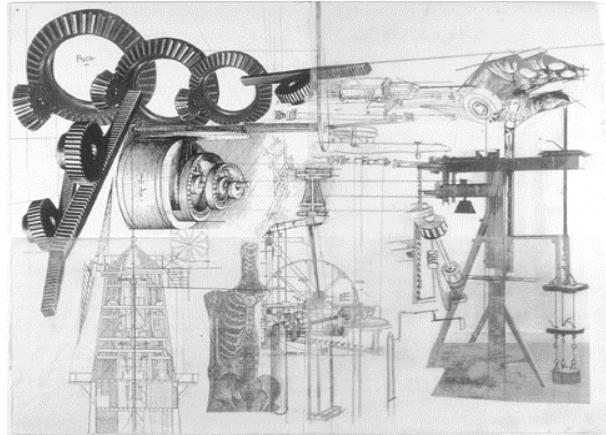
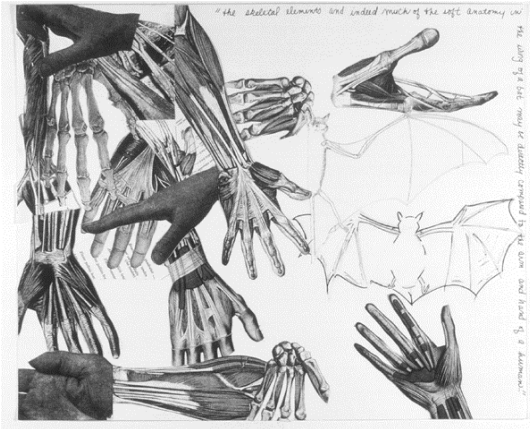


Arms, Wings, & Mechanical Things analogue...assimilation...appropriation

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Abstract/ Introduction

Using analogy in the form of design assimilation, one is positioned to rely on his or her creative ability to associate and fabricate objects that engage materials into relationships that convey parallel meanings. These constructions can, in turn, establish formal orders that become the basis for an architectural grammar of details. Their meaning is gained through their ability to conform or transform to the context in which they are placed. These construction details can also be employed as a point of departure in the development of a design process. Through an analogical study of the joints in the body, the invention of a joint detail can form the basis of an architectural vocabulary that can lead to several forms of design development.

This studio is the third in the design sequence at our school. It acts as a bridge between the design principles of space and form stressed in your earlier studios, to issues of 'materiality,' 'structure,' 'modes of representation,' and the 'process of making.' Design exercises utilize analogical investigations to explore the expressive potential that material can achieve in structure and detail. The primary mode of representation will be models. Drawing will be used as a means of construing and constructing an idea. They will work hand and hand with the process of design. Imagination and invention will be emphasized in the process of interpretation and implementation of your ideas into highly crafted artifacts.

This design research will begin with the investigation of joints and connections and their dynamic forces inspired through our observation and analysis of the arm of the human body. Through comparative analysis we will study 'the wing' and make creative relationships with our studies of the arm. The goal of this phase of our study is to search for conditions that simulate the particular dynamic structural qualities of tensive and compressive forces found in the direct

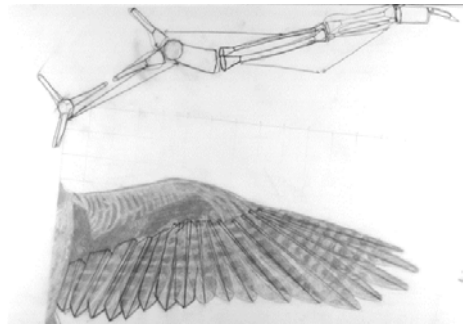
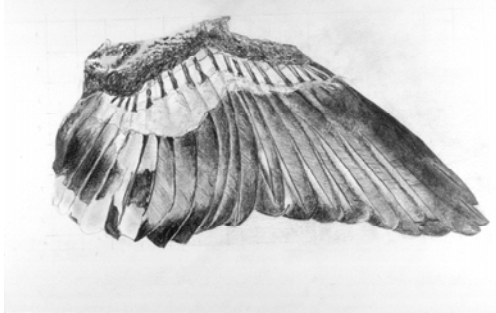
and indirect actions of the muscles and joints of these two body forms. From these findings, we will search/research existing mechanical devices that demonstrate similar differences and different similarities, to direct design and construction of assimilations of these conditions in the form of highly crafted small wooden models while simultaneously documenting their evolution through drawing. These exercises will eventually lead to studies that are specific creative structural and material propositions, such as, cantilevers, corbels, arches, trusses, hinges, and pivot joints. This form of study hopefully will provide *“pieces that can eventually mediate between building and user in crucial ways, serving both an intermediate scale that people can immediately relate to and a sensually crafted presence that invites tactile contact. They should also elicit empathetic responses with structurally explicit forms that are often shaped to suggest they have a life of their own.”*

