The Chiasma of Architecture (re)Production

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INTRODUCTION

> The printed book, that gnawing worm of architecture, sucks her blood and devours her limbs. She strips off her robes, she sheds her leaves, she grows thinner and thinner to the eye. She is sickly, she is poor, she is null. She no longer expresses anything, not even the recollections of the art of by-gone days. Reduced to herself, abandoned by the other arts because abandoned by human thought, she calls on the laborer in default of artists. The pane of glass replaces the stained glass window: the stone cutter succeeds the sculptor. Fare well all vigor, all originality, all life, all intelligence! She drags herself, poor beggar of the studio, from copy to copy.
> - *Victor Hugo, "Ceci tuera cela,"* Notre Dame de Paris

In 1832 Victor Hugo proclaimed, "architecture is dead, dead beyond recall, killed by the printed books, killed because she is less lasting, killed because she is too dear." To Victor Hugo, architecture was "the great book of humanity" written in stone. Architecture was the "handwriting of the human race" comprised of letters (pillars), syllables (arcades), and words (pyramids) which were set in motion by the laws of geometry and poetry. According to Hugo, the story of humanity had been incised within the stone walls of architecture until the invention of the printing press in the fifteenth century. Hugo's reasoning: "the book is soon made, costs little, and reaches far."[1] In other words, the printed book is efficient, economical, and reproducible.

Jacques Ellul in the *Technological Society* describes technique as a complex of standardized means for attaining a predetermined result. Spontaneous and unreflective behavior is thus converted to that which is deliberate and rationalized. Formulas are developed to describe "the one best way" in search of the most economical and efficient. No longer is there an "original" copy. Technique reduces action to numerical calculation. The magic once associated with number is lost. Geometry and poetry no longer work together.

Today's computer is pure technique. History incised in

Figure 1. Albrecht Dürer, *Melencolia I*, 1514.
Melancoly is one of the four humors of the body and was held to be an attribute of seekers after knowledge. This engraving has many symbols of alchemical significance such as the compass, balance, hourglass and polyhedron representing the philosopher's stone.

stone has been replaced by the printed word which now is stored within the virtual world of hyperspace located within the logs of computer networks. History which once was shown through stone images to the illiterate masses now has become pure information: textual and graphic information which is part of a system of extensively cross-referenced catalogues, files and lists. This information which once was within the tactile realm of three dimensions and materiality has now become hypermedia, which is within no dimension

Figure 2. *Mystic Mill,* column capital, La Madeleine de Vezelay

at all and all dimensions simultaneously, displayed as images on the computer screen.

THE BOOK AND THE BUILDING

> That architecture down to the fifteenth century was the principal register of humanity; that during this period there did not appear in the world a thought of any complexity which was not worked into a building; that every popular idea and every religious law had its monumental records; that, in fine, the human race had no important thoughts which it did not write in stone.
> *- Victor Hugo, "Ceci tuera cela,"* Notre Dame de Paris

Gutenberg's invention of the printing press in the mid fifteenth century coincides with a radical shift in the history of architecture. Although history can never reveal a precise demarcation of change, there can be seen a revolution in the production of architecture as the reproduction of text moved from the copyist's to the printer's workshop. The unique illuminated manuscript of the middle ages which was written and illustrated by hand with all its inconsistencies was replaced by the uniform, synchronized and reproducible printed book of the renaissance.[2] The unreproducible hand-hewn medieval building which was also a book yielded as well to the renaissance work which, in relying on the imitation of classical architecture, no longer had stories to tell.

