

Drawing Towards a More Creative Architecture: Mediating between the Digital and the Analog

JACOB BRILLHART

University of Miami

"The computer is an important tool – no one could do without it – but for me it's a tool and it doesn't replace thinking. It can make you disconnected and autistic, and that is why we always say, bring it out of the computer, print it up, use paper, use the physicalities and models to understand and anticipate what this thing will be in the end: something physical, something real, something for the people."¹
- Pierre de Meuron

Six years ago in a feverish need to escape the paperless studios of Columbia University, I set out on a series of European road trips to rediscover the forgotten practice of drawing on the road. Using Le Corbusier's detailed sketchbooks as my sole travel guides, I was specifically studying his *Journey to the East*, which outlines that mysterious time of Le Corbusier's intellectual and visual development between 1907 – 1911. I retraced his steps through Florence, Siena, Rome, Athens, Istanbul and Pompeii, observing and recording daily by making new drawings from actual places Le Corbusier stood 90 years earlier.

Revisiting history while understanding architecture spatially, I realized how observation and experience, translated through drawing, inevitably informs design. Taking a more contrarian approach to the digital cartooning flooding schools and offices today, I became deeply vested in the relevance and necessity of drawing in the digital age.

Particularly for students and young architects, hand drawing accesses the right side of the brain more so than the digital process and builds a foundation for visual thinking. Hand drawing lends authorship to drawings, originality, understanding, and scale to developing work.

In practice, the fusing of media - or hybridizing the digital and analog worlds of design - makes for a larger, more creative palette from which to work. This cross-fertilization of media in architecture spans history, beginning with Vitruvius, and has been carried on by Leonardo da Vinci, Michelangelo, Le Corbusier, Frank Gehry, and Peter Zumthor – thus proving that the integration of technology with traditional artistic methods continually leads to intellectually substantive and more imaginative design.

This paper supports a hybridized practice of digital and analog design, but only one where the tools at hand are deployed with regard to timing, strength, and appropriateness. The case for each tool is made using the research of neuroscience, observation of the impact of the computer on the design process, and the nuances of architects who embrace both in their work.

ARCHITECTURE OF THE BRAIN

To discern the effects of the architectural tools at hand, it is important to understand what actuates the human brain. In the creative development of young architects, certain exercises and design methods should be carried out with different tools, based on the manner in which they engage the brain intuitively, creatively, or rationally.

To better understand this implication, one should look to the longtime research of Betty Edwards (whose work has recently been resuscitated in *The Architect's Brain: Neuroscience, Creativity and Architecture*, by Harry Mallgrave). In *Drawing on the Right Side of the Brain*, Edwards outlines basic

A comparison of left-mode and right-mode characteristics

L -mode		P -mode	
Verbal	<i>Using words to name, describe, define.</i>	Nonverbal	<i>Using non-verbal cognition to process perceptions.</i>
Analytic	<i>Figuring things out step-by-step and part-by-part.</i>	Synthetic	<i>Putting things together to form wholes.</i>
Symbolic	<i>Using a symbol to stand for something. For example, the drawn form  stands for eye, the sign  stands for the process of addition.</i>	Actual, real	<i>Relating to things as they are, at the present moment.</i>
Abstract	<i>Taking out a small bit of information and using it to represent the whole thing.</i>	Analogic	<i>Seeing likenesses among things; understanding metaphoric relationships.</i>
Temporal	<i>Keeping track of time, sequencing one thing after another: Doing first things first, second things second, etc.</i>	Nontemporal	<i>Without a sense of time.</i>
Rational	<i>Drawing conclusions based on reason and facts.</i>	Nonrational	<i>Not requiring a basis of reason or facts; willingness to suspend judgment.</i>
Digital	<i>Using numbers as in counting.</i>	Spatial	<i>Seeing where things are in relation to other things and how parts go together to form a whole.</i>
Logical	<i>Drawing conclusions based on logic: one thing following another in logical order—for example, a mathematical theorem or a well-stated argument.</i>	Intuitive	<i>Making leaps of insight, often based on incomplete patterns, hunches, feelings, or visual images.</i>
Linear	<i>Thinking in terms of linked ideas, one thought directly following another, often leading to a convergent conclusion.</i>	Holistic	<i>(meaning "wholistic") Seeing whole things all at once; perceiving the overall patterns and structures, often leading to divergent conclusions.</i>

Figure 1. pg. 44, Edwards⁴

neurological studies, as explained through Roger Sperry's scientific work, that explore the "dual nature of human thinking." The submissive right brain engages the non-verbal, analogic, non-rational, spatial, intuitive, and holistic ways of thinking. Our analytical thinking, which occupies the left hemisphere and that side of the brain we exercise most often, engages verbal, analytical, rational, digital, logical and linear forms of thinking.²

Edwards also extracts research by Richard Bergland, (*The Fabric of the Mind*), which further illustrates the underlying importance of engaging the right brain for design:

"Modern brain scientists now know that your left brain is your verbal and rational brain; it thinks serially and reduces its thoughts to numbers, letters and words... Your right brain is your non-verbal and intuitive brain; it thinks in patterns or pictures com-

posed of “whole things”, and does not comprehend reductions, either numbers, letters or words.”³

The elements on the right side of the chart are those that are required in the beginning stages of nurturing an architectural idea – where visual thinking takes place. To activate these parts of the brain, one should sketch and quickly draw conceptual ideas, and maintain a sketchbook as an incubator of ideas. Maya Lin describes this as “thinking with our hands.” Not to mention, drawing in R-MODE allows one to design, think, plot, and print simultaneously, or better said, in “real time plotting.”

Conversely, when working on the computer - or in L-MODE⁵ - creative and spatial thinking is reduced to letters, numbers and menu bars. L-MODE is verbal, rational, digital, logical, temporal and linear, all of which possess an inherent sequential nature. The verbal and the rational are essential skills to be developed on the front end of the project, in pre-design, while the digital, logical, temporal and linear characteristics are best suited after the conceptual framework of the design has been solidified. However, if one only designs in L-Mode the results are flattened computer drawings that are void of feeling. This systematization and filtering process into language is rendered almost certain, given that one inputs data through the interface of the keyboard. Thus, reduced to L-Mode from the beginning, inspired drawings never even have a chance. As educators, we need to promote the stimulus of right brain activity and refrain from defaulting to the left side of data entry in the computer. We should recognize that up to now, the computer’s greatest strength for the student rests in the back end of the process, as a production tool.

Exacerbated by new technology and advanced software programs, the distance from creative thinking becomes all the more remote, and begs the question, “Who’s in Charge?” To have real authorship of work - meaning individual creativity of the design and originality in the representation of the work - one must directly engage the right brain. It has been suggested the real moment of authorship rests in the mastery of the tool – whether that be by fully engaging the right brain or grasping every detail of the software. This thought is partly correct. If one is the master of the computer and understands all of its’ commands, one is more free to explore design possibilities and ideas are less visually compromised. However, given the current physical nature

of the computer and its bifurcated link to the brain, the design process remains a two-step, disjointed operation. Furthermore, the fact that new releases of Photoshop and other graphic tools continue to come on the market only exposes the limiting nature of previous versions of the software. Until the moment when we can begin to draw in, or on computer screens, we will still be drawing by hand.

SCALE

When implemented into the curriculum at the wrong time, or over-emphasized as the premier tool (as publications do today), software programs such as CAD, Revit, and 3D-Max unintentionally compromise education and creative, intellectual development. In contrast to today’s students, Le Corbusier (as well as da Vinci, Michelangelo, Vasari, and Kahn among others) drew by hand - on site - to understand directly and deeply scale as well as light, shadow, and form in full, physical three dimensions rather than in the flat virtual two –where there is no sun, no shadow, no gravity, no weight, no material, no scale and very little physical and cultural context.

While all elements are critical to understand, I will focus on simply understanding scale from the vantage point of the contemporary student, staring blankly into a computer screen at the Cartesian grid. Working with computer drawings is working in a digital vacuum with regard to scale. The Cartesian grid, which is the basis for both CAD and Revit, forces one to understand size through numbers instead of relationships. Without a reference to the human body or some other understandable object, one does not understand a drawing’s size. Currently students work for hours detailing drawings and then later realize the details will never be seen when printed at a scale that is relevant during a review. Most often they are working in all scales at once or no scale at all.

Hand drawing enables one to understand size in relationship to something, such as the body or another object. As far back as the Renaissance, we have relied on relationships between objects as the basis of dimensioning design ideas. The widespread use of paper, coupled with the invention of “scale”, allowed architects to draw construction “instructions” at a small scale for the builder to then construct at full-scale. Though the scaled reference was not standardized, “measures were still directly related to the human body such as the finger, palm and

foot."⁶ Thus, we began to understand measurements in relationship to ourselves.

"With the computer, data is recorded at 1:1 or full-scale, but only as an abstraction. The size of the screen image indefinitely varies as the operator zooms in or out to consider various aspects. [CAD's] absence of scale...makes it more likely that the designer looks at the image as an object rather than projecting oneself into the image through an imaginative inhabitation. Scaled sight is not an abstraction; it is achieved through judging the size of things in relationship to ourselves. With CAD, we do not operate at any particular scale because the image is severed from our (bodily) frame of reference. Moving from scaled drawings to CAD, 'man the measure' is replaced with 'man the measurer'."⁷

Three-dimensional spaces are difficult to comprehend when one designs in numbers and in terms of distances. As architects, we need the assistance of scales and spatial relationships to more fully understand distance and measure. Without that mastery, our buildings are plagued with being too big or too small.

LOSS OF UNDERSTANDING

Improvements in technology also create other unintended consequences: as technology improves, our understanding of how it actually works decreases. In addition to working without scale, new computer programs perform more complex tasks that require less and less thought from the user. The extensive menu bars, spreadsheets and templates that once advised us on how to do things now just perform the tasks without us even knowing how they are done.⁸

With Revit software, one can click "wall type," select one of the given options, and enter the dimensions. Instantaneously the wall is drawn with each concrete block, complete with mortar, rebar, stucco, and interior insulation. The relationship of these materials, their type, cost, thickness and physical properties, need not be understood. Additional commands are available for roofs, floors, stairs, window and door assemblies, and foundations. Within three hours, a 2000 square foot building can be designed.

Revit and BIM models are excellent tools to facilitate construction documents and schedules, reveal future construction and assembly problems, and increase detailed documentation. This technology

has proven to be invaluable in the professional arena; however, having students begin their design in Revit will continue to foster intellectually limiting work. Revit's ease of "shopping" for - and assembling - details only breeds more banal, lazy and uneventful designs that are void of intellect, imagination and emotion.

Scarily, the blind dependency on AutoCAD and other software tools occurs in the real world as well, as nascent architects continue to draw things they do not understand. Interns make maximum use of copy/paste commands, pulling details, elevations, and wall sections off the office server from past projects and reassembling them. The drawing can be altered and then reproduced by the new author without tracing over every line. While a swift and economically efficient technique, the shortcut undermines the apprenticeship process of the architect. When one draws, one remembers and understands; when one uses the "copy" command, one does not. Unfortunately, one generally chooses the known or path of least resistance, leaving the computer in charge to deliver a menu of defaults and previous details.

Gone too are the days when architects used t-squares and triangles to construct drawings. These tools give architects a fundamental understanding of the mechanics of construction.⁹ When building an actual model, tools, such as the metal straight edge, xacto blade and compass, and materials, such as wood, chipboard, and clay, force one to further realize structure.

"The squares and the parallel bar on the drawing board of the architects who practice free hand drawings are a haunting guarantee for the proper use of carpenter squares and batter boards, strings, plumb bobs, and snap lines on construction sites. The tools used in freehand drawings are not the abstract tools of drafting machines or CAD plotting; they set the common aspects between the microcosm of drawings and the macrocosm of construction."¹⁰

Given our current, abstract relationship with the computer, we have simply become less involved. As the author's participatory process in the design of a building becomes ever more simplified, the variety of built works becomes increasingly limited.

REGAINING CONTROL

Given that the older analog tools fundamental to drawing and construction are now out-of-date, and

the new software tools are becoming more abstract and more difficult to deftly control, the distance between the author and his/her drawings will inevitably widen. How do architects regain control of production, and what is it that we want to draw?

In the student's case, the phrase "I didn't know how to draw what I really wanted to do on the computer" or "when I went to print this is what happened, I am not sure why" seem to be the modern day equivalent of the "dog at my homework."

Today, the repercussions of this kind of blame have changed. In our more supportive roles as teachers, these comments are now usually met with, "ok, we'll work with these drawings." This exchange is commonly accepted because most people, students and teachers alike, do not understand the technology they are using. The "norm" is to blame the plotter or the computer for poor drawings, which again, begs - "Who is in Charge?" As the computer unquestionably belongs in schools and architectural offices, the obvious answer is for teachers, students and practitioners to develop a more advanced mastery of the latest drawing software.

Frank Gehry recognized how lagging the architectural discipline is in relation to other industries such as aerospace drawing and engineering, and took it upon his office to confront the digital deficiencies. His company, Gehry Technologies, developed out of his architectural office, forges new architectural drawing software that has, in turn, led to a new architecture and several of the world's most iconic projects. Paul Seletsky writes in *Provisional*:

"Gehry's adaptation of technology should be viewed as a watershed for architects: Transforming the computer transformed from a tool to expedite production of the traditional "instruments of service" into an instrument of service itself. Architecture imbued with the formal and structural qualities of art but manifested exclusively through the computational technology. Gehry's innovation... may be compared to Brunelleschi's dome in Florence for its historical impact."¹¹

In addition, CNC technologies are beginning to restore the architect's role in the construction process, ushering in the return of the architect as master-builder. SHoP Architects' Porter House project in Manhattan employs a custom-fabricated wall panel system for the façade. SHoP's understanding of CNC technology was realized in the architectural studios at Columbia University, during

which they directly sent their designs delineated in AutoCAD to the laser cutter to expedite and facilitate model making. In practice, they translated this knowledge into drawing the paneling systems digitally and sending the work directly to the fabricator. This hardwired link to construction eliminates the need for shop drawings, affords a better factory-quality product and expedites assembly on the job site, all resulting in fewer dollars spent.

However, what we cannot forget - and what some students often forget - is that this new computer generated architecture, with all its wonder, is still based on visual thinking and the fundamental methods of architecture. Take Frank Gehry's case, which is rooted in drawing and sculpture. The conceptual front-end thinking - the idea - is developed and exercised through hand drawing before it is translated and solidified in the computer. In the case of students, when this critical step is either skipped or simply undeveloped, they wind up relying and focusing on architectural representation and the phatic¹² game of image-making that is rendered, unmonitored, overnight and through the computer. The hope is that a compelling image will emerge by morning. Usually, the result is a panorama of more and more of the same.

The reasons why the work begins to take on a greater sense of homogeneity are two-fold.

LACK OF EDITING CREATED BY THE TWO-PHASED PROCESS OF THE MACHINE

Unlike the single-phase process of hand drawing, computer drawing is a two-phased process. For the student, it is harder to show authorship and editorial control because the computer's inherent functionality plays a very large role in the making of the image. There exists a disproportionate production ratio between the architect and the computer.

The student designer captures his or her ideas, inputting thoughts through a series of logical commands of menu bars and letters and numbers. Working in a two-phased process (compared to the real-time plotting of a hand drawing), the work remains ephemeral; it is not a drawing yet, but rather intangible, changeable, and temporary. It is only during the second step, the plotting of the image - the last creative filtering process - that the drawing takes on life, delivered from the virtual to the actual. There are no consequences for poor

quality in the first phase; the enormously-helpful digital software has also unintentionally lulled our analytical and editorial skills to sleep. Given that we do not have to pay for or be confronted by the second phase, the printing of the image, we feel less responsible for the creation of the details of the design. Therefore, we feel less responsibility for its possible poor quality, and thus, we tend to more easily abandon the process of editing.

While computer functions are rapidly executed by the student, they are nonetheless disjointed from the printing process – which is far different from the hand drawing’s holistic process of creation and production. This time lapse in computer drawing between perception/ idea and printing precludes a sense of tangible ownership and prevents continuous editing and real-time reflection. Often, the end result is not what we expected, and is then further transformed and filtered by the nature of the plotter.

THE LEVELING EFFECT OF THE PLOTTER

Harking back to the need to reclaim control, the complexity of *plotting* creates another layer of distance between the final output and the architect’s actual hand or signature on the work. Not only is the end product often a surprise, but the drawings, collectively within the studio, in fact all look the same. Mallgrave, in his book, *The Architect’s Brain*, calls the overall flattening of work the “leveling effect.” He states, “the computer, as the first tool of design, tends to have a leveling effect on presentational techniques and, arguably, design originality.”¹³ He also points out that in architectural schools today, many final architectural representations look extremely similar and standardized, reduced to just image-making contests. “As a profession, we have become focused entirely on the image [in creation and representation], and in the process are shunting aside all social, theoretical and constructional interests.”¹⁴

When the printing head of the plotter becomes the only hand delineating the work for the studio, the work becomes immediately systematized. The dimensions, the speed, the paper, the ink, are all even. There is little curiosity in the perfectly-plotted straight line. There are no marks of human pressure which begin to underscore a visual intensity of thinking in the drawing; the subtle marks of the creative process have been removed. The plotter is perfectly smooth and flawless in its delivery. There

is a difference between the hand drawing of a building and a computer drawing of the same building. Hand drawings imbue ambiguity in the fact that not every single detail is drawn or specified. This editing at the micro scale (micro drawing takes place during a rendering) keeps the larger ideas in the forefront. The lack of microscopic detail allows the viewer and creator alike to fill in the details with their own imagination. This level of ambiguity is particularly necessary as students begin to represent conceptual ideas in the early stages of the project.

WHO FUSES ANALOG AND DIGITAL MODES?

Understanding the impact of designing entirely in the computer is critical, given that it is the defacto approach in many schools today, and what will be deployed to a greater degree as those students enter the workforce. Yet, many of the world’s most renowned architects are those who have learned to integrate both digital and analog modes of architectural investigation, design and representation. For many of these architects, the era in which they were trained pre-dated digital representation and directed them to engage in traditional drafting and design methods. However, the offices of architects such as Zumthor, Diller and Scofidio, and others have proven to be more dynamic in comparison with younger generations; the fundamental skills of traditional drawing, coupled with the added benefits of newer technology, round out their professional tool chests and lend a greater range in which they can test and communicate their ideas.

Exhibits of Peter Zumthor’s work showcase a dynamic co-existence between models, sketches, hand drawings, digital drawings and paintings. The power of his work rests in the authenticity, authorship, tactile, emotional qualities and real feeling born out of the dual nature of his design methodology.

Meanwhile, Diller and Scofidio have been able to merge traditional hand-drawn perspectives with computer software such as Photoshop to enhance the image quality and to help clarify the overall concept. Similarly, Lewis, Tsurumaki, Lewis work offers a finished yet ambiguous look via the fusing of mediums. Hinting at the work of the famous delineator Hugh Ferriss, Lewis, Tsurumaki, and Lewis projects allow the viewer’s eye and imagination to enter their work via hand drawings. Their drawings are open, not finished, and frame ideas without delineating every detail. Lewis, Tsurumaki, Lewis add:

"we don't have a puritanical stance on either digital technology or hand drawing, which limits the approach. We search for - through the act of drawing - an approach that is more opportunistic...It is impossible for us to ignore or to push aside the commingling of media, or to have an overly nostalgic view about hand-drawn methods. We have a tendency to hybridize or cross-pollinate those methods."¹⁵

Outside the realm of architecture, though equally relevant is the work of Pixar Animation Studios, the Academy award winning computer animation production company. In *Graphite and Pixels: Drawing at Pixar*, Harley Jessup underscores the fundamental importance of hand drawing in the creative process of making movies. Jessup explains that at Pixar "the story is King." Development of the idea is most critical and is manifested through 5-15 artists who create comic-strip storyboards loaded with hand drawings. They design characters, develop the set design and the world they will inhabit. "We probably do ten drawings for everyone (that works) on average - so, 200,000 drawings or a cool half a million (for the entire film). We're constantly, constantly drawing."¹⁶

Pixar's creative director and founder John Lasseter wrote:

"Many people don't realize that we have almost as many artists...working in traditional media - hand drawing, painting, pastels, and sculpture - as we do in digital media. Most of their work takes place during the development of a project, when we're working out the story and the look of the film. The wealth of beautiful art created for each film is rarely seen outside the studio, but the finished film we send around would never be possible without it."¹⁷

The rigorous exploration into visually crafting a story is the soul of Pixar. Architectural students need to follow this lead, developing their own curiosities, architectural concepts, and theoretical pursuits through drawing and redrawing.

CONCLUSION

As modern brain scientists continually research the dual nature of the brain, we gain critical insight into the machinations of the mind. It is imperative for us, as architects, to discern how this continued research can enable us to create better designs. Though some contemporary research suggests that both hemispheres of the brain are engaged for all types of thinking, the principle characteristics of the Right and Left brains remain. Edwards' work

is now decades old, and illustrates the creative impact derived from stimulating the Right Brain. Particularly for designers, Edwards' de-coding of R-Mode and L-Mode activities has become all the more relevant in the digital age, and makes the neurological case for hand drawing as a means of informing design.

Unarguably, it is an exciting time for an architect, who has at his or her fingertips the tool of the computer. Yet, relative to the hundreds of years in which we have been traditionally practicing architecture, the technology is still so new and so unvetted. Observation of creative output in the last 30 years has revealed that the computer's shortcuts unintentionally create a digital vacuum in terms of scale; diminish our understanding; and weaken our editing processes. Meanwhile, the computer imposes a natural leveling effect from designing in L-Mode, defaulting to image-making representations via the plotter.

With foresight, we can regain control and use the tools of the computer to their greatest advantage. Learning to balance the benefits of both digital and analog modes, we may ensure that hand drawing does not become the forgotten tool of the imagination.

It is only human nature to ask, "There must be an easier way." With new technology, we tend to make the sweeping assumption that the computer is the simpler solution. It is progress. In reality, the computer is just one tool among many and does not replace visual thinking or the creative search.

ENDNOTES

- 1 Alastair Gordon, "Credit Swiss," Interview with Pierre de Meuron and Jacques Herzog, in *WSJ*. The Magazine from the Wall Street Journal (Winter 2008), 27.
- 2 Betty Edwards, *Introduction to The New Drawing on The Right Side of The Brain*, New York: Penguin Putnam Inc., 1999), XVIII.
- 3 Richard Bergland, *The Fabric of the Mind*, (New York: Viking Penguin Inc, 1985), 1.
- 4 Edwards, 44.
- 5 *Ibid.*, 44. Terms L-MODE and R-MODE are Betty Edwards' Terms.
- 6 Paul Emmons, "Drawn to Scale," in *Models to Drawings*, ed. Marco Frascari, Jonathan Hale and Bradley Starky, (New York: Routledge, Volume 2, 2007), 65.
- 7 *Ibid.*, p. 70,71.
- 8 Marco Frascari, "Architects' Virtues or a Much Needed Demythologization of Shallow Design

Procedures" accessed June 13, 2008, <http://marcozibaldone.blogspot.com/> (accessed July 20th 2008), 6.

9 Ibid., p. 20.

10 Ibid., p. 20.

11 Paul Seletsky, "The Digital Design Ecosystem: Toward a Pre-Rational Architecture," in *Provisional*, ed. Elite Kedan, (New York: Princeton Architectural Press, 2010), 35.

12 Harry Francis Mallgrave, *The Architect's Brain: Neuroscience, Creativity and Architecture*, (West Sussex, UK: John Wiley & Sons, 2010), 215.

13 Ibid., p. 214.

14 Ibid., p. 216.

15 Interview with David Lewis, Paul Lewis and Marc Tsurumaki" in *Provisional*, ed. Elite Kedan, (New York: Princeton Architectural Press, 2010), 130.

16 Harley Jessup, "Graphite and Pixels: Drawing at Pixar," in *Drawing / Thinking : Confronting the Electronic Age*, ed. Marc Treib, (London and New York: Routledge, 2008), 171.

17 Ibid., 170.