

Animated Case Studies: Digital Analytique

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Sound architecture must be able to bear the closest analytical examination, externally, internally, structurally and mechanically, and the solution of each problem which presents itself in the development of a design must be not only possible, but possible in a concise and orderly form as a consequence of the organic foundation of the original conception

– G. Howe¹

The design philosophy expressed in this epigraph to the PSFS Building in Philadelphia underlies the selective categorization of certain buildings as appropriate and worthy of study. It points out that it is the intellectual coherence of a work that makes it exemplary, canonical.² If the unity, order and logic of assembly is discernable and demonstrable, the architecture is *sound*. The close analytical examination of sound architecture is valuable for both student and architect; it has value as both a pedagogical and a design tool. Renzo Piano's work is noted for demonstrating "...an ability to break down the construction of a building into its constituent parts and to use this articulation as a stratagem bestowing an appropriate character on the work in hand."³ In other words, the method of analysis is used as a design strategy. The development of a method for studying buildings often owes much to methodologies from other disciplines. The imported method brings with it connotations of all sorts, including sets of criteria for establishing value. Howe's use of the biologically-connoted terms, *sound* (body) *organic* . . . *original conception*, recalls themes of architectural corporeality identified by Marco Frascari. These bodily themes, which he traces historically to the writings of Vitruvius, are accompanied by particular modes of evaluation and models of anatomical analysis. Scientific drawings, for example those of Andreas Vesalius, are a model of the analytical system used in surgical research.⁴ The body is cut apart and the constitutive elements are examined separately. The knowledge revealed by the dissection, about the parts and how they are assembled, is represented in the drawings. The drawings are seen as constructions that record the scientific operation through its

representation. In the drawings of Venetian architect, Giovanni Rusconi, Frascari finds an example of how this model was applied to architecture in "an attempt to elevate the role of construction documents into monuments of architectural science." Architecture that has the capacity to produce meaning is the result of both a *manual construction* and a *mental construing*. He describes drawings where the buildings are as if dissected, "stripped of their plastery skins to show the structural skeleton."⁵

This kind of description can be seen as antecedent to the descriptions of the "anatomical visibility" of canonical modernism. The "plastery skins" are replaced by glass, a material much less cumbersome to visibility. The structural skeleton is revealed through the transparent glass skin. In the inaugural issue of the avant-garde magazine, *G*, edited by El Lissitzky and Hans Richter, the text that accompanies the first publication of Mies' office building of 1922, calls it "skin and bone construction." Both this and Howe's in-depth *analytical examination* is forensic: in Frascari's terms they are examples of a "retrospective invention of the real through a postmortem, an anatomical demonstration."⁶

With its solid, translucent cube, the French National Library competition entry by Rem Koolhaas exposes the limitations of this method of analysis. The anatomical metaphor stills holds: organ-like shapes float within the cube, but their status as solid or void is ambiguous, constantly being negotiated through reflection and refraction. The floating shapes are sometimes voids, carved out of the translucent solid. The cube either has no skin, or is all skin: not a surface, but a volume with both interior and exterior surfaces. Either way, "stripping" the cube will result in an incomplete or incorrect representation. The skin cannot be isolated from the building as a disassembled, constituent part. A different analytical method is required to study and evaluate the project.⁷

ANALYTICAL METHODS AND THEIR ARTIFACTS

Determining what and how we discern is a tangled proposition, but it is surely enmeshed with what we are able to see. If how we understand and evaluate buildings is related to the analytical methods that we use to demonstrate their coherence through representation, then these methods deserve careful consideration. When new technologies prompt new methods of representation, this examination becomes vital. The consequences of photography, for example, have fundamentally transformed both the methods of analysis and its findings. As a comparison between the scientific methods of Etienne-Jules Marey and Claude Bernard demonstrates, the photographic methods of the motion-scientist, as opposed to the concurrent practice of the vivisectionist, impart significantly different results. Certainly, cutting something apart is a way to understand the way it operates, but like the case of vivisection, the very act of disassembly terminates the operation one hoped to study.