These idiosyncratic pieces when subjected to natural growth patterns [component-element-unit, element-system network] become less striated or autonomous to become continuous systems that can form the basis for architectural projects focusing on such things as interactive walls, ceilings/roofs, spaces, as well as, multiple frame and panel assemblies.

In the Renzo Piano Building Workshop, the piece with its immediate responsibility to engender formal and tectonic negotiations also serves to generate systemic grammars that direct design and development:

More than anything, it is the piece that gives each building its particular identity: most of the buildings are as readily recognizable from the piece alone as by the whole. The pieces mediate between building and user in other crucial ways, providing both as intermediate scale people can immediately relate to and a sensually crafted presence that invites tactile contact, both especially pertinent qualities in buildings of large fluid spaces. They also elicit empathetic responses with structurally explicit forms that are often shaped to suggest they have a life of their own. But there are other reasons for picking on the piece as the focus of so much attention. It is the piece that is most susceptible to a sustained and objective refinement. Technical improvements to it are easily judged, and so are aesthetic ones. Many may contribute to this refinement, architects, engineers, and clients. And contributions can be made at all stages of development through sketching and drawing, hand crafting of prototypes and preparing shop drawings. With all this input, intellectual, visual and tactile, the piece is the one element that might approximate both the precise tailoring to purpose and the satisfying sense of being exactly right that is found in the products of natural evolution. Often too, the piece can and does continue to be refined long after the rest of the design has been settled. In an analogy from evolution, focussing on the piece could be seen as a neoteny strategy. (Neoteny is a way by which evolution speeds itself up by prolonging childhood, as in the case of humans, and so the learning period of each generation. Of course, in developing the piece the concern is not with a single object in isolation, but equally with what is created by the collective assembly of the pieces. Obviously then, connections are important, and so too is the whole that results when the pieces are assembled with all the other elements. Those who see the piece as a mere component that can be taken up and easily used in other designs, profoundly misunderstand its far more intrinsic role to a specific building, its scale and place (1)

Forming Relationships Through Analogy

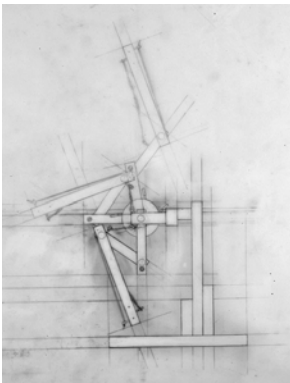


To begin the design process, the students are asked to research, collect images of the human arm, and make comparisons to collected images and descriptions of wings. After making an inventory their parts, they are to make speculations on the evolution or transformation between the two. Analyze the skeletal and muscular principles that direct its action and establish an individual focus on a particular aspect. They are to be conscious of the direct and indirect action of the muscles, tendons and joints and how they demonstrate the structural qualities of tensile and compressive forces.

Exercise One • the students are asked to make two collages, one focusing on the arm and another on the wing (on 11x 14 bond paper), relating their investigations by demonstrating findings through images, drawings, and words. Define relationships. Look for analogical connections. Associate and disassociate from the images you collect to find formal, as well as, literal correlation.

Exercise Two • after completing the collages on the arm and the wing, make a third collage (on 11x 14-bond paper) of mechanical things that have an affinity to your previous studies. Look for simple devices such as lamp arms, car jacks, umbrellas, drawing instruments, before extending your search into more complex machines. How did DA Vinci use the notion of prosthetics in the design of his mechanical inventions? How is a drawing compass a prosthetic device?

