**A6825: The Architecture-Engineering Hybrid and the Formal Domain**

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Spring 2015
Fridays 11AM – 1PM
300 Avery Hall
Office hours by appointment

In recent times, major progress in data calculation, programming languages and software integrating project design, construction and management has brought about a novel type of scientifically driven designer in architecture. This seminar construes the evolvement of this figure as the fulfillment of a historical lineage of producers whose design ethos prefigured, decades before the digital means became available, that of their contemporary incarnations. Further, it suggests that the current proliferation of this kind of designer signals that the limits of the engineering mindset, traditionally rooted in science, are stretching, and consequently that the distinction between architecture and engineering is blurring.

Thus, in the context of this class, the phrase *architecture-engineering hybrid* will designate a design domain whose basis lies at the intersection of both disciplines. The driving argument will be that a specific subset of this domain, emerged only during the second half of the twentieth century, is particularly productive in our field as it lends itself to be the medium through which to construct a new conceptualization of form in architecture—one grounded in *spatial articulation*. The course will trace the tradition of the architecture-engineering hybrid and will show that, in fact, it is older than those around the figures who fall unambiguously in either of the two categories, architect or engineer. Within this tradition we will delineate a lineage which originated around the mid-1950s through careful examination of three case studies and their related contexts—Italian Vittorio Giorgini (1926-2010), Israeli Michaël Burt (b. 1937), and Sri Lankan-born, London-based Cecil Balmond (b. 1943). Rather than each separately being regarded as architect-engineers in any customary sense, it is their work that we will read together as featuring distinctive aspects of the architecture-engineering hybrid. Those involve primarily an approach to design which, while deeply inflected by an engineering valance, nevertheless yields the full range of spatial arrangements that are characteristically architectural. The seminar will conclude by analyzing how a discussion of such an approach to design may help us establish a notion of architectural form centered around questions of three-dimensional configuration.

This course is being taught in close rapport with *The Building*, an ongoing project which so far has yielded two international symposia organized by José Aragüez at the Architectural Association (with Gabriela García de Cortázar) and Columbia GSAPP (with Aaron White). Both are initiatives aiming to produce discursive knowledge by recasting architectural design thinking as a central realm of historical and theoretical research.

***Course Structure, Requirements and Outcome***

The course will proceed as a reading and discussion group intersected with segments of work in progress. Texts will be posted on Courseworks on a weekly basis. Students are expected to take an active role in all sessions, lead the seminar once before Spring break by completing an in-class presentation on a theme raised by the readings, and identify a case study through which to develop their final project. This case study may be a designer, body of work or set of writings relating meaningfully to the seminar's subject matter. It will be introduced by way of a mid-term presentation; research in progress will be workshopped in class after Spring break; findings will be shared and debated in the context of a review at the end of the semester. Guest faculty will be invited to selected sessions.

The final project, due sometime after the review, can take the form of either a graphic document or a paper. If the former (20 pages), the design thinking embodied in the case study should be deconstructed and analyzed through drawings, diagrams and images; if the latter (15 typed pages), through the writing of a critical essay. Based on the nature of the materials submitted, we will consider staging the course production as a collective endeavor by having a presence at the End-of-Year Show, and by compiling it into a publication which would become part of Avery library's holdings. On the first day of class I will bring a precedent for such kind of publication, one we put together two years ago.

***Sessions***

**Week 1_Jan 23 –** Introduction to the Problem of Form in Architecture; *Form* as Articulation vs. *Shape* as Envelope (I)

Christian Norberg-Schulz, *Intentions in Architecture* (Cambridge, Mass: M.I.T. Press, 1968): pp. 131-160.

**Week 2_Jan 30** – Introduction to the Problem of Form in Architecture; *Form* as Articulation vs. *Shape* as Envelope (II)

Kent Bloomer, "Form, Shape, and Order in the Work of Charles Moore," in *Charles Moore: Buildings and Projects 1949-1986* (New York, N.Y.: Rizzoli, 1986): pp. 21-28.

