

### The Design Threshold

When digital technology finally assumes its far-reaching potential, it will cross the Design Threshold. It will assume its own innate and universal identity -- not the misplaced identity often ascribed by computer programmers or the mimicry of traditional process dictated by status quo architects -- but an identity and awareness that plays to the unique capabilities of digital design. Uniqueness occurs at the design threshold. It can be identified as the point where:

1. The digital process becomes integral to the conclusion, a design that would not have been reasonably anticipated otherwise.
2. The intention of the designer is substantially dependent on the interaction of digital process to accomplish the intended result.
3. The complexity of the task exceeds the ability of the designer to accomplish that task by any other reasonable available means.

This pedagogy is explored through graphic experiments that exhibit DNA like properties.

### No limite do projeto.

No momento em que a tecnologia digital finalmente se aproximar do seu máximo potencial, terão sido superadas os limites do projeto arquitetônico. Esta deverá então assumir sua identidade universal e inata – não a falsa identidade criada por programadores de computador ou aquela criada pela imitação dos processos tradicionais ditados pelos arquitetos do status quo – mas uma identidade e uma compreensão geradas pelas capacidades singulares do projeto digital. Singularidade que ocorre no limite do ato de projetar e poderá ser percebida no momento em que:

- 1- O processo digital integra-se ao resultado final, gerando um projeto que não poderia ser razoavelmente desenvolvido de outra maneira.
- 2- As intenções do projetista dependem substancialmente das interações do processo digital para que sejam alcançados os resultados esperados.
- 3- A complexidade da tarefa ultrapassa a habilidade do projetista em resolvê-la de qualquer outra forma possível.

É esta a pedagogia a ser explorada através das experiências gráficas que exibem DNA como propriedades.

## The Design Threshold El umbral de diseño

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### El umbral de diseño

La tecnología digital cruzará el umbral de diseño cuando asuma su inmenso potencial. Debe asumir su propia e innata identidad universal — no la equivocada identidad a menudo atribuida a ella por programadores de computadoras, o la apariencia de procesos tradicionales impuestos por arquitectos del status quo — una identidad y percepción, que representan las capacidades únicas del diseño digital.

Singularidad que ocurre en el umbral de diseño y ésta puede ser identificada como el punto donde:

1.- El proceso digital forma parte integral del resultado, un diseño que de otra manera no hubiese podido ser razonablemente previsto.

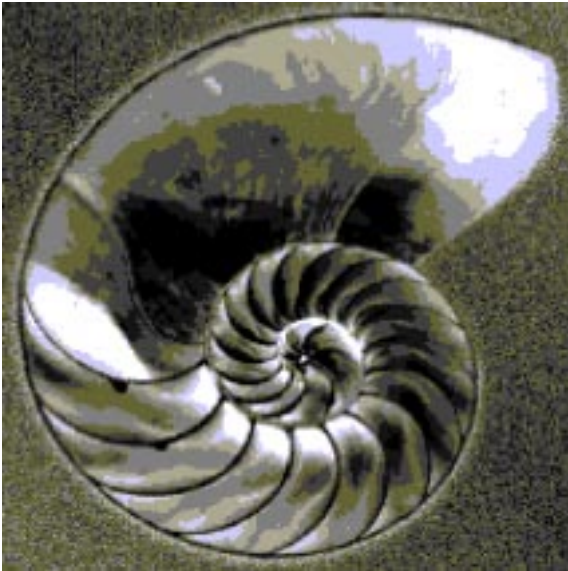
2.- La intención del diseñador, es substancialmente dependiente de la interacción del proceso digital para el logro del resultado esperado.

3.- La complejidad de la tarea excede la habilidad del diseñador para lograr realizar la labor impuesta mediante la utilización de otros medios razonables y disponibles.

Esta pedagogía es explorada mediante experimentos gráficos, que muestran propiedades similares a las del ADN.

## The Design Threshold

When digital technology finally assumes its far-reaching potential, it will cross the Design Threshold. It will assume its own innate and universal identity -- not the misplaced identity often ascribed by computer programmers or the mimicry of traditional process dictated by status quo architects -- but an identity and awareness that plays to the unique capabilities of digital design. While the purpose of this paper is to demonstrate the point of entry to the design threshold, through illustration, the discussion is fundamentally



*Fig. 1 The essence of beauty and the principles of design are timeless, and immutable. However, the processes necessary for their creation are in a constant state of evolution. The design threshold explores this potential.*

## Cultural Phenomena

At the end of the twentieth century, the durability and direction of the information revolution is difficult to ascertain, particularly with respect to architectural education. Our understanding suffers from a myopic vantage point, the penalty that history imposes when observations and evaluations overlap. Nevertheless, the promise of technology

has seduced our culture into its digital embrace. While we do not know exactly what we hold — it appears to be of significant value and natural curiosity fuels our interest.

Conventional wisdom suggests that the consequences of the Information Revolution parallel the radical changes born of the Industrial Revolution. Architecturally, this is ironic since today, as then, there is a nagging perception that human creativity is at risk and that individual initiative is endangered by demands for greater productivity and mechanization. In the 1850's, philosopher and critic John Ruskin admonished the Victorian reader "to look at the sumptuous furnishings of his house and to view them not as a triumph of modern progress, but as the expression of industrial slavery."<sup>1</sup>

In architecture today, there is a widespread perception among practitioners and educators that while the digital revolution has increased productivity, it has done so at the expense of the creative control of the individual. Computers are therefore shunned by conventional designer/architects for potentially, "spoiling the design process."<sup>2</sup> This negative stereotype is often unknowingly promoted by CAD advertising. Contrary to its' intention, the imagery appears dull, repetitive and conceived in a world of plastic trees and witless cartoon people. A marriage of computer programming and marketing, it is difficult to imagine a serious designer seduced by these visions,. It should then come as no surprise that, "Most Architects still prefer to deal with 2-D blueprints and cardboard mockups."<sup>3</sup>

This resistance to technology is a reaction against shoddy and uninspired design practices that have trespassed, or perhaps more appropriately blundered, into the exclusivity of the design sanctum – technology, not as an inherent evil but as a spoiler,. This leaves design as the architect's last stand, a resistance to the indomitable forces unleashed by the information revolution. With this one noted exception, architectural practice in the 1990's has undergone a thorough digital transformation.

## Educating the Architect

At the University of Colorado, computers are not generally engaged in the design studio for

creative purposes. While computers are widely used to compose graphic presentations, they see little application in core design/theory applications. There are individual exceptions. However, these maverick attempts are handicapped by their isolation from the traditional culture of sequential studio development. A fractured educational model results, one that has at present relegated technology to the niche application of graphic composition.

Compounding this digital identity crisis in the studio is the larger issue of Architecture's identity crisis within the structure of the University. When architecture is pursued as a professional endeavor at the Departmental level, it becomes marginalized and isolated within the research university. This occurs because the currency for validation at the individual and the Departmental levels is published papers, traditional research and grants – not building design. Significantly, the Ph.D. empowered history, theory and philosophy components have recognized this and have assumed prominent leadership roles in order to fill the vacuum left by the design culture. This trend of theory driving design has some concerned; "...that architecture has been hijacked by theory."<sup>4</sup> Blame is assessed as the studio focuses on the, "...'purely abstract intellectual architectural project'"<sup>5</sup>. Under this tutelage, computers can be conveniently disengaged from design, since structured digital design methodologies are not critical to theoretical propositions.

Even if a common goal of incorporating digital technology into the fabric of architectural education is agreed upon as a necessary development, a common pedagogical strategy is unlikely to emerge any time soon. Some initial pedagogic propositions suggest that Ruskin's warnings were prescient. Consider this statement excerpted from the *Journal of Architectural Education*; "A new interconnected computational environment demands the sharing of knowledge and methods. It supports collaborative design and engenders the tools to engage in it. However, to realize the potential benefits of incorporating the computer into design education, an explicit shift from the individual to the collective must occur."<sup>6</sup> A pedagogic mandate for 'collaboration' raises the question; does the migration of power from the individual create subservience to collective interests? Does architecture become a polite

collective response of economic necessity? Does the computer inevitably consume individuality? In the academy, digital technology requires a rethinking of architecture.

### **Professional Practice, Professional Resolve?**

The professional community responds to the issue of digital technology through the dynamics of profitability, not theory. Certainly, design is a strategic function, but it often exists in a complex and supportive role, subservient to the efficiency of the business of architecture. In any case, it is a tiny financial component in the overall architectural schematic. In many architectural offices, design has established a unique cache of professional stature, a reward that is jealously guarded and rarely abandoned. Frustration erupts when digital technology proves resistant to mimicry of established design processes. Also, senior designers can rarely commit the time resources necessary to master digital technology, while lesser attempts demonstrate that design methods are opaque to the technologically illiterate. This has created a situation — with design the noted exception — where professional architecture has undergone a complete digital transformation.

Education has been left in the gaping chasm between the pragmatism of the profession and the requirements of the university. Students can spend years focusing on theory and design, yet find employment in the business of architecture difficult to obtain. Conflict is inevitable.

If employment becomes the focus of the student's existence, and the emphasis is computing, the only guarantee is the prospect of a job in architectural production — a career as a cog in the wheel of office machinery. Many students dread this cultural perception of 'computer operator,' a non-designer, toiling away until dreams are a memory and the soul is worn away<sup>7</sup>. On the other hand, if design is the *raison d'être*, there are two likely complications: First, there are rarely the necessary resources to propel a digital design career from within the current university curriculum, especially a comprehensive approach with professional ambitions. Second, if traditional methods of design are engendered, the intern designer is likely to experience the same complications now frustrating professionals who are

attempting to master digital technology.

It is a conundrum of extraordinary proportions. No single strategy is likely to adequately engage the educational, professional and human proportions of this issue. Ultimately, theories must be tested, in the fluid environment of technological and social change. Of course, mistakes will be made, but they are the necessary burden of all progress. The work presented here is hopefully on the right track, but there are no guarantees. The methodologies are but a few of the extensive library that would be necessary for a comprehensive architectural design capability.

Whether or not architecture has been hijacked by theory, or if architecture can peacefully exist as an anomaly within the structure of the traditional university are issues of extraordinary consequence. The focus on these issues has already diverted critical resources of time and intellect from the rigors required of digital design development. For too long, digital technology has been little more than an educational curiosity. Is now the time that digital technology will assume its own innate and universal identity?

### Crossing the Design Threshold

Uniqueness occurs at the design threshold. It can be identified as the point where:

1. The digital process becomes integral to the conclusion, a design that would not have been reasonably anticipated otherwise.
2. The intention of the designer is substantially dependent on the interaction of digital process to accomplish the intended result.
3. The complexity of the task exceeds the ability of the designer to accomplish that task by any other reasonable available means. (Efficiency of production may provide more time for design, however this is only a temporary advantage, and in any case, is not considered here.)

### Process Defines Design Threshold

In its essence, computer aided design is a collaboration of artist and machine, a dependency of intellect and invention. One characteristic that identifies this state is when: the digital process becomes integral to the conclusion, creating a design that would not have been reasonably anticipated otherwise., illustrates this category of

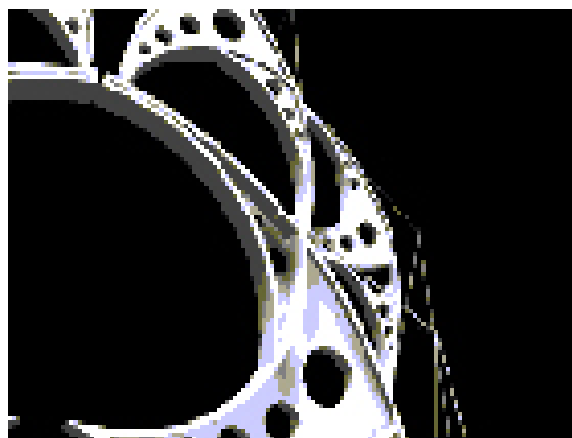


Fig. 2 Joe Hosek

This student work is from an introductory elective class that investigated the fundamentals of design and analysis using digital technology. The students are from the three and one-half year Master of Architecture program at the University of Colorado at Denver.

The hypothesis and questions presented to frame this investigation were: Space is often a derivative of a fundamental code played out on a repetitive stage. At an elementary stage, a crystal is the seed for a self-repeating form. What effects can be achieved through regeneration and organization of form in architectural space?

The assignment was to create a space conceived from one structural form. The function was at the student's discretion. In terms of design, the most significant consideration was the use of a solitary reference form (Fig. 2) to create a hierarchy of design intentions (Fig. 3) and to form an iterative relationship between design intention and design expression.



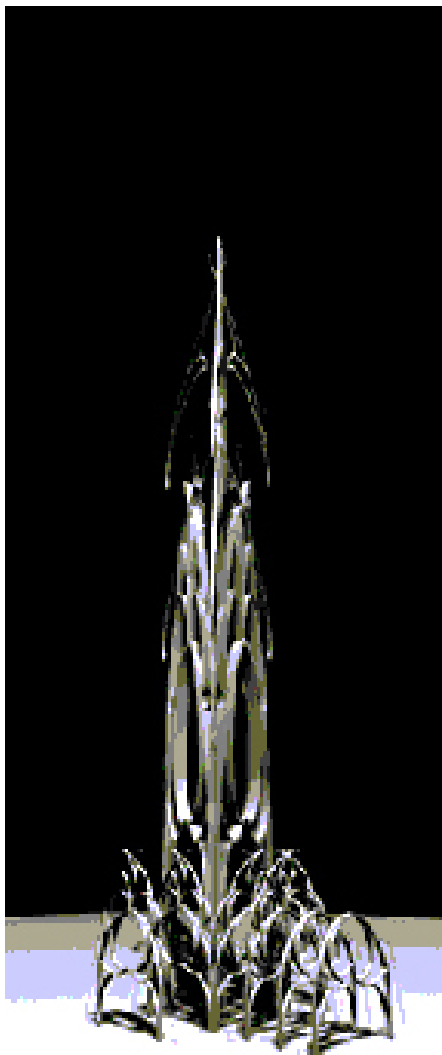


Fig. 3 y Fig 4 Joe Hosek

The work illustrated here was created in Autocad R.12 and imaged in 3D Studio R.3. In Autocad, a single form was used to create a structure, which in turn created a compound structure based upon variations in scale and orientation. The third drawing is a composition of the first two reference objects (drawings). The final Autocad model was imported into 3Dstudio and imaged with light and shadow. The output was printed in Photoshop. Additionally, animation was created using DPS-PAR hardware and Razor Pro software to compose sequential TGA files into animation.

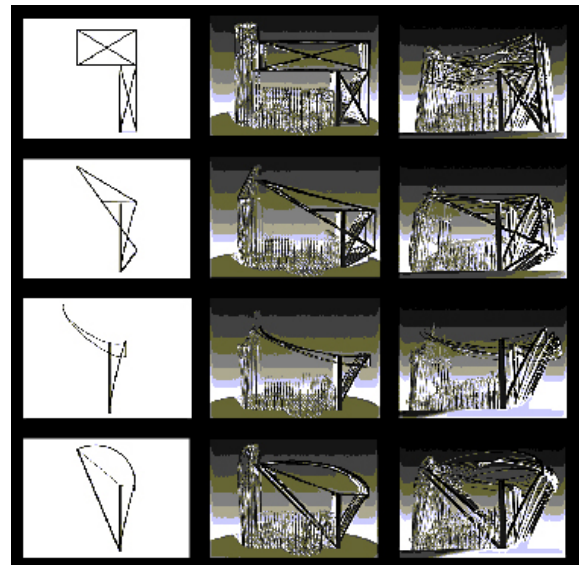


Fig. 5 Robin Morrison

### Design is Alive

The concept of placement and substitution is a primary consideration in digital design. It is through this iterative development in the design process that it is possible to refine design, especially with materials and details. Fig. 5, presents a matrix of design possibilities created through the process of substitution for the initial form. I refer to this as the DNA of design space since the design is 'alive'. A change to any of the parts systemically and simultaneously affects all structure and space, an organic response. This hierarchy forms a DNA like chain where design is dependent on the process. A break in this chain results in the end of the design process.

It has been recognized for centuries that architecture is dependent on the repetition and manipulation of form to create a basic visual vocabulary, but it was difficult to observe and even more difficult to implement. This experiment is intended to allow the novice designer to explore principles of harmonic geometric composition.

### Intention Defines Design Threshold

The example shown in Fig. 6 and figure Fig. 7 are from an experiment to combine traditional sketching with digital techniques to explore design potential. The chalkboard became the design medium to explore ideas in plan and elevation. A digital camera was used to record the design sequence. Images from the chalkboard design were imported into 3Dstudio MAX R.2 as background for virtual design investigation. The image on the right is a computer model combined with the background photograph and no real model was ever constructed. Note that shade and shadow were established through the use of shadow map materials.

These models were part of the studio design effort of three students in the spring of 1997<sup>8</sup>. The project was the Otis Elevator Urban Housing Competition. Briefly, the concept responded to issues of fast (highway), medium (streets and neighborhood) and slow (river). After these massing concept studies, the students also employed design methodologies of materials and structure based on the concept of placement and substitution noted above.

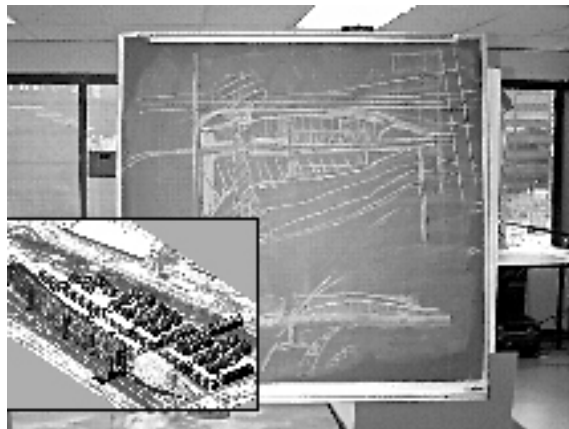


Fig. 6, Greg Smith, Erik Hall, Gina Gerber

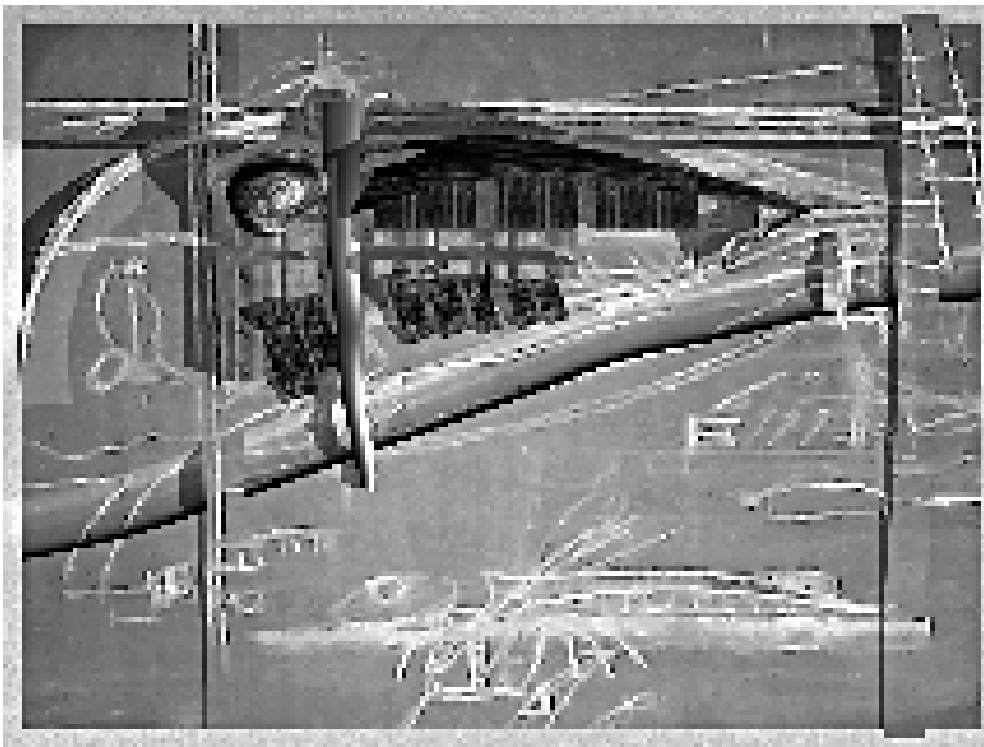


Fig. 7,  
Greg Smith,  
Erik Hall,  
Gina Gerber



### Complexity Defines Design Threshold

In this final example, the designer reestablishes a prior reality within the photograph. 6 points are used to match the known conditions to the geometry of the site with the coordinating points in the photograph. This is not a cut and paste composition. Fig. 8 shows the empty site and the building that is to be renovated for construction of a hotel. Fig. 9 shows one of the multiple vantage points (photographs) used at this stage as a basis for this iterative design process.



Fig. 8,  
Fig. 9,  
Fig. 10, Kuhn  
Park

The student's design intent is to preserve the existing structure, protecting it with formed surfaces that wrap and engage the proposed hotel tower Fig. 10. In addition to the issue of contextual design complexities, there are significant structural, form and material investigations of great difficulty that can now be reasonably explored. All design work was done in 3Dstudio MAX Version 2.0.

### Foundations Conclusions.

The digital revolution of the 1990's is rooted in the development of the Personal Computer (PC) of twenty years ago. The most significant social issue then, was the rejection of mainframe (centralized) computing in favor of the PC. The individual prevailed. Now, with the explosive growth of the internet, the distinction between individual and group has blurred. A battle over the primacy of the individual looms. Would a node on the internet earn Ruskin's condemnation as, 'a cog in the great engine of commerce?' Networking promotes collaboration; but does it promote good architecture?

Crossing the digital Design Threshold is presented here as an individual event. While many people are required to plan and construct an idea, it is the individual architect that creates the vision. Ultimately, at least with respect to design, our salvation lies in the indomitable spirit of the individual.

### Notes

- <sup>1</sup> **Steven Coote, William Morris:** His Life and Work, (New York: Smithmark Publishers, 1995), p. 19.
- <sup>2</sup> **Peter Coy with Robert D. Hof,** "3-D Computing", Business Week (McGraw-Hill, September 4, 1995) pp. 70-77
- <sup>3</sup> **Ibid.**, p. 73
- <sup>4</sup> **Neil Leach,** "Fractures and Breaks," in Martin Pearce and Maggie Toy, ed., Educating Architects (New York: St. Martin's Press, 1995), p. 26.
- <sup>5</sup> **Ibid.**, p. 26.
- <sup>6</sup> **Joseph Press,** "Soul Searching: Reflections from the Ivory Tower," Journal of Architectural Education Volume 51, Number 4 (May 1998), pp. 235-36.
- <sup>7</sup> **Steven Coote, William Morris:** His Life and Work, (New York: Smithmark Publishers, 1995), p. 18.
- <sup>8</sup> **Greg Smith, Erik Hall & Gina Gerber,** Studio, ARCH6701, University of Colorado, Inst: Kelly Shannon & Robert Flanagan, sp. '97.