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DIETMAR FROEHLICH + MICHAELE PRIDE, EDITORS

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Design Probes: Three Dimensional Tools for Ideological Programming

CHRIS FORD
University of Nebraska-Lincoln

Fig 01. Design Probes that explore the ideas/phenomena of: (from left to right) consumption of natural resources, harvesting, and self-similarity found in scalar oscillation.

INTRODUCTION

If scientists are responsible for expanding what is *known*, then artists are responsible for expanding what is *possible*. Recognizing this dichotomy immediately places the designer, as one who serves these dual interests simultaneously, in perpetual creative uncertainty.

In the face of such uncertainty, today's mainstream architectural practice (i.e. a professional office that emphasizes architectural *service* over architectural *product*) tends to address the intrinsic programmatic and performance criteria of an architectural project divorced from affiliate experiential and aesthetic considerations. At its most mundane, mainstream design thinking equates the act of design with the act of problem solving. However, for those architectural designers interested in breaking this prevailing tendency, one method is to incorporate an explicitly different tool into their larger architectural methodology. Design probes present one such opportunity.

WHAT IS A DESIGN PROBE?

If there is a direct relationship between a final architectural work and the particular design process employed by its author, then the incorporation of a design probe in one's design methodology creates a pathway to higher creativity. While architects are certainly capable of generating compelling architecture without utilizing design Probes, their use facilitates an ideological detour away from the impending approach of the much-too-often emphasized aspects of site, program, and user and further provides an opportunity for architectural creativity to flourish. Design Probes are useful to both architecture students and practitioners alike and are especially helpful to both when one decides to explore creative possibilities through abstraction. Artists and designers alike may perceive design Probes to be within the natural movement from initial generative idea to end creative product. However, since design probes are not typically present in more normative design methodologies, we should understand their execution is first a deliberate action.

To execute a design probe, one must identify a non-architectural idea or phenomenon that is 1.) of sustained interest to the designer and 2.) initially believed to be a strong heuristic device for a forthcoming architectural work.[1] The success of a Probe is largely proportional to the mutual fulfillment of these two requirements.

The intentional employment of a design Probe, as a precursor to architectural design, becomes a vehicle for ideological programming. If we believe that architecture is capable of manifesting ideas and phenomena through its physical form, then in the least, design probes serve multiple roles in the formulation, refinement, and execution of a particular generative design intent.

NECESSARY AND DANGEROUS

Designing with ideas and phenomena imported into the architectural realm is simultaneously a necessary and dangerous endeavor. This action is necessary due to the emptiness present at the crux of every architectural design problem – the origin for architecture "has no presence: It is a verbal noun, an attitude; it has no internal ability to generate form out of the void."[2] This same action is dangerous due to a sharply increased likelihood that the aesthetic and spatial experience of a resulting architectural work is synonymous with the referenced origin.

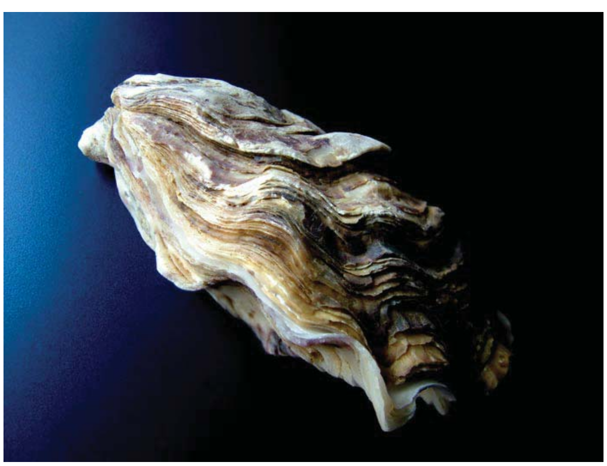

Fig 02. An oyster lacks the capacity to generate a pearl under its own power. Instead, the creative process for a pearl requires something Other, (a grain of sand) in order to begin.

Consider the relationship that exists between an oyster and a pearl. In his essay "Either OR/igins," architect Wes Jones reminds us that an oyster lacks the capacity to generate a pearl under its own power.[3] Instead, it is through the agency of a grain of sand, something externally *Other*, that engages the interiority of the oyster in an ebb-flow process of irritation and relief. With each new irritation, the oyster secretes layers of nacre upon the sand granule as a protective act. Jones' effective analogy underscores the oyster's dependency for pearl generation upon a kinetic dialogue with something *Other*, and not upon will or independent desire.

