

# **A Beginner's Mind**

**PROCEEDINGS**

**21st National Conference  
on the Beginning Design Student**

**Stephen Temple, editor**

**Conference held at the  
College of Architecture  
The University of Texas at San Antonio  
24-26 February 2005**

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Situating Beginnings  
Questioning Representation  
Alternative Educations  
Abstractions and Conceptions  
Developing Beginnings  
Pedagogical Constructions  
Primary Contexts  
Informing Beginnings  
Educational Pedagogies  
Analog / Digital Beginnings  
Curriculum and Continuity  
Interdisciplinary Curricula  
Beginnings  
Design / Build  
Cultural Pluralities  
Contentions  
Revisions  
Projections

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## ***Digital Assimilations: Novel Approaches to Integration***

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The University of Pennsylvania

“... trusting the formulations of the next generation that by definition defy the logic of the present. Education becomes a form of optimism that gives our field a future by trusting the students to see, think, and do things we cannot.”

-Professor Mark Wigley, 2004 Dean’s Statement<sup>1</sup>

For the past three years our School of Architecture has explored the integration of digital tools, techniques and thinking into the foundation level of undergraduate design studio. Courses in design and computing are now structured to strategically intersect and interact throughout the first studio semester. A strong emphasis is placed on integrating digital processes into all phases of analysis, design, and representation. Assignments explicitly embrace a “messy overlap” of digital/analog imaging, drawing, diagramming and modeling. Critical to this approach is fostering an open-source long-term dialogue between students, faculty, and the world beyond academia. This paper/presentation attempts to elucidate the pedagogical framework of this approach with an emphasis on understanding its history and conceptual basis, as well as the practical aspects and future promise of “digital assimilations”.

One of the driving forces behind this paper is the desire to articulate how this approach might influence larger threads of exploration (curriculum) within our school, and beyond. From the beginning I have thought that a carefully considered approach to digital integration would only help to foster the education of thoughtful, articulate and experimental young designers. What were once considered “binary oppositions” are now territories of abundant speculation: traditional distinctions between analog/digital, natural/artificial, and physical/virtual are being contested on every intellectual and spiritual front of contemporary society. And, as I propose in this paper, it is precisely through a critical engagement with this “in-between zone” of contention – what Malcolm McCullough calls the, “Middle/Ground” or what Nicholas Negroponte simply terms, “Being/Digital” [to exist, to have life + electronic digits, signals] – that we may find the most fertile ground for the future of design education and practice.

***as-sim-i-la-tion*** 1. *The amalgamation [merging] and modification of newly perceived information and experiences into the existing cognitive structure.* 2. *Adopting the customs and attitudes of the prevailing culture.*

***in-te-grate*** 1. *To unify, bring all parts together into a unified whole.*

### **Background**

The UVA Undergraduate Department of Architecture is a four-year Bachelor of Science program with approximately 300 enrolled students. Prior to 2002, all computer courses [including my own Introduction to Digital Design] were taught outside the structure of undergraduate design studios. These courses were limited to interested students and course content was highly specialized. In 2002, I initiated a restructuring of the 6-credit second-year design sequence into a “separate but integrated” 2+4 approach: 4-credit Introductory Design Studio and a 2-credit Introduction to Computing in Architecture course. The idea was that computing skills would be

critically infused into design studio work throughout the semester. Technical tutorials and hands-on practical training would take place one day per week and would reinforce/intersect with content and techniques being pursued within the design studio environment. At this point in time [new millennium, almost ubiquitous computing, etc.], the big question in our minds was not whether this should happen, but how would this happen? What would be the best, most productive, most resourceful approach? How would design computing participate in the rich weave of learning already fostered at the foundational levels of our school?

“The degree of personal participation, more than any degree of independence from machine technology, influences perceptions of craft in work.”

-Malcolm McCullough<sup>2</sup>

### **Surveying Viewpoints and Asking Questions**

In recent years there have been a variety of debates centered on the issue of integrating digital medias into design studio culture. The recent “Binary Oppositions” dialogues published in the ACADIA Quarterly Journal [Assoc. for CAD in Architecture] epitomize the pedagogical dilemma, and influenced our approach to assimilating computing into our design studios. The question posed in Issue 20 (2001) was: “*Should Introduction to Computing in Architecture be taught as a separate course?*”<sup>3</sup> There were two sides – one arguing that, “YES: a distinct subject deserves a distinct course ... the ultimate purpose of CAD software is to improve the process and product of design ... taking that time from studio can harm both subjects.” The other side argued that, “NO: By integrating CAD/graphics instruction into a studio, students become comfortable with the computer as a design and presentation tool, and will use their creativity to push the medium to its limits ... And, unless one integrates the computers into the design process itself- and this is reinforced by the design studio critic-students may miss some opportunities to understand the capabilities of digital design processes”<sup>4</sup>

While both sides made compelling arguments, I was left wondering why we could not combine both logics? Why not separate the courses [techniques], yet integrate their content [ideas]? With coordination and cooperation between design critics, was a “separate but integrated” design-computing model the best approach? Would it be effective and what would we be compromising? Would a single required course in the second-year be enough to initiate the integration of computing throughout the entire undergraduate core sequence? How would it build on the rich set of skills (diagramming, drawing, building) and thinking they have previously explored in Arch 101 and 102? How would the skills and thinking be reinforced in other core studios, expanded in other courses, and supported by the institution? Would the course simply be assimilated, or would it actively seek to instigate new thinking and influence new approaches? How might such a course participate in our school’s strong emphasis on design thinking, dedication to issues of craft and precision, commitment to issues of design ethics and rigorous aesthetic engagement?

These questions assisted in the development of the course, and the three main ideas that underpin the pedagogical agenda of our (“separate but integrated” 2+4) approach:

**1. Get Messy >** *We should be embracing overlapping complexities. [Design and digital processes should not be fully compartmentalized, rather they ought to be critically overlapped and intertwined. Allow all involved design critics to have direct input into the structure and content of both courses.]*

**2. Converse and Multiply >** *We should be fostering a dialogue with critical feedback loops. [We must look for opportunities to share information at all levels of our academic network. Tap into the collective intelligence of the school – ph1: teacher > student, ph2: student > student, ph3: student*

> teacher. ph4: teacher > teacher. Create productive synergy and digital integration will take on a life of its own.]

**3. Explore and plant seeds** > We should rigorously explore new ways to foster intelligent design. [Embrace creative, productive and ethical changes ... seek to understand the potential of new design disciplines, driven by technology, metered by ethics. Schools need to cultivate students who are facile with cutting-edge technologies - not only to tap their potential, but also to explore and question their ethical use, efficacy and potential.]

### **Get Messy > Embracing Overlapping Complexities**

“A right approach to tools may lead us toward more measured positions on technology. There may not always be a cutoff between tool and medium, between manual and mechanized, or between traditional and digital. We are likely to explore this middle ground.”  
-Malcolm McCullough <sup>5</sup>

The principles and methods structuring our foundational curriculum embrace design as a critical practice of thinking, exploring and constructing the built environment with precision and creativity. The pedagogy of the digital curriculum is intertwined with this structure and has fostered a productive and critical dialogue not normally associated with an introductory digital media course. Most importantly, studio design critics regularly critique the digital work not only on the basis of technique, but also on concept and clarity of content. Analog and digital explorations are reviewed side-by-side with the goal of understanding how the chosen method of representation contributed to the conceptual and/or technical basis of the work. We begin with an exploration of the student’s own body – its various contours, layers, systems, scales, profiles, and material qualities – our students are asked to pursue conceptual ideas using both digital and analog tools. The students are initially asked to explore a variety of predefined techniques, tools, and generative logics. After a process of concentrated exploration, review and critical reflection, students are simply asked to move back and forth between tools, discovering what works best for them – what expresses their conceptual intent effectively, and with the most clarity. They are pushed seek the boundaries of what the tools might enable – and ultimately they are encouraged to question the tools themselves.

In addition to emphasizing customary analog studio tools [sketching, modeling], it is now standard practice for the majority of our students to bring personal computers into the introductory design studio. Wireless laptops sit intermingled with messy reams of sketches on trace, chipboard study models, laser cut material studies, et cetera. The studio environment has become a “lab” – an exciting place for peer-to-peer collaborations, productive interactions, accidental discoveries and learning.

The design studio is no longer a closed atelier sealed from outside influences. Rather, the studio is closer to the idea of a laboratory [a complex and intelligent ecology weaving multiple threads of design exploration]. Intrinsic to this notion are processes of research, exploration, fabrication, and communication. Highly productive laboratories are technologically diverse ecologies [relationships between organisms and their environments] – mixing fields of research, modes of exploration, techniques of production, and mixed tendencies of socialization and contact. When these ecologies are retarded in any way, the entire process suffers. For instance, when design studios are cut off from say CNC fabrication facilities, the accidental and innovative possibilities are severely limited. When design studios are rich, dense, and vibrant with ideas and potential – critical and exciting possibilities emerge. Mark Wigley [the Dean at Columbia University] has inherited such a place, and in his recent Dean’s Address he articulated it this way: “Up above are the dense and chaotic studio spaces bristling with electronics and new ideas. Somewhere between the carefully catalogued past and the buzz of the as yet unclassifiable

future, the discipline evolves while everyone else sleeps. Having been continuously radiated by an overwhelming array of classes and waves of visiting speakers, symposia, workshops, exhibitions, and debates, the students artfully rework the expectations of their discipline.”<sup>6</sup>

### **Fostering a Dialogue with Critical Feedback Loops**

**feed-back** 1. The process in which part of the output of a system is returned to its input in order to regulate its further output. The return of information about the result of a process.

**Converse and Multiply >** We should be fostering a dialogue with critical feedback loops. [We must look for opportunities to share information at all levels of our academic network. Tap into the collective intelligence of the school –Create productive synergy and digital integration will take on a life of its own.]

**ph1:** teacher > student [*a241 techniques, tap into a201 ideas, reviews, day-to-day at the desk*]

**ph2:** student > student [*informal reviews, symposia, web site, lectures by past students in 300, 400 levels*]

**ph3:** student > teacher [*symposia dialogue, day-to-day at the desk, keep in touch with recent grads*]

**ph4:** teacher > teacher [*allow other profs to audit the course, informal workshops, reviews*]

While students are eager to embrace new technical and conceptual approaches, the institution as a whole remains resistant to assimilating digital media into core pedagogy outside the foundation level. In order for instructors to effectively communicate with students using digital medias, teachers need to be equipped with the some basic “digital” language and navigation skills. In addition to the loops initiated above [ph1: teacher > student, ph2: student > student, ph3: student > teacher. ph4: teacher > teacher.] a series of informal workshops were structured to generate a dialogue between design critics (which ultimately benefits the development of student work). The workshops were structured around the following four themes:

**1. Ideas** for encouraging your students to use Imaging/Modeling Software as an instrument for analytical/visual communication in a design studio setting – not as a replacement for drawing or model building but as a complement to more conventional modes of design exploration.

**2. Tools** for enabling Design Critics to effectively navigate through a student’s 3D model and encourage a clearer, efficient and more legible dialogue in studio and during reviews.

**3. Strategies** for promoting the use of Modeling Software as an iterative design tool – as a way to investigate variable spatial configurations, explore variable lighting conditions, experiment with ideas related to time/progression, research multiple qualities of material transparency/reflectivity, etc.

**4. Suggestions** for how to assign specific work and what to expect of students.

It is students who ultimately push the use of technologies to new and exciting territories. A series of student + faculty symposiums were structured after each project to generate a critical dialogue across studios, share new ideas and exchange thoughts about possible trajectories for further exploration. Other structures such as the Arch 201-241 web site, student online portfolio/archive, open-source tutorials, etc. are also instrumental to sustaining and pushing each class beyond the next.

## Rigorously Explore New Ways to Foster Intelligent Design

**Explore and plant seeds** > We should rigorously explore new ways to foster intelligent design. [Embrace creative, productive and ethical changes ... seek to understand the potential of new design disciplines, driven by technology, metered by ethics. Schools need to cultivate students who are facile with cutting-edge technologies - not only to tap their potential, but also to explore and question their ethical use, efficacy and potential.]

While earlier generations of architect-educators express anxiety and hesitation over “digital assimilations”, the latest generation of young designers is fluidly intertwining analog and digital crafts without question or pause [but also typically without a critical “long-term” ethical, theoretical, sustainable viewpoint]. In order to keep things in perspective – schools should understand the longer-term trajectories of where contemporary design practices are heading. Making an investment in some direction is critical. Schools should at least attempt to articulate a vision: How are we going to positively ASSIMILATE [engage] technology into our design curriculum? Where do we see both the professional and other experimental practices heading in the long term? What models, or precedents can we look to?

Theorist John Rajchman wrote this: “ ... there can be no thought without some critical relation to the future.” When I dream about the future, I often find myself thinking about the past – for example: The design process of the Colonia Guell Church (Barcelona, 1898-1914) holds some remarkable insight into the creative potential of a digitally assimilated design practices. [I use this example as a kind of fantasy of where design computing is headed, but also what it must surpass.] The design process revolved around a large funicular model suspended from the rafters of Antonio Gaudi’s workshop . This “virtual” model afforded the multi-disciplinary group of architect, structural engineer, sculptors and other collaborators the ability to share ideas in an abstract, immersive and parametric environment. This example of an early collaborative model is informative to our notion of “digital assimilations” on several levels:

First, the model was not created as a literal representation of the church. Rather it was constructed as a “working” operative wire frame – an abstract medium of cords, weights, skins and adjustable connectors. This framework was not understood as a “finished” design fixed in space, but rather as a flexible structural “underlay” to support diverse layers of active exploration. Thus, because of its operative simplicity, the framework became a shared resource for all levels of individual creativity and collaboration.

Second, the immersive nature of the physical model facilitated continuous feedback between idea and material, between virtual space and physical assembly. Within the limitations of the funicular system, spatial and material ideas could be tested in real-time using a designer’s own hands to manipulate dynamic parameters within the model. Ideas could be further developed using techniques at the discretion of the individual collaborator (For example, Gaudi sketched over inverted photographs of the funicular model to study both interior spatial conditions and exterior volumes.) This “active” method of physical and virtual immersion, fluid visualization, and integration of multiple tools and techniques, facilitated a versatile and open-ended design process.

Third, the hanging funicular model promoted an interactive “parametric” process where the results of small local design changes could be studied globally as they rippled through the larger system. If one collaborator decided to change a parameter through the redistribution of weights, the other members of the design team would see the implications instantaneously. Interactions between structural, spatial, material and organizational decisions could be studied within a single modeling environment.

The funicular model was at the core of a collaborative experimental design environment. Thus the Colonia Guell Church was not the product of a singular design vision, but of a

multifarious, highly conceptual, immersive and interactive process of design. This suggests that new modes of practice, enabled by similar, albeit enhanced, digital frameworks (much like Gaudi's interactive funicular models) might change the very nature of design. As we learn to incorporate new technologies into architectural practice, the processes of design, simulation and production will converge. It is here that we can perhaps find the most promising future of a contemporary design practice. Through the embrace of a messy process of virtual and physical tools, techniques, models and materials, we will enrich the design process – open up new avenues for experimenting with richness, efficiency, variation and craft.

## Conclusion

The notion that individuals will become “activators” or participants in the real-time generation of their environments is a compelling vision driving many emerging design practices. Architects might essentially become purveyors of generative codes – algorithms guiding the activation of their designs in space and time. Experimental projects by designers such as Jesse Reiser of Princeton University (his catenary space-frame experiments), and perhaps most poignantly, Mark Gouthorpe of MIT (the “Aegis” collaborative project) are actively pursuing new technologically-driven architectures where virtual and physical spaces are fluidly networked and animated – each informing and transforming the other. These experimental practices, defined best by their creative techniques and collaborative methodologies, are important models for the assimilation of digital tools, techniques and thinking in all design disciplines.

Dreaming about future modes of architectural practice [sustainable digital ethos: Physical Computing, Responsive Environments, Robotic Architectures] might help us to structure the present. Most importantly, through a critical engagement with contemporary technologies and practices, we might move design forward to where its “ethos” is defined by form, function, and meaning. It is my belief that through a careful, creative, and open-minded engagement with the “in-between zones” [analog/digital, natural/artificial, and physical/virtual] that we may find the most fertile ground for the future of design education and practice.

## NOTES

[1] Mark Wigley “2004 Dean’s Statement” [Columbia University GSAP]

[2] McCullough, 69.

[3,4] Binary Oppositions: “Should *Introduction to Computing in Architecture* be taught as a separate course?” Column by Scott Johnson (UMich), with contributing remarks by Glenn Goldman (NJIT). Published in the *ACADIA Quarterly 20, 2001*.

Interpretation of the “YES” (to computing should be taught separately) other main points:

1. “... we may someday have CAD systems that are so natural that they require no special instruction. We may have CAD systems so integral to design that it is impossible to distinguish between design topics and CAD topics. Unfortunately, that day has not yet arrived.” [but how will we know when that “breaking point” is?]
2. “... each coherent course (or sequence of courses); conceptually, this is THE reasonable way to divide up the curriculum.”

Interpretation of the “NO” (to computing should be taught separately) other main points:

1. Like learning to play a musical instrument (which is generally not accomplished in a lecture course) students learn best by doing.
2. The computer can change the design process itself as it offers new types of abstractions.
3. The computer is not only a tool for representation; it is a tool for designing. Image processing, painting, modeling, rendering and animation can all be integrated into the presentation and design processes.

4. The CAD/graphics knowledge and skills needed to design should be integrated at the very beginning of a student's design career, where he/she can learn to use them as an integral part of the process and not as a separate "add-on."

[5] Malcolm McCullough, *Abstracting Craft: The Practiced Digital Hand* (Cambridge: MIT Press, 1998), 68.

[6] Mark Wigley "2004 Dean's Statement" [Columbia University GSAP]

[7] See: "Flexible Generic Frameworks" (Chapter 5.1) in *Design Through Digital Interaction* by Chengzhi Peng (Intellect Books, UK. 2001). See also: *Gaudi His Life, His Theories, His Work* by Martinell, C. Barcelona Editorial Blume, 1979. See also: *The Designs and Drawings of Antonio Gaudi* by Collins and Nonell, Princeton University Press, 1983.

[8] Similarly, in the studio-laboratory of the structural engineer-poet-architect Robert Le Ricolais (at the University of Pennsylvania) this kind of interactive, immersive testing was the foundation of his design approach. His "Experimental Structures Workshops" (1954-76) continuously oscillated between the study of physical structural prototypes, sketching, diagramming, and abstract mathematical analysis. His emphasis was on having "some identity with phenomena" and "to start on the concrete and slowly converge with the abstract". His interest in understanding dynamic formations (bubbles, spider webs, bone micro-structures, radiolarian, etc.) filtered into his experimental method of teaching and practice. Through a frenzied "integration" of differing tools, techniques and content, "Le Ricolais ingeniously bundled, "matter, materials, constructional systems, structural configurations, space and place..." into productive hybrid assemblies. See: *Robert Le Ricolais: Visions and Paradox* (Edited by Peter McCleary, Fundacion Cultural Coam, Madrid. 1997)

[9] Catenary space-frame experiments: Projects > Catenary Experiments [<http://www.reiser-umemoto.com/>]

[10] The "Aegis" collaborative project published in *PRAXIS 6: New Technologies://New Architectures* [Precise Indeterminacy, P. 28]