The methods of analysis and their artifacts have an effect not only on the answers, but on future questions. Marey, who began by studying the human circulatory system using a whole series of non-invasive measuring devices, went on to invent *chronophotography* in order to do expansive studies on motion itself. His studies captured the unseen realities of the world at microscopic scale and accelerated speed. At his Station Physiologique, he recorded the motion of insects, birds, horses, falling cats.⁹ The possibility of multiple exposure and the relative ease of image registration lead to the emergence of serial repetition and superimposition as techniques for representing motion. The artifacts of these methods, first glass, then celluloid film images, were the direct result of repeated exposure to the light sensitive surface: a pure index.

While scientific experiments to capture and represent motion continued, from Harold Edgerton's drop of milk to the Media Lab's *Salient Stills*, the photographic work of artist Eadweard Muybridge represents a concurrent and parallel trajectory. At first, Muybridge did not superimpose exposures, as in the spatio-temporal montages of Marey, but placed them side by side in long strips or stacked in a grid. This technique of temporal montage, using sequentially arranged images to create a linear narrative, both predates and persists outside of cinema, for example, in 15th c. altarpieces and church frescoes, and in 20th c. comic strips. Muybridge advanced the technique by mounting his images on picture discs and projecting them through his invention, the *zoopraxiscope*. This created the illusion of movement, the precursor to Marey's *chronophotography* and ultimately, cinema.

Although also considered scientific studies of bodies in motion, Muybridge's serial photographs are composed re-constructions of motion. The proofs of the images made at the University of Pennsylvania between 1884-1886, when Muybridge worked

with painter Thomas Eakins, show evidence of cropping, negative substitution and reprinting. Muybridge invented these new techniques to alter the indexical artifacts in the service of the final image. The distinction between the indexical and the manipulated image series came to categorize works in this new medium as either cinema or animation. Often, value-laden criteria of this nature were also applied to photographs, which distinguished those that did not employ darkroom processes seen as corrective to the final image.⁹ Digital media codifies and integrates photographic, cinematic and animation techniques as software programs, making these categorizations practically moot.¹⁰

The workshop, "Animated Case Studies: Digital Analytique" experiments with the possibility that temporal and spatial montage can have transformative effects for the analysis of architecture. Used as constructive analytical methods, the results of these montage techniques have little to do with preconceived notions of achieving photogenic form. The aim is to engage serial repetition and superimposition in ways that will reveal realities that are imperceptible through other means: to achieve images that push the boundaries of simulation to represent the *mental construing* of the assembly.¹¹

VISUAL STUDIES + CASE STUDIES IN CONSTRUCTION TECHNOLOGY

Visual Studies III is a required course is given in the third semester of the Graduate Program at the University of Pennsylvania. It is organized as a series of two-day intensive workshops which introduce digital media techniques into the design studio with an aim to provoke a reconsideration of the uses of digital representation through the active identification of its salient strengths.¹² "Animated Case Studies: Digital Analytique" is the third workshop of the Visual Studies III sequence. It coincides with the end of the research phase of another required course, "Case Studies in Architecture: Emerging Technologies" for which it supports research and provides visualization. The products of the workshop and course, case studies of contemporary buildings in digital format, offer the possibility of an electronic, easily distributed, dynamic treatise that allows information to be shared on progress and innovation in construction technology, sustainable systems and ecological building.

"Animated Case Studies: Digital Analytique" describes the two assignments of the workshop. The first explores spatio-temporal montage both as a serial repetition of static images and as an *animated image* in the spirit of Muybridge's *zoopraxiscope* and the second challenges students to create an *information-image* which exploits imported and invented techniques of digital media to manipulate their representations.



Fig. 1. Animated Case Study: Rogan Shields Exterior Wall Detail sequence, Cultural Center, Rafael Moneo.

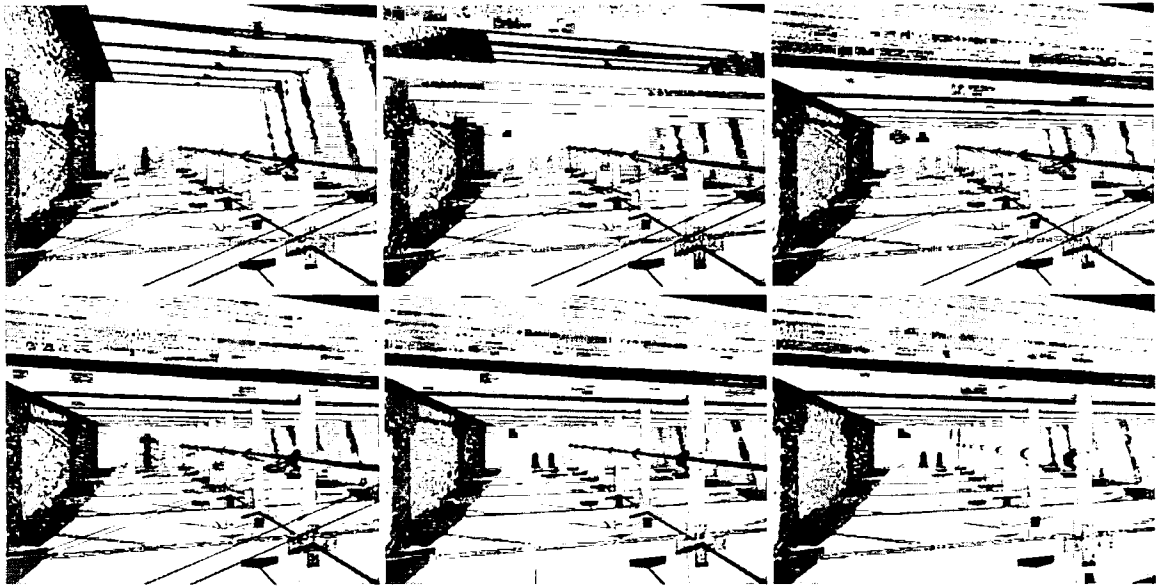


Fig. 2. Animated Case Study: Sydney Stewart Renovation sequence, Mass MOCA, Bruner Coli.

ANIMATED CASE STUDIES

In the first assignment, the students are asked to undertake the digital representation of a specific system of the building they have been researching as a Case Study. In the Case Studies course, students work in teams of three. They continue in these teams for Visual Studies, but each student is required to focus on a different aspect of the building and to produce their own work. Building on the skills of the previous Visual Studies workshops, the drawings are required to represent the selected components or systems as closely as possible. Formal, spatial and construction accuracy is required. The animated case study begins with the careful three-dimensional digital construction of each element, constructed in the manner delineated by Frasari in his description of the work of Rusconi:

He collects fragments of construction and explains them generically. His representations are not simple sections and elevations but rather sophisticated axons. Three-dimensional representations of details tell the full story of the process of Rusconi's constructing. The system of representation of details also tells the full story of the process of construction.¹³

In the second phase, students use three-dimensional animation to set their images in motion, recreating the physical construction or the mental constructing, or logic of the assembly. Cinematic techniques like superimposition and blurring assert themselves in the images. The dynamic analysis challenges the stationary viewpoint of perspectival representation and also the omniscient abstraction of the section or plan cut. Qualities that depend on multiple points of view in both space and time can be represented simultaneously. The potential is for a representation to capture both the spatial and temporal narrative. Ideally, the process of representation and the process of construction can productively mark design thinking.

In the first phase, the construction sequence is created using a limited number of rendered still images assembled into a temporal montage. The scale of analysis varies across the studio, from the study of a single component of a wall assembly to the construction sequence of an innovative renovation. The following images are ultimately presented digitally, in a transition-enhanced sequence using PowerPoint.

In the second assignment of the workshop, the students are challenged to create a new kind of image which draws on the

DIGITAL ANALYTIQUE



Fig. 3. Animated Case Study: Heewon Park, Jin Won Choi. Stills from an animation. Reichstag Dome, Sir Norman Foster.

Analytique of the Ecole des Beaux Arts.¹⁴ However, the interactive potential of the digital image serves as a catalyst to the creation of complementary compositional and expressive strategies that move beyond those of the medical model found in the *analytique*. The drawings aspire to the edict engraved on the portrait of Italian Enlightenment theorist Lodoli, also discussed by Frascari: "Let the representation be functional." The goal is to produce a single complex image, which represents the building system or component precisely and makes the maximum information available regarding its sequential construction, the logic of its assembly and its link to the conceptual order of the building.