Jones' use of this oyster analogy is applicable in the discussion of design probes for two reasons.

First, it underscores the necessity with which architects need to identify conceptual weaponry for their design process. Architectural solutions cannot be, (nor at any time in architectural history could they truly have ever been) the summation of the fundamental intrinsic aspects of Site, Program and User. Despite finding congruencies with a designer's particular design intent, these fundamental aspects of site, program, and user are creatively vacant for establishing any specific expectation for architecture, whether it be environmental, functional or aesthetic in nature.[4] In 2008 we are witnessing an explosion of compelling architecture that emanates from a variety of *Other* sources; unprecedented ideas, observations on existing and emerging systems, observed phenomena, parametric thinking, algorithmically-generated geometries and material theory / science, to name a few. Also in 2008, we encounter a lesser number of design methodologists who champion the creative potential of site, program, and user, perhaps due to these fundamental aspects having never acted as decisive heuristic devices in the first place. At best, these aspects are informative constraints towards defining an architectural design problem and possess no capacity to assist the decision making process about forthcoming solutions.

Second, Jones' oyster analogy illustrates the effect when a designer takes a germinating idea and manifests it in a necessarily transformative way – The value of formulating a generative idea does not lie in its identification and exact re-presentation, but rather, lies in its ability to physically manifest something both purposeful and useful while satisfying a stated heuristic need.

The execution of a design Probe which allows an idea or phenomena to first engage a non-architectural construct further insures the transformation necessary for serving as an effective heuristic device. Ideas that are used as generators, but remain untransformed, are highly problematic for architects and non-architects alike. The reality of untransformed ideas is to equate the experience of an architectural work with its aesthetic image, which immediately fails to exploit a greater range of potential experience. Altogether, it drastically reduces expectations for architecture, (far below any cultural expectations otherwise) to a point it might be interpreted as patronizing its group of users. The un-transformed idea, or rather, the image-based re-presentation of a generative idea, becomes the architectural equivalent of a comedian's flat one-liner that only gets laughs from the back of the room.

There are several architectural examples in which the referenced generative idea remains untransformed. Frank Gehry's frequent interest in the formal qualities of fish have appeared in several of his projects, the most literal of which is the Fishdance Restaurant (1987) in Kobe Japan. The company headquarters of the Longaberger Basket Company (1998) in Newark, Ohio by NBBJ Architects so accurately represents the proportions of one of Longaberger's baskets, that it features straps in order to complete the viewer's cognitive understanding. Both of these projects maintain a mimetic clarity between their respective design generator and state of architectural finish, which in both of these cases, achieve an iconic state of being due to the employ of an image based generator instead of an ideologically based one.

To understand the value of designing in a non-representational way, consider the role of gesture drawings. In his title *The Natural Way to Draw*, artist Kimon Nicolaïdes introduces the use of the gesture drawing to his student audience. For Nicolaïdes, gesture drawings serve a different role than observation based contour drawings. Gesture drawings are interested in the impulse of a subject, not its edges.[5] When executed correctly, there may or may not be anything in the gesture drawing that suggests the physical, observable identity of the subject. The gesture "will sometimes strike the edge (or contour) of the form, but more often it will travel through the center of forms and often it will run outside of the figure, even out of the paper altogether."[6] Free from the responsibility of cognitive understanding as required by contour drawings, gesture drawings will likely reveal a non-observable yet physical presence within a subject that otherwise remains hidden from the illustrator's consciousness. It is within this same spirit that three-dimensional design probes operate and flourish as pre-functory acts. Although design Probes must be three dimensional, they relate to a forthcoming architectural design just as gesture drawings relate to a forthcoming sustained contour drawing.

The effectiveness of design probes can be owed to a shared physicality with its forthcoming architecture. As such, two-dimensional investigations are challenged to yield generative design value that is proportional to that of three-dimensional investigations. Whereas, Steven Holl's watercolors, Paul Rudolph's perspectives, and Antoine Predock's collages play an instrumental role in their respective probing of architectural possibility, these two-dimensional efforts differ from design Probes considerably due to limitations imposed by their representational media.