Adrian Forty, "Form," in *Words and Buildings: A Vocabulary of Modern Architecture* (New York, N.Y.: Thames & Hudson, 2000): pp. 149-172.

Antonio Juárez, "Topology and Organicism in the Work of Louis I. Kahn. Notes on the City Tower," *Perspecta 31* (January 1, 2000): 70-80.

Louis Kahn, "Form and Design" (1960), in *Louis Kahn: Essential Texts* (New York: W. W. Norton, 2003): pp. 62-74.

**Week 3_Feb 6** – Generic Form vs. Specific Form and Form vs. Program

Peter Eisenman, *The Formal Basis of Modern Architecture* (1963) (Baden, Switzerland: L. Müller, 2006): pp. 11-95.

Colin Rowe, "The Mathematics of the Ideal Villa" (1947), in *The Mathematics of the Ideal Villa and Other Essays* (Cambridge, Mass: MIT Press, 1982): pp. 1-27.

John Summerson, "The Case for a Theory of Modern Architecture" (1957), in *Architecture and Culture 1943-1968*, ed. Joan Ockman (New York: Rizzoli International, 1993): pp. 226-236.

Anthony Vidler, "Toward a Theory of the Architectural Program," *OCTOBER 106* (Fall 2003): pp. 59-74.

*Recommended:*

Ian Bruce, "Plato's Theory of Forms" (1998), http://www.ccs.neu.edu/course/com3118/Plato.html

Greg Lynn, "Multiplicitous and Inorganic Bodies" (1992) in *Folds, Bodies & Blobs: Collected Essays* (Bruxelles: La Lettre Volée, 1998): pp. 33-61.

**Week 4_Feb 13** – Form vs. Formation

Sandford Kwinter, "Whose Afraid of Formalism?," in *Phylogenesis: Foa's Ark* (Barcelona: Actar, 2004): pp. 96-99.

Gottfried Semper, "Style in the Technical and Tectonic Arts or Practical Aesthetics" (1860), in *The Four Elements of Architecture and Other Writings* (Cambridge, MA: Cambridge University Press, 2010): pp. 181-214.

Johann Wolfgang von Goethe, excerpts from *On Morphology* (1790-1808), in *Scientific Studies*, ed. Douglas Miller (Princeton, N.J: Princeton University Press, 1995): pp. 53-69.

D'Arcy Thompson, *On Growth and Form* (1917), (New York: Dover Publications, 1992): pp. 1026-1090.

*Recommended:*

Philip Steadman, *Architectural Morphology: An Introduction to the Geometry of Building Plans* (London: Pion, 1983): preface, pp. 1-19, and 247-249. Browse through rest of graphs and diagrams.

**Week 5_Feb 20** – The Disciplinary Split between Architecture and Engineering

Jean-Nicolas-Louis Durand, *Précis of the Lectures on Architecture; with, Graphic Portion of the Lectures on Architecture* (1802-5, 1821), (Los Angeles, CA: Getty Research Institute, 2000): pp. 73-76, 122-141, and 185-201.

Robin Middleton and Marie-Noelle Baudouin-Matuszek, *Jean Rondelet: The Architect as Technician*, First Edition (Yale University Press, 2007): 161-169.

Antoine Picon, *French Architects and Engineers in the Age of Enlightenment* (Cambridge Studies in the History of Architecture. Cambridge, England; New York, USA: Cambridge University Press, 1992): pp. 1-15, and 99-139.

*Recommended:*

Andrew Saint, *Architect and Engineer: A Study in Sibling Rivalry* (New Haven [Conn.]; London: Yale University Press, 2007): pp. 436-445, and 485-493.

**Week 6_Feb 27** – The Consolidation of the Engineering Science and its Intersections with Architecture

Sigfried Giedion, *Building in France, Building in Iron, Building in Ferroconcrