SQFT 930

930 SQFT OF ARCHITECTURE - A COMPENDIUM OF RESEARCH PROJECTS

930 SQFT OF ARCHITECTURE A COMPENDIUM OF RESEARCH PROJECTS

DAVID B. CLARK II

THESIS SUBMITTED TO THE FACULTY OF VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY IN PARTIAL FULLFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARCHITECTURE.

OCTOBER 20, 2008
BLACKSBURG, VA

ROBERT J. DUNAY CHAIR

ROBERT P. SCHUBERT

JOSEPH H. WHEELER

Keywords:
Form
Material
Technics
Solar House
Meditation Room
PLUG

ABSTRACT

There is no primacy to Architecture.

For centuries architects have posited formulaic approaches to creating spatial environments. Bold maxims for design have defined entire periods and styles of architecture, and each subsequent postulation attempts to disprove the former by challenging its theories against imperfect realizations. Yet nearly all have the same fault; they prioritize characteristics of architecture, attempting to design according to absolutisms and ideologies. I believe this to be a dangerous mode of operation, as absolutisms can be extremely complex and difficult to grasp conceptually, let alone to manifest into realities. Reducing architecture to processes of selection, generalization, singularities, and priorities is just a clever way of dealing with complexity in an attempt to make the intangible tangible. This ‘reduction’ and ‘simplification’ can only hold value as a tool for the study and analysis of architecture, not its practice and execution. Although architecture is universally conditional, it has been assigned universal qualities over time in theory and practice. I believe time requires that those qualities be subject to change and reinterpretation so that architecture may maintain proper relevance, barring one constant: all qualities must exist by virtue of the others and cannot be seen independently; one quality is no more than an aspect of the others.

To better explore this notion, three criteria (qualities, generators) have been identified as a measure for critical analysis of three architectural research projects. They are built from a history of pre-defined criterion, named and redefined in an attempt to elevate a personal study and practice of architecture at a period in time. These projects have a high degree of personal influence and involvement, and so this becomes in a way a self-analysis in the study and practice of architecture. The intention of this compendium is to gain insight towards a personal definition of architecture through an analysis of architectural theory and precedence in comparison to work that is reflective of personal architectonics. In time, I hope it will have continued to develop.

dedicated in memory to

James Lee Hockman

and

Norma Gardiner Hockman

ACKNOWLEDGEMENTS

Thanks to my Parents (Brad and Teri), Siblings (Whitney, Taylor, and Marshall) and entire family, for your unfaltering love and support through the many years. The joking gift of a T-shirt many years ago has become all-to prophetic; these seven + years have been the best of my life. I could not ask for it to have been any different.

To my Committee, your guidence and support through the years has provided me with unique educational paths and experiences that could never fit the academic mold. Thanks for your confidence in my abilities and inviting me to be a part of all these architectural adventures.

Thanks to the College of Architecture and Urban Studies, its Faculty and Staff, for your convictions in what architecture is and can be. I am proud to have passed through your doors.

To my colleagues (in and out of architecture) who shared in the experiences and opportunities each project brought. You have been great teachers.

To friends through the years, in touch and out; life is not a solitary journey, thanks for being a part of mine.

CONTENTS

This page left blank intentionally for printing format

LIST OF FIGURES

The following images claim Fair Use under US Code, Title 17, Sect. 107
All other images by the author

CONTINUED LIST OF FIGURES

The following images claim Fair Use under US Code, Title 17, Sect. 107
All other images by the author

FIGURE 1. *PHOTOGRAPH* BY DR. JATINDER SINGH, 2007 (FAIR USE)

Measurements are taken for a photvoltaic installation in a remote forest of western Tanzania.

INTRODUCTION

We behold, touch, listen and measure the world with out entire bodily existence and the experiential world is organized and articulated around the center of the body. [1]

Three major works have come to define my architectural education and comprise this compendium. I have been fortunate to see them through to fruition, to become tangible evidence that architecture exists. These are full scale, working studies of architecture and a testament to the ultimate educational experience of building design. They are compelling models of truths and falsehoods for what architecture is and can be, indicative of personal methodologies, skills, and beliefs regarding the art of architecture. The practice of any art is dependant on developing understanding through comparison and measurement to establish criteria, which in turn are applied back to the art, and likewise re-measurement. This cyclical cross-influencing yields temporal manifestations of all art, making it dynamic. A true art is not static, so art in any manifestation is merely a fragmental development at a specific moment in time. This compendium of architectural research represents specific moments in an exploration of the art Architecture.

Throughout architectural history, bold maxims have been the theoretical cornerstones to entire periods and styles of imperfect design realizations. They are imperfect because they are based upon absolutisms: linear Primacy. Seemingly simplistic, absolutes are actually complex and difficult to truly realize, enabling each subsequent postulation for an architectural absolute to challenge its formers. I do not believe there is Primacy in architecture. My experience has left me with a notion that establishing and enforcing one only reduces architecture to processes of limited selection, generalization, and singularity, ‘clever’ ways of dealing with its complexities that result in imperfect realities. Instead, this art is a non-linear chaos that eventually orders itself into finished products when all necessary criteria are satisfied. Any primacy, or strategy, towards architecture is no more than a tentative proposition used to approach, simplify, and describe the chaos around us. It holds a dangerous capacity to blindly exclude everything it considers irrelevant, losing a generosity all architecture should

PHOTOGRAPH BY DAVID CLARK, 2007 (FAIR USE)

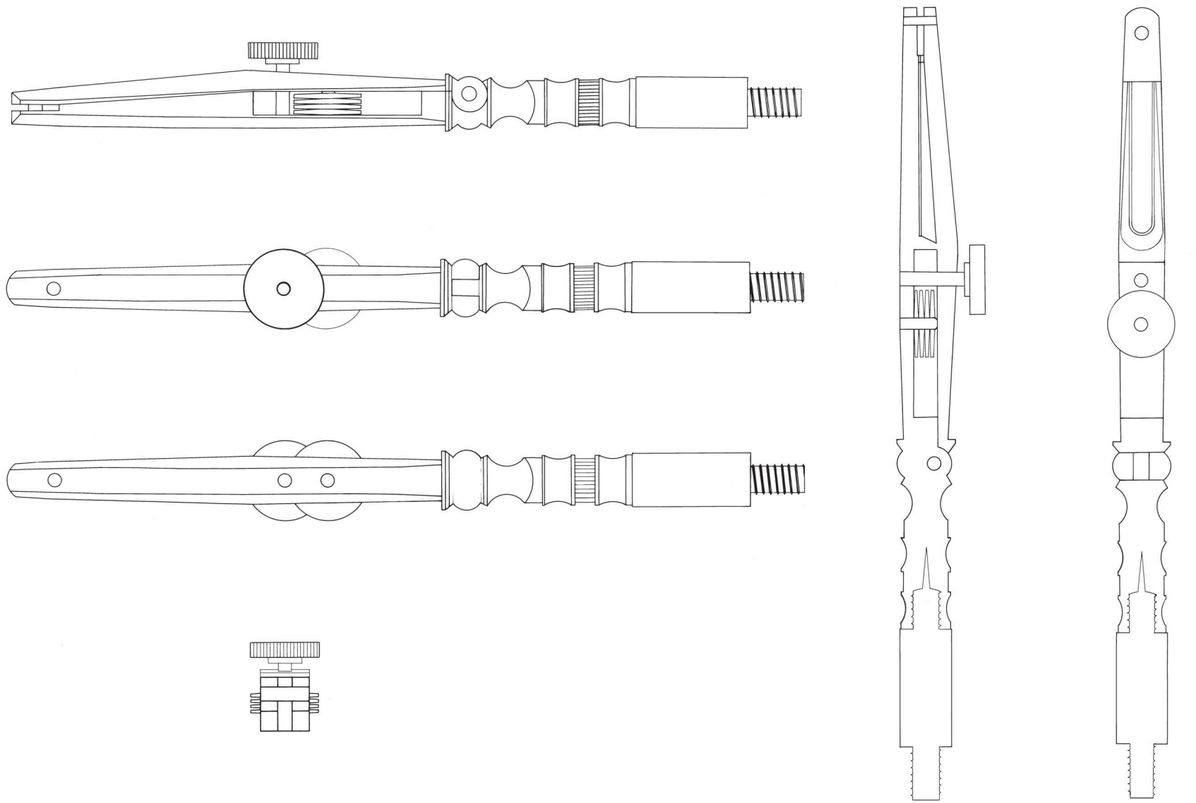
A subtle inscription around a ventilation porthole offers playful insight to an overall applied context.

be imbued with.

The following pages are a personal investigation and analysis into what architecture is, and how it is approached as an art form. Through research of other architects' methodologies and qualifiers of architecture, in conjunction with my own initial understandings, I have designated three criteria I believe to be intrinsic to the art of architecture: Form, Material, and Technics.[2] Each exists by virtue of the others and cannot operate independently, lending a teleological [3] property to the art. These serve as the personal base for the creation, criticism and comparison of architecture thoughout this document.

The numbered title of this thesis is derived from the square footage sums of three research projects that I believe are imbued with an architectural generosity that is made even more prevalent through their modest sizes. They exemplify an important character of small spaces and, compared to the standards of our contemporary built environment, offer an unfamiliar case study for the use of Form, Material, and Technics. In a social climate that often measures against the quantity of quality, it has been a great exercise to investigate quality in a quantity of small Architecture.

In the discussions regarding a complete theory of architecture, the essential concern stems towards Vitruvius' interrelated architectural necessities *firmitas, utilitas*, and *venustas*. The myriad of theorists' attempts to shift the equillibriums of the Vitruvian Triad, make radical value modifications, or assign primacy, shows that these theoretical qualities may cease to maintain value relevance as time progresses. Therefore a case is made to continuously reassess these values according to the Time of Architecture. Despite statements of maintaining interrelation, the theorists' 'Triads' have been given a heiarchy through their order of print, but not necessarily attributing more importance across sequences, since due to the nature of communicable print standards across time the three criteria



DRAWING BY DAVID CLARK, 2001

An architectural drafting tool (left) - an inking pen for drawing dashed lines. A series of wheels held in the body offer a variety of line patterns. Can evaluative architectural criteria be devoid of scale? Does this tool have architectural merit?

cannot be presented simultaneously. A curiousity can be noted in that *venustus* comes last in nearly all earlier printed arrangements [4], suggesting beauty is the logical decendent of the other two fundamental criteria. Later theorists reversed the orders within their treatise [5], as academic advantages could be gained with arguements suggesting that considerations of venustas exist almost entirely within the theory of architecture, whereas utilitas and firmitas cannot be properly taught without practical experience to accompany. The specific arrangement of these criteria has had a resounding impact on the architectural world, creating academic and professional sects based around criteria primacies supported by independent developments in fields such as psychology, art-historical method influences, and scientific techniques of structural and spatial analysis. The result is a treatment of architectural criteria as separate disciplines [6] and an abandonment of the most critical statement: Haec autem ita fieri debent, ut habeatur ratio firmitatis, utilitatis, venustatis.

There now exists enough precedence and means for qualifying and quantifying aspects of architecture, coupled to major paradigm shifts in the theory and practice of architecture due to technological advancements, that there cannot be plausable arguements for a primacy in contemporary architectural values. Architecture cannot be successfully taught and practiced with exclusive value sets.

Defining a personal architecture starts as a concentration on minor modifications to the concept of architectural criteria as required by the sociological and technological developments of today. The criteria Form, Material, and Technics are designed to be specific yet encompassing and overlapping to handle an ever-expanding architectural gammit. They will serve as the lens for a personal review of architecture without primacy. My only regret is that these criteria are presented in an order, against the essence of this document. Perhaps it is a personal Platonic relation manifesting itself...

PHOTOGRAPH BY DAVID CLARK, 2004 (FAIR USE)

Systems are constantly being developed and employed to achieve architecture, and are a language of that reality, not reality itself. Systems of communication are constantly re-developed and invented for the particular understanding and investigation of architecture. Drawing, or perhaps more accurately, visual representation of architecture, is a means of speculating about the realities of architecture. It is a means through which the relationships of Form, Material, and Technics can be explored and speculated about, much more rapidly and with less penalty than being physically realised. Notions of Form most often find inception here, temorarily void of Material and Technics. A particular form, in regards to specific materials and technics, is quickly investigated and discussed on an empty coffee cup (left). Architecture can often be an impromptu exploration.

FORM

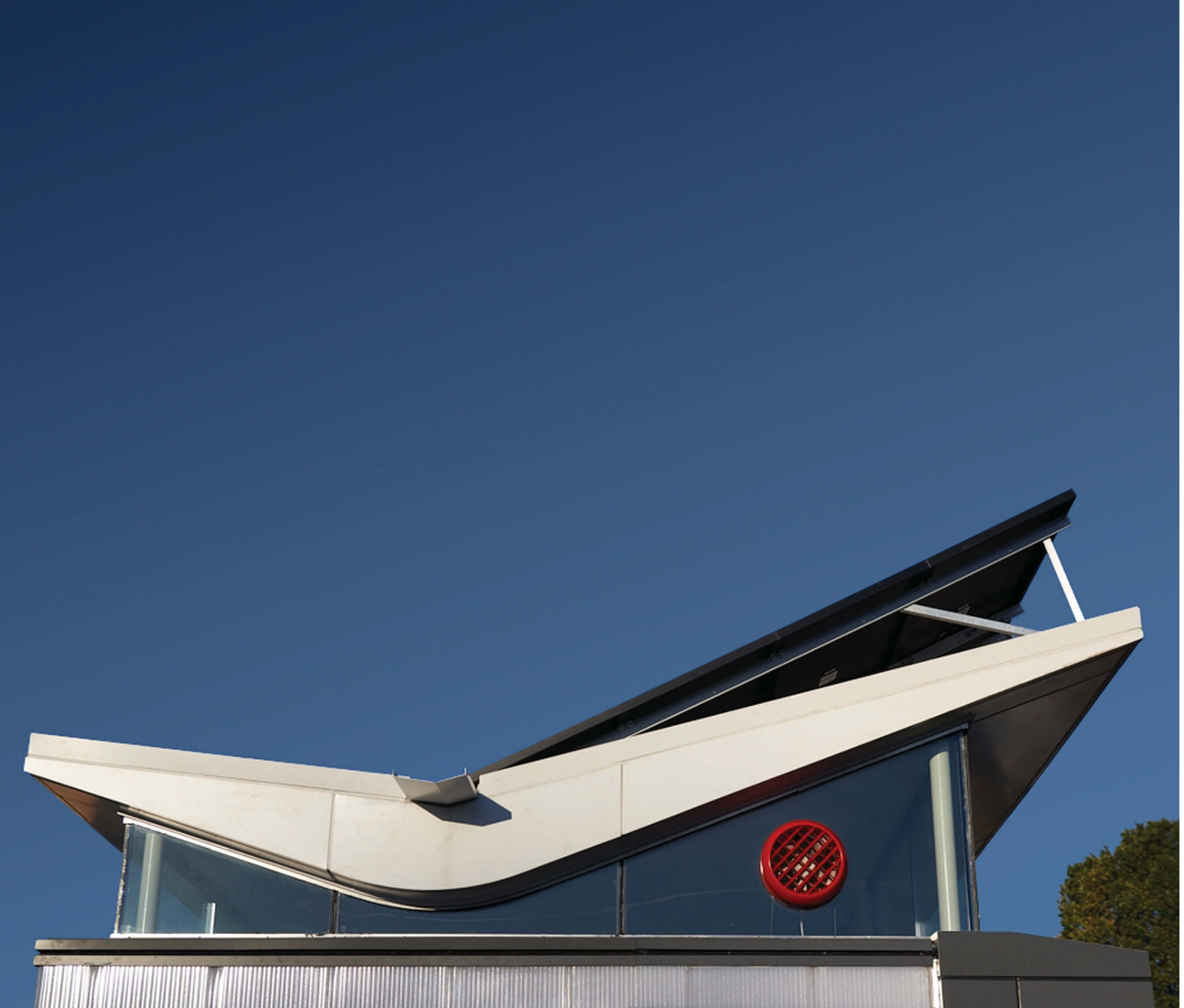
Form may be the most subjective of the three criteria chosen, often associated as the provider of meaning in architecture and a vessel of beauty. In terms of “Delight”, Form is most often regarded as beauty, an inaccuracy stemming from the misreading and summation of a deep and highly theorized subject.[7] Leon Battista Alberti says that beauty results from Forms, that it is the result of transcendental mathematical proportions that are often not even found in nature. He conveys this concept of beauty, and likewise form, through the subject of lineaments (devoid of materiality) writing:

“All the intent and purpose of lineaments lies in finding the correct, infallible way of joining and fitting together those lines and angles which define and enclose the surfaces of the building.[8] When you make judgments on beauty, you do not follow mere fancy, but the workings of a reasoning faculty that is inborn in the mind.” [9]

These statements begin to mechanize beauty by giving it a foundation to be created from, while stating an Innatistic [10] position for the ability of Forms to be beautiful to a viewer. This approach to beauty and form is dependant on another outlying process of joining, an elusive statement considering lineaments are not concerned with material, so what is being joined? Tools, like geometry, are employed and developed within which architects can search and derive ‘lines and angles’ as confined by rules. Corbusier’s writings of the “Engineer’s Aesthetic” furthers the notion of beauty mechanized, dismissing architectural styling and applying a renaissance conception of beauty that is the Modern movement.

“Our engineers produce architecture, for they employ a mathematical calculation which derives from natural law, and their works give us the feeling of HARMONY.” [11]

Mass, Surface, Plan, and Regulating Lines continue to comprise beauty and Form for Corbusier, as they did for the Alberti, but



Architecture is a matter of plastic emotion.
The purpose of architecture is to move us.[12]

posterity has given the architect new tools and materials with which to develop Form. Therefore, beauty is interpretable, and Forms have the potential to take on different readings across time. The influences and demands of technology are quickly reshaping our perceptions of beauty (and the Forms we develop where beauty can be found) faster than ever before. But architecture is slow to adjust, apprehensive and untrusting of the "fads" that cultures create and destroy within short years. Timelessness then becomes a goal of design – but what is timelessness? Aren't all buildings and their Forms dated, and therefore judged with that knowledge against their surroundings and the present? Do refinements of Customary [13] or Arbitrary [14] beauty actually cloud the accurate perceptions of Forms, especially as desired by the architect, or should Forms carry the details that led to their inception and provide a viewer the potential to better understand it regardless of Innatism. The notion of arbitrary beauty cannot be mechanized because it has no absolute foundation, but it is inevitable since it is a product of cultures and time, so its mastery requires careful and extensive study. This is the realm of beauty in which Robert Venturi explored his notions of Post-modernism and the decorated shed.[15]

Form is as important in a general work of architecture as it is in the smaller elements of which it may be comprised. Every component has a form, and a perceivable beauty, which affects the overall design, whether seen or not by a viewer. That component has been seen by the architect/designer, and connects to the larger Form, ultimately affecting it. Form in turn can carry traces of its components, informing viewers of the layers upon which it is built and exciting curiosities of investigation. Form becomes an engaging component of architecture, and its ability to be perceived by viewers and users differently engages people with their environment and each other. It is in engagement that the intent of the designer can be realized.

A roof elevation develops a strong presense of Form and iconic identity (left).

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

PHOTOGRAPH BY DAVID CLARK, 2006 (FAIR USE)

The presence of a lightwell dramatically affects the Form of a celing and roof, providing another layer for interpretting meaning and intent.

We enter into the “either – or” argument of precedence and priority regarding Form versus Function. The Meisian stance of Form being resultant of the work of architecture, of building, and its counter that Form is the primary concern and a building’s function will work itself out as a matter of course. Neither makes for a universal approach to architecture, as their cognizant disregard for the irrelevant limits their potential. A separate position outside the polemic is Frank Lloyd Wright’s “form and function are one,” which Bernard Hoesli [16] writes “[i]f rendered operative this formula can lead to the hunch that suggests the idea that form is an instrument of design.” Suddenly form and function become two different aspects of the same architecture and “they have to become fused through stubborn, patient work in a process of mutual adjustment, adaptation and reconciliation in which each is judiciously interpreted in terms of the other.” If architectural form is created in order to designate and inform, than architectural form is not autonomous; it cannot be separated from the intent and content of a building.

As stated earlier, the approach to investigating three research projects is through reducing the analysis across three criteria. And as the subject of Form is broached, and the breadth of Form is realized, it seems appropriate to again reduce and focus on a specific architectural component – I have chosen the Roof.

“In particular, great attention should be paid to ensure that the design of the roof is the best possible. For unless I am mistaken, the roof of its very nature was the first of all building elements to provide mankind with a place of shelter: so much so that it was for the sake of the roof that the need arose not only for the wall and all that goes with it, but also for anything constructed below ground.” [17]

Alberti’s words resonate as strong today as they did when he wrote them, if not more so. A quick survey of the suburban

PHOTOGRAPH BY DAVID CLARK, 2007 (FAIR USE)

An extra cutout finds an alternative re-use as a sliding door pull. It was designed to be welded onto the beam it was cut from.

sprawl epidemic, focusing on the conditions of roofs, leaves a viewer to wonder if anyone had ever read Alberti's words. Roofs everywhere can be read as results of their walls, which in turn seem to be assigned and dimensioned according to a spreadsheet formula for a space-giving contest of square footage. It is a wonder that if roofs do possess such architectural merit and governance, how could it be so neglected? It is not because of material restraints, posterity has provided great advancements in building methodologies, yet the majority of our built environment still uses greatly outdated technology, while every other tool we use and develop stays cutting-edge and up to the minute. The frustrations that fed Corbusier and his architectural treatises continue to plague us decades later, not that he and the others like him failed, but that their subject matter is so vast and general, and at the same time particular and circumstantial and therefore slow to change. If architecture is so slow to change as a whole, perhaps it needs to start with individual components. The Roof would be an ideal place to start a 'revolution.'

PHOTOGRAPH BY DAVID CLARK, 2007 (FAIR USE)

MATERIAL

It is through material that the fancies of design can be made into tangible forms. While Form can be studied independent and devoid of specific materials, it will undoubtedly require the support of the material world to be realized. Material does more than physically support Form; material can reinforce the meanings and emotions of Form, adding depth and layers that can be orchestrated into architecture. William Morris held Material to be the foundation of architecture; the appropriateness and scale of Material in building determined the ultimate success of an architect's conveyance of beauty. His writings on architecture and ornament radicalized Ruskin's Seven Lamps of Architecture by applying a social aspect to the functional and artistic hierarchies established by his predecessors and imbuing architecture with an aspect of humanity.[18] While most of the critical writings of this reform era target the subject of beauty (and what has been addressed as Form so far), Material supplies the base of the argument. I mention Morris and the late 19th century design movements because of the parallels they share with more contemporary designers and architects, namely the works and writings of Louis Kahn and Peter Zumthor. Morris stated in his delivery of "The Influence of Building Materials on Architecture":

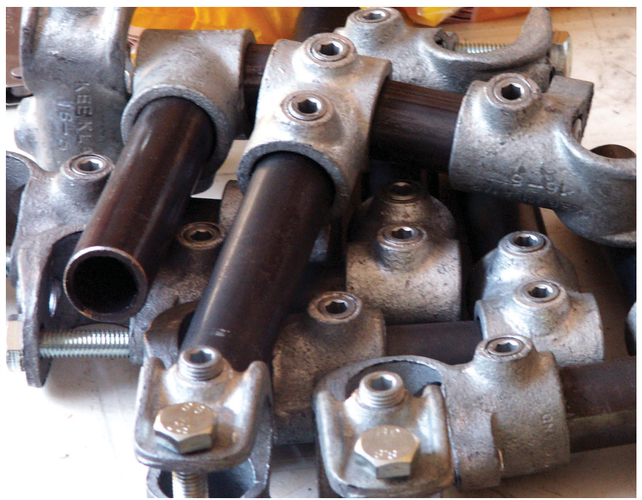
"It seems to me that the use of stone in a proper and considerate manner does in the first place lead to your being able to get a definite size and scale to a building…You can see, in fact the actual bones and structure. But it is more than that; you can see in point of fact the life of it by studying the actual walls. This organic life of a building is so interesting, so beautiful even, that it is a distinct and definite pleasure to see a blank wall without any ordinary architectural features, if it is really properly built and properly placed together…This seems to me almost the beginning of architecture, that you can raise a wall which impresses you at once by its usefulness; its size, if it is big; its delicacy if it is small; and in short by its actual life; that is the beginning of building altogether." [19]

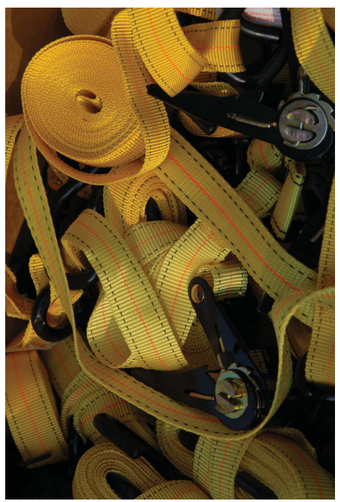
PHOTOGRAPH BY DAVID CLARK, 2006 (FAIR USE)

Looking up a free-standing 'dry-stacked' slate wall.

There is an intimate relationship between our emotions and the things around us... the atmophere of places and spaces that kindle our emotions.[20]

Reading this immediately conjures visions of Louis Kahn's walls in the Institute of Public Administration and the National Assembly in Dacca, and Zumthor's Thermal Baths and Bruder Klaus Chapel. These projects exemplify Morris' words nearly a century later supporting theories of Form and Material assessed as inceptions of their time. In particular, Zumthor's regard for Material is most pertinent because it composes an architecture constrained and liberated by all aspects of current building and design. Adding to the timeless qualities of Material, he writes that in the context of architectural objects, Material can assume a poetic quality, but only if a meaningful situation is generated by the architect: "Materials in themselves are not poetic… Good answers to those questions can throw new light on both the way in which the material is generally used and its own inherent sensuous qualities." [21] We are urged to constantly ask what the use of a particular material could mean in specific architectural contexts through statements that apply to both architects and users in the pursuit to deliver and understand intent and meaning. Zumthor stresses materials that have a variable presence, that can speak to a visitor in tones and decibels set by the visitor. In his reflections on characteristics of good buildings, he writes "good architecture should receive the human visitor, should enable him to experience it and live in it, but it should not constantly talk at him." [22] There is always a minimal presence a material has after it has been enacted upon space. In conjunction with supporting and contrasting materials, that individual presence can be lost, potentially resulting in a cacophony of stimulation. This insinuates a certain lack of control the architect has over a visitor's response to space. The skill of the architect therefore determines the severity of this control-loss through tools of Form and Material. If Zumthor is correct in that Material speaks in tones and decibels set by the visitor, should the visitor be extended some control over space? It is impossible to anticipate every user's predisposition towards characteristics of space, Form and Material, and reliance on innatism/nativism in regards to the perception of architecture cannot guarantee interpretation and understanding. Instead,





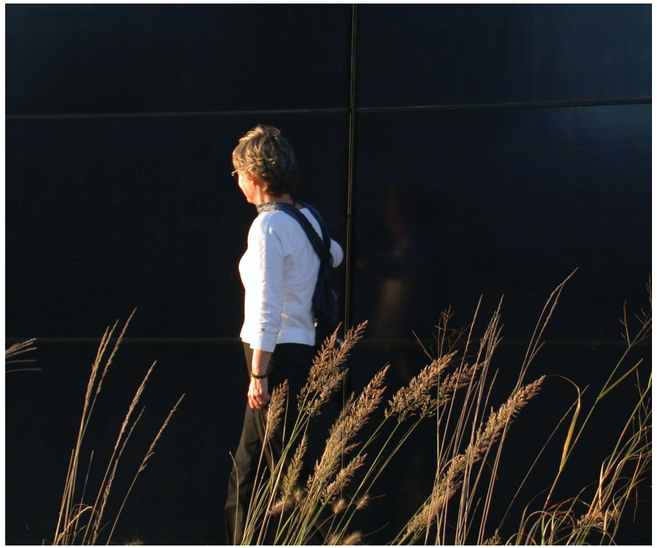
PHOTOGRAPHS BY DAVID CLARK, 2007 (FAIR USE)

A cross-section of materials used in specific circumstances per their material capacities. (left to right) Synthetic line, aluminum pipe fittings, ratcheting nylon webbing.

the offering of limited control over Material can focus user engagement and in turn, perception of intent and meaning. An ability to tune space enables participatory human action and connection to it. We must question how necessary this form of user control is, as it is not appropriate for every architectural circumstance. There is a danger in instilling user-control; it can become a crutch compensating for a lack of mastery over space as defined by Form, Material, and Technics, and possibilities of misconstruing.

Placed out of standard context, Material can spark intrigue and curiosity. We approach the built environment armed with experiential knowledge and navigate accordingly. The curiosities of childhood establish particular emotional memories that can be revisited with the feel of a particular doorknob, the smell of wood-trimmed rooms, or frozen condensation on an old window. Unfortunately over time we develop numbness to some materials because of extreme familiarity; we know what to expect from our surroundings and anticipate material encounters. Architecture continues to base construction on the appropriateness of certain basic materials (earth, stone, wood, iron, etc.) as perfected and reevaluated over time. It is the reevaluation that becomes exciting and dynamic when regarding material. To encounter a familiar material in an unfamiliar way is extremely stimulating and engaging for a user because their understanding is challenged. Though commonly relegated to stimulating the five senses, Material should also engage the mind, offering a new participatory degree to the enjoyment and memory of architecture. Fortunate is a work of architecture that can make the familiar unfamiliar, and the unfamiliar familiar.

The desire to control ones space (environment, habitat) stretches through existence to the day when a roof was first built overhead because the cave lacked user control.[23] The provision of user-control regarding Material may be an evolutionary step in the development of habitat and an increase



PHOTOGRAPHS BY DAVID CLARK, 2005 (FAIR USE)

A new line of production photovoltaic panels adress the aesthetic stigma of solar panel technology.

for the capacities of space, a potential that in turn may rely more heavily on Technics.

Solar panels, often constrained to overhead applications, have taken on a new appearance due to technical innovations in efficiency and construction. These panels (left) do not bare the stereotypical imagery of solar technology and take on a dematerialized form, especially when placed out of anticipated context at ground level. People are unaccustomed to being able to see, let alone touch, a solar panel up close, so the panels bring intrigue and inquiry to what they are, and why the are there. These panels in particular relate to the interior spatial configuration of structure they serve. From a performance aspect, the vertically orientated panels become more effective in winter months when the sun is lower in the sky and more energy is required to power the home. Medium Density Fiber panels, a readily available material at any lumberyard, are transformed into textural art through a process of CNC routing (right). These panels express a narrative of their creative process. The texture is a result of the simultaneous axial movements of a router using a particular cutting tool. The tool, a hemispherical cutting bit, determines the scalloped radius of the texture when applied to geometrical paths of travel. The placement of the panels becomes critical to their spatial contribution. Set into alcoves carved from a volume of apple wood, the panels are dramatized by contrast of color and lighting. The mundane becomes magnificent through the capacity of the material.

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

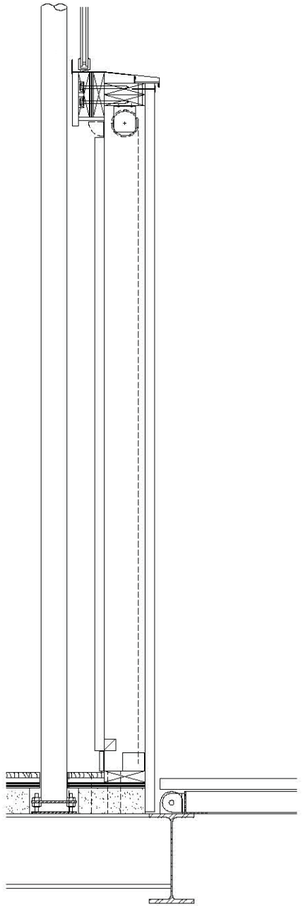


FIGURE 2. *DRAWING* BY 2005 SOLAR TEAM, 2004 (FAIR USE)

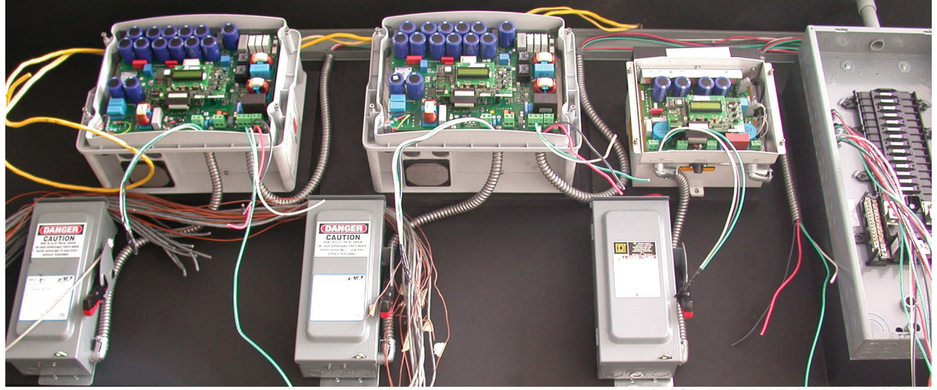
Section detail of a high-performance translucent wall system (as-built left).

TECHNICS

The criteria Technics is the most radical of the three, being comprised of the philosophy of Techne, the discourse of tectonics, and the implementation of technology. A difficult relationship to grasp in this discussion is between the philosophical ancient Greek 'Techne' and the prolific architectural rhetoric of tectonics. Techne [24] is defined as the principles or methods employed in making something or attaining an objective; it is the implication of knowledge of principles with the intent of making or doing. Techne is a practical application of knowledge towards craft rather than the theoretical or aesthetical, deriving its means through art but is philosophically distinguished from art (poiesis). Tectonics[18] is the science or art of assembling, shaping, or ornamenting materials in construction: the constructive arts. For ease of handling, this is all placed under an umbrella of Technics and comprises technology with the fundamentals in which it is handled. Ultimately, Technics is the crafting of architecture through Form and Material.

Marco Frascari sources architectural meaning in construction, privileging the joint as the generator of construction, and likewise meaning. The detail or joint, Frascari claims, can therefore impose order on the whole and has a tectonic capacity for unlimited architectural ideas. The built environment is a testament to the possibilities of innovation and invention that details hold. Frascari states that details can be [M]aterial joints or [Form]al joints, making them "a direct result of the multifold reality of functions in architecture (the structure and the use of buildings)." [25]

Alberti's search for Beauty (Form) is based on a relationship between details and their attached meanings. The detail becomes the minimal unit in the process of signification, manipulating meaning through its specific placement and relation to the whole. Meaning lies on two sides of architectural discourse according to Jacob Voorthuis: The discourse of the Designer, and the discourse of the User. The tectonic debate



PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

The autonomy of a solar powered system is made possible through electrical management components. These components are comprised of hardware and software, each exising by virtue of the other. Because they are human manifestations, an order is established which translates the workings of each part to the whole. This is interpreted across a scale of implimentation to give an intuitive reading of the system's complex workings. The syntax of electrical engineering presents a graphic diagram of logical system orders of operation.

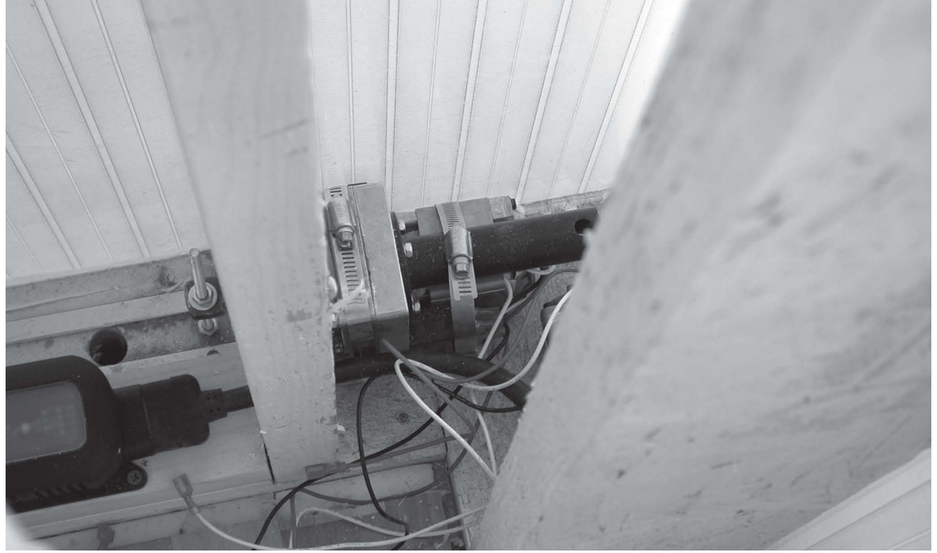
PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

Architecture is an art because it is interested not only in the original need for shelter but also in putting together spaces and materials in a meaningful manner. This occurs through formal and actual joints.[26]

becomes about intent: this being a representation of that. "When the building is a representation, a theatrical performance, it becomes an object narrowed to a set of codes. In order to approach the object as a representation one needs to be armed with the conventions and the jargon of the language it was written in… That is where the user and the architect threaten to lose each other, especially when the architect only writes plays for other architects." [27]

Voorthuis references John Rawls' veil of ignorance as a means in which the formalized language of architecture is regarded. The user experiences a space as they undergo it, forging a personal relationship that is their responsibility. This responsibility is meaning generated on each user's experience of space, and their knowledge based on a long process of experiential association and comparison. Here is where the detail acquires meaning, and intentions are realized to be just beginnings, never endings. "[B]uildings are more than intentions, they are the product of them, a very different thing." [28] Details coordinate visual and tactile sensations, and their locations create conventions tying meaning to perception of Form and Material. All perception of space depends upon conventions, and treats qualities and details as no more than signs, whose meanings are learned only by experience. The placing of details is key to the process of inference, of perception of meaning. Frascari dedicates the second half of *The Tell-The-Tail Detail* to the working of Carlos Scarpa, inferring that many of Scarpa's inventive details develop clear functions through re-presentation (re-use). He finds Scarpa's "adoration of the joint" to be a perfect realization of Alberti's Concinnitas. [29] Details may occur numerous times through a specific work to establish meaning and gain further clarity across multiple projects.

Details can be based on technology, or are technology in and of them. Either way, technology is a tool, so proper implementation is of more importance than capability. The subject of Technics is one that must be looked at linearly with



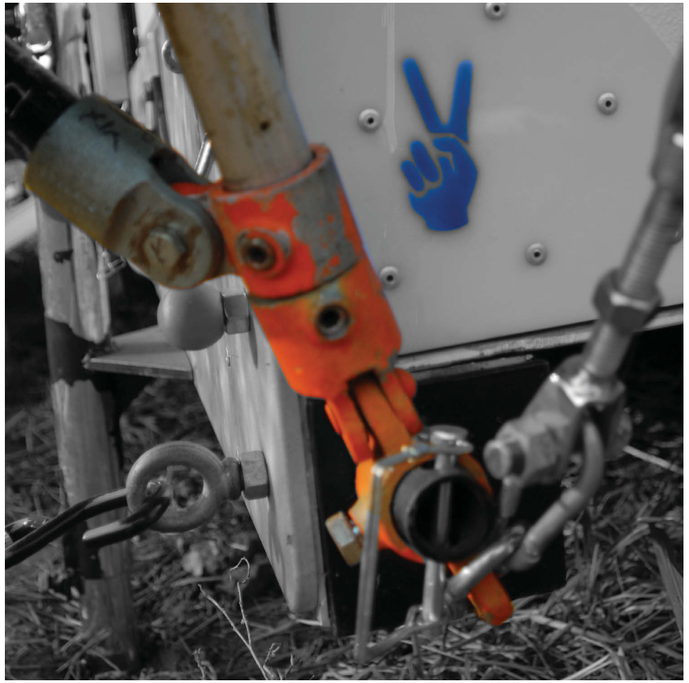
PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

The inner workings of a translucent wall assembly: screw actuators slide dampners to ventilate the cavity (above); LED modules transform the wall into a source of light (below).

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

time. Each execution of building and of architecture exhibits a degree of knowledge and technology congruent with its time in history. For an executed work to obtain maximum architectural merit, it should be implemented using Technics current in its time and at the disposal of the designer/craftsman. I stress this point because not all architectural situations can (or should) be measured equally. Much goes into the context of architecture, so this maxim of Technics is extremely variable and must take into account circumstance when measured against time. Again, I do not condone a hierarchy or precedence of Form, Material, and Technics; these criteria, these tools, are co-dependent and cross influential. Technics allows the differentiation between architecture and building beyond the “exhausted philosophical distinction between the good and the beautiful, while remaining in the context of a thoroughly utilitarian, ‘constructed’ world, i.e., our technological world.” [30] Modern Technics must incur the latest technologies and theories to progress the art of Architecture. The current pace of integration leaves the field grossly out-dated. The injection of modern appliances and retrofitted systems may prolong the usefulness of existing structures, but it cannot account for the presence of Technics, or lack there of. There is no architectural merit present in building if any quality (Form, Material, Technics) is found lacking, and this particular quality seems most removed from the development of our environment.

The architect, like a chef, is fortunate to have at his disposal libraries of ingredients and recipes for preparation. Countless methods for the joining of materials through details support our palates for dwelling and taste. Even more fortunate is that architects and chefs find challenge and enjoyment through the interpretation and re-interpretation of those ingredients and recipes, inventions specific to intentions. The adaptation of existing building components to Form and Material is as much an art as is creation (Technics). A standard component of the construction industry is the pipe clamp, used to assemble working scaffolding. Its capacity lies in an ability to join stock



PHOTOGRAPH BY DAVID CLARK, 2007 (FAIR USE)

"A good detail tells the story of its making, of its placing, and of its dimensioning." [31]

pipe per specific circumstances through compressive screws housed in sleeves, leaving the pipe relatively unchanged and preserving its capacity as pipe. These fittings have an evolutionary lineage of development through circumstantial applications and posses compounding capacities for joinery. The addition of a rotational connection between fittings permits articulation within an axial relationship to one another. When compounded, they develop an ability to perform complex tasks under the governance of simple rules. Pipe fittings join a dynamic frame of fiberglass rods, in tension and compression, to a rigid frame (left). The rotational capacities of the fittings allow the stresses of the rods to be transfer dynamically and more naturally per their material characteristics. This adaptation of application elevates the nominal fitting into a prominent detail which gives Form to Material of specific dimensions and qualities. The fittings are repeatedly used through the structure in varying sizes and configurations.

A CNC abrasive water jet (right) cuts joint details from aluminum stock. The creation of a new detail was deemed appropriate and necessary when measured against specific design intent. These parts will be welded to beams providing specific connection details for a component-driven design. Digital design and analysis can be reinterpreted to digitally aided means of fabrication and constructions, allowing some materials to possess new capacities for Form through Technics.