The medieval church in itself was a book which fostered the telling of *historie*. The body of the building was adorned with stone sculptures which could be read as stories of God, creation, fables, and even astronomy and astrology. The sculptures were usually painted with watercolors and accompanied with explanatory inscriptions for the benefit of the literate and semi-literate. The medieval person, however, was generally illiterate or half-literate and required not only images to tell these stories, but also needed the translation of the abstract ideas inherent in the stories into terms of spatial relationships which is possible through the three-dimensional medium of sculpture. These stone sculptures allowed for multiple readings due to elements which could be interchangeable at will. Theoretically the peasant could attain wisdom through an ambiguity which permitted countless identifications and equations in a kind of mystic algebra and geometry.[3]

An example of a marvelous book which is also a marvelous edifice is La Madeleine de Vezelay which was restored over a period of 20 years during the mid-nineteenth century by the architect Eugène-Emmanuel Viollet-le-Duc. This basilica had been extensively damaged during the Wars of Religion in the sixteenth century and the Revolution of the eighteenth century. Viollet-le-Duc also restored Notre Dame de Paris and was a contemporary of the author Victor Hugo. It could be no coincidence that Hugo was aware of the architectural debates of his time.[4]

To Viollet-le-Duc, architecture was divided into two parts: *theory,* which deals with principles of geometry and laws of statics, and *practice,* which through continued and familiar service adapts these principles and laws to the changing conditions of time and space. Ideally, practice would be the poetic manifestation of structure in the original Greek sense of *poesis*, as an act of making and revealing. Viollet-le-Duc was attracted to medieval architecture because it incorporated the eternal rational laws of art and of building science, or geometry and poetry. His admiration for the middle ages was shared by others of his time, most notably John Ruskin and Augustus Welby Pugin.[5] These architects share a common thread: the belief that originality comes through the *practice* of making and using materials, through spontaneous and unreflective behavior. In addition

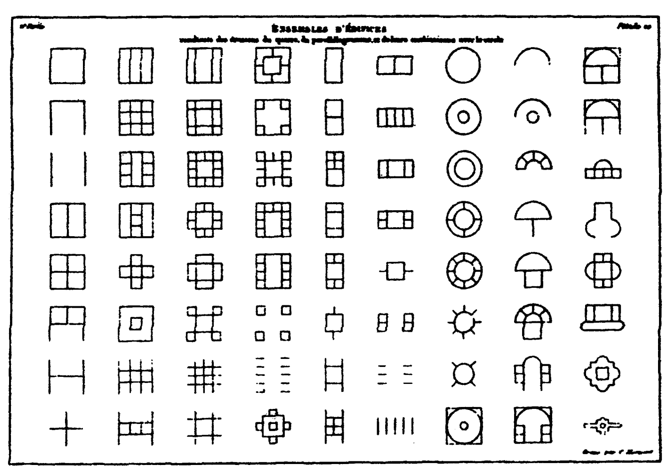

Figure 3. J. N. L. Durand, *Précis,* 1802.

to practice, Viollet-le-Duc included *theory* as a part of architecture. This attitude can be traced back through his professional training with A. F. R. Leclère who had begun his career in the atelier of Jean-Nicolas-Louis Durand.

Durand is known for his rationalization and systemization of architecture. For him there were two principles inherent in the rationalization of building: (1) convenience, or efficiency of functional relationships and (2) economy. His attitudes toward efficiency and economy were directly influenced by Napoleon's distrust of architects who "should have been made responsible when they exceeded their estimates and put into debtors' prison for payment for this excess" and preference for engineers who designed for an economy of means. Durand came out of a milieu of visionary dreamers who thought in metaphorical terms, architects like Ledoux, Boulée, and Lequeu who understood the imitation of nature as *mimesis*, whereas the rationalist Durand could only understand nature through a scientific quantification which substituted as a model of thought mathematical logic for metaphor. The principle of rationalism assumes that God/the creator has made the universe beautiful, harmonious and mathematical, and that through scientific experimentation the principles of creation can be discovered. The objective is to

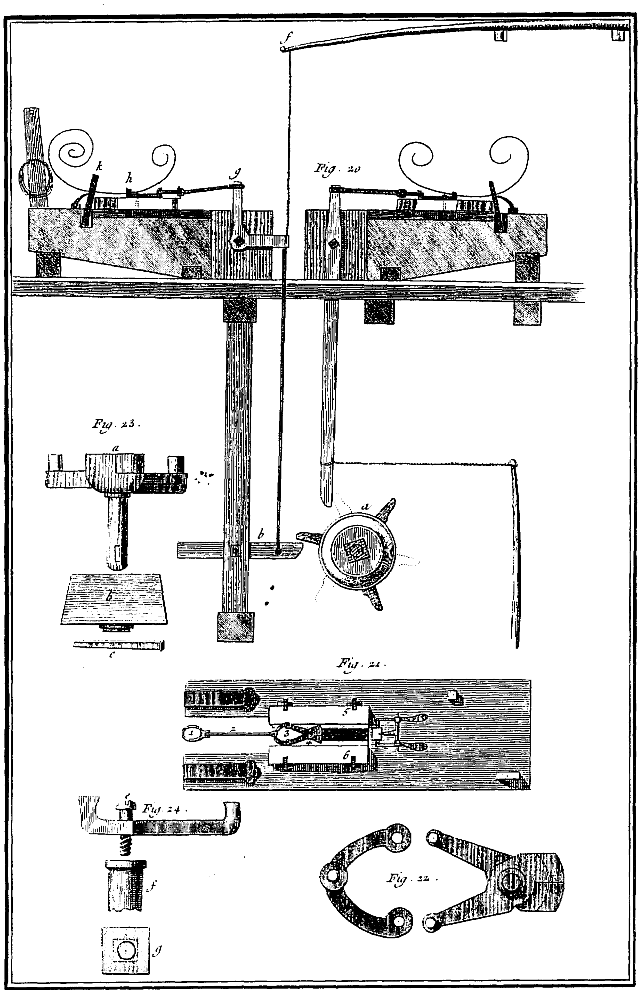

Figure 4. Denis Diderot, *Recueil de planches, sur les sciences, les arts libéraux, et les arts méchaniques*, 1763.

deduce the laws of nature, the general from which all the particulars may then be derived.[6]

Durand identified a set number of clearly definable principles, or formulas, upon which architecture was to be built. This rational attention to efficiency and economy led to his systemization of architecture and to the publication of two books: *Précis des leçons d'architecure donnés à l'Ecole polytechnique* in 1802/5 and *Recueil et Parallèl des édifices en tout genre, anciens et modernes* in 1809. The *Recueil* catalogues, in equal scale, buildings of the past and reduces them to a formal repertoire of two major groups: historical and functional. In the process, Durand consciously modified some of the plans to make them seem more systemmatic and geometric than they actually were in order to illustrate generic principles of architecture. In the *Précis* Durand attempts to standardize construction by proposing rational prescriptive rules for the composition and assembly of basic elements of a structure. This was an attempt to develop a codified system which began with gridded paper to which the various elements of architecture were added. Economy of means was demonstrated through the use of grids, simple geometric figures and simple building types. Durand boldly proposed that the design of a building could be the result of technical rules or formulas which could codify architectural knowledge in the form of methods, which could easily be passed on to other architects. Future architects could then learn about architecture through these abstract methods of design. In this way, architectural knowledge could become scientific.[7]

Large, illustrated printed books which systematically catalogued technological developments were nothing new to Durand. They originated in the engineers' notebooks of the fifteenth and sixteenth centuries and gradually developed into heavily illustrated printed works of machines called "theatres of machines." Durand, no doubt, was familiar with Denis Diderot whose works of the late eighteenth century were the culmination of this two-hundred year tradition of illustrating actual machines, tools, and processes. While Durand was working on his books, others at the Ecole polytechnique, such as Jean N. Hachette, were classifying mechanical devices by function through schematic drawings arranged systematically in a chart.[8] The vast array of visual technical knowledge available at this time contributed to the notion that scientific processes could be made schematic and mathematic.

The chart as a visual aid and the grid as a generator of form is prevalent today in architectural education, arriving via a lineage which has continued from Durand's grid as a generator of the plan, to Le Corbusier's plan as a generator of form and Hannes Meyer's "the plan calculates itself." The Bauhaus tradition presently taught in our schools is based on measurable processes with codifiable causes and effects, from biological functions such as the act of seeing to psychological requirements, such that design itself has become a method of computation.[9]

Building upon this tradition of rational, scientific reasoning we have propelled ourselves headlong into the information era where value is no longer in the tangible, but exists simply as data stored within the logs of computer networks. If the computer could be programmed with a matrix of design variables similar to those found in the charts of Durand's *Précis* and *Recueil*, then the advantage of using a computer to design would be in its computational speed with the result of a more efficient and economical operation than could be done by hand.