For instance, while Holl's most celebrated watercolors are those executed without regard to a specific creative need, it is surprising then to find in his 2002 title *Written in Water*, that 63 percent of Holl's 350 watercolors are of concise architectural conditions whereas only 37 percent are of an abstracted non-architectural subject.[7] In turn, it seems the majority of Holl's watercolors are a record of preliminary spatial conditions or architectural sequences, while maintaining a healthy distance from specific site and programmatic constraints. For Holl, two dimensional watercolors are a vehicle for capturing fleeting thought – to identify his "seed germ" -- instead of further exploring abstracted ideological development within his watercolor medium.[8] The inherent value of each watercolor is the specific subject intended, however abstract. In contrast, the three-dimensional physicality of a design probe may have latent value that is only discovered after several analyses, however formal or casual.

THE OPPORTUNITY FOR PROBES

Nonetheless the question remains, if it is necessary for architectural designers to reference something Other, then how does one do this in a meaningful and beneficial way? One method is to embrace abstraction of an idea through the creation and execution of a design probe. In turn, its author will find that it provides several developmental benefits, including the isolation and physical memorialization of a design intent through the creation of a physical three-dimensional artifact. The probe is not an architectural option, nor a possible iteration within a range of architectural options. The Design Probe is first a destination unto itself, but while engaged with the architectural design problem at hand, it orbits tenaciously around an otherwise chronologically-linear process.

As an educator, I have typically required students to design and build design Probes as an immediate pre-cursor to their forthcoming design problem for studios of third year standing or above. However, the design probes featured in this writing were generated as part of a 4th year architectural design studio at the University of Nebraska whose primary curricular goal is architectural tectonics. Prior to the introduction of the assignment, students were provided with full site, program and user group information for the forthcoming architectural design problem. Of the thirteen weeks spent on their project, the first two and one half weeks were earmarked for the design and execution of a design probe.

The assignment requires that design probes:

1. shall identify an idea or phenomena that is both:

• of sustainable interest to the designer.

• believed to act as a strong heuristic device for making three-dimensional design decisions.

2. shall physically manifest the chosen idea or phenomenon through the deliberate construction of an abstracted three-dimensional construct.

3. shall not exceed a collapsed or compressed volume of 2 cubic feet.

4. shall consider its own materiality, aesthetic expression and craftsmanship. (The design probe is itself a finished physical artifact, *not* a representation or scale model of an artifact)

5. shall consider its own operation, function or utility. (if applicable)

6. shall be of deliberate intent and meaningful construction. A probe is not a found object, although it may contain found objects.

From these studios, I am convinced that design probes serve multiple heuristic roles in a designer's thinking, whether from a conscious or subconscious level. As a means for a student designer to consciously extract value, I find they do so from one primary set of probe attributes: The Physical, the Performative, and the Phenomenological. While the student examples that follow can be categorized into three distinct groups, it would be unfair to conclude that either the designer's thinking, or the latent value to be extracted, lies firmly within the compartmentalization of these suggested categories. For student designers who possess strong self-awareness, the identification of one set of attributes enables a prioritization in value to be extracted, while reserving the full right to intellectually revisit the design Probe on an as-needed basis.

EXTRACTING VALUE: PHYSICAL PROPERTIES

The first design Probe example demonstrates how the *physical* properties of a design Probe may serve as a heuristic device.

As student designer Kevin Augustyn familiarized himself with the spatial needs for a renewable energy research center, he also began to consider the relationship between our energy supply and the larger society which it serves. Citing an increased proliferation in electronic devices (such as computers, cell phones, and iPods) and a decreased cultural awareness of the variables that form the national electrical infrastructure, he identified that energy issues receive society's sharpest attention, ironically, during energy's absence. Other energy issues, such as conservation or environmental impact, remain secondary to the primary interest of necessitating a constant electric supply to meet the public demand.

The probe design consists of an exoskeleton of welded threaded rods with a black painted finish. This exoskeleton enables the attachment of various items suspended within its own cubic cavity. Specifically, there are two axles, each spanning the diagonal of the cube. Each of these axles attaches to its own radio-controlled electrical mo-

Fig. 03. Design Probe investigating the duality of energy's presence and absence, and final presentation renderings for the Nebraska Center for Energy Sciences Research, Fall 2006 semester, by University of Nebraska M.Arch student Kevin Augustyn.

tor; however, both motors are operated from the same remote. As each axle spins, they rotate two shaped blades made of aluminum flashing, which are located at the extreme ends. When all four blades rotate, they cradle their illuminated centroid represented by a halogen lightsource. Although it is not clear to the observer if the rotating blades are working to contain the centroid or if they are providing this centroid protection from external entities, the performative aspects of this design probe create a theatrical event in the transition from its latent state as a fixed aesthetic object to its fully kinetic state as a compelling demonstration of quickness, brightness, and beauty of an electrical machine. Despite these performative characteristics however, the student designer also identified two physical characteristics during a post-production analysis that were of generative value.