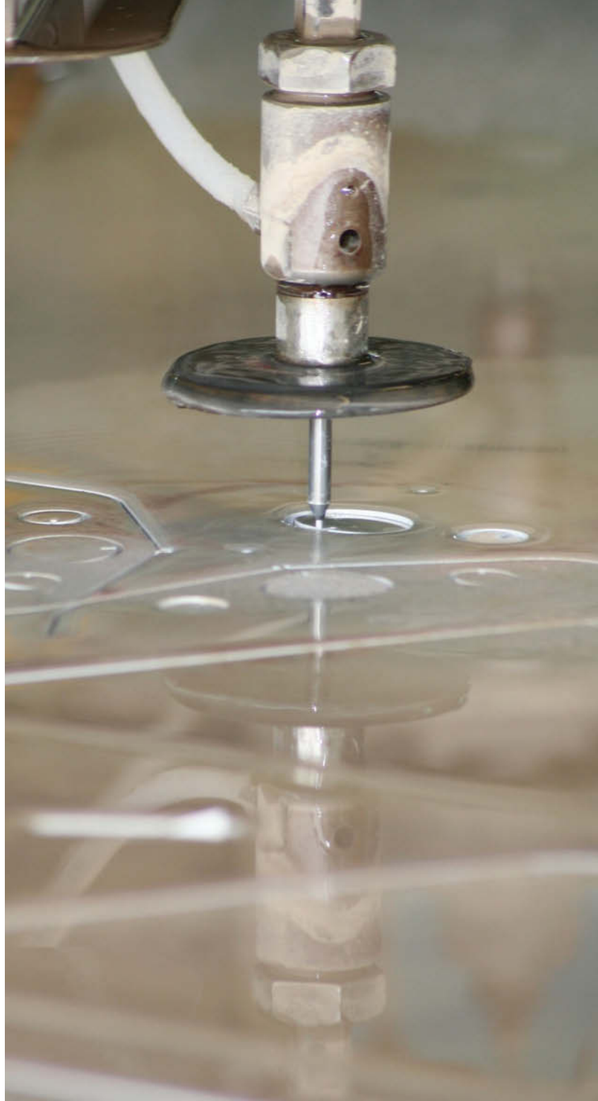
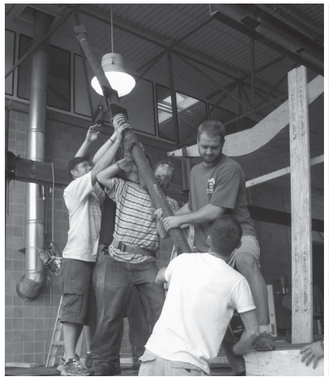
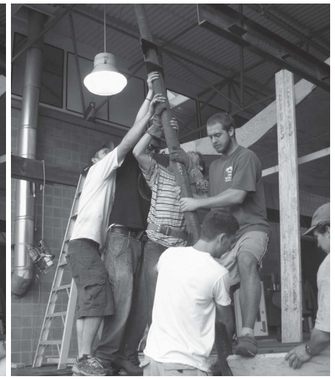


FIGURE 3. (RIGHT)

PHOTOGRAPH BY JONATHAN KING, 2006 (FAIR USE)


FIGURES 3, 4, 5, 6.

PHOTOGRAPHS BY ROBERT DUNAY, 2005 (FAIR USE)

Erecting a steel column to be weilded into a transportable superstructure for a solar-powered house prototype.

ARCHITECTURAL RESEARCH

This section contains three individual research projects and their constituent parts used in support of Form, Material, and Technics. Their constituent parts can now be seen in the light of full compositions, making the criteria relationships more prevalent and the contextual influences understood. The projects are presented in chronological order and therefore are infused with a linear progression of design influence and execution. Design research projects often involve preceding projects through analysis of their strengths and deficiencies, transferring and transforming the knowledge derived from each initial endeavor to the challenge at hand. “Each project is driven by a multidisciplinary approach that challenges research through application, harnessing the tension created by dualities of calculation and intuition; technological innovation and architectural expression; optimized performance and sensible materials; and between physical fact and psychic effect.” [32] Recent Architecture seems to strive for an evocativeness that lures photography; success is measured through an ability to be captured in two-dimensional depictions. Culture is drifting towards an abandonment of the human relation to reality, settling for the implicit, desensualized but overstimulating virtual worlds. We no longer demand explicit realities, instead finding contentment within postulated design algorithms and architectural veneers. Our sensory environments are being written in the ephemeral shorthand of technological progressions. “The current over-emphasis on the intellectual and conceptual dimensions of architecture further contributes to a disappearance of the physical, sensual and embodied essence of architecture.” [33] “A real architectural experience is not simply a series of retinal images; a building is encountered – it is approached, confronted, encountered, related to one’s body, moved about, utilized as a condition for other things, etc.” [34]

The following projects are tangible, sensual realities born of applied research and built by their designers. They are intended for a full and stimulating human experience.

FIGURE 7. *PHOTOGRAPH* BY ROBERT DUNAY 2005 (FAIR USE)

572 SQFT - 2005 SOLAR HOUSE

D.O.E. SOLAR DECATHLON VA TECH ENTRY

"Solar technology is burdened with a stigma that contradicts a sense of proportion and beauty in building. Arbitrarily attached to new or existing construction, the technology is often associated with a small clique of individuals disenfranchised from the mainstream. This project is designed to challenge these perceptions and reestablish the ideals of solar energy by integrating architecture and technology. It pushes existing paradigms by proposing architectural form that celebrates solar power while obtaining a high level of system integration. As each technical decision was measured against its contribution to spatial effect, the project attained a simultaneous sense of the sustainable and the beautiful." [35]

With the security and future of energy in mind, collaboration between private industry, practice and academia are pivitol to address systematic issues of architecture and building technology. This project is an effort to research, realize, and test building components that will reduce the nations demand for energy while improving the quality of architectural space. The focus centers on research of alternative energy and sustainable systems, and its applicability to architectural practice, academia, the construction industry and ultimately the general public.

The program is derived from the U.S. Department of Energy's International Solar Decathlon Competition - a competition in which teams of college and university students compete to design, build, and operate the most attractive, effective, and energy-efficient solar-powered house. The event is held on the National Mall, where the houses are tested across ten contests and opened to the public. The design builds from the analysis of the 2002 VA Tech entry and its success within the first Solar Decathlon. The pioneering effort of the initial project and its team allowed the 2005 design to achieve a higher level of complexity expressed in an elegant simplicity. As the 2002 project has been refered to as a ribald confederation of pristine parts, the 2005 was reconsidered as a systematic whole.

FIGURE 9.

FIGURE 10.

The identity of the house is derived from the specific relationship of its components: an inflected wing-shaped roof hovering above a three light-filled translucent walls and mssive service core. Its dynamic walls and peculiar roof compose a house of light in its every capacity.

FIGURE 8. (LEFT) *PHOTOGRAPHS* BY ALDO TUCINO, 2005 (FAIR USE)

FIGURE 11. (LEFT) *PHOTOGRAPH* BY ALDO TUCINO, 2005 (FAIR USE)

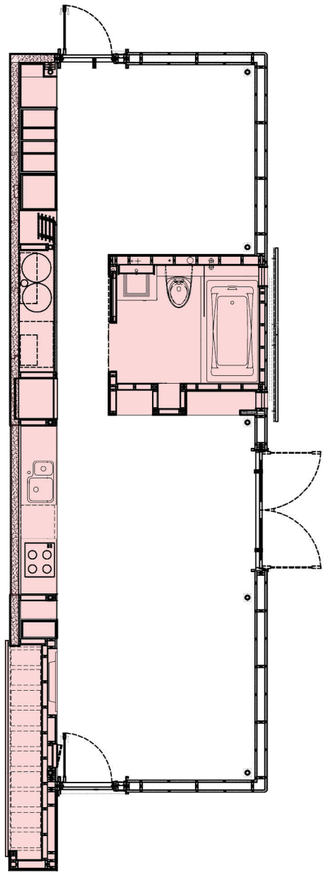


FIGURE 12. *DRAWING* BY 2005 SOLAR TEAM, 2005 (FAIR USE)

Spatial plan highlighting the 'cores' of the house (above) and the spaces they serve and separate (opposite).

Spatial richness is the result from dedicated distillation of a rigorously ordered plan and section simultaneously. This generous, yet efficient engine psychologically appears larger than its small footprint and lays the foundation for the house's theme - The Art of Integration. A rectangular plan wrapped on three sides with a translucent skin and hovering curved roof inflected toward the sun define the initial spatial dimensions. A thick linear core defines a massive north wall containing the technical equipment (batteries, electrical, mechanical) and service functions (kitchen, laundry, storage, closets) of the house. Through Form and Material, this element establishes a sense of stability and permanence that is reinforced by contrast with the delicacy of the translucent walls. The plan is divided lengthwise by a second core (bathroom) into public and private sectors. This offers a personal, cave-like environment of echoing dark slate set within the contrasting openess of the house. Material differentials create a sense of generosity, psycologically expanding the volume.

The unorthodox appearance of the roof belies a rationale that presents Form based on meaningful and efficacious criteria. The steep northern slope expresses the capture of the sun's energy at optimum angle for a specific geographical possition; a broad sense of place is given through the Technics of climate and orientation. A perimeter clerestory lets the roof be read as suspended over the walls and tranforms the ceiling into a fixture for diffusing and reflecting light (both natural and electric) to the interior and exterior. Form is derived from the dense program assigned to the roof, and gains structure from Material applied to it. Supported on columns, a grid of beams (non-uniform in section) skinned with plywood create a folded-plate/stressed skin system. The roof's Form is a combination of structural principles (Technics) and Material orchestrated into a crescendo of dematerialized curiosity.

The spaces of the house use an interplay of forms, materials,

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

The kitchen window is laced with form that gives and recieves meaning across the space. The low, long horizontal window provides natural light across the whole working area with a panoramic view to the north exterior. Set across from double doors of the same width, it helps to define a dining space in the short axis.

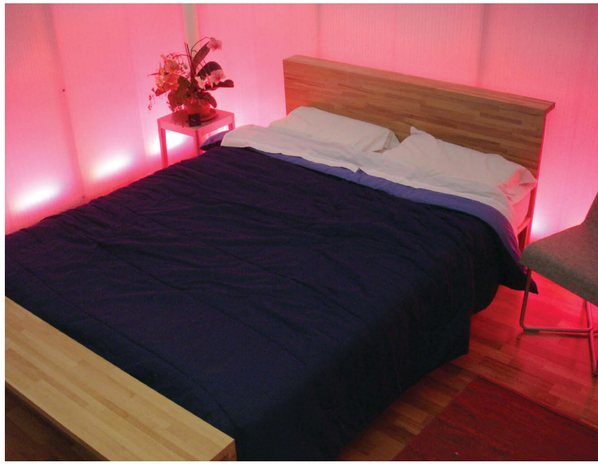
and technics to separate its programs. The house achieves a spatial generosity by minimizing physical separations and instead implyies it through contrast, repetition, and introduction of materials. All services are carved into the dark north core to liberate the floor plan from all obligations but living. This service wall quickly becomes self-implying since the remaining walls are soley tasked with the handling of light. The bathroom is the only element to physically separate space into public and private sectors.

Material has consequence. So many known properties and characteristics comprise it that that it could be relegated to the objective, factual side of design. It is in the contrasting juxtaposition of materials that these properties can be emphasized, intentionally or not. Therefore great care and understanding must be exersized to mitigate unintentional moments between materials. Glass has known, measured levels of transmittence, reflectivity, and porosity. A choice was made to have the kitchen table top of glass, supported by maple frame of smaller proportions. This creates an object of discrete presence through a dynamic interplay of transparency and reflection dependent of lighting and point-of-view perspectives. Subjective moments as this derive success through their objective foundations.

While raw material choices prescribe functionality throughout the design, material color adds deeper layers of complexity and contrast affording a sub-concious afluence to the spaces. Formica usually lacks a material presence worthy of celebrating, but its capactiy for de-materialization allows pure color to carry forth notions of Form and Technics. The north core wall cabinetry is faced in carbon-toned formica to offer a heavy, monolithic grounding element to the space. The presence of cabinetry doors is only hinted at by the blonde baltic birch plys peeking out through the reveals between panels. Blue becomes a color indicative of working surfaces; the kitchen (lower right) and home office, both carved into

FIGURE 13. (ABOVE RIGHT), FIGURE 14. (BELOW RIGHT) *PHOTOGRAPHS* BY ALDO TUCINO, 2005 (FAIR USE)

service cores, reinforce this notion through repetition. This subtlety of color influence is a strategic postition within the design concept. Color use has long been a part of design with a ubiquitous presence throughout all cultures of the world. The house broaches the topic of color psychology as a factor in human behavior by offering a level of color control throughout the space. Color is the sensation caused by certain qualities of light that the eye recognizes and the brain interprets; it belongs to the environment, acting not just as a percieved stimulus, but as an inherent concious, subconcious, and unconcious part of our psyches and human behavior. While the reaction to color is always initially a psycological one, it often results in physiological reactions. Expectations based on inherent biological developments and personal color associations can alter perceptions of reality; a placebo effect occurs. The goal in offering these levels of color control throughout the house is to tap into these physiological responses, beyond the subjective arguements of color perception, and create altered states of reality for the benefit of the occupants. Integrated LED modules within the three major polycarbonate walls can apply color theory techniques dynamically to the architectural space. The implications of these fields can: lead to reduced energy use in space conditioning - a warm-toned room can psychologically increase comfort on a cold, dreary day without physically changing the room temperature; increase or combat particular moods and behaviors based on color theory responses - a cool color can help calm and diffuse an angry or upset demeanor. Each half-meter panel has the capacity to emit a full spectrum of color independent of the others, providing a truly dynamic and tailored result for the interior and exterior of the house. This lighting system can become a responsive element for the house and/or its occupants, offering clues towards those respective demeanors. The home becomes an outward expression of its occupants at a dynamic level unfamiliar to most residential design.

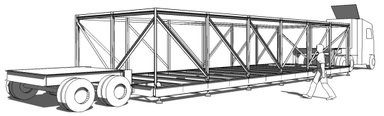


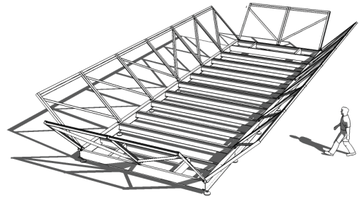
PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

FIGURE 15. (LEFT) *PHOTOGRAPH* BY ALDO TUCINO, 2005 (FAIR USE)

PHOTOGRAPHS BY DAVID CLARK, 2005 (FAIR USE)





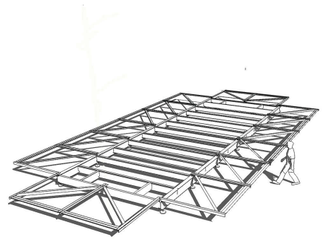


FIGURE 16. *RENDERING* BY 2005 SOLAR TEAM, 2004 (FAIR USE)

Early renderings illustrating the Truss transformation concept (above).
A successful demonstration of the completed house being transported (opposite).

The transportation components of the house are some of its most innovative and integrated features. To permit travel across the highway systems fully constructed, the house has adapted and modified principles of the double-drop lowboy trailer. This trucking industry standard can transport tall loads by suspending them between the load-carrying wheels. The chassis of the house has integrated torque boxes that accept structural connections for the respective accessories: a detachable gooseneck, forward; a detachable boogey, aft. This permits an unlimited reuse of these specialized accessories and facilitates a more economical industrial procedure for the fabrication and delivery of large-scale architectural components than what is the current practice.