Dutch genre paintings offer useful strategies for organizing information and structuring the viewer's experience that differ from those inherited from their Italian counterparts in that the impulse to represent depth, using perspectival techniques, was overwhelmed by the Dutch impulse to map. The valorization of flatness that was manifest because of this tendency is comparable to the surface nature of screen technologies. Accordingly, the images can be used to navigate linked or imbedded information. Research points to the exquisitely rendered objects in Dutch genre paintings as establishing another kind of ordering system that positions the viewer inside the scene as a moving figure. The eye travels from object to object, rather than fixing on the static vanishing point of perspectival constructions. The image operates, not as a simulation of three-dimensional space, but as an *information-interface*: "the intended function of the image had something to do with the kind of knowledge or information it conveyed and the kind of accuracy that was desirable. According to whether it was used to enable a ship to navigate the seas or to enable a state to tax, different kinds of things were demanded."¹⁵ Using this analytical model, the image links content-based information, tracing the development of a similar detail from one building to another. The links can also connect to data bases which provide information on

the building materials, conceptual sketches, construction photos or costs.

The set of construction drawings and specifications are the *information-interface* of architectural construction. The proprietary nature of three-dimensional digital models makes this information-interface dynamic and controllable. This has far-reaching implications for the architectural profession.¹⁶ Following the automobile industry,¹⁷ architects eager to experiment with rapid prototyping and digital manufacturing inherit analytical methods and artifacts suited in scale, material and economy to industrial design objects. The traveled path in the field of digital manufacturing currently favors exterior form, mass production and industrial materials. Not unexpectedly, these characteristics are similarly privileged in building designs that appropriate these methods.

On the web, or at the ATM, the image functions as an *image-instrument*, the screen is a control panel, initiating activities in a remote location. Future explorations will address the cultural implications of CAD/CAM for the design and production of architecture. The economic model dictates that once investments have been made to meet difficult production expectations, manufacturers and contractors try to make their investments pay off. The step from image as *information-interface* to *image-instrument* is as short and quick as the point and click that charges your credit card.

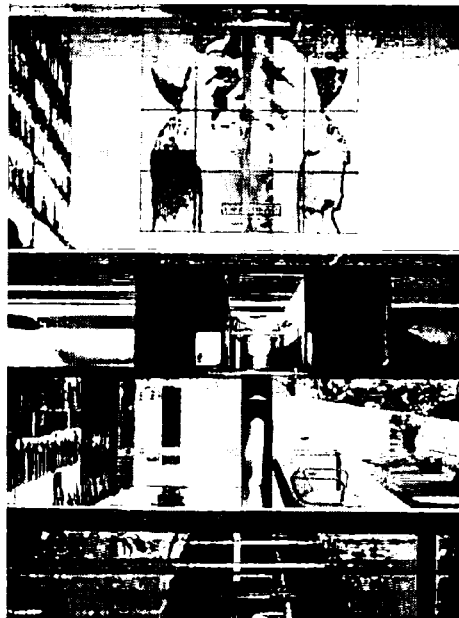


Fig. 4. Digital Analytique: Larry Cohn Bordeaux House, Rem Koolhaas.

NOTES

¹George Howe, *JSAH*, May (1962): 98-99, quoted in William H. Jordy, *American Buildings and their Architects: The Impact of European Modernism in the Mid-Twentieth Century* (New York: Doubleday & Co., Inc., 1972) 116.

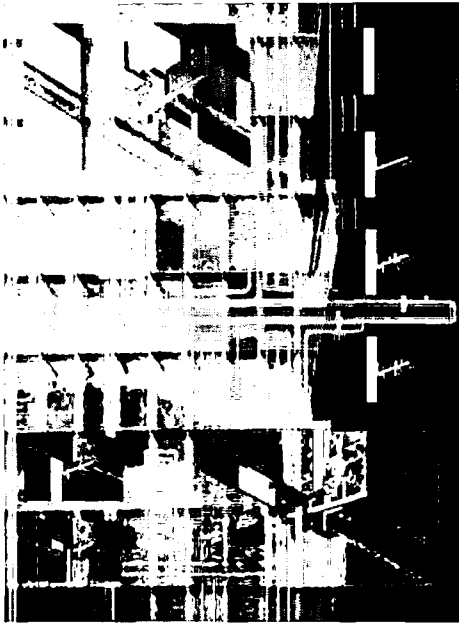


Fig. 5. *Digital Analytique: Susan Law Kunsthaus Bregenz. Peter Zumthor.*

² Jordy nominated the statement as a fitting epigraph and added: "Comparable statements of intent abound in the modern movement, but few of its buildings so well meet Howe's exacting criteria." Jordy, 117; For a discussion of the nature of the canonical, particularly with regard to the PSFS, see David Leatherbarrow, "What Goes Unnoticed: On the Canonical Quality of the PSFS Building" *Harvard Design Magazine* 14 (2001): 16-23.