The first physical characteristic is the composition of the blades proper. Once identified, it was important to the student designer that these characteristics found themselves again in the forthcoming architectural work. The geometry of the blades possesses an angularity found in both elevational profile and section. This prompted the student designer to consider multiple angular compositions on the site that, while accommodating the designer's programmatic intent, would also satisfy a particular aesthetic expectation. The final architectural proposal therefore reflects angles that separate and converge as the building meets the ground plane. In plan, the research center is nestled into the far southwestern corner of the

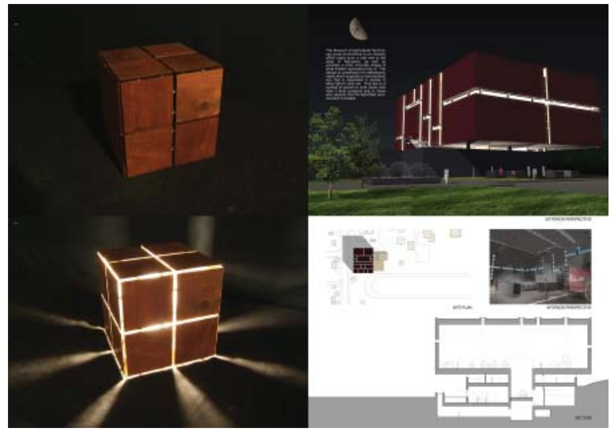

Fig. 04. Design Probe investigating the perception of an aesthetic object while inverting the affect of light, and final presentation renderings for the Museum of Agricultural Technology, Fall 2005 semester, by University of Nebraska M.Arch student Cole Wycoff.

allowable site area, and finds an obtuse geometry informed by a bicycle path to the west, and a vehicular roadway to the south. However, the final architectural composition itself seems to erupt from the ground rather than being placed upon it. While the elevational profiles of main walls and the sloped roof possess the same obtuse geometry as found in plan, the ground plane behaves much more acutely, as found within the transverse section. Beyond geometry, the student designer also identified the material of the blades as having desirable characteristics; therefore the blades' dull gray finish and high metallic sheen were also present in his final design with his specification of a titanium panel rainguard system.[9]

The second characteristic is the presence, and associative absence, of the light source. Whereas the design probe fixes the position of the light source which plays a role in the visual aesthetic and experience of the probe during full operation, the student designer chose to strategically regulate the light levels within the architectural composition so as to teeter on the threshold of just-barely-enough and not-enough illumination in public areas. While the student designer provided full artificial lighting for the needs of energy research labs and private offices, the intentional contrast between these occupied spaces and the public corridors was to serve as a visual reminder for the important work conducted within the facility. To this end, the student designer decided against any apertures in the titanium envelope. Instead, the interior of the building only receives ambient daylighting from two entry-level glass endwalls above grade, and a longitudinal break between earthen retaining wall and the building's below-grade enclosure, also a glass storefront system. This same architectural enclosure, which by day mediates the amount of ambient light emitted into the interior, is by night a filter for light from within. It is a similar interest in the direction of light that brings us to the next example.

EXTRACTING VALUE: PERFORMATIVE PROPERTIES

The second example demonstrates how the *performative* properties of a design Probe may serve as a heuristic device.

Once a program for a forty thousand square foot Museum of Agricultural Technology was issued, student designer Cole Wycoff identified an interest in the dramatically enhanced phenomenon of light when inverting its natural direction. In recognition that solar lighting is typically cast from above, this design probe originally intended to demonstrate a mere inversion of light's most natural direction. The designer's interest in this dynamic was prompted neither by a congruency with the site, nor the program, nor the user group in question – the origin was admittedly from outside the design problem proper.

The designer's first conceptual image was a fissure in an earthen surface from which a highly-intense lightsource pierces upward towards the atmosphere above. In his further development of a probe that would best demonstrate this identified phenomenon, the designer concluded that a construct with more volumetric qualities would be more appropriate to showcase this phenomenon.