Drawing Constructions / Constructing Drawings



In this process of investigation and discovery, drawing acts as a means of construction, of ideas, of images, of analysis and of association. The drawings will be viewed as scaffolding; a temporary architecture used to help concretize an idea that leaves its trace in your final construction, allowing 2-D and 3-D to collude in the process of design.

observation/analysis, interpretation/translation, transformation/fabrication

The next phase of this series of observations begins with a detailed enlargement of a particular wing scaled up at least double in scale. This means of magnification and rendering intensifies one's focus to prevent shifting attention to quickly assuring that observation will not be short-circuited into translation as mere imitation. It is more important to continue the seeing process by forcing hand/eye coordination to slow down permitting a closer look. It will allow the mind to wander generating creative associations to occur while rendering tonal gradations. This releases the daydream. It is in that zone that tangential coincidences collude to form new interpolations of hand/ mind and mind/ hand thinking.

The exercise will consist of three layers: Each layer will look at a different aspect of the wing: a realistic look at the nature of its parts, a geometric abstraction and a mechanical extrapolation. Each sheet conveys a distinct view of your specimen. All sheets are pencil on Mylar except the first sheet, which is on watercolor paper stock.

observation/analysis.....as is

We began looking very close so the eye could attain a tactile sense—inhabiting the detail. After reviewing the visual collages, each student clarified a particular perspective that would direct this next phase. Students now choose an appropriate image of their wing to further his/her research. Draw the wing at least twice the size of the photo to be placed in the middle of a 24x 32 piece of watercolor paper [hot press] leaving at least a 6” border on all sides for even closer studies. This first sheet is to be purely observation of the actual wing analyzing its parts through realistic close up rendering.

interpretation/translation.....as ab

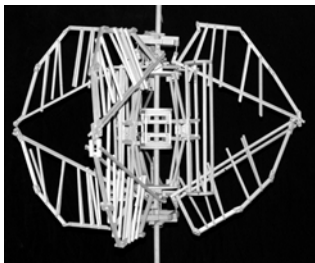
The next sheet is on Mylar and drawn in pencil to interpret the workings of the wing in a more geometric construction. This technique requires a translation of the parts into a geometric vocabulary viewed as an overlay upon the preliminary realistic drawing. This **abstraction** will allow you to see the workings as interpreted through geometry.

transformation/fabrication.....as ob

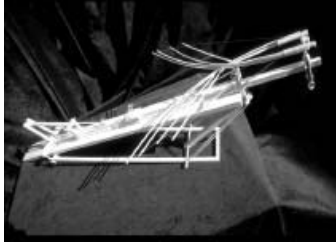
This final sheet of Mylar will transform the visual information into a construction analog to direct the fabrication of a series of tectonic devices.....workable, buildable **objects two model**

SIMULATION vs. ANALOGY

simulacrum



From their studies, each student created a *mechanical simulacrum* that could demonstrate the dynamic actions from their wing analysis. Using the form language they derived from the geometrical abstraction (sheet #2) these constructions attempted to translate the actions of the wing in its *entirety* not as a series of disconnected joints. [resemblance is good]



analogue

This model developed as a *mechanical analog* to a specific part or detail of their wing analysis. It gained its potency from the nature and fit of its parts. This model did not attempt to resemble but to demonstrate metonymically the action of a particular condition. The parts could be separated from their context or viewed as a series of parts disconnected from the whole. [resemblance is not good]

Definitions

sim-u-la-tion n

1.the reproduction of the essential features of something, for example, as an aid to study or training 2.the imitation or feigning of something 3.an artificial or imitation object 4.the construction of a mathematical model to reproduce the characteristics of a phenomenon, system, or process, often using a computer, in order to infer information or solve problems

sim-u-la-crum n

1.a representation or image of something 2.something that has a vague, tentative, or shadowy resemblance to something else

a-nal-o-gy n

1.a comparison between two things that are similar in some respects, often used to help explain something or make it easier to understand 2.a similarity in some respects