Upon arriving at its destination, the house can be resting on an integrated leveling foundation system of hydraulic jacks within an hour. Once the house is self supporting, the transportation accessories are uncoupled and taken away with the delivery tractor to be resused.

A light footprint, minimal site preparation and disturbance, and repeatability are the rewards of this system. The bounding box of transportation contraints has expanded now that spatial latitudes have been regained. Architectural expression and form have more room within the realm of manufactured and modular design, and the stigma of ‘mobile homes’ can move from standard practice to the archives of history. There are no longer justifiable reasons for not providing more humanistic spatial environments which enhance dwelling.

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

The dual-purpose deck support frames hinting to their other role as a structural truss system (opposite).

The north and south decks are set into steel frames which rotate vertically into their primary role as structural trusses, allowing the house to span its full length without deflection. This structural necessity maintains a presence through the triangular forms of each deck module, a duality that holds a narrative telling a much more complex story of what this building is and how it works. This theme of dualism is carried throughout the overall design. With a capacity for supporting 30000 lbs, each truss is comparatively light to handle. With one edge pivoting against the house, the 1000 lbs of free end can easily be handled by a dozen people and lowered onto adjustable foundations. This operation was intended to be mechanically assisted using winches, but can still be accomplished easily with human hands alone.

The result of these efforts is a great expansion of the house's usable space. It offers a consistent outdoor spatial environment despite geographical location and serves as extensions to specific indoor spaces, allowing the house to feel much larger than it actually is. The full-perimeter deck establishes a new primary ground plane that blurs the threshold between interior and exterior living environments that gives the occupants dynamic dwelling choices day to day, season to season.

Full access to the house as an instrument for living is granted to the user. The south decks give full exposure to the sun and extend the general living space. The west side is partially covered by roof to offer the main entrance rain and snow protection. An inset aluminum grate lets water from the roof scupper spill through the deck plane into a cistern below, making each rain an remindful event about water conservation. The north deck serves the outdoor electronics space and provides a consistant shaddy escape. The east deck admits access to the bedroom door and a place to enjoy morning sunrises. Much of the house's spatial success can be attributed to the simple inclusion of a deck system, greatly improving its capacity as an educational exhibit as well as a potential model for living.

FIGURE 17. (RIGHT) *PHOTOGRAPH* BY ALDO TUCINO, 2005 (FAIR USE)

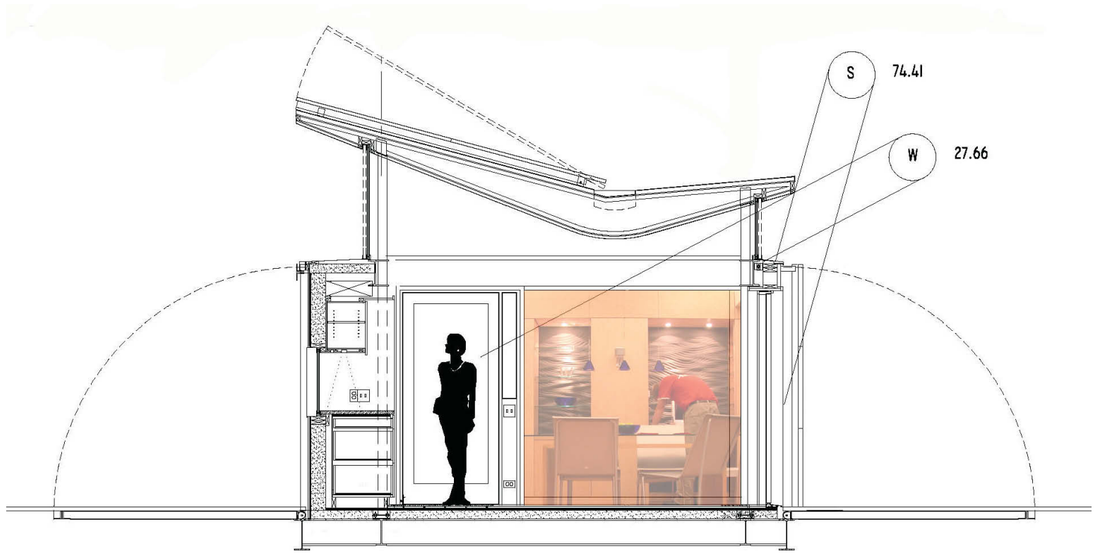


FIGURE 18. *DRAWING* BY 2005 SOLAR TEAM, 2004 (FAIR USE)

Transverse section illustrating influential technical elements that led to specific forms throughout the design.

PHOTOGRAPH (LEFT) BY DAVID CLARK, 2005 (FAIR USE)

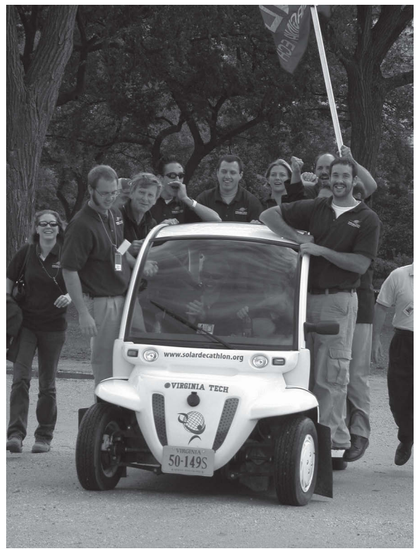


FIGURE 19. *PHOTOGRAPH* BY ROBERT SCHUBERT, 2005 (FAIR USE)

FACULTY PRIMARY AND CONTRIBUTING

Robert Dunay	Director, Industrial Design
Michael Ellis	Prof. Mechanical Engineering
Robert Schubert	Assoc. Dean of Research, Arch.
Joe Wheeler	Assoc. Prof. Architecture
Ed Dorsa	Assoc. Prof. Industrial Design
Michael Ermann	Assoc. Prof. Architecture
Ben Gauslin	Asst. Prof. Architecture
Ben Johnson	Prof. Landscape Architecture
Michael O'Brian	Prof. Building Construction
Mehdi Setareh	Prof. Civil Engineering - Arch.
Jay Stoeckel	Assoc. Prof. Architecture
Gregory Tew	Director, Interior Design

STUDENTS PRIMARY AND CONTRIBUTING

Brian Attwod	Architecture
Mike Christopher	Electrical Engineering
Chip Clark	Architecture
Dan Gussman	Architecture
Phil Hassell	Electrical Engineering
Nancy Hodges	Landscape Architecture
Brandon Lingenfelser	Architecture
Kyle Longbrake	Mechanical Engineering
Ben Mohr	Structural Engineering, Architecture
Brett Moss	Architecture
David Rariden	Architecture
Tom Shockey	Architecture
Alan Todd	Architecture
Matt Wagner	Architecture
Alec Clardy	Building Construction
Nathan Gabriele	Industrial Design,Architecture
Chuck Hoover	Interior Design, Architecture
Nathan King	Industrial Design, Architecture
Nick Monday	Industrial Design, Architecture
Adam Tomey	Electrical Engineering
Seanene White	Architecture

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

PHOTOGRAPH BY DAVID CLARK, 2006 (FAIR USE)

The annexed Meditation Room of a residence for a former professional dancer.

230 SQFT - MEDITATION ROOM

E.M.H.E. BLACKSBURG, VA

230 sqft - Coming off a successful showing of their 2005 Solar Decathlon entry, the Va Tech team returned to Blacksburg to unwind and assimilate back into the pace of Fall class schedules. The excitement soon picked up again following a phone call in the middle of the night to lead faculty of the Solar House project. It was the middle of November, and this call was in regards to something secretive. “Can you get together a small design team for something big, something important?” was the question. “We can’t tell you what it is about yet, not over the phone.” So a select group met that evening, speculating while waiting for a conference phone call that would disclose the details and reason for this feverish assembly. ABC’s Extreme Makeover Home Edition had chosen a local Blacksburg resident for its 16th episode of season three. The building site was known, and a Roanoke Contractor was in place to take charge of construction logistics. Now they needed a design. Because the town and the University are so intertwined, they believed it was only natural to involve Va Tech in the process. Working closely with the show producers and contractor, a select group of faculty and students within the College of Architecture and Urban Studies became responsible for the design of the house. A whirlwind of work followed, fueled by research and coffee, and before Thanksgiving a design was agreed upon by all parties. Construction would follow only two weeks later.

The Carol Crawford-Smith Residence would be constructed on the site of the original home; a small single story house situated on a deep narrow lot, the typological standard for the street and neighborhood. The dwelling had become increasingly difficult for Ms. Crawford-Smith who was diagnosed with multiple sclerosis. A stepped entrance to the house and a sunken living room made maneuvering on crutches extremely challenging and impossible in a wheel chair. This house would be demolished in a day and the site prepared for a new home, suited to the user’s developing needs.

PHOTOGRAPHS BY DAVID CLARK, 2006 (FAIR USE)

The new house design provides ample space through a single level house for ease of movement and care of the home. The design quickly became larger than the neighboring homes, and concerns regarding context and appropriateness arose. The design breaks down the home into smaller constructs and is treated as a tightly-nested ‘village’ of small houses. The full length of the site is used, employing the flow of southern ‘shotgun’ housing design, and terminates at a shed-like annex where the design team took full liberties to provide a unique space.

Crawford-Smith is a formally trained dance instructor in the town and former professional ballerina. Her limiting condition requires an exercise regime and she had turned to yoga and other meditative exercises to maintain her health and spirit. A personal space was needed, deserving and assistive, where she could practice this art. Potential was identified in the iconic suburban shed, but this building would hold a different set of tools.

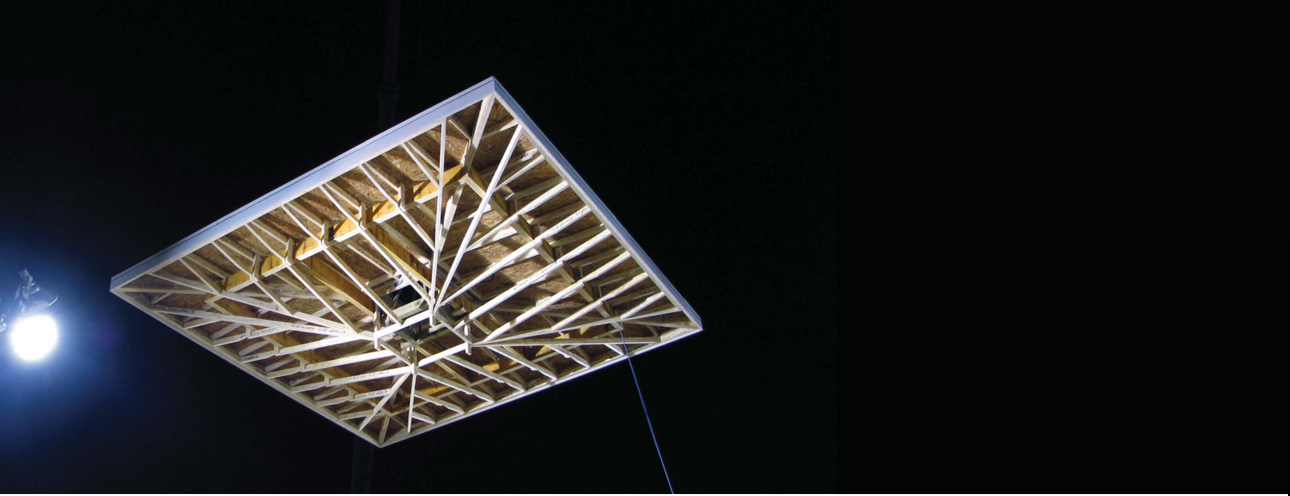
This seemed a perfect opportunity for the design team to practically apply research from other projects. The show’s producers approved a proposal to model a meditation room from the recently exhibited 2005 VA Tech Solar House and included the Solar House in filming to provide context for the radical design. Ultimately all elements were measured against their contribution to a meditative environment and the specific user. Details from the 2005 Solar House could not be cut and pasted, only their intrinsic values if deemed appropriate.

Because the show operates on the premise of building a home in seven days, the components of the meditation room were pre-fabricated off-site at a school research facility. Walls, columns, platform, and roof were designed and built as deliverable components for quick re-assembly and finishing on site. Partnerships built from Solar House research exhibited new products and refined details to systems in preparation for

PHOTOGRAPH BY DAVID CLARK, 2006 (FAIR USE)

The composition of materials and forms creates a specific solitary environment. The fundamental elements of the space (above and left): lightwell, slate water wall, clerastory, platform, translucent walls.

PHOTOGRAPH BY DAVID CLARK, 2006 (FAIR USE)



PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

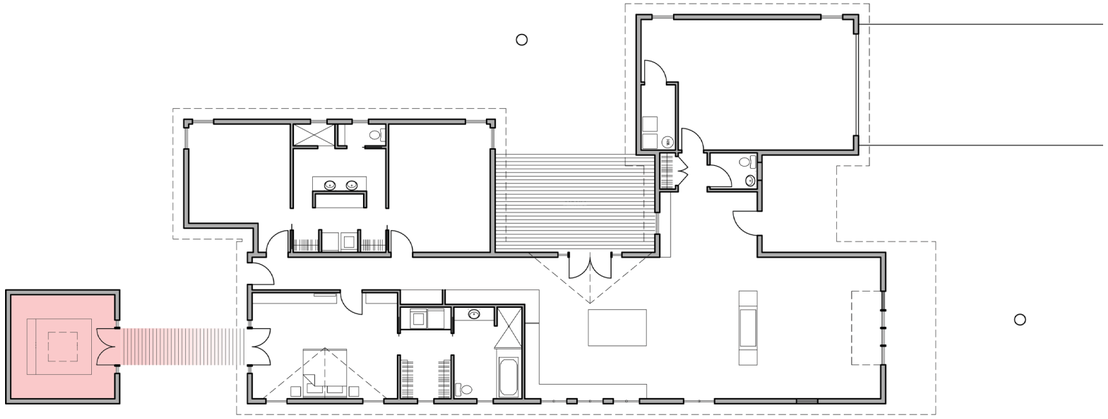


FIGURE 20.

