAR ENTILED POP-UP STUDIO: UNFOLDING A DWELLING BE ACCEPTED AS FULFILLING, IN PART, REQUIREMENTS FOR THE DEGREE OF MASTER OF ART IN INTERIOR DESIGN.

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POP-UP STUDIO
UNFOLDING A DWELLING

Darlene M. Molnar, LEED AP
Master of Arts/Interior Design

In partial fulfillment of the requirements
For the Degree of Master of Art
Corcoran College of Art and Design
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This thesis introduces the Pop-Up Studio, an unfoldable dwelling derived through the examination of conceptual spaces as instruments of architectural progress.

ABSTRACT

This thesis introduces the Pop-Up Studio, an unfoldable dwelling derived through the examination of conceptual spaces as instruments of architectural progress. The Pop-Up Studio is an intentionally whimsical building that can best be described as Imaginary Architecture, a label created, defined and realized with the Pop-Up Studio's execution. It is a form of expressive architecture, one which marries radical one-room living and artful mobility.

The Pop-Up Studio probes beyond conventional boundaries of traditional building where technique is a subsidiary importance to design expression. Research for this thesis includes the study of evolving utopian forms from historically notable paper architecture to present-day virtual modeling. The Pop-Up Studio takes inspiration and techniques from futurist designers and theorists such as Antonio Sant'Elia, Archigram and Martín Azúa. Inspired by the craft of pop-up greeting cards and children's books, research for the Pop-Up Studio consists of an extensive study of unfolding forms.

As a prototype home, the Pop-Up Studio addresses evolving architecture intended to alter expectations and revolutionize the common dwelling. Here, a living space is developed out of an easily constructed and easily demountable unfolding geometric form. It is a micro-dwelling for one to two person living.

By unfolding a geometric form into a dwelling, the Pop-Up Studio treads the line between architecture and visual art. The Studio is manifested in the imagination and designed based on theory. It's development links Imaginary Design to the progression and future of architecture.

PREFACE

During a holiday visit with my family in 2007 I picked up a children's pop-up book belonging to my young niece. It was the ultimate in pop-up books, opening up to a colorful two-level home for the perfect paper family. With that, the idea for a pop-up home of human scale was born. To borrow from Archigram, "Random situations have from time to time generate ingenuity that has directly fed the development of architecture."[1] This was my "random", which was followed by months of research, brainstorms, sketches, and contemplation. What I found was that we too, like the paper people, can live in pop-up architecture. As a prototype building I am accepting of the construction challenges experimental architecture presents. This thesis, however, does not bear markings of editorial notions that some things just can't be done. Doubting its construction would be turning my back on the power of imagination, a designer's most influential tool. As such, this thesis introduces Imaginary Architecture, the purposeful and intentional use of whimsical allusions in architecture. Imagination cannot be taught by means of formulas or rules, yet is just as essential to design as form and function. Where visionary architecture involves seeing into the future and is often connected to the supernatural, Imaginary Design is of the present. Pop up homes fit right in, right now.

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INTRODUCTION

Design provides an opportunity for amusing and eccentric individual expression. The most common place household objects are displays of metaphor and fantasy. Philippe Stark's Juicy Salif was initially criticized for its seeming impracticality, but became a best seller for its manufacturer, Alessi.[2] By taking an object out of its comfortable and predictable context, design appeals to a human need for change and visual stimulation.

As a discipline of design, architecture must also call attention to its expressive nature. Traditionally formed by culture and use, exploration of the inhabitants passions and imaginations has worked its way into building composition. The most influential design work of the twentieth century, in many ways, was paper architecture that never got off the drawing board. And only in the twentieth century did earlier ideal schemes acquire a retrospective importance.[3] Inspired by the underlying ideologies and displays of shattered restraints paper architecture and design extremists like Archigram continue to have an influential effect on evolving architecture.

As a movable pod-like structure, the Pop-Up Studio responds to a global society always on the move. Not purely for shelter, however, the Studio's design lures the homeowner by breaking custom. It is in this way that the Studio bridges art and design, and in many ways, speaks to a revolution.

1: PAPER ARCHITECTURE AND IMAGINARY DESIGN

The Pop-Up Studio is characterized by the lighter type of mental activity it is derived from – a flight of the imagination. By unfolding a geometric form into a dwelling, the Pop-Up Studio treads the line between architecture and visual art. It provides a lesson for current architecture, which too often denies itself the pleasure of intentional whimsy. Perhaps best defined as imaginary design, this purposeful use of vision and allusion is and emerging force in mainstream architecture. Similar to the paper architecture that developed after World War I, imaginary design brings to the designer a feeling of participation that demands inventiveness.

The period immediately following the First World War was a time of limited construction with economic constraints keeping designs on paper. This architecture, essentially 'built' only in theory, was less concerned with function than with architectural form.[4] Coined "paper architecture", designs were represented in journals and exhibitions and today provide an explanation for the relationship of thoughts and evolving architectural practice.

In the context of the drawing, the possibility of a project's existence was suggested, free of constraints. The proposed architecture manipulated forms sculpturally and drew upon human senses. Their designs had a dynamic quality that

reflected or commented upon the building's intended function and revealed inner meaning through structure.[5] Drawings and sketches often exhibited fluid expressions and organic shapes, as in the case of the allusions by futurist architect Antonio Sant'Elia. Sant'Elia's architectural sketches described a future of molded forms, newly explored material intersections and the articulation of openings.

Sant'Elia's flowing lines and exaggerated scales reinforced the monumentality of speculative architecture. His stepped-back structures anticipated modernist skyscrapers and engaged the observer's imagination (see fig. 1).

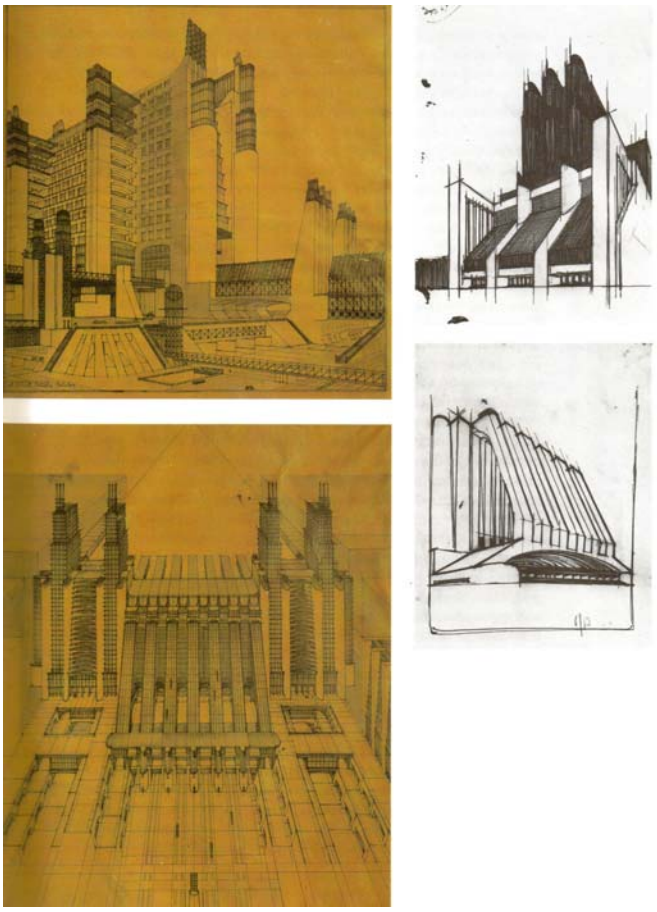

Figure 1. Antonio Sant'Elia's sketches for a futurist city, La Città Nuova, proposed monumental volumes and shapes. C*lockwise from top left*: New Town, 1914; Study for a Theater, 1913; Study for a Station, 1913; Terminal for Aeroplanes and Trains, 1914. *Source:* Robert Hughes, The Shock of the New (New York: Alfred A. Knopf, Inc., 1980) 171.

These imaginative drawings were an important influence on the evolution of modern architecture. Massive, out of scale, and surreal in concept, his drawings were not the works of a crazed designer with no regard to function or human relevance. In his manifesto, Sant'Elia indicates his intention for a city built for human needs with technical expertise. What distinguishes him as a visionary, however, is his call for a break from the past and a new frame of mind in building.

> It is a question of creating the Futurist house according to a sound plan, of building it with the aid of every scientific and technical response, of fulfilling to the limit every demand of our way of life and our spirit, of establishing new forms, new lines, a new harmony of profiles and volumes, an architecture whole aesthetic values are in perfect harmony with our sensibility. This architecture cannot be subject to any law of historical continuity. It must be as new as our frame of mind is new. [6]

While most of his designs were never built, Sant'Elia's vision for an artful architecture of "synthesis and expression," [7] reverberates today. His drawings and writings brought together a progressive attitude that expressed itself more in hypothesis than by finished buildings. In designing, Sant' Elia had the freedom of a science-fiction illustrator, and beyond any classifications, his works are that of fantasy.[8]

The pure visions of "paper architects" triumphed over economic adversity and decades of monotony, creating architectural utopias unique in history. They displayed a markedly new orientation towards the world of the private individual; thinking in "mass" terms was replaced by the creation of personal worlds. In a historical sense, the "paper architects" were the forerunners of a new "private" architectural trend at the turn of the millennium.[9] Their purpose was to demonstrate the wide range that

came under the heading of “visionary” and how major movements could be understood in terms of the drawing and aspirations of their various members than through their built structures in the realization of which their precepts may have been altered.[10]

This generation of conceptual artists who escaped into fantasies of works on paper aspired to solve real life problems, but they also dreamed, philosophized, and satirized. Today, this method of design has even less constraints. Designs are not limited to two-dimensional paper, as technological advances have given the designer more tools to imagine with. Computerized modeling programs and expansive material libraries allow designers to re-imagine what may have been previously dismissed as undoable. Imaginary design is a blanket term for this level of conceptualization and concept realization. Here, design is a reflective process, going beyond pure function to take into account experiences, knowledge, and emotions. While material and function remains under consideration, the expressive value is of the same importance paper architecture was.

Virtual technology has allowed designs to come off the paper and into a more clearly expressed three-dimensional state. It has also influenced a more provocative thought process and exerts its own pull on the evolution of a concept. Neil Spillar, author of *Visionary Architecture: Blueprints of the Modern Imagination*, provides six fundamental paradigms to design that have consequently arisen with technology. Most notably, “Biotechnology, nanotechnology and cyberspace have caused the old adages of architecture to collapse. ‘Form no longer follows function.’”[11]

These advances allow the designer's most important tool, imagination, to be explored a step further. Sites are virtually visited, materials researched more quickly, and forms constructed and deconstructed more readily than ever before. Architect Greg Lynn is distinguished for his use of computer-aided design to produce irregular, biomorphic architectural forms. Lynn's works explore the integrating of structure and form. He is also one of the forerunners in exploring and integrating the tools of digital fabrication, into the process of design and construction (see figs. 2-3).

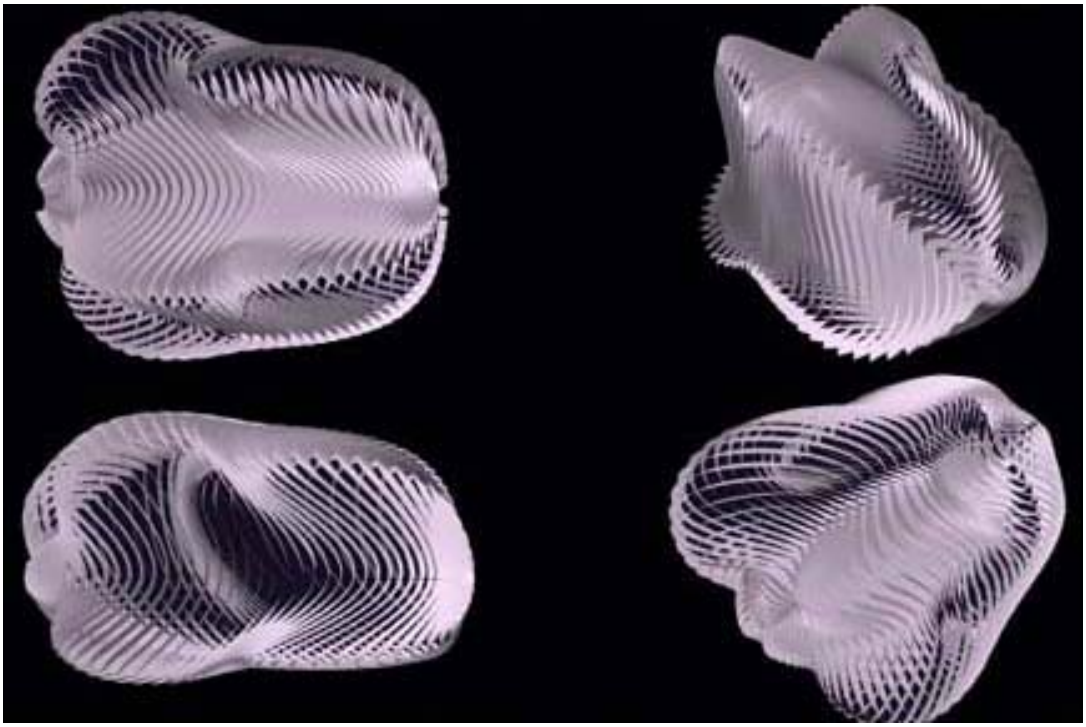

Figure 2: Computer rendering of the exterior skin of an Embryological House and its system of shredded windows and opening. *Source:* Photo Courtesy Greg Lynn FORM in Innovators Photo Gallery www.time.com (Accessed November 20, 2008).

Figure 3: Greg Lynn's Model for Form: Embryological House, 2002, digitally conceives an inhabitable biomorphic form. *Source:* Courtesy Greg Lynn FORM/ Marvin Rand in Visionary Architecture: Blueprints of the Modern Imagination (New York: Thames and Hudson, 2006

Unusual shapes and a revolution of ideas, which display a sense of risk-taking, define imaginary design. It looks beyond form and content to process, association, and concept. Its elements can shock, entertain, or make statements. Like paper architecture, the use of elements in an unfamiliar context and the experimental characteristics of imaginary design may prematurely be deemed unbuildable. It differs from paper architecture in that it employs futuristic technology with futuristic ideas to allow for virtual habitation. It is through this process of design where imaginary designs mitigate perceptions of what is acceptable to expand the meaning of common forms and surfaces. Art Historian George R. Collins answered the *why* of

this type of visionary design, rather than the *how*, in his introduction to a 1978 exhibition at The Drawing Center in New York:

> In general the visionary represents a theoretical, speculative, or even imaginary statement or position that is likely to be considerably ahead of its time and may not even be intended to be carried out. But is later executed more or less as projected; today our advanced technology makes possible almost anything, the most daring dreams. On the other hand a visionary scheme may bear only a corollary or abstract relation to physical actuality and be rather a statement of spiritual or intellectual commitment or fantasy on the part of the designer.[12]

Imaginary design is the same kind of expressionism that grew in the years after WWI, where architects embraced utopian ideals with mysticism. Like paper architecture, designing in a fictional context provides a more progressive way of thinking. By transcending the realm of imaginary design to the built form, projects of the future are created.

2: FROM ARCHIGRAM TO AZUA

Half a century after paper architecture's initital boom, in the early 1970s, a group of novice architects – Warren Chalk, Peter Cook, Dennis Crompton, David Greene, Ron Herron, and Mike Webb – produced an alternative architectural publication as a venue for their drawings, called Archigram.[13] Wildly imaginative, Archigram's most radical innovations were inspired by their ambition to create an architecture that promised personal freedom and expanded consumer notions of logic.

Archigram questioned the assumption that buildings need to be fixed entities and instead offered mobile alternatives. The publication of sketches and models included capsule housing and movable structures. In one of the most bizarre concepts, Mike Webb created a series of drawings that pushed the boundaries of what could, or should, be considered a home. The Cushicle was an inflatable body suit containing food, water, radio, and miniature projection television.[14] The design distorted distinctions between body, clothing, media, and shelter. It enabled the modern nomad to satisfy his or her every need unfettered by material restrictions of traditional architecture (see fig. 4).

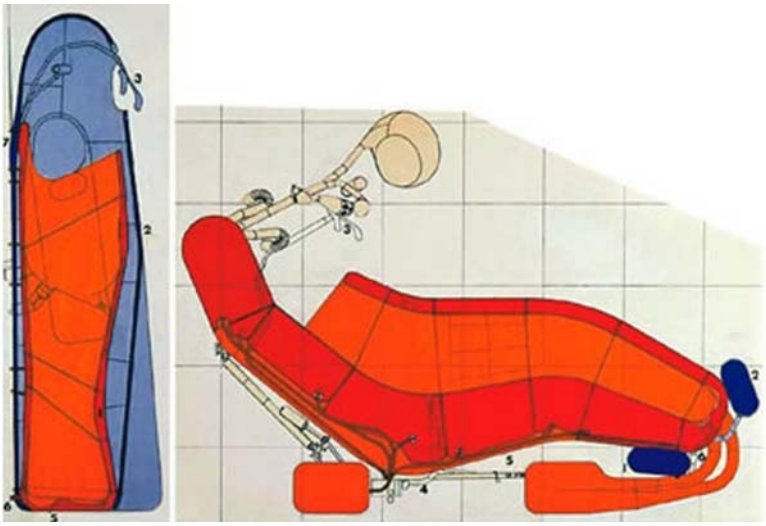

Figure 4: Drawings by Mike Webb show the Cushicle unfolding. Originally published in Archigram 1966. S*ource*: www.archigram.net /projects_page/cuishicle (Accessed December 1, 2008).

Archigram's use of pun and humor gave outlandish concepts merit. The Manzak, a radio-controlled, battery-powered electric robot could do everything for you – from grocery shopping to acting as your own personal voyeur (see fig. 5). Equipped with "magic eye bump detectors," the Manzak was a product of Archigram's unfettered imagination that spoke to an evolving, futuristic society.

Figure 5: Manzak in New York by Ron Herron, 1969. *Source*: Ron Herron Archives in Visionary Architecture: Blueprints of the Modern Imagination (New York: Thames and Hudson, 2006) 85.

While Archigram showcased a convenient lifestyle of robots and homes that enabled one to live more leisurely than ever before, it also suggested an architectural anarchy. “If our work is studied closely there will be found traces of a very real concern for people and the way in which they might be liberated from the restrictions imposed on them,” noted Warren Chalk.[15] By situating themselves in the culture of the consumers, Archigram was able to engage with the market outside of the architectural critique. An architect’s taste became a thing of the past as non-conformist building took center stage.

The visionary images produced were, and continue to be, enormously influential. One of Archigram’s most developed ideas was the Living Pod, a miniaturized capsule home that allowed people to settle anywhere by simply plugging into the city of their choice. The space of the capsule was to be sculpted of thin plates, similar to those found in car engines but pod-plan-sized. Like the Cushicle, owning a Living Pod meant you could take your home with you.[16]

Archigram encouraged both consumers and designers to think about what was really needed from architecture and whether the conventional approach was providing optimal solutions. The dry wit and irony of Archigram continues today, most notably with designers that create sublate objects and forms. Martín Azúa is one of those designers. Defining utopias as “thinking in the future overcoming problems that today seem irresolvable,”[17] Azúa seems to have met Archigram’s nomadic visions with his Basic House, an inhabitable volume that literally fits into a pants pocket.[18]

Currently an experimental prototype in metalized polyester, Azúa has turned an unusual, yet shockingly simple, concept into an inflatable and reversible home (see fig. 6).

Figure 6: Martín Azúa's basic inhabitable unit, Casa Básica (Basic House) as photographed by Daniel Riera for MOMA New York collection. *Source*: Martín Azúa, Questions, Utopias, Emergencies: Martín Azúa (New York: Actar, 2007) 3.

The Basic House pushes our understanding of built forms and, like Archigram, is an icon of imaginary architecture. Azúa proposes a bare habitable space that considers both form and function:

> Our habitat has turned into a place of consumption in which an unlimited number of products satisfy a series of needs created by complex relations difficult to control. Cultures that keep a more direct relation with their environment demonstrate [to] us that the habitat can be understood in a more essential and reasonable way. Learning from these attitudes and using the most advanced technology, I came up with an almost immaterial house that swells itself up from the heat of our own body or from the Sun; so adaptive that if we turn it, it protects us from the cold or from the heat; so light that it floats; besides, it is possible to fold it up and put it into a pocket. A life on the move without material ties. Having everything without having scarcely anything. [19]

There are almost forty years between Archigram and Azúa, yet their imaginative elements and the stories they tell about human nature are similar. Starting out with profound ideas that place a high importance on innovation, these designers demand evocative thoughts from themselves. They define, conceptualize, design, and in some cases prototype and manufacture their creations. However, they are set apart from their peers because, regardless of how radical an idea may seem, they do not accept that realization as far-reaching.

3: THE POP-UP STUDIO

The Pop-Up Studio is a form of expressive architecture that marries radical one-room living and artful architecture, as expressed in the early conceptual models (see fig. 7).

Figure 7: Early conceptual images show the design intent not to be site-specific. *Sources*: Images adapted from original photographs. *top left:* http://z.about.com/d/gomiami; *bottom left:* http://farm4.static.flickr.com; *right*: http://z.about.com/d/studenttravel/nomads_melbourne_roof.jpg

To understand the interlocking design, scored elements, and support, necessary for the Pop-Up Studio, an extensive study of unfolding figures was undertaken. The Pop-Up Studio's frame was determined through the craft and photographic examination of pop-up cards. Designs that required two flat planes (unfolding like a book) to anchor the structure were quickly eliminated; at a human scale, the planes would end up outside of the frame taking up an unnecessary and unsightly footprint. The self-bracing capabilities of spherical systems came to the forefront. The strength of a dome-shaped Pop-Up Studio would allow for a column-free interior. A frame of interlocking circles stood out in the study. Originally a Christmas ornament with additional elements and folds, a modified version now represents the Pop-Up Studio's framework. Pop-up greeting card designer, Petrina Case supplied the paper model seen in the upper left corner of figure 8.[20] Whimsical in theory, the exterior spells out clarity and simplification when stretched out (see fig. 9).

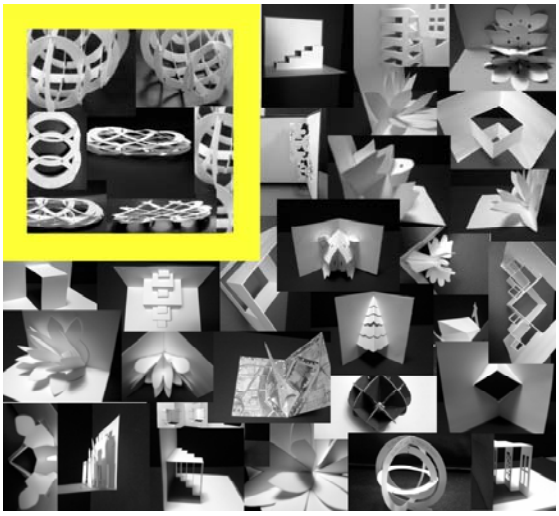

Figure 8: Study of pop-up card construction. The Pop-Up Studio's frame is based on the paper form in the upper left box.

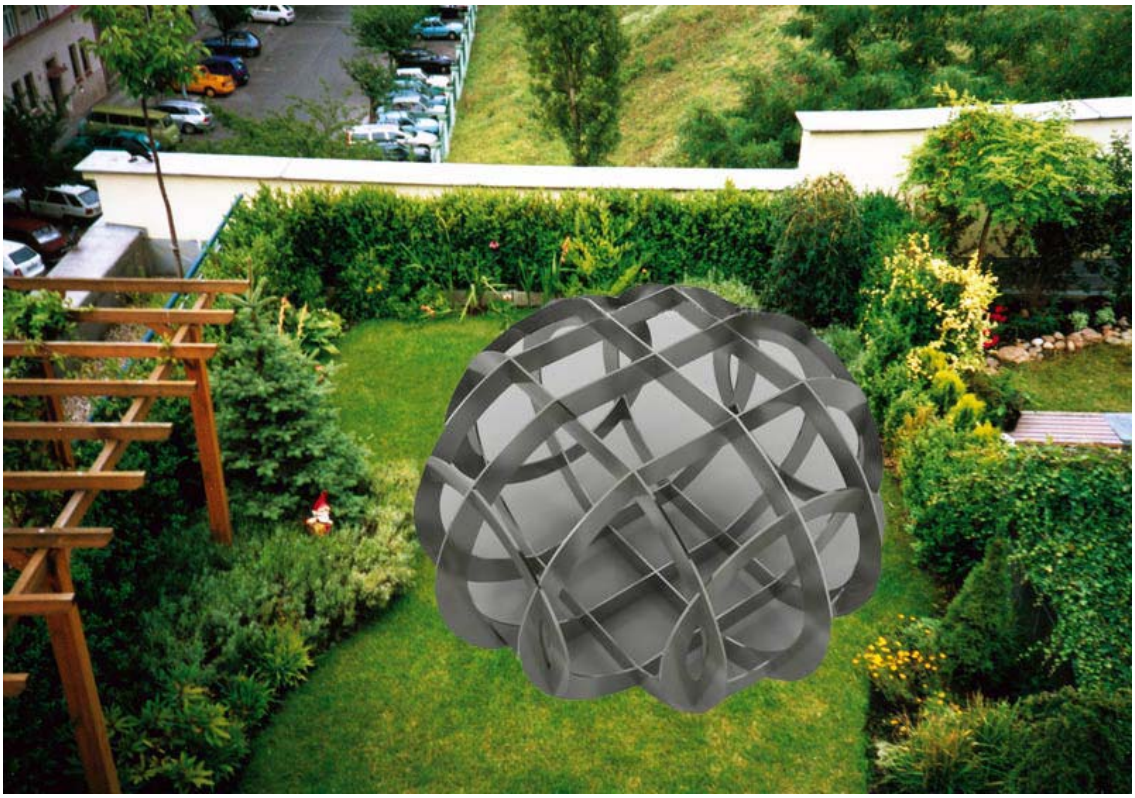

Figure 9: Pop-up frame superimposed on background shows the Pop-Up Studio at a human scale. *Source*: Image adapted from original photograph from http://marigreen.cz/images/sluzby.

Three aluminum oval shaped rings provide the basis for the frames' construction. Three identical rings are inserted in pieces at a 90 degree angle into the base rings. Roller hindges are fixed to each intersection. Constructed in a controlled environment, this frame is collapsable. It is brought in its collapsed state to the job site where it is literally "popped", or stretched open and into place. Each corner opposite a hindge is then fixed with a block to keep the frame from folding on itself. The smallest, exterior rings are then placed onto the frame to complete the sphere (see fig. 10).

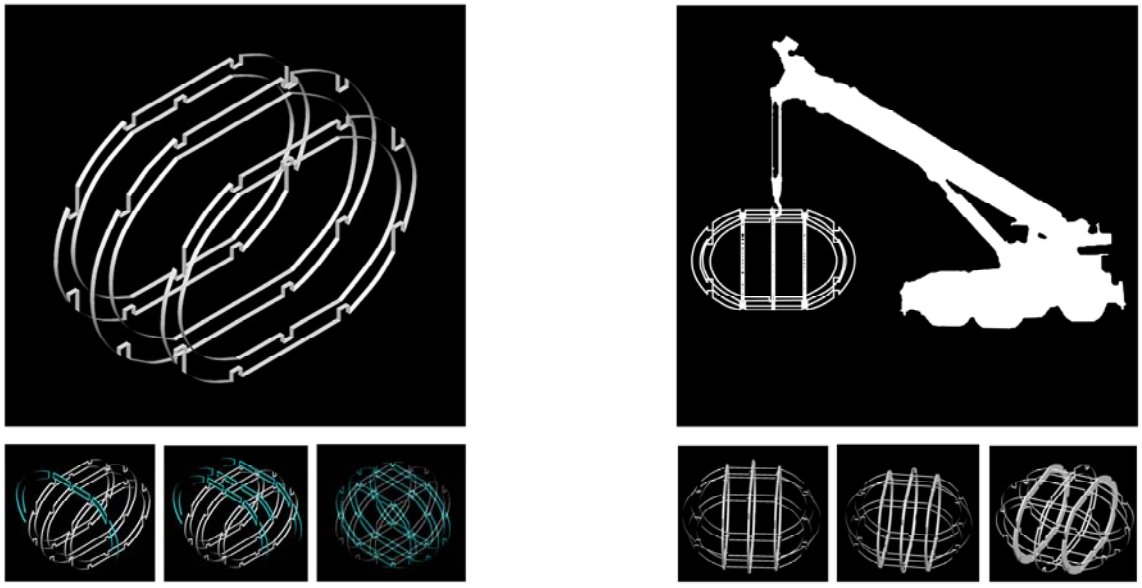

Figure 10: Conceptual drawings show the progrssion of the Pop-Up Studio's frame construction.

The flexibility of aluminum allows for the thin, sinuous silhouette the Pop-Up Studio demands (see fig 11). Initial sourcing has determined that curved framing experts, Radius Track,[21] are capable manufacturers of the Pop-Up Studio's notched interlocking system.

Figure 11: Early conceptual wire on wood model experiments with curved metal.

For insulation the aluminum may be painted with a 1/16-inch-thick coat of high-performance insulating aerospace epoxy. This technique was taken from the Penguin House, a 549 square foot home in Japan by design firms Atelier Tekuto and Mias. [22]

Eight glass wall surfaces (see fig. 12) round out the Pop-Up Studio's exterior.

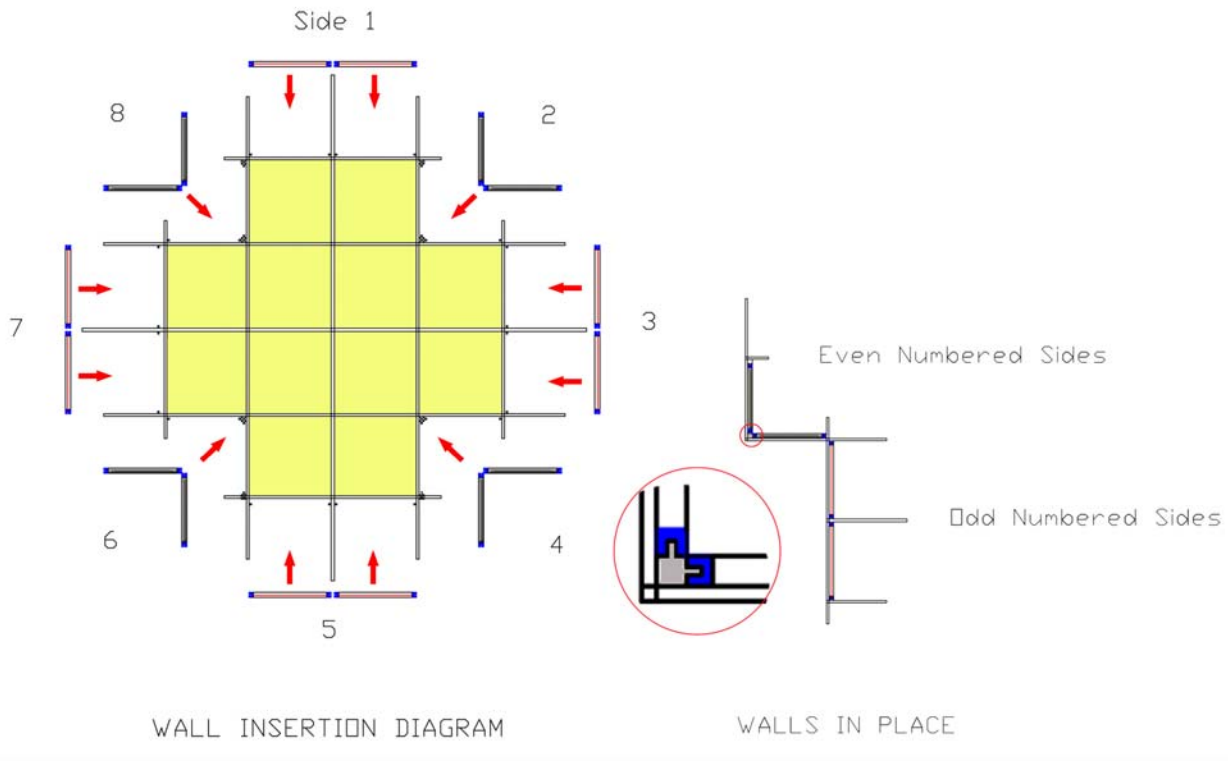

Figure 12: *left:* Plan view drawing shows eight "sides" of the Pop-Up Studio. *right:* Walls shown in place.

If desired, translucent glazed glass or aluminum may be used as walls. The technique for the translucent glass walls' development is taken from Natural Wedge House of Japan by Endoh Design House and again Mias. The walls are a sandwich of translucent polyester fiberfill for insulation, translucent Gore-Tex for ultraviolet protection, and glass. The glass provides a sophisticated wall surface with a luxurious sheen that plays an intriguing counterpoint to the industrial, high-tech steel framing (see fig. 13).[23]

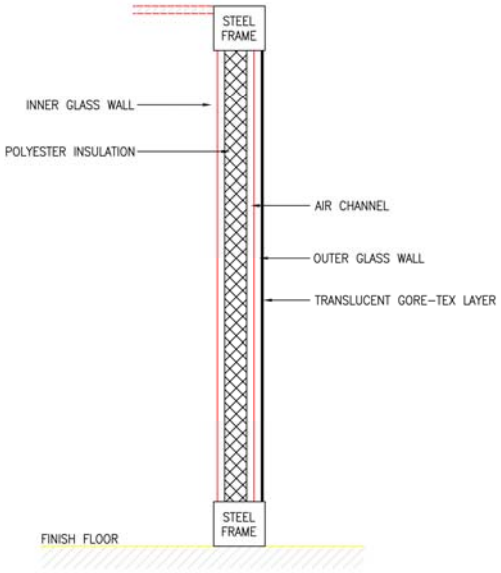

Figure 13: *left:* The Natural Wedge House's glass walls are both functional and aesthetic. The sandwich of glass and insulation may be used in the Pop-Up Studio. *Source*: Azby Brown, The Very Small Home: Japanese Ideas for Living Well in Limited Space (Tokyo: Kodansha International Ltd., 2005) 67; *right:* Detail of glass wall "sandwich".

The curves of the home's frame create an unusual sculpted interior. An x-shaped floor plan, measuring approximately 16 feet across is set into the dome (see fig. 14). This shape allows for niche areas including a bathroom to the left of the entrance, a sleeping area with bunk, and kitchen.

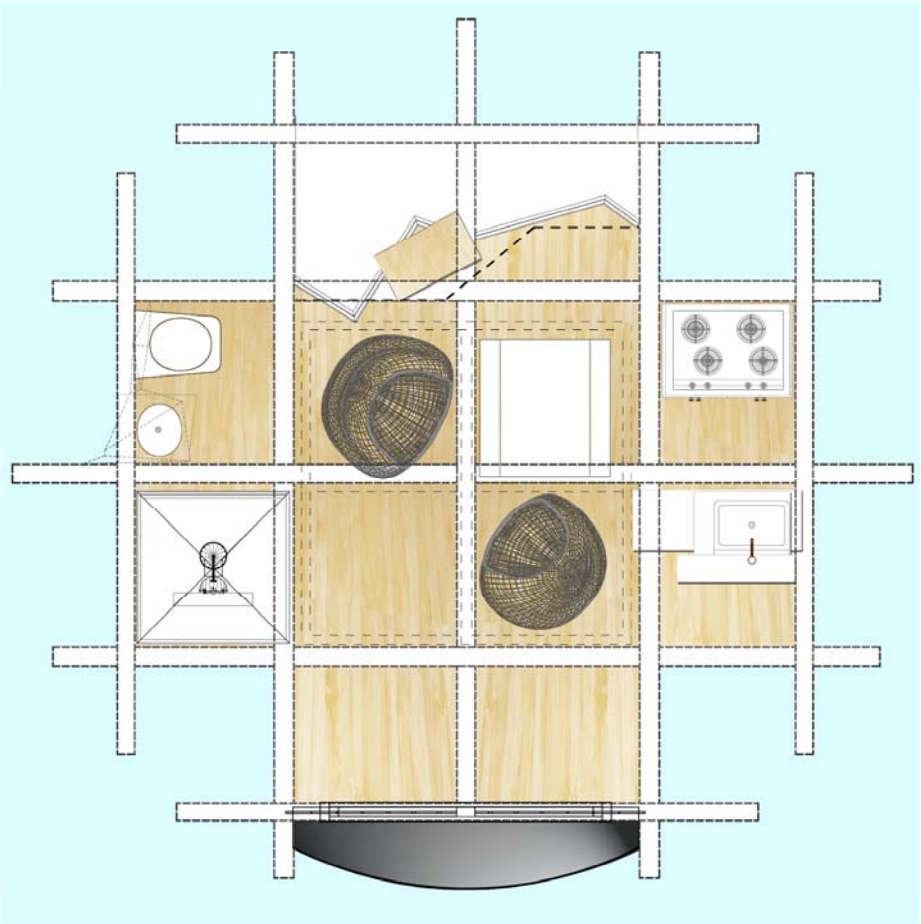

Figure 14: floor plan drawing shows basic layout of the Pop-Up Studio's interior.

Additional seating and table rise from the center of the Studio. Storage space is also available inside the raised, double floor which provides space for air ducts, heating and cooling (see figs. 15-16).

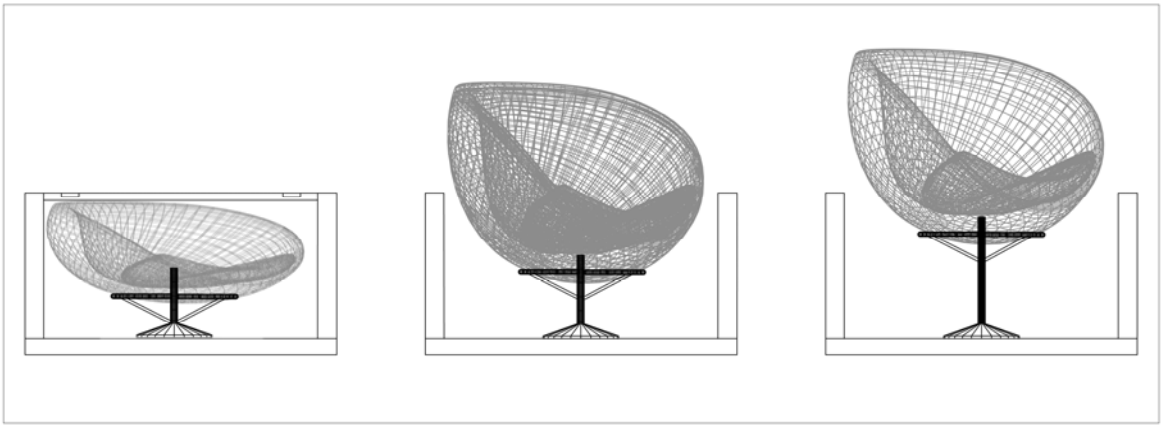

Figure 15: Conceptual drawing for seating set into Pop-Up Studio floor.

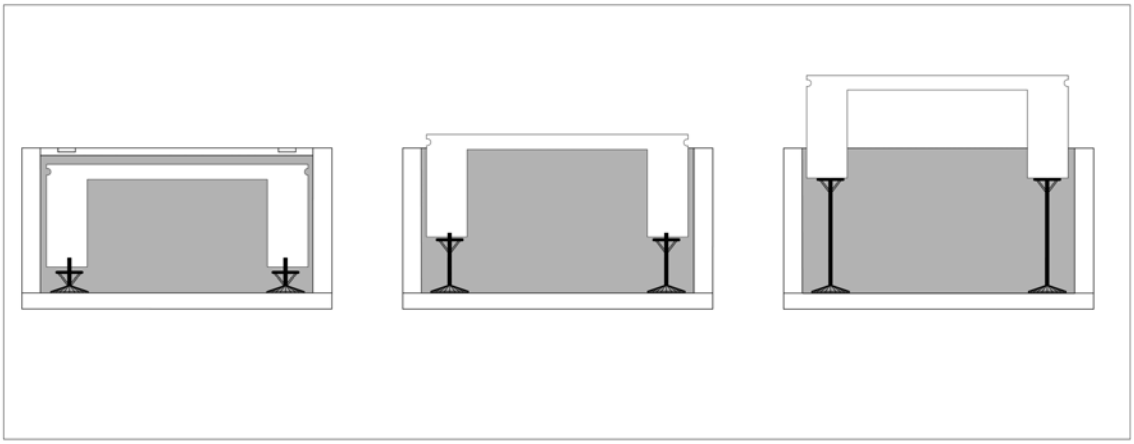

Figure 16: Conceptual drawing for table set into Pop-Up Studio floor.

In juxtoposition to the dome exterior, sharp geometric forms are used in the interior. To articulate the various shapes used in the Studio's design, interior finishes are limited to bamboo and white Medium Density Fiberboard. All the walls of the Pop-Up Studio can be customized to varying degrees or pre-plumbed if desired. They are precision cut, delivered in modules, and set right into the structural frame. As it works on a grid system and is fairly simple to construct, there is minimal waste of materials and reduced labor costs. The only site work required is a simple concrete matte foundation and utility connections. While the Pop-Up Studio can be constructed by a layperson with a basic knowledge of construction, the use of a licensed General Contractor is strongly recommended, as they are responsible for site work, foundations and slab, and mechanical, electrical, and plumbing equipment.

CONCLUSION

At the heart of architecture is fantasy suspended in the designer's experiences and imagination. Conceptual building suggests that progressive architecture is possible through fantasy. The poetic visions of paper architects and Archigram helped us advance further and more daringly than rational theorists. The examination of post-WWI paper architecture and virtual design today informs us of the value of imaginative design.

The creative resonance a certain object can have on a designer is paramount. In the case of the Pop-Up Studio, a children's book sparked a flight of the imagination that demanded investigation and inventiveness. The mere thought of living in a life-sized pop-up can only be understood when imagination becomes a part of the process of perception. Through reflection and examination an ordinary paper object was blown up into an inhabitable space and the Pop-Up Studio was realized.

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ILLUSTRATION REFERENCES

Figure 1. Antonio Sant'Elia's sketches for a futurist city, La Città Nuova, proposed monumental volumes and shapes. Clockwise from top left: New Town, 1914; Study for a Theater, 1913; Study for a Station, 1913; Terminal for Aeroplanes and Trains, 1914.
Source: Robert Hughes, The Shock of the New (New York: Alfred A. Knopf, Inc., 1980) 171.

Figure 2: Computer rendering of the exterior skin of an Embryological House and its system of shredded windows and opening.
Source: Photo Courtesy Greg Lynn FORM in Innovators Photo Gallery www.time.com (Accessed November 20, 2008).

Figure 3: Greg Lynn's Model for Form: Embryological House, 2002, digitally conceives an inhabitable biomorphic form.
Source: Courtesy Greg Lynn FORM/ Marvin Rand in Visionary Architecture: Blueprints of the Modern Imagination (New York: Thames and Hudson, 2006.

Figure 4: Drawings by Mike Webb show the Cushicle unfolding. Originally published in Archigram 1966.
Source: www.archigram.net /projects_page/cuishicle (Accessed December 1, 2008).

Figure 5: Manzak in New York by Ron Herron, 1969.
Source: Ron Herron Archives in Visionary Architecture: Blueprints of the Modern Imagination (New York: Thames and Hudson, 2006) 85.

Figure 6: Martín Azúa's basic inhabitable unit, Casa Básica (Basic House) as photographed by Daniel Riera for MOMA New York collection.
Source: Martín Azúa, Questions, Utopias, Emergencies: Martín Azúa (New York: Actar, 2007) 3.

Figure 7: Early conceptual images show the design intent not to be site-specific.
Sources: Images adapted from original photographs. top left: http://z.about.com/d/gomiami; bottom left: http://farm4.static.flickr.com; right: http://z.about.com/d/studenttravel/nomads_melbourne_roof.jpg

Figure 8: Study of pop-up card construction. The Pop-Up Studio's frame is based on the paper form in the upper left box.

Figure 9: Pop-up frame superimposed on background shows the Pop-Up Studio at a human scale. Source: Image adapted from original photograph http://marigreen.cz/images/sluzby.

Figure 10: Conceptual drawings show the progression of the Pop-Up Studio's frame construction.

Figure 11: Early conceptual wire on wood model experiments with curved metal.

Figure 12: Figure 12: *left:* Plan view drawing shows eight "sides" of the Pop-Up Studio. *right:* Walls shown in place.

Figure 13: *left:* The Natural Wedge House's glass walls are both functional and aesthetic. The sandwich of glass and insulation may be used in the Pop-Up Studio. *Source*: Azby Brown, The Very Small Home: Japanese Ideas for Living Well in Limited Space (Tokyo: Kodansha International Ltd., 2005) 67; *right:* Detail of glass wall "sandwich".

Figure 14: floor plan drawing shows basic layout of the Pop-Up Studio's interior.

Figure 15: Conceptual drawing for seating set into Pop-Up Studio floor.
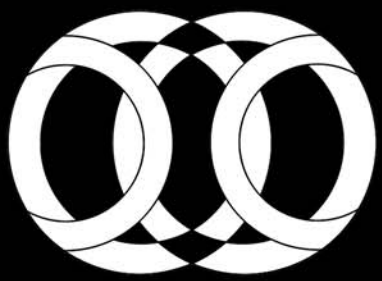
Figure 16: Conceptual drawing for table set into Pop-Up Studio floor.