an-a-log or an-a-logue n

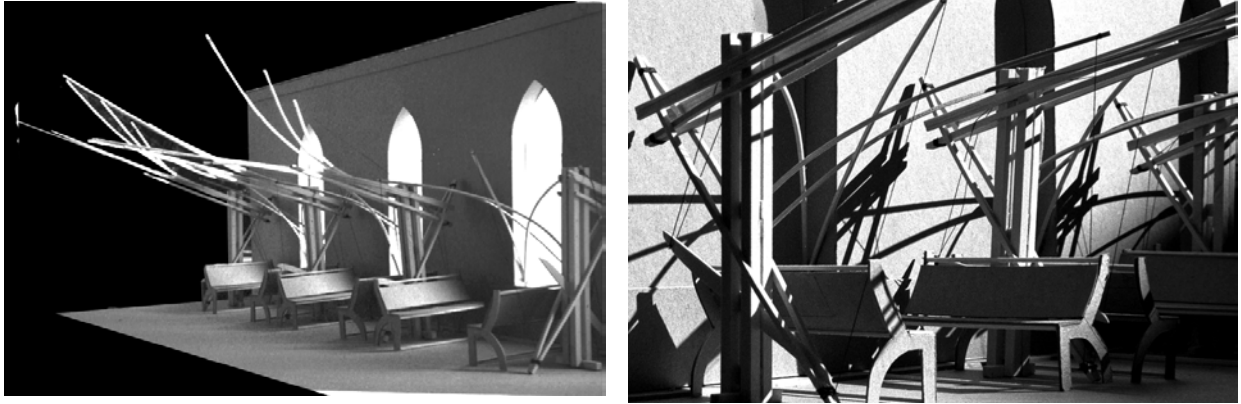
a chemical [construction] with a similar structure to another but differing slightly in composition. (3)

re-MAPPING the FINDINGS

The development of these models continued simultaneously to the evolution of the constructing drawings, each informing the other in an interactive dialogue. Each model obtained intrinsic value in relation to its function but also acted as an initiator to new refinements and innovations. They were well crafted, where each and every joint and connection acquired a distinct character. After this phase of work the students and I discussed the potential value of their discoveries and attempted to assign roles, relationships, and functions to their architectural constructions. We attempt to find what the systems do by looking at function as a response to the manufactured artifact rather than as the initiator of design. How can the meaning of their tectonic inventions be derived through a re-mapping of these constructions as applied to several architectural situations? Do they become roofs, walls, or both simultaneously? Can they adapt to the body from which they were derived...housing habits as prosthetic extensions? The building systems led this form of dialogue.



In several applications, the architectural projects turned to the body to generate function and application. Interactive wall and ceiling systems were designed as gallery display installations for exhibit and small pavilions, as well as, complete architectural interventions into dissimilar shells.



AN ARCHITECTURAL INTERVENTION

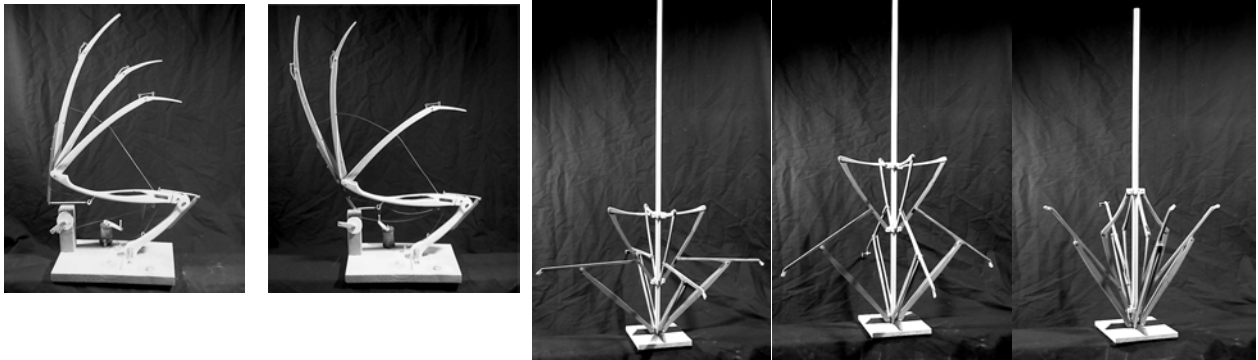
According to the American Heritage Dictionary, **to intervene** means; 1) *to come, appear, or lie between two things*, 2) *to come or occur between two periods or points of time*, 3) *to occur as an extraneous or unplanned circumstance*, 4) *a. - to come in or between so as to hinder or alter an action, b. - to interfere, usually through force or threat of force.... (4)*

The Unitarian Universalist Church in North Bethlehem asked us to design a temporary inner architecture that would give clarity to the nature of their new location in the remains of an old Presbyterian Church building. The interventions were to clearly speak to the present philosophy of the UU Church as a conceptual dichotomy coexisting within a predetermined context of another space and time (a brick miniature Gothic cathedral). Our design interventions should allow for a dialogue between the old (memory) and the new (imagination), the permanent (static) and the temporary (dynamic), the container and the contents, and the body and the building.