DRAWING BY EMHE DESIGN TEAM, 2005 (FAIR USE)

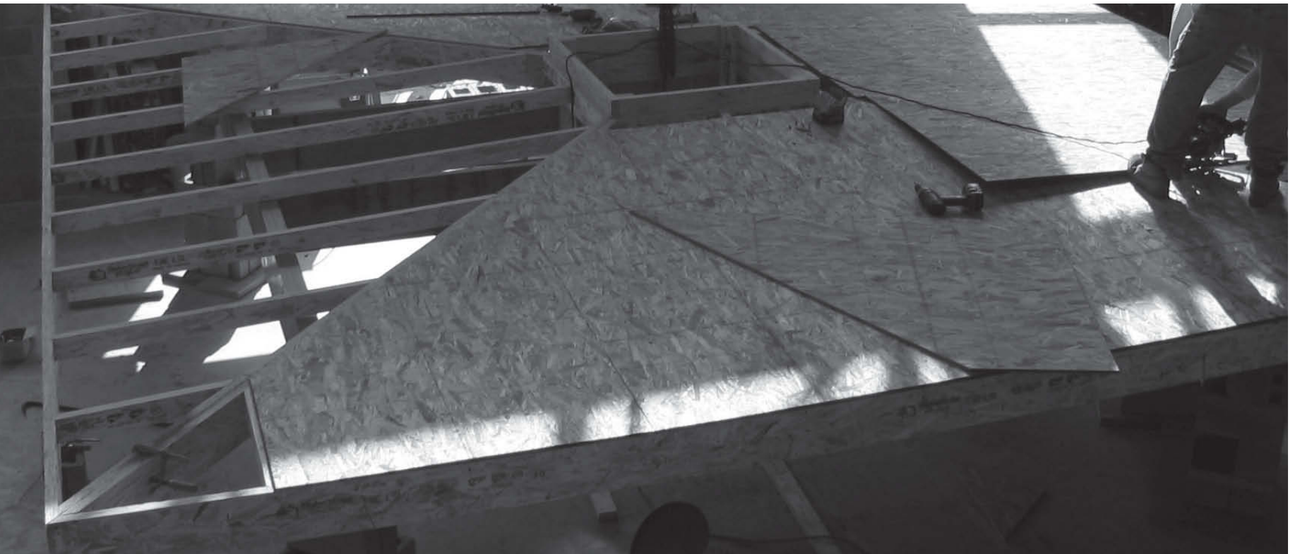
Plan showing the Crawford-Smith residence. The Meditation Room is highlighted in red.
Above and right: the roof of the Meditation Room being craned over the main house and placed on columns.

national exposure. The translucent wall assembly had become an available product in itself, coupled with LED lighting control, that was being exhibited to viewers for consumer use.

The meditation room is connected to the main house by a bridge spanning a rock garden leading to the master bedroom. The room is square in plan, with a central raised hardwood platform. Upon entering, the room visually terminates at a stacked stone wall rising out of a pool of water set at the far end of the platform, grounding the lightness of the structure with material mass. A pooled water at the top washes the wall in water and giving an auditory quality to the space. A square aperture projects through the center of the ceiling, giving any person under it an axial connection to the sky. The user is centered, the space focuses on them. The roof hovers overhead, tied to the earth through four steel columns. A perimeter clerestory washes the ceiling in natural light with views to exterior tree scapes. The roof has an ethereal presence, especially when illuminated at night from below. A perimeter lighting trough treats the ceiling as a fixture by washing it with indirect light. The wall assembly holds LED modules at its base, sandwiched between translucent aerogel-filled polycarbonate panels. The walls become another fixture of light, diffusing sunlight during the day and emitting a user-defined range of 16 million colors at night. This system starts to explore the psychological effect of space in color and adds another dimension to support meditation and exercise.

The prefabricated components of the meditation room exhibit a redundancy in structural details, a signifier of transport and re-assembly methods. The roof is made of four segments joined to a central compression ring doubling as a light well for the space below. Designed to rest upon columns inset of the perimeter, the roof is primarily a compressive structure. It will be hoisted overhead by crane from the center, and therefore must handle stresses opposite of its initial design. The underside framing triangulates these stresses as well as creating a dynamic spatial

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)



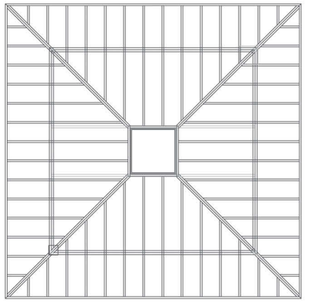
environment for the room. The inverted ceiling pushes the interior through the clerestory to the outdoors while bringing light in.

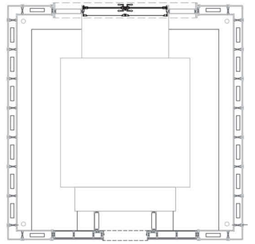
Details of the roof construction reveal a use of engineered lumber and decking (left). The structure needed to be as light as possible and still consistently retain a high level of strength integrity. The four roof modules key into each other and are centrally locked to a compression ring that also serves as a light well for the space below. The topside is finished with a white EPDM across the decking, and half inch tempered class over the light well. The interior underside ceiling is finished with gypsum, and the light well is finished in apple-veneered plywood. The central platform is decked with tongue-and-groove white oak in the fashion of traditional dance floors. The perimeter floor space is tiled with electric resistance meshes laid into the grout bed for radiant heating.

The main house shared similar techniques in its construction design. The shop drawings were sent to a pre-fabricator and panelized for transport and rapid construction. The walls were raised and under roof within twenty-four hours to allot the majority of time for interior finishing.

As exhibited in its drawings (right), the meditation room is of modest construction and assembly. It derives its uniqueness from an interrelationship of Form, Material, and Technics. The space is about user control and presence; everything about the room is focused to the user as they are centered in space. The platform physically elevates towards a ceiling that draws you towards it. You cannot help projecting yourself through the overhead aperture into the sky. Ephemeral walls emitting varied intensities of color can echo or set a mood. It is a new interpretation of the Japanese Pagoda.

Across seven days of snow and freezing temperatures, the original house was demolished and a new home was built. It





PHOTOGRAPHS (LEFT) BY DAVID CLARK, 2005 (FAIR USE)

FIGURE 21. *DRAWINGS* BY EMHE DESIGN TEAM, 2005 (FAIR USE)

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

The house as it was first presented to the Smith family on December 13, 2005. (above and right)

took an entire community to accomplish such an ambitious goal. The new house more than doubles the square footage of the original while maintaining a modest street presence. The over-all house design was approached as a suburban village, evident by roofs that differentiate between spatial programs. This keeps the home in an appropriate context of relation to the neighboring structures while having a much larger footprint. A great cantilevered roof off the main living space creates an outdoor living room that blurs boundaries between public and private. The iconic front porch has been stripped of its elevation, columns, and railing, becoming a much more inviting and usable space due to the absence of those bounding elements. Extensive research in spatial planning from the 2005 solar house endeavor was reapplied to the Smith residence to permit maximum ease of use and space giving. The result is a generous home of a modest but high-quality presence.

A balance needed to be achieved between the needs of the users and the clients, two very different groups with very different agendas. Though the ultimate goal was a convincingly usable home for a specific individual with specific needs, there were many underlying requests and requirements by the clients - the television show producers - that affected the end product. The placement of doors and windows became extremely particular for ensuring certain camera shots during the walk-through filming. The design process took on a new theatrical element as the designers surmised viewpoints through a mental director's lens. The main entrance space had to be reworked because it was thought to be too difficult to film. Hallways were exaggerated to give greater senses of depth and expansiveness. The design had to have a fluidity to it, not just for Crawford-Smith's successful future use of the home, but also for the brief moments of filming so the house could best be delivered to a nation-wide audience. None of the team members had dealt with a situation quite like this. It proved to be a tedious and taxing dichotomy that fully challenged the designers' fundamentals of architecture.

PHOTOGRAPHS BY DAVID CLARK, 2005 (FAIR USE)

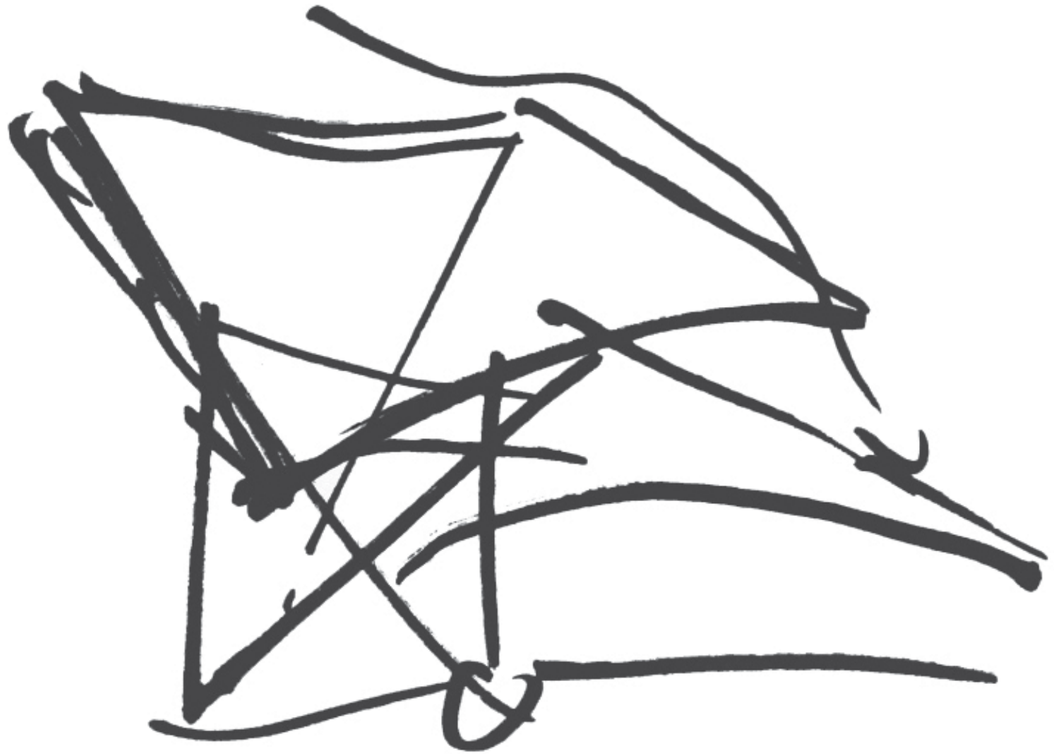
Primary Design Team

Robert Dunay	Professor, Director of Industrial Design
Joeseph Wheeler	Assoc. Professor, Architecture
Amanda McCreary	Designer, Building Specialists, Inc.
Chip Clark	Architecture
Brandon Lingenfeltser	Architecture
Ben McCreary	Architecture
Tom Shockey	Architecture

Realized by the hundreds of volunteers from
the Blacksburg and Virginia Tech communities

PHOTOGRAPH BY DAVID CLARK, 2005 (FAIR USE)

Rear panorama of the Crawfor-Smith home. The Meditation room walls (red) are internally lit.



Preliminary sketch of PLUG and air movement across the structure (left).

FIGURE 22. (LEFT) *DRAWING* BY JONATHAN KING, 2006 (FAIR USE)

128 SQFT - P.L.U.G.

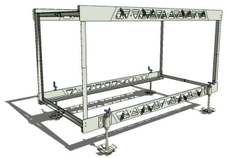
MAHALE MTNS, TANZANIA

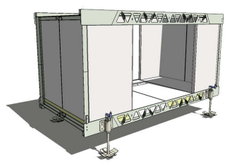
P.L.U.G. (Portable Living on Uncommon Ground) is a collaborative research project between the College of Architecture and Urban Studies and the College of Veterinary Medicine within Virginia Tech. The program comes specifically from the Bush-to-Base Bioinformatics research project within the College of Veterinary Medicine, calling for a field-ready research laboratory with comfortable living accommodations to be deployed in remote and environmentally sensitive locations.

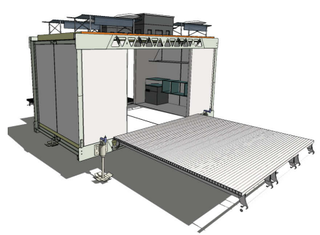
Bush-to-Base Bioinformatics is an electronic architecture designed to facilitate the study of dynamic interrelationships between animals, humans, and the environment. This belief in a dynamic and perpetually interwoven relationship serves as an important organizing principle for research and educational endeavors. Bush-to-Base's cyber infrastructure is designed to capture, organize, store, share, analyze, and disseminate biological data by technologically bridging the gap between field and lab work.

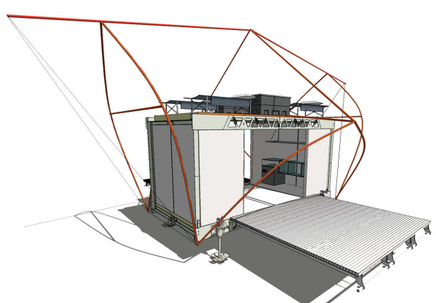
Conceptually, P.L.U.G. is an architectural component solution that benefits from the repetition, reuse, and standardization of details to create lightweight adaptable and interchangeable structure. Specific programmatic demands and locations dictate refinements to this "kit of parts." This interpretation of the Bush-to-Base program facilitates long-term field research in the Mahale Mountains National Park, Tanzania. P.L.U.G. simultaneously acts as a research lab and dwelling for researchers collection observational and physical data on chimpanzees. Therefore the structure must respect the delicate environment it is located in, and can leave no memory of its stay when removed.

Like all buildings, P.L.U.G. is system of parts. Unlike most, it must meet the technological demands of laboratory research while maintaining a capacity for light-weight rapid deployment and removal. The project is dominated by a vast number of constraints and demands that are measured against one general









criterion – two people must be able to carry and assemble it. Nothing is useful in the bush if you cannot get it there, and in an environment where each step is often a pioneering effort, the degree to which this rule is satisfied can be the determinate of success or failure.

On paper adequate shelter may seem to be the primary concern for P.L.U.G., but this would be an incorrect reading of its program. Integration, by every means and sense of the word is the concern. A rigid orthogonal volume enveloped by the more freely-formed compound curves of a fabric skin becomes a means through which researchers can integrate a laboratory into their research and home environment. Autonomy of power is derived from photovoltaics with a battery bank as the storage medium.

The structure containing the laboratory is comprised of modular aluminum moment frames serving as chassis, infilled with structural insulated panels (SIP) for floors and walls. Four adjustable foundation posts elevate and level the structure, mitigating site impacting and flooding during seasons of heavy rain. Component connectivity is achieved through a tool-less assembly process by two people. The roof of the lab-box serves as sleeping quarters under a tent superstructure. The fabric tent provides rain, wind, and thermal protection for the lab-box, keeping the working space passively temperate. A lightweight modular frame of 1” diameter structural fiberglass rods, metaythlcrylate adhesive, and articulating structural pipe fittings translates the dimensional plans of the lab-box to a compound canvas field that echoes the surrounding tree canopies. Aluminum exterior decks fitting the module of design permit a doubling of the usable floor space and blur the boundary between interior and exterior. The decks can be rotated vertically over the lab openings and transformed into an additional layer of security when the laboratory is not in use.