³ The Lowara Office Building, Vicenza (1981-85), the San Nicola Stadium, Bari (1987-90) and the rue de Meaux housing in Paris (1987-90) are cited in particular; Kenneth Frampton, *Studies in Tectonic Culture: the Poetics of Construction in Nineteenth and Twentieth Century Architecture* (Cambridge, MA and London: MIT Press 1995) 385-386.

⁴ Marco Frascari, *Monsters of Architecture: Anthropomorphism in Architectural Theory* (Maryland: Roman & Littlefield Publishers, 1991). For the historical discussion, see 1-6; anatomical drawings referred to can be found in Andreas Vesalius, *Human corporis fabrica*, (1541; reprint, New York: Dover Publications, 1973).

⁵ Frascari, 27; 26.

⁶ *ibid.*, 12.

⁷ For a discussion of this project relative to the destabilization of the subject and the problematization of modernist premises regarding transparency, see Anthony Vidler, "Transparency" in *The Architectural Uncanny: Essays in the Modern Unhomely* (Cambridge, MA and London: MIT Press, 1992) 217-225.

⁸ Laurent Mannoni, *Etienne-Jules Marey, la Mémoire de l'œil* Exhibition catalogue (Milan-Paris: Cinémathèque française - Mazzotta) 1999.

⁹ Recent so-called *Dogme 95* films reinvigorate this distinction, challenging directors to create a pure, indexical cinema by honoring a "Vow of Chastity" which includes shooting on location using only hand-held cameras.

¹⁰ For an extended discussion on how the cinematic and the graphic were reunited in digital media see Lev Manovich, "What is Cinema?" in *The Language of New Media* (Cambridge, MA and London: MIT Press, 2001) 286-330.

¹¹ Sergei Eisenstein described how disparate images, when brought together through the montage technique of sequential juxtaposition, could produce a meaning that was not contained in either single image. See Sergei Eisenstein, "Montage and Architecture" *Assemblage* 10 (1989): 128-129. For a discussion of digital media techniques imported from cinema and some of its effects on architectural representation, see Cathrine Veikos, "The Dominion of her



Fig. 6. *Digital Analytique: Marion Jones Educatorium. Rem Koolhaas.*



Fig. 7. *Digital Analytique: Jeonken Song, Beyeler Museum, Renzo Piano.*

Instruments; Examining the Techniques of Digital Media" (paper presented at the ACSA National Conference, New Orleans, April 2002).

¹² For an overview of the entire course, see Cathrine Veikos, "Visual Studies: Integrating Digital Media into the Studio Sequence" (paper presented at the ACSA International Conference, Havana, Cuba, June 2002).

¹³ Marco Frascari, "Sortes architecti in the eighteenth-century Veneto", (Ph.D. diss., University of Pennsylvania, 1981) 24.

¹⁴ *ibid.*, Frascari describes the history of the drawing type: In the Beaux Arts tradition the understanding of the role of detail as a generator of the character of buildings determined a very peculiar graphic means for the study of it, the analytique. In this graphic representation of a designed or surveyed building the details play the predominant role. They are composed in different scales in the attempt to single out the dialogue among the parts in the making of the text of the building.

¹⁵ Svetlana Alpers, *The Art of Describing* (Chicago: University of Chicago Press, 1983) 133.

¹⁶ Renee Cheng has written about how Frank Gehry has reincarnated the full-size template through his use and control of the digital model. (Dassault Systems' CATIA) specifically in the Experience Music Project, Seattle. See Renee Cheng, "Master Architect Redux: How Digital Progress Helped Restore the Role of Master Architect", *Proceedings ACSA National Meeting, Baltimore, April, 2001*.

¹⁷ The 1993 Dodge Intrepid was the first fully digital process car, designed, assembled and tested using Dassault Systems' CATIA.