As an architect one is constantly confronted with this condition at all scales of the architectural project; from the relationship between two materials in a connection, to the formal relationship between two spaces in time. To intervene one must mediate or step in to form a negotiation between two, sometimes diametrically opposed, situations resulting in a resolution that is either *symbiotic*: mutually beneficial to each party or one that is *parasitic*: unilaterally beneficial to one party while being destructive and/or re-constructive to the other. Through rigorous and creative design thinking, the students were to propose interactive architectural frameworks that can make a place where science, spirit, and wonder commingle with function and experience. I originally prepared the early exercises to establish a tectonic vocabulary with this application in mind. Therefore, the students were to use their tectonic inventions previously developed as initiators for their design proposals. This process of translation and interpretation concluded as a series of architectural projects presented to the Church congregation. Many stimulating discussions ensued.

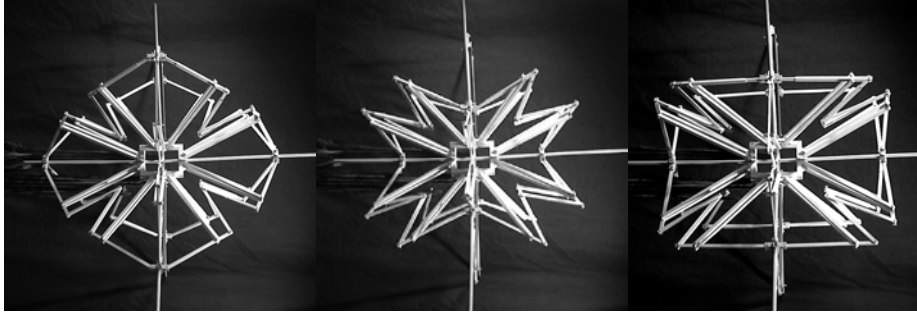
GROWTH "the Form is in the Forming"

In all things natural, growth generates form. Without it, nothing would exist. Paul Klee in his pedagogical sketchbook refers to form as having a conjugational nature, allowing elements to transgress from active to medial to passive in the process of becoming. In other words, it is in the act of making or in the transformation of matter that meaning is allowed to be imbued into form.... "the Form is in the FORMING."



In the first part of this study we focused on the nature of the part and the detail as the mode for analogy, starting the process with the body as a collection of parts that could be artificially separated from the whole. It is necessary now to reconstruct the body and look at it dynamically as an instrument of change or metamorphosis. Dynamic growth symmetries such as repetition and rotation can initiate causes of growth as a strategy to generate geometric moves on the field. These causes can further be clarified by studying the growth patterns of vegetables and minerals to understand and translate into guidelines for formal multiplication. These means of growth can be hierarchical in nature and rigid in their formative principals. Therefore, it would be important to look at the **rhizomatic forms** of growth (bulbs) and attempt to translate non-hierarchical growth patterns as form generators. This type of action can transform striated space (differentiated) into smooth fluid space through repetition, allowing the idiosyncratic to transform into collective meanings through multiples.

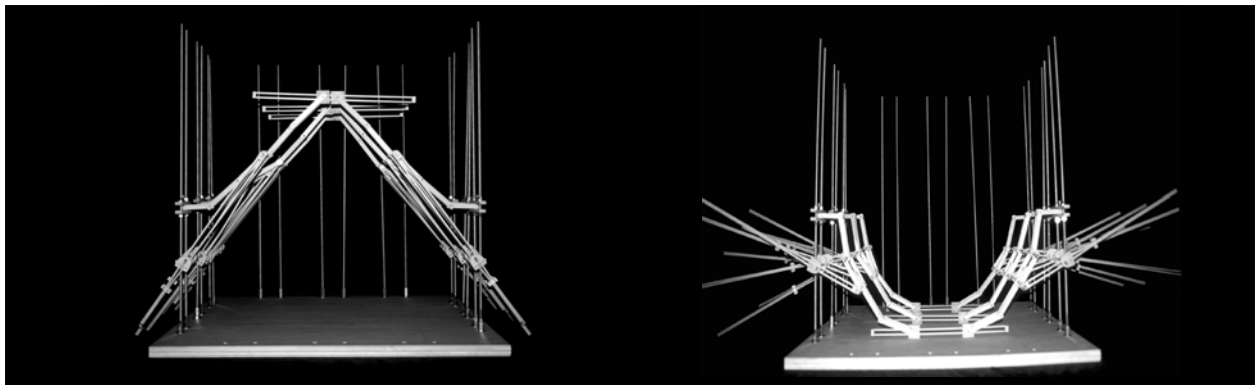
I will now conclude by presenting the results of a different form of inquiry. In this studio, I allowed the project to gain its meaning through its own conception and evolution. This is not just a description of one specific design studio though, but a proposition for a means of design thinking. To allow discovery to continue to regenerate upon itself, one must be placed in a more fluid form of thought/action experience. I have found that this regenerative process can be short-circuited when the design process becomes too goal oriented and deterministic early in the idea/design development. When the students' design/research becomes more investigative in nature and reliant on analogical relationships they become more open to unsterotypical thinking and prepared for amazement.