The laboratory program divides the box interior into three

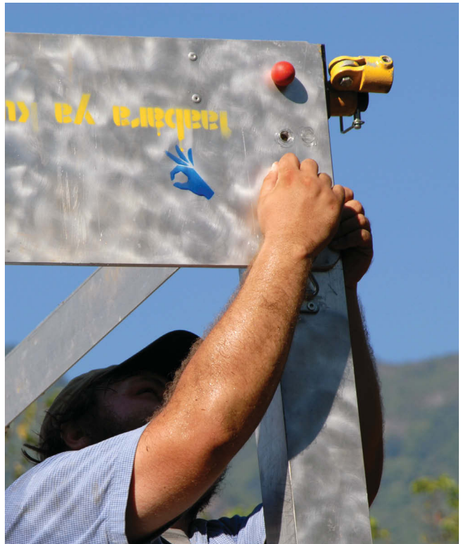
FIGURES 23, 24, 25, 26 (LEFT), 27 (ABOVE) *RENDERINGS* BY PLUG DESIGN TEAM, 2006 (FAIR USE)

FIGURE 28. *PHOTOGRAPH* BY DR. JATINDER SINGH, 2007 (FAIR USE)

A tool-less connection system facilitates true hand assembly.

distinct spaces: a controls center, a clean room, and a swing space. The control center houses an electrical power panel, electrical research equipment, charging stations, and heavy electric-load appliances. The clean room is a semi-sealed lab environment that offers more environmental control for sensitive biological analysis. The swing space is a dynamic interstitial room that can flow into the control center, clean room, and exterior decks to accommodate daily living, meetings, and exhibits as needed.

In the early design stages of PLUG a component-based structure became inevitable. With that comes the necessity of fastening components and their supplemental tooling. To increase the universality of the project, great effort went towards developing tooless connection details and hardware for decreasing the overall loads being transported and mitigate detrimental impact from the loss of special tools. An adjustable wrench can be hard to come by in the bush, especially when you need one. This also makes them quick to disappear. Standard and common mechanical fasteners were employed often as possible. This meant research into what was available locally if parts need to be replaced or modified. All critical components were duplicated with many of the building's details exhibiting a controlled level of redundancy, should parts not make the full journey. Intended to be transparent in its assemblage, large components are stamped with symbols matching them to their correct mates. The structural frame could be erected upside down without any affect towards assembly afterwards. Parts are color coordinated to make their function and location within the system more discernible. A rationality of systems governs the assembly process of PLUG, therefore it was decided not to have a printed how-to manual for assembly. We believe who ever comes to move the structure will gain enough knowledge through its disassembly to competently rebuild it. We dream instead that they may find a more beneficial arrangement and use of the components we left in those mountains. That would be an exciting thing to see.



PHOTOGRAPHS BY DAVID CLARK, 2007 (FAIR USE)

FIGURE 29. *PHOTOGRAPH* BY DR. JATINDER SINGH, 2007 (FAIR USE)

The lightweight aluminum structural frame is rapidly deployable and easily leveled using trailer jacks.

FIGURE 30. *PHOTOGRAPH* BY DR. JATINDER SINGH, 2007 (FAIR USE)

Panelized wall modules enclose the frame. Fiberglass rods give form for the tent and general identity of the lab.

FIGURE 31. *PHOTOGRAPH* BY DAVID CLARK AND JONATHAN KING, 2007 (FAIR USE)

Research and building components had to be carried off the transport boat and in-land to the site.

The greatest challenge for the project may have been transporting it from Blacksburg, Virginia, USA to Mahale Mountains National Park, Tanzania. To meet the scope of the project, more than just the building needed to be transported. A forty foot shipping container was filled with all necessary items for the Bush-2-Base endeavor to be initially executed for one year. That includes all research equipment, building components, miscellaneous goods for daily living, and a seventeen foot aluminum boat for transport to neighboring villages and outposts. The shipping container left Blacksburg, VA for Norfolk, VA. There it was loaded onto a container ship which crossed the Atlantic Ocean into the Mediterranean Sea, passed through the Suez Canal, and ended in the port of Dar-es-Salaam, Tanzania. The container was then loaded onto a truck and trailered west across the entire country to Kigoma Town and Lake Tanganyika. At the water's edge, the container's contents were transferred to a wooden boat and motored 17 hours south to a beach off the Mahale Mountains. With the boat moored fifty yards off shore, each item had to be hand carried to the beach and staged for the next leg of the journey into the forest to the laboratory site twelve-hundred yards away. Unlike other National Parks in Tanzania, Mahale has no roads or infrastructure, only foot trails and bush camps.

Much of the travels within the country of Tanzania were met with unanticipated challenges. Initial plans for transporting the project changed often and unexpectedly. Each new leg of the journey proved to be more difficult and less certain as PLUG moved west and into more remote regions. The two-man criteria for all project goods and materials proved itself to be quite adaptable in transport. It was best demonstrated when packed deep in the bowels of a local fishing and transport ship; the ship's crew, researchers, and build team perched atop and around all that comprised PLUG for over 130 kilometers through a body of water that acted more like an ocean than a lake.

FIGURE 32. *PHOTOGRAPH* BY DR. J. SINGH, 2007 (FAIR USE)

FIGURE 33. *PHOTOGRAPH* BY J. KING, 2007 (FAIR USE)

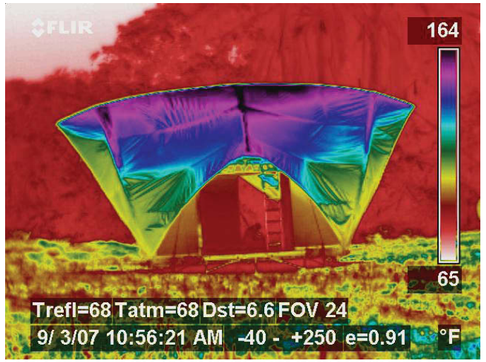


FIGURE 34. *PHOTOGRAPH* BY D. CLARK AND J. KING, 2007 (FAIR USE)

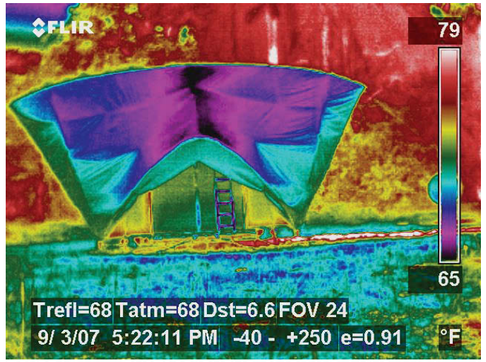


FIGURE 35. *PHOTOGRAPH* BY D. CLARK AND J. KING, 2007 (FAIR USE)

Infrared thermal photography documents the tent's effectiveness for mitigating extreme daytime temperatures.

FIGURES 36, 37, 38, 39, 40. *PHOTOGRAPHS* BY DR. J. SINGH, 2007 (FAIR USE)

Pictures from a thermal imaging camera (used by the biology researchers to identify abnormalities in their subjects) shows the effectiveness of the tent/lab double-envelope system (far left). Before 11 am, the tent has reached a temperature of 164 degrees Fahrenheit while the lab interior stays in a comfortable range comparable to the forest beyond it. The tent shape also serves to direct airflow around the lab, increasing the presence of even the slightest breeze. As impossibly hot as the ridge of the tent may get, this buildup surprisingly becomes advantageous (aside from having an inhouse sauna). Convection currents are created with the rising heat, creating passive air circulation through the lab and out the ends of the tent ridge. As evening sets in, the tent rapidly cools while the lab still maintains temperature. Evenings spent sleeping under the tent and on top of the lab box are as pleasant and cool as the location's daily climate will permit.

The Mahale mountains experience a great rain season during the winter months. Coupled with this is an increase in the insect population and likewise the spread of disease. The tent becomes a critical line of defense for this period, offering partially covered exterior spaces and a means for attaching invaluable insect screening in the sleeping quarters above.

Tent Specifications:
- exterior umbrella canvas, sealed
- custom tailored from panelized design
- approx. 1000 sqft, 120 lbs
- zip-in insect screens, two ply constuction (safety mesh, no-see-um insect screen)
- storm flaps for lab entrances

Living in PLUG can best be described as an 'executive camping' experience. Every effort was made to provide the resources needed for comfortable living and quality field research. The laboratory creates and stores its own electricity, pumps water, and incorporates a shower/outhouse/wetroom component, all

FIGURE 41.

PHOTOGRAPH BY JONATHAN KING, 2007 (FAIR USE)

PLUG - complete and operational, looking towards the sacred mountains of the Mahale range.

with minimal ecological disturbance as possible. At a meager 126 sqft, the structure can quickly grow small for two people through the course of a year. Separating work and living spaces is critical to the researchers' well-being. The sleeping loft above the lab box can be accessed independently of the working space below. Drop-in panels comprise the ceiling of the lab box and offer an array of configurations to meet the demands of specific live/work relationships. Ladder access to the sleeping loft can therefore be accomplished from inside to increase security and convenience by removing one of the ventilation grates (lower right).

The terrain is mostly rugged and hilly, and is dominated by the Mahale Mountains chain that runs from the northwest to the southeast across the park. The mountains are considered a sacred place for the local Watongwe people; the highest peak Nkungwe (2,462 m) is a spiritual focal point and tribal burial ground for chieftains (left). A typical day begins with breakfast on the deck of PLUG as the sun rises over the mountain ranges in the distance and ends with a cooling swim in the lake watching the sun set over the Congo across the water. Evenings are spent compiling data and exchanging information with researchers who are just starting their days on the other side of the world. The laboratory is situated at the base of the Mahale Mountain range at one of the last flat sites before constant steady elevation increases. The area was chosen for its balanced proximity to the lake, established guide trails, and chimpanzee feeding areas.

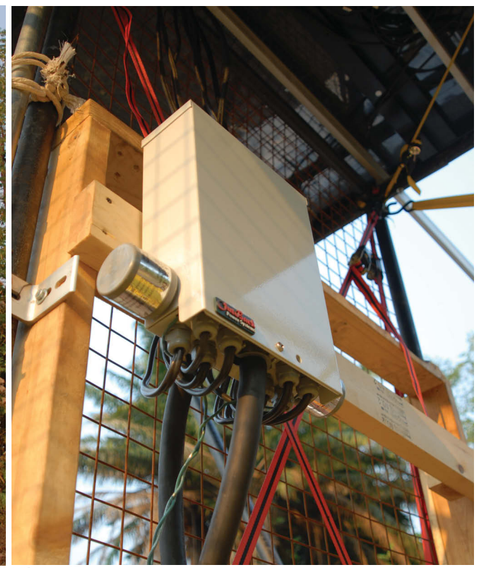
Special consideration had to be given to the 'neighbors' sharing the site. Encounters with warthogs (upper right), baboons, vervets, porcupines, snakes, monkeys, and leopards can be a daily occurrence. Even if they are not seen, signs of their presence can usually be spotted. Precautions must be taken in regard to the building itself - its tent structure must be able to withstand curious baboons, monkeys, and chimpanzees climbing it. The elevated lab and decks can serve as a haven for

FIGURE 42.

FIGURE 43.

PHOTOGRAPHS (RIGHT) BY D. CLARK AND J. KING, 2007 (FAIR USE)

FIGURE 44.



PHOTOGRAPHS BY D. CLARK AND J. KING, 2007 (FAIR USE) FIGURE 45.

The PV annex for PLUG, provides power generation via an electrical cable umbilical. It is partitioned inside to serve as a secure storage space as well as a bathroom and shower space. The steel mesh will be woven with dried grass for privacy and security.

animals escaping the sun or rain, so visibility to the underside is a safety precaution. Doors cannot be left open and equipment left out if the building is unattended. Baboons are aggressive enough to walk in and steal anything they can carry, even when you are there. Food always attracts attention, so it must be stored appropriately. Leopard droppings from the night before spotted beside a deck the next morning meant most food would be moved to the PV annex before nightfall, especially fresh caught fish.

Power production for the laboratory comes from a photovoltaic electric system sized to meet the demands of the research program and provide continuous power even through the rainy season of October through May. Eight photovoltaic panels (PVs) and eight deep cycle batteries are managed by a custom power panel distributing alternating and direct currents throughout the lab (center, right). The design and budget constraints of the project meant the PVs could not be integrated directly into the lab design, therefore an annex structure was devised and built from spare components and local materials to serve as a support structure for the lab (left). PVs roof a pipe-framed structure clad in steel mesh, floored with grating, and braced with shipping straps. A galvanized wire fence gate offers securable access to the space. Lumber initially used for packaging containers is repurposed for mounting electrical components and creating storage for research material. Half of the annex interior is dedicated to large and hazardous storage, the other serves as a shower and restroom facility. Grass is eventually woven into the steel mesh offering privacy and weather resistance.

Space is at a premium in the lab, so having dedicated work environments is a necessity to protect equipment and the integrity of the research. A 'wet' space can be quickly configured if a more controlled environment is required by unfurling clear vinyl panels that velcro shut, separating it from the central swing space (top, right). Opposite side is the electronics space,

FIGURE 46. *PHOTOGRAPH* BY DR. JATINDER SINGH, 2007 (FAIR USE)

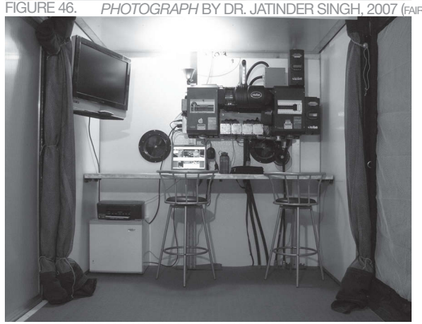


FIGURE 47. *PHOTOGRAPH* BY D. CLARK AND J. KING, 2007 (FAIR USE)

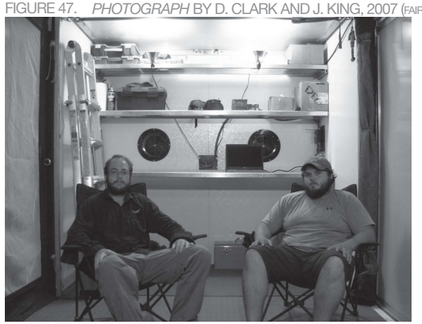


FIGURE 48. *PHOTOGRAPH* BY D. CLARK AND J. KING, 2007 (FAIR USE)

FIGURE 49. *PHOTOGRAPH* BY DR. JATINDER SINGH, 2007 (FAIR USE)

The laboratory with its constituent auxillary compoents: weather station (left), thatched PV annex (right), and satellite dish obscured by the annex.

dedicated to heavy-draw appliances and charging bases. This space can also be partitioned off by unfurling zip-in bug screen panels if the central swing space is left open to the outdoors.