The student designer first secured an electrical light source, with a thumb switch on its cord, and a compact fluorescent bulb fixture. Since it emits significantly less heat than an incandescent bulb, the decision to use a compact fluorescent bulb would allow for a greater number of enclosure designs, divorced from any internal ventilation requirements. When considering the character of various enclosures, the designer focused first on the materiality of the probe. The student secured a long piece of Bolivian Rosewood due to its distinctive color and densely compacted wood grain. The student conceived of a methodical panel system that would use small basswood armatures to connect the structurally rigid wood panels to those immediately adjacent. Individual wood panels were 4.5 x 4.5 inches and the constructed design probe has the physical extents of 9.5 inches cubed. By quickly equating the overall form of the design probe with a cube, the designer allows himself to better consider other physical aspects that are believed to be of greater importance or informative impact.

Upon a post-production analysis, the designer tweaked his primary interest. Once in operation, the designer observed the dynamic between solar lighting typically cast upon a worldly object and a change of perception when placing the light source within the object instead. While the Probe was valued for its performance to demonstrate this dynamic, it easily correlates with any architectural work exposed to a natural day / night lighting cycle. Furthermore, the Probe also commands interest as a beautiful aesthetic object.

As the designer engaged the architectural design problem, and contemplated how to interface his expectations with the issued site, program, and user group, he maintained an interest in a certain aesthetic performance first discovered in his design probe. The final solution bears a strong physical resemblance to the final probe, however the architectural solution operates at a scale of over forty thousand square feet and has a composition that is dependent upon more than one volumetric mass. In turn, this tectonic enclosure serves as a premiere hall for showcasing historically-significant tractors. Due to the fondness for the probe's aesthetic qualities, the designer chose to retain as many of those qualities as possible in his final architectural solution. For instance, apertures were kept at exaggerated vertical or horizontal proportion which allow for visual access to the continuously running structural frame beyond. While the red finish of the architectural proposal was originally prompted by the Rosewood, the designer cited a congruency with the University of Nebraska team colors as a reason for retaining this finish. Finally, due to the floor area necessary to properly showcase the museum's collection, the designer chose to not insist upon a cubic form for the grand hall, but instead allowed the programmatic requirements for the architectural design problem to prevail.

Fig. 05. Design Probe investigating the physical composition of a corn stalk, and final presentation materials for a Museum of Agricultural Technology, Fall 2005 semester, by University of Nebraska M.Arch student Britt Woolf.

EXTRACTING VALUE: PHENOMENOLOGICAL PROPERTIES

The third example demonstrates how the *phenomenological* properties of a design probe may serve as a heuristic device.

Student designer Britt Woolf demonstrated initial apprehension toward the employ of a design probe into her architectural thinking. The design probe was not seen as an opportunity for enhancing her approach to the design of a Museum of Agricultural Technology but rather as a hurdle to its realization. With a declared interest in the design of a building's tectonic-enclosure, she perceived the Probe requirement as delaying her engagement with architectural issues of greater interest. However, once the opportunity for a design probe was more fully recognized, the student designer identified a phenomenological congruency between the agricultural program of the forthcoming facility and the agricultural crops themselves. Although this student designer's interest was grounded firmly in the architectural realm, she decided to systematically deconstruct and rearrange the multiple layers of an ear of corn as a means for making new discoveries.

A corn stalk is composed of the stalk proper, the husk, its kernels, and the cob. In identifying these parts, the student designer then began to consider an appropriate reorganization of the various parts in better anticipation of architectural possibility. To this end, the probe did not accurately re-present the ear's original construction but was organized in a manner that strongly considered light passing through filtered layers made from the most porous components to the most opaque. This is not to say the design probe was viewed as a quasi-architectural model, however, probe design decisions were made while forecasting the potential for maximum architectural effect. More often than not, this mindset derails the act of Probe making and circumvents the spirit in which the Probe was originally assigned. While the student designer anticipated certain architectural uses, the Probe was never directly analogous with the final wall-envelope section, no matter how effectively it forecasted certain phenomenological properties.

The design probe has overall dimensions of 12 x 6 x 6 inches. Within the probe, each layer of corn stalk material is organized and attached to its own steel subframe and is suspended with high-strength fishing line. The subsequent subframes are rectangular in profile, but are of a proportionally nested scale. Of the four side elevations, only one reveals the section view of these exploded ear components. While it is the most visually revealing, it is also clear how the organization of the probe has influenced the design of the corresponding architectural envelope. In the previous two example projects we have witnessed the sequential development of a physically manifested idea or phenomena that is evaluated and applied to the architectural realm, however this example is fully concurrent with both the physicality and prevailing character of constituent materials as they suggest architectural use. As a larger site strategy began to interface with the generative yield of the design probe, we see a correspondence between the corn stalks forming the outside zone of the probe and the concrete exoskeletal frame of the final architectural solution.