This provides more opportunities for discovery and invention. Wonder becomes the motivation for the acquisition for knowledge and imagination provides the stimulus for thought. Meaning is derived from an implicit search for understanding formative principals rather than definitive conclusions.

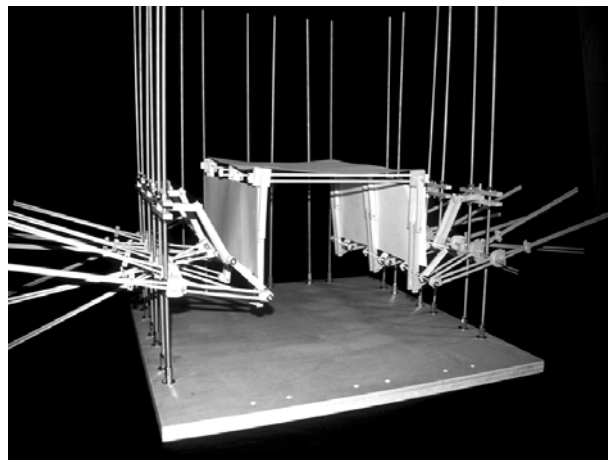
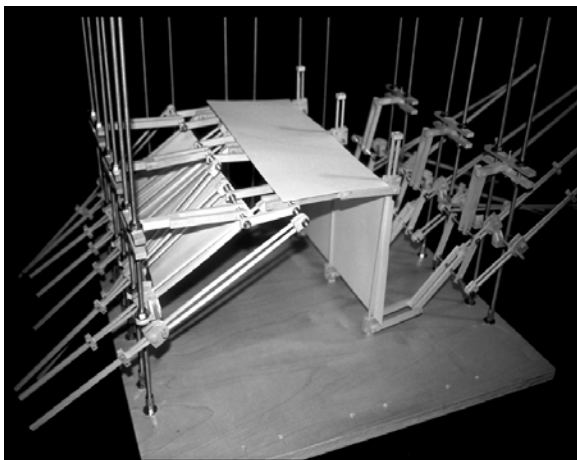
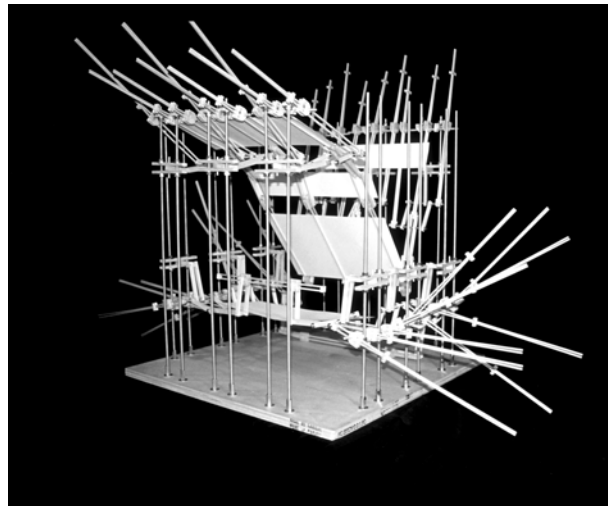
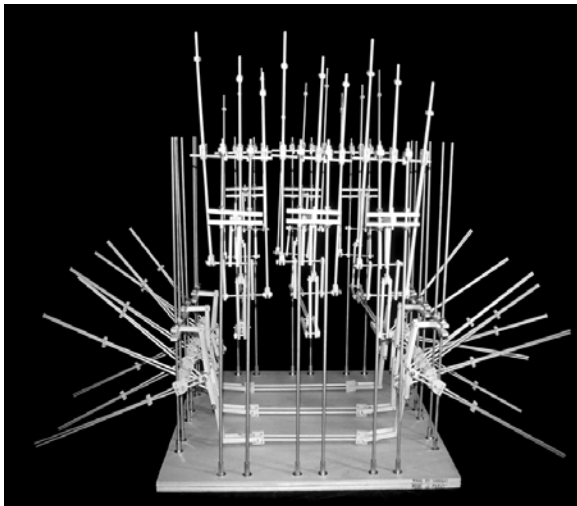
This is all predicated on a non-problem solving technique that allows palimpsests of analogical screens to generate new worlds of discovery thus opening up alternate views or perspectives. Through this type of investigative process new analogical screens are continually overlaid to project new interpretations of what one “sees” and interprets into their form transformation.