Famous for containing some of the last remaining wild chimpanzees in Africa, the Mahale Mountains National Park is a 1613 km^2 peninsula on the eastern shore of Lake Tanganyika. The land in and around Mahale is the traditional homeland of the Watongwe and Waholoholo tribes. Japanese primate researchers began exploring along the shore of Lake Tanganyika, south of Kigoma as early as 1961. In 1965, the researchers established their first camp, 'Kansyana', in Mahale and began habituating chimpanzees. The cinder block compound they constructed is still in use and serves as an interesting case study for the ecological impact of long-term research facilities. It is situated further into the mountains, well over 3 times the distance from the lake as PLUG. Its permanence has led to inefficiencies as the chimpanzee population slowly moves about the vast park. Japanese researchers visited PLUG, impressed and complimenting it for its lightness, compactness, and efficiencies; a great measure of success coming from seasoned researchers fully accustomed to life in the bush. Local managers of the Mahale Mountain National Park service and leaders of TANAPA (Tanzanian National Park Authority) made regular visits to PLUG during its first weeks to assess how the proposal for such a research venture was carried out and executed. Again, it was received with praise and excitement for the potential of more facilities like it, both in Mahale and across all the other national parks of Tanzania.

There is a necessity for structures and programs like PLUG. While this particular case was driven by a specific research agenda, it is built from a conceptual design platform focused towards light-weight, rapidly deployable structures that are flexible enough to accommodate broad and varied programs for remote, inaccessible environments throughout the world.

Faculty Advisor

Matthew Lutz	Professor, Interior Design CAUS

Lead Student Team

Chip Clark	Architecture
Nathan King	Industrial Design, Architecture

University Collaborators

Dr. Taranjit Kaur	Professor, Researcher CVM
Dr. Jatinder Singh	Professor, Researcher CVM

Student Collaborators

Chris Carpenter	Volunteer
Howard Chen	Industrial Design
Melissa Pyles	Interior Design
Katie Dufresne	Interior Design
Bert Green	Industrial Design
Shelly Gross	Interior Design
Danielle Jove	Interior Design
Paul King	Volunteer
Brandon Lingenfelser	Architecture
Christine Manfredo	Industrial Design
John Mills	Industrial Design
Clay Moulton	Industrial Design
Jamie Radeke	Interior Design
Brian Szekely	Biomedical Sciences and Pathobiology
Clive Vorster	Environmental Design and Planning
Jason Zawitkowski	Industrial Design, Architecture

FIGURE 1. (RIGHT PAGE) *PHOTOGRAPH* BY DAVID CLARK AND JONATHAN KING, 2007 (FAIR USE)

This page left blank intentionally for printing format

A PERSONAL DEFINITION

In reflecting (literally) on a glass detail he made, Carlos Scarpa said he hated himself. He had not anticipated that result. In discussing the event, he said: “These are mistakes which one makes in thinking, acting, and making, and therefore [it] is necessary to have a double mind, a triple mind, the mind like that of a robber, a man who speculates, who would like to rob a bank, and it is necessary to have that which I call wit, an attentive tension toward understanding all that is happening.” [35] I enjoy this passage and find it supportive in my positions regarding primacy to architecture. It is clear that Scarpa has a predication towards detail, specifically the joint, but in being cognizant of “all that is happening,” he must recognize the balancing circumferal logos of architecture - each generator of architecture exists by virtue of the others and cannot be seen separately; one is no more than an aspect of the others.

Why Vitruvius settled on three qaulities for all of architecture to possess, i am unsure. Be it a harmoneous rule of Threes, or a system of checks and balances, this notion of a Triad has served as a cornerstone for the development of architecture. I chose to step into a long line of posited architectural criteria with a personal set because I recognize an issue with applying ancient theories to contemporary times; their applicability is based on relevance to time in architecture. To maintain equillibrium, these value sets must be reassessed so as to include new developments in relating and outlying fields, as well as those already lain down in full governance of architecture. This personal triad, Form, Material, and Technics, has given me critical insight into research projects that reflect my approach to architecture thus far and enabled me to weigh each, both in its constituent parts and wholly against one another and the art of architecture. I never conclude the exact successes and failures of each project; instead I have constructed a forum based in a specific time period in my development that allows me to continuously revisit and reassess these criteria against future positions and values in architecture.

In establishing this argument against primacy and absolutisms, something unforeseen occurred. In stating a position that all architecture embodies Form, Material, and Technics, each existing by virtue of the others, I have proposed an absolute. This comes as slightly self-defeating but at the same time redeeming. I realize that primacy and absolutism are not interchangeable; one is a division of the other and the denouncing of a part is not a denouncement of the whole. So I find temporary contentment and solace in my absolutism.

Dwelling is a necessity of life, dependent on architecture, and the essence of architecture is product of man-in-the-world. Buildings are extensions of people; they are spatial extrusions of humanity, and record our existence against time and selves. There is no primacy to humanity; we cannot be something before anything else without objectifying ourselves and being reduced to convenient modes of operation. We are more than constructions, more than just Form, Material, and Technics. Our humanity lies in the cohesive intertwining of those values. To say otherwise would be to negate the complexities of our complete working, and our humanity. Therefore architecture is, and must be approached on the basis of, a complete inseparable working as human product – **a human supplement**.

This page left blank intentionally for printing format

ANNOTATED LIST OF IMAGES

The following images claim Fair Use under US Code, Title 17, Sect. 107
All other images by the author

page.	credit
xi.	Dr. Jatinder Singh
23.	2005 Solar House Design Team
30.	Robert Dunay
31.	Robert Dunay
32.	Aldo Tucino
33.	Aldo Tucino
34.	Aldo Tucino
35.	2005 Solar House Design Team, modified by author
37.	Aldo Tucino
38.	Aldo Tucino
41.	2005 Solar House Design Team
43.	Aldo Tucino
45.	2005 Solar House Design Team, modified by author
46.	Robert Schubert
52.	E.M.H.E. Design Team, modified by author
55.	E.M.H.E. Design Team, modified by author
60.	Jonathan King
62.	Collaborative Sketchup® model by P.L.U.G. Design Team
64.	Dr. Jatinder Singh
66.	staged by: D. Clark, J. King; taken by: Dr. Jatinder Singh
67.	staged by: D. Clark, J. King; taken by: Dr. Jatinder Singh
68.	David Clark and Jonathan King
69.	Dr. Jatinder Singh (upper image)
69.	Jonathan King (lower image)
70.	David Clark and Jonathan King
71.	staged by: D. Clark, J. King; taken by: Dr. Jatinder Singh
72.	Jonathan King
73.	David Clark and Jonathan King
74.	David Clark and Jonathan King
75.	Dr. Jatinder Singh (upper image)
75.	David Clark and Jonathan King (middle and lower images)
76.	Dr. Jatinder Singh
79.	David Clark and Jonathan King

This page left blank intentionally for printing format

ENDNOTES

1 Juhani Pallasmaa, *Questions of Perception*, 35
2 These criteria have a kinship to the Virtuvian triad “firmitas, utilitas, and venustas,” more popular in Sir Henry Wooten’s form, *Commodity, Firmnesse and Delight* from the 1624 publication ‘Elements of Architecture.’ “These qualities are so closely related that if one is found wanting anything, the rest will not meet approval.” – Alberti.
3 Teleology - being defined as (in vitalist philosophy) the doctrine that phenomena are guided not only by mechanical forces but that they also move toward certain goals of self-realization; the study of the evidences of design or purpose in nature.
4 Virtuvius gives these terms in the sequence *firmitas, utilitas, venustas*, whereas both Alberti and, following him, Andrea Palladio reverse the order of the first two.
5 Latin text: Book I, 3.2 of ‘De Architectura’ from the Teubner edition of 1899 by Valentin Rose.
6 ex. Jaques-Francois Blondel, and his nine-volume ‘Cours d’architecture’
7 Vitruvius, Alberti, Henry Wooten, Christopher Wren, Corbusier, and Claude Perrault are a few who have addressed the subject of beauty in architecture to various lengths across the centuries, ultimately helping architects to define new movements through their positions regarding Form and beauty.
8 Leon Battista Albert, *de re aedificatoria*, 1.1.7, 4-4v
9 Leon Battista Albert, *de re aedificatoria*, 9.5.302, 164-167
10 Leon Battista Albert, *de re aedificatoria*, 1.1.33, 20-21v. Alberti writes regarding this term, “It is remarkable how some natural instinct allows each of us, learned and ignorant alike, to sense immediately what is right or wrong in the execution and design of a work. It is precisely with regard to such matters that sight shows itself the keenest of all senses.”
11 Le Corbusier, *Towards a New Architecture*, 15
12 Le Corbusier, *Towards a New Architecture*, 16, 19
13 Lydia Soo, *Wren’s ‘Tracts’ on Architecture and Other Writings*, I, 154. Christopher Wren’s notion of Beauty being distinguished between “natural” and “customary,” the latter being defined as geometric, uniform, and proportioned and customary as a result of familiarity.
14 Claude Perrault, *Treatise of the Five Orders*. Perrault furthers Wren’s dualism of beauty and continues to distinguish between absolute (natural) beauty and arbitrary (customary) beauty.
15 Robert Venturi’s *Complexity and Contradiction in Architecture* and *Learning from Las Vegas* are viewed as manuscripts for creating and understanding Post-modernist architecture. Venturi separates beauty (Form) from its relationship to firmness and commodity by giving new meaning to décor as seen in the decorated shed.
16 Bernard Hoesli, *Transparency*, 88. The 1982 addendum by Hoesli to Rowe and Slutzky’s *Transparency*, in regards to form and the notion of the book’s title, benefits from time to process the notion of the book much further, making it invaluable to the publication.
17 Leon Battista Alberti, *de re aedificatoria*, 2.1.33, 20-21v.
18 Morris being credited as the founder of the Arts and Crafts movement, I believe it is important to mention him to gain perspective of how long architecture has spoken of and struggled with the criteria of Form and Material. Likewise, his (Socialist) political writings had great influence on designers and theorists in England as well as the United States and therefore maintain influence as the subject evolves today.
19 William Morris, *The Influence of Building Materials on Architecture*.
20 Peter Zumthor, *Thinking Architecture*, 85
21 Peter Zumthor, *Thinking Architecture*, 10
22 Peter Zumthor, *Thinking Architecture*, 33
23 Marc-Antoine Laugier, *An Essay on Architecture*, 11-12. Laugier begins the first chapter of his essay with a romantic notion of man first housing himself.
24 Webster’s Third New International Dictionary. Danbury: Merriam-Webster, Incorporated, 1990.
25 Marco Frascari, *The Tell-The-Tail Detail*.
27 Jacob Voorthuis, *Towards a Descriptive Tectonics: Making a Relation*, 5
28 Jacob Voorthuis, *Towards a Descriptive Tectonics: Making a Relation*, 4
29 Leon Battista Alberti, *de re aedificatoria*, 9.5.302-303, 164v/165. Concinnitas is beauty as the result of the composition and connection of number [numerus’, outline [finitio], and position [collocatio], the Albertian triad. “It is the task and aim of concinnitas to compose parts that are quite separate from each other by their nature, according to some precise rule, so that they correspond to one another in appearance…”
30 Alberto Perez-Gomez, *Questions of Perception*, 8
31 Marco Frascari, *The Tell-The-Tail Detail.*
32 Robert Dunay, *No Compromise: the art of integrating technology and aesthetics.*
33 Juhani Pallasmaa, *Questions of Perception*, 29
34 Juhani Pallasmaa, *Questions of Perception*, 35
35 Robert Dunay, *No Compromise: the art of integrating technology and aesthetics.*
36 Marco Frascari, *The Tell-The-Tail Detail.*

This page left blank intentionally for printing format

BIBLIOGRAPHY

Alberti, Leon Battista, and Joseph Rykwert. On the Art of Building in Ten Books. Trans. Neil Leach. New York: MIT P, 1991.

Bachelard, Gaston. The Poetics of Space. New York: Beacon P, 1994.

Best, Steven, and Douglas Kellner. Postmodern Theory. Minneapolis: Guilford Publications, Incorporated, 1992.

Calvino, Italo. Six Memos for the Next Millennium. New York: Vintage, 1993.

Dunay, Robert. “No Compromise: the integration of technology and aesthetics.” 2006 NCARB prize, Virginia Polytechnic and State University entry. April, 2006..

Frank, Isabelle, ed. The Theory of Decorative Art : An Anthology of European and American Writings, 1750-1940. Trans. David Britt. New York: Yale UP, 2001.

Frascari, Marco. “The Tell-The-Tail Detail.” Theorizing a New Agenda for Architecture: An Anthology of Architectural Theory, 1965-1995. Ed. Kate Nesbit. New York: Princeton Architectural P, 1996.

Holl, Steven, Alberto Perez-Gomez, and Juhani Pallasmaa. A+U Special 94:07 - Questions of Perceptions. Phenomenology of Architecture. Tokyo: A & U, 1994.

Laugier, Marc-Antoine. An Essay on Architecture. Trans. Wolfgang Herrmann and Anni Herrmann. Danbury: Hennessey & Ingalls, Incorporated, 1985.

Le Corbusier. Towards a New Architecture. Trans. Frederick Etchells. Minneapolis: Dover Publications, Incorporated, 2000.

Mahnke, Frank H. Color, Environment, and Human Response: an interdisciplinary understanding of color and its use as a beneficial element in the design of the architectural environment. New York: John Wiley & Sons, Inc, 1996.

Morris, William. “The Influence of Building Materials on Architecture.” William Morris - The Influence of Building Materials on Architecture. Jan. 1892. The William Morris Internet Archive. 24 Sept. 2008 <http://www.marxists.org/archive/morris/works/1891/building.htm>.

Palladio, Andrea, and Adolpf K. Placzek. Four Books of Architecture. Ed. Isaac Ware. Minneapolis: Dover Publications, Incorporated, 1977.

Rowe, Colin, Robert Slutzky, and Bernhard Hoesli. Transparency. New York: Birkhauser Verlag AG, 1997.

Soo, Lydia M. Wren’s ‘Tracts’ on Architecture and Other Writings. New York: Cambridge UP, 2007.

Venturi, Robert. Complexity and Contradiction. New York: Museum of Modern Art, 1977.

Vitruvius. Ten Books on Architecture, Ed. Ingrid D. Rowland and Thomas Noble Howe. Cambridge: Cambridge University Press, 1999.

Voorthuis, Jacob. “Towards a Descriptive Tectonics: Making A Relation.” Tectonincs, Making Meaning. 8 Oct. 2008 <http://www.voorthuis.net/tectonics/voorthuis,%20towards%20a%20descriptive%20tectonics.doc>