CONCLUSION

Design probes necessitate a level of abstraction for their own success and thereby present an excellent opportunity for ideological programming. While abstraction will always be present when one takes a non-physical idea and gives it three dimensional form, it is through the necessary process of physical manifestation that additional creative discoveries can be made, whether during the design probe's construction, or upon a post-production analysis. The agility with which a design probe can physically manifest an idea is enhanced largely by its pre-cursory disconnect from the architectural aspects of Site, Program and User group. As finished three-dimensional artifacts, similar value can not be extracted from either two-dimensional investigations or three-dimensional investigations in the virtual realm. As an act of making, the design probe stands the test of construction at a personal scale and whose physicality is identical to the architectural discipline whose larger interest it will serve. As a vehicle, the design probe tests both the generative potential and helpfulness of the chosen idea while prompting its author to either tweak, amend, or out rightly jettison the identified idea altogether prior to working with it in a forthcoming architectural design problem.

In the event that a design probe is constructed where the concluded maximum yield is equivalent to the idea or process that generated it, then the probe fails in its ultimate purpose to trigger new discoveries. Should this resulting construct merely demonstrate the identified idea, instead of critiquing it or taking ownership of it in some other way, then its helpfulness for addressing architectural decisions is naught and its usefulness plummets to that of a 5th Grade Science Fair project, no matter how elegantly or expertly built.

Design probes do not require an interpretation identical to the generative thinking that created it. A design probe, like Architecture, is not only capable of physically manifesting an idea or phenomenon, but it also projects an aesthetic that is of deliberate intention. In turn, we must continue to recognize that new observers will typically employ their own interpretive metaphors to understand what they see and experience, especially when they encounter something new. This is what makes public critique of design probes so helpful: Eyes familiar with the probe, especially those informed with the knowledge of its making, are biased while observing the finished object before them – Unfamiliar eyes however are ready to make fresh observations while observing the exact same object.

If through the creation of a design probe the designer enhances his/her understanding of the fullness of an identified generator -- that original *granule of sand* -- then the designer has extracted its best value and has hopefully discovered why a design probe investigation is both a provocative and helpful methodology for architectural design.

IMAGE CREDITS

Fig 01. Image by author.

Fig 02. Image courtesy of Tony Boon. Used with open permission.

Fig 03. Image by author, work by student designer Kevin Augustyn.

Fig 04. Image by author, work by student designer Cole Wycoff.

Fig 05. Image by author, work by student designer Britt Woolf.

ENDNOTES

1. The term "heuristic device" is used here in the same spirit as introduced in Peter Rowe's title Design Thinking. Rowe offers that a heuristic device in architectural design is a "Specific problem-structuring device… applied to general kinds of procedures for guiding the search for solutions." Peter Rowe, Design Thinking (Cambridge: MIT Press, 1986) 75.

2. Wes Jones and Peter Pfau, "Either OR/igins," Pamphlet Architecture #12: Building Machines. (New York: Princeton Architectural Press, 1987) 51.

3. Ibid, 44.

4. Architects interested in the role of sustainability may argue that a specific site will lend itself to several environmental heuristic strategies. I do not disagree. Some sites will have better access to solar, wind and geothermal resources. However, these site aspects are highly performative and none directly affect the specific aesthetic or experiential expectations for the comprehensive architectural design to follow. Sustainability can only enhance the performance of architecture in the same way that the American Disabilities Act enhances accessibility in architecture -- Sustainability has yet to prove that it has a larger generative impact on architectural design problems. Therefore, many LEED buildings today are aesthetically and experientially indistinguishable from many non-LEED buildings.

5. Kimon Nicholaïdes, The Natural Way To Draw: A Working Plan for Art Study (Boston: Houghton Mifflin, 1941) 23.

6. Ibid., 15.

7. Steven Holl, Written in Water (Baden-Baden: Lars Muller Publishers, 2002)

8. Ibid. Holl credits use of the term "seed germ" to Louis Sullivan.

9. This decision was reinforced in late Oct 2006 during a studio field trip to the Denver Art Museum addition designed by Studio Libeskind.