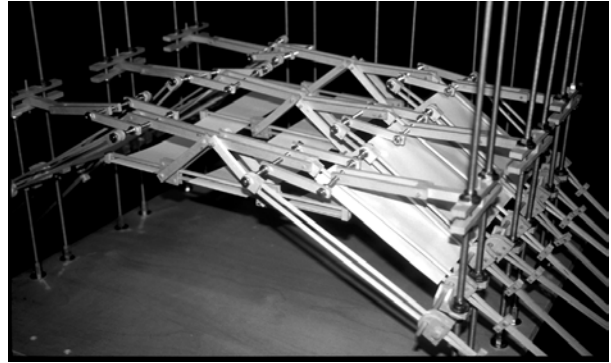
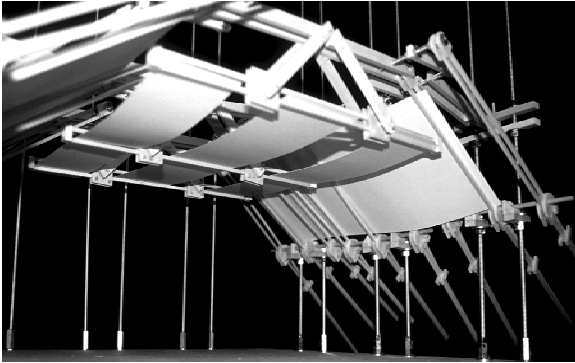
The challenge of keeping the discovery process fluid and open as you introduce more specific architectonic criteria is of great concern and difficulty. Ideally, the form gains its meaning and function through programmatic readings of it newly formed character. One might say that function and meaning, in this case, become a product of the imagination rather than the impetus for its action. As the implicit actions begin to collude with explicit targets, design gains a new dialectic form of intuitive actions and reactions followed by rational juxtapositions. These forms of thought/action fold into each other to present propositions *that* still allow the form to remain fluid with its newly found function and meaning. For once, function is allowed to be as fluid as form letting design research to remain open ended and implicit rather than deterministic and explicit in its nature. Granted the architectural practice must find explicit ways to address client needs but does this preclude the need for the art of invention as a means and directive for design inquiry? Can form be allowed to direct the search for meaning and resolution? Can function be the product of imaginative formal manipulations that foster the art of invention? These are not new questions and obviously the answer is yes, testified by the work and writings of great thinkers/inventors such as Leonardo DaVinci and Albert Einstein...”Imagination is more important than Knowledge”



This next phase of the design studio began with our design research pointing in the direction of natural forms of growth and habitation. We began with three sketch problems focusing on vegetable growth, animal architecture and geometric patterns and constructions. After producing several pictorial collage studies, the students were now, to subject their idiosyncratic devices from part one to a rigorous series of growth exercises in drawing format to generate dynamic systems. [Specific symmetrical moves learned in earlier design studios were used as their guide in manipulating the growth of their constructions.]

These studies were in direct response to the first three sketch problems. [The cumulative progressions of 1,5,50,and 500 were to be the range of growth projections]. The following series of images show several architectural propositions that demonstrate the studio's progressions from **simulation** through **analog** toward **appropriation**. This form of design exploration remains open and in constant motion. This is one of the most important aspects of my design research and the most mystifying aspect of our particular design methodology. It continues to reform-ulate upon itself...“the form is in the forming.”





NOTES:

1. Time and Place, Technology and Nature in the Work of The Renzo Piano Building Workshop, 1996
2. Ibid
3. American Heritage Dictionary
4. Ibid
5. All images are of student projects. Photographs were taken and are the possession of the author.