An important part of design thinking is the ability to form associations between ideas. Two forms of associative reasoning in computer-aided design are hypermedia and neural networks. Hypermedia is an interactive network which consists of units of information, both text and graphic ideas or pictures, connected by links. Hypermedia can catalogue images of historical buildings with textual annotations in a like manner to Durand's illustrated works, with the advantage of having all the images and textual information cross-referenced. One can navigate through a card catalogue of images which is organized by the visual association of similar ideas stored as discrete cards. The neural network model, on the other hand, simulates the neural connections in the human brain. Stored patterns are recalled from partial patterns which are stored in a data structure located at the nodes in a regular matrix in a computer system. It works as a net, information consists of both the node and the connection, its traversal a labyrinth in which every point is connected with every other point. Another method is the shape grammar model which involves parametric and schematic transformations. It is a computer program in the form of a shape-scripting language which recognizes shapes and transforms them through a series of permutations in order to arrive at a design.[10]

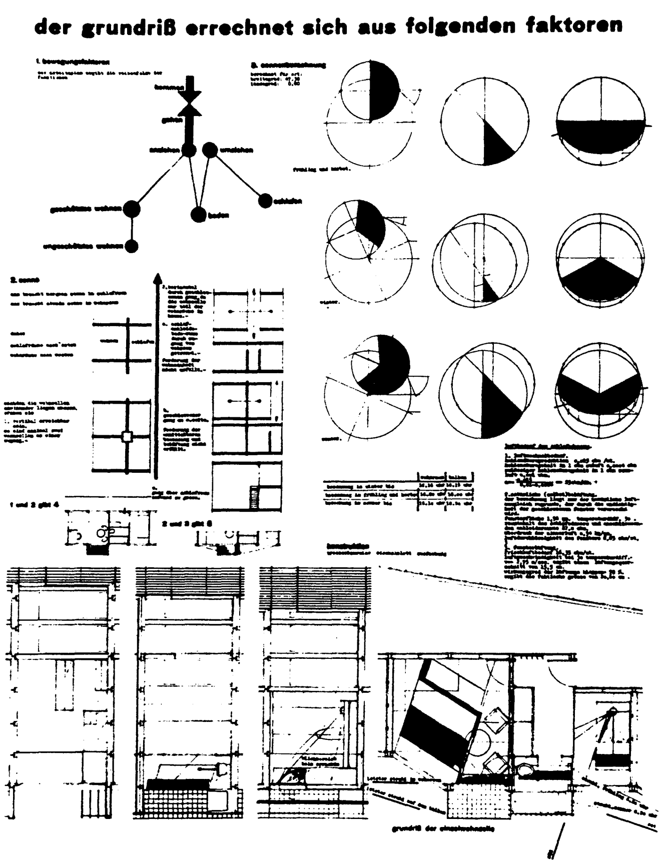

Figure 5. Hannes Meyer, *The Plan Calculates Itself from the Following Factors*, Bauhaus, Dessau, 1930.

Through these types of uses of the computer, design can become more schematic and mathematic, the plan can calculate itself, generate its own form, and help students visualize what they cannot in their own minds. Perspective rendering programs with shadows, lighting and textures can produce fantastic images of mediocre designs. The computer can work so rapidly and efficiently, it almost works by itself: the Sorcerer's Apprentice's dream. This is the clever apprentice in Goethe's parable who repeated the sorcerer's magic formula in order to transform a broom to automatically clean the house. However, in the apprentice's desire to be free of all labor, he soon found himself overrun by the broom's automated energy. In this respect, students could regard the computer as a shortcut instead of a useful tool like the parallel rule and triangle. Students can also easily get lost browsing through large, interconnected databases such as those created by hypermedia and neural networks. And unfortunately, in this ultimate striving for efficiency and economy, the patterns and diagrams produced through shape grammars are merely geometric designs which have little to do with functional requirements. Even Durand's application of his method of design resulted in buildings which seem rather uniform due to standardized, repetitive, economical forms which appear to be so unspecific in their primary geometric form as to be interchangeable. Most importantly, critical thinking skills can be eclipsed through an architectural education which relies primarily on the computer. For it is the ability to think critically that allows students to see beyond the machine in order to continue to learn as the technology rushes past them.[11] Critical thinking can only be acquired through an architectural education which integrates both theory and practice, geometry and poetry.

TECHNIQUE AND (RE)PRODUCTION

> While Daedalus who is force was measuring, and while Orpheus who is intelligence was singing, the pillar which is a letter, the arcade which is a syllable, the pyramid which is a word, all set in movement at once by a law of geometry and a law of poetry, grouped themselves together, combined, amalgamated, descended, ascended, drew up side by side on the soil, rising stage after stage to heaven, until they had written, at the dictation of the general idea of an epoch, those marvelous books which were also marvelous edifices, the pagoda of Eklinga, the Rhamseion of Egypt, and the Temple of Solomon.
>
> *-Victor Hugo, "Ceci tuera cela,"* Notre Dame de Paris

According to Jacques Ellul, magic is the first expression of technique and relies on ready-made formulas which yield precise results. Because these magical techniques are efficient and predictable, they are rapidly elaborated into a rigid, unchanging system. To Ellul, reason also considers results in terms of the most efficient in its quest for the one best means, however, in the absolute sense: in terms of numerical calculation. By abstracting the laws of nature, therefore, reason does not lead to an imitation of nature, but to the ways of technique. Spontaneous and unreflective behavior through technique becomes deliberate and rationalized. The example he cites is the swordsman who fabricates a sword, the form of which could be justified by numerical calculation, however formula had no bearing on the technical operation of making the sword.[12] Therefore, the sword is a product of both the geometry of its form and the act of its making.

Pure technique *is* magical. Machines are magical: they perform marvelous, mysterious operations, the mechanisms of which are not fully understood by the people who use them. The computer is pure technique. When working on the computer results happen as if by magic, and like the magical technique, its operations are hidden from view.

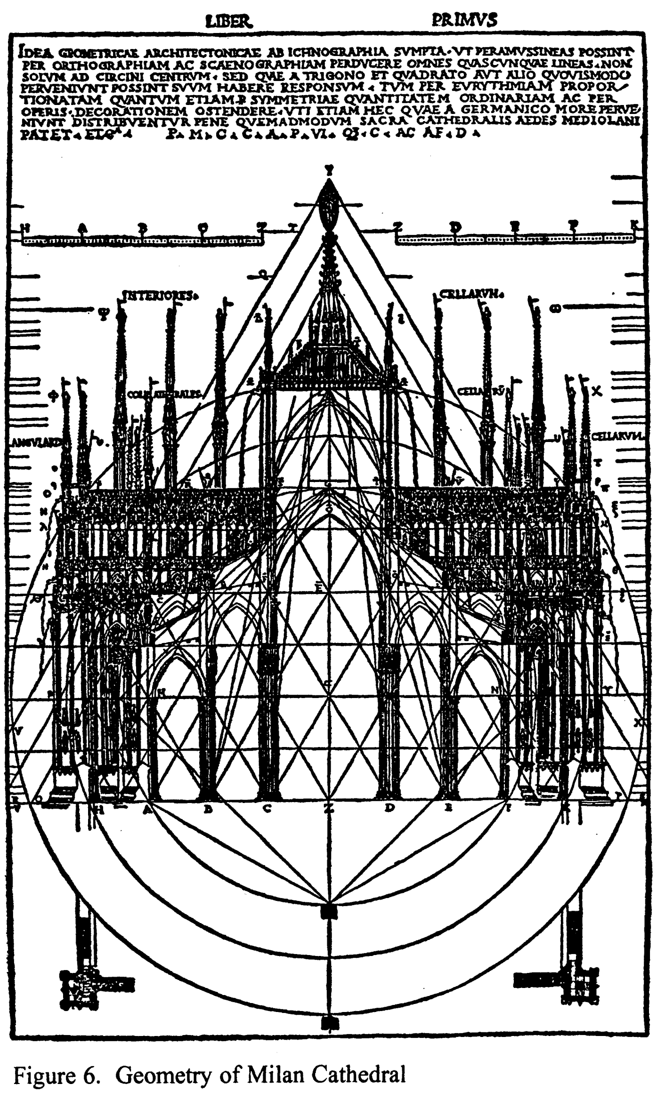

Figure 6. Geometry of Milan Cathedral

Although the computer is "user-friendly," what began as a simple binary system of zeroes and ones, and on-and-off switches, is now encased within a technological system which is so complex as to be understood only by the systems analyst. Just like magical formulas which were kept within the select province of a few enlightened sages, operations on the computer are so mysterious that we have no idea of how they are performed.

The computer is a modern-day paradigm of the most efficient and most economical technique and is a natural result of the technological developments of the printing press, photography, cinema and television. One thread which unites these techniques is that they are all technical processes of reproduction.

According to Walter Benjamin, the technique of reproduction substitutes a plurality of copies for a unique existence; and in so doing shatters tradition because each copy reactivates the original out of context. In other words, traditionally images were reproduced as unique works of art in the service of a particular ritual tied to a particular place and were, first and foremost, instruments of magic. However, through mechanical reproduction their cult value was replaced by exhibition value. The reproduced image, therefore, no longer mirrored reality, but took on its own cult value distinct from its origin. A modernday example of this would be the movie star who through the larger-than-life medium of film no longer has the magic of being a unique person, but instead becomes a "personality" or commodity distinct from her or his being.[13]

To Lewis Mumford, mechanical reproduction is characterized by regularity and repetition and produces such a proliferation of ubiquitous images that the magic of the original is forfeited. We become surrounded by reproduction and no longer live in the multi-dimensional world of reality, but in a secondhand or ghost world which mirrors life as a "pallid simulcrum of real existence."[14]

The image which can be transported or reproduced at will is worse than the mirror-image. To Jean Baudrillard, an image detached from the original becomes simulation: a representational imaginary which threatens the difference between "real" and "imaginary." Simulation is no more a "mirror of being" but a genetic miniaturization which produces the real from "miniaturized units, from matrices, memory banks and command models" and reproduces an indefinite number of times. According to Baudrillard, simulation is a hyperreal without origin or reality which is capable of unlimited combinations in a hyperspace without atmosphere. The hyperreal is no longer rational because it is no longer measured against some ideal. It is nothing more than operational,[15] or pure technique.

The chiasma of architectural (re)production lies at the juncture of geometry, *mathesis* and poetry, *poesis*. The preclassical Greek concept of *mathesis* referred to what could be taught and learned: its exemplar was number. It was the first step on the road toward theory. Originally, only the magician had access to the knowledge of *mathesis*. It was

Figure 7. Michaël Maier, *Scrutinium chymicum*

Figure 8. Pythagoras experimenting with bells, water-glasses, stretched cords, and pipes to determine the relationship between number ratios and sound frequencies.

believed that the manipulation of numerical entities was a powerful form of magic which affected the order of the real world.[16] This miracle of the order of nature was revealed through the *mimetic* use of number: the order of the cosmos, music, and the soul. Imitation was in the representation of all things in terms of numbers and the ratios between them. According to Pythagorean doctrine, the pure relationships among the numbers constituted the very nature of order.[17] This poetic imitation was a (re)presentation of order as a kind of showing as in *poesis*, an act of revealing.

In ancient Egypt the Nile would annually flood its banks, obliterating the orderly marking of the farm lands. This yearly flood symbolized the redefining of boundaries and each year these areas would again be measured out with ropes and boards. The work was called geometry (*geo* earth *metria* measure) and this activitiy became the basis for a natural law embodied in the forms of circle, square and triangle. These primary geometric forms were considered to be the primary thoughts of creation, and the human hand in manipulating these forms revealed the force of intention.[18] The act of drawing reveals the intention behind the force of the hand guiding the pencil. Building became a science with the advent of descriptive geometry because the architect could then describe means of construction without actually having to be involved in the craft of making the building. Thus began the change in architectural production from being a process of making to becoming a product made. Due to the traditions passed down from Durand on through the Bauhaus, the modernday architect views architecture as the mathematization of human needs and values. Because so very few architects in the past two hundred years have constructed their own buildings, they regard drawings as substitute buildings.[19]

An architectural drawing is not a "picture" of a building but a "picturing" of the architect's imagination. The drawing does not represent the building, as a substitute for, nor does it simulate or imitate the building. Architectural production is a mimetic process which copies, but copies the procedure

Figure 9. *The Jaquet-Droz Writer*, 1774, who has written, "I do not think, therefore I will never be"

of production rather than the product itself. For this reason, the computer as an instrument of production is ineffectual in architectural production because in producing the new in light of the old, it manipulates patterns without imagining. Design on the computer is schematic and mathematic and results in a simulation which is purely operational. The fantastic images produced on the computer confuse the difference between "real" and "imaginary."

CONCLUSION

> . . . invention no more depends on imagination than imagination has the ability to create anything whatever. The fact is, production of the new - and imagination - are only productions: by analogical connection and repetition, they bring to light what, without being there, *will have been* there. . . Imagination is what *retraces,* what produces as reproduction the lost object of perception. . .
>
> - Jacques Derrida, "Imagining"[20]

Architectural (re)production relies on imagination in the sense that imagination is what *retraces*: what produces as reproduction the lost object of perception. In other words, imagination is the production of the new based on the analogical connection and repetition of *images*. Architectural (re)production is a metaphoric function which through the reproduction of images, adds something more. This metaphoric construction is a type of stereoscopic vision which allows us to entertain two different points of view at the same time. This imaginary construction suspends ordinary reference and projects new possibilities of redescribing the world. This is not a mere *picturing* of the ordinary world which solely re-presents what has already been seen, but an imagining. The metaphorical construction is a mimetic production which is both a thinking and a seeing of likeness.[21]

Imagination is best explained through the analogy of E. H. Gombrich's "hobby horse." The hobby horse is not an image of a horse: it is a horse's head on a stick. In play, the child does not confuse the hobby horse with a real horse, it merely acts as a substitute for a horse in that it fulfills the child's desire to ride. In representing a horse, the hobby horse is not imitating a horse by reproducing its exact image, but the function of riding.[22] Mimetic imitation is a play of imagination, in the sense of to *show*, as in an appearance, however not as an attempt to approach an original by copying it as nearly as possible. When a child "plays" at being someone else, they imitate an action and they do not see themselves as a substitute for, but as a re-presentation of the subject of their imitation.[23]

The representation of play in the process of making as a showing is what is poetic in the production of architecture. Architecture (re)production relies on the chiasmatic relationship of geometry and poetry. When the production of architecture relies solely on ways of technique, the product becomes deliberate and rationalized. Lost is the spontaneous and unreflective behavior of the child at play. The intention inherent in the mimetic production is no longer revealed through the force of the human hand drawing. In educating future architects we can only hope they leave our schools after having mastered both theory and practice: equipped like knights in full armour with the force of Daedalus and the intelligence of Orpheus, armed with the ability to play.

NOTES

1 Victor Hugo, "Ceci tuera cela," *Notre Dame de Paris*, trans. Joseph L. Blamire (New York: George Routledge and Sons, 1881), 230-249.

2 Elizabeth L. Eisenstein, *The Printing Press as an Agent of Change,* vols. I and II (New York: Cambridge University Press, 1979).

3 Pamphlets, *The Basilica of Vezelay* (Bellegarde: Scop-Sadag, 1972), 11-14 and *La Madeleine de Vezeley* (Lyon: Lescuyer, 1985).

4 For a thorough discussion of the relationship of the book to the building see Neil Levine, "The Book and the Building: Hugo's theory of architecture and Labrouste's Bibliothèque Ste-Geneviève," *The Beaux-Arts and nineteenth-century French architecture*, ed. Robin Middleton (Cambridge, MA: The MIT Press, 1982), 138-173.

5 Joseph Rykwert, *On Adam's House in Paradise* (Cambridge, MA: The MIT Press, 1981), 29-42.

6 Stefan Polónyi, "The Concept of Science, Structural Design, Architecture," *Daidalos* 18 (15 December 1985): 33-45.

7 Leandro Madrazo, "Durand and the Science of Architecture," *JAE* 48/1 (September 1994): 12-24 and Antonio Hernandez, "J.N.L. Durand's Architectural Theory," *Perspecta* 12 (1969): 153-160. See also Alan Colquhoun, "Typology and Design Method" and "The Beaux-Arts Plan" in *Essays in Architectural Criticism* (Cambridge, MA: The MIT Press, 1981), 43-50 and 161-168. For a more comprehensive discussion see Alberto Pérez-Gómez, *Architecture and the Crisis of Modern Science* (Cambridge, MA: The MIT Press, 1983).

8 Eugene S. Ferguson, *Engineering and the Mind's Eye* (Cambridge, MA: The MIT Press, 1992), 115-152.

9 Klaus Herdeg, *The Decorated Diagram* (Cambridge, MA: The MIT Press, 1983), 78-97.

10 Richard D. Coyne, "Tools for Exploring Associative Reasoning in Design," and Takehiko Nagakura, "Shape Recognition and Transformation: A Script-Based Approach," in *The Electronic Design Studio*, ed. by McCullough, Mitchell, and Purcell (Cambridge, MA: The MIT Press, 1990), 91-106 and 149-170.

11 Mark D. Gross, "Roles for Computing in Schools of Architecture and Planning," *JAE* 48/1 (September 1994): 56-64. See also Gary R. Bertoline, "The Role of Computers in the Design Process," *Engineering Design Graphics Journal* 52/2 (Spring 1988): 18-22, 30, who wrote, "In the hands of good designers, computers will become an effective tool. In the hands of others, computers will become the tool to create more visual garbage than the world has ever seen."

12 Jacques Ellul, *The Technological Society* (New York: Alfred A. Knopf, Inc., 1964), 3-27.

13 Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," *Illuminations,* trans. Harry Zohn (New York: Harcourt, Brace and World, Inc., 1968), 217-231.

14 Lewis Mumford, "Standardization, Reproduction and Choice," *Art and Technics* (New York: Columbia University Press, 1952), 85-110.

15 Jean Baudrillard, "Simulacra and Simulations," *Selected Writings* (Stanford, CA: Stanford University Press, 1988), 166-184.

16 Pérez-Gómez, 9.

[17] Hans-Georg Gadamer, "Art and Imitation," *Relevance of the Beautiful and Other Essays* (New York: Cambridge University Press, 1986), 101-2.

[18] Robert Lawlor, *Sacred Geometry* (New York: Thames and Hudson, 1982), 6-17.

[19] Alberto Pérez-Gómez, "Architecture as Drawing," *JAE* 36/2 (Winter 1982): 2-7. See also Marco Frascari, "A New Angel/Angle in Architectural Research: The Ideas of Demonstration," *JAE* 44/1 (November 1990): 11-15.

[20] Jacques Derrida, "Imagining," *The Archeology of the Frivolous: Reading Condillac* (Lincoln: Univ. of Nebraska Press, 1980), 71.

[21] Paul Ricoeur, "The Metaphorical Process as Cognition, Imagination, and Feeling," *Critical Inquiry* 5/1 (August 1978): 143-159.

[22] E. H. Gombrich, "Meditations on a Hobby Horse or the Roots of Artistic Form," *Aspects of Form*, ed. Lancelot Law Whyte (Bloomington: Indiana University Press, 1951), 209-228.

[23] Hans-Georg Gadamer, "The Play of Art," *The Relevance of the Beautiful and Other Essays*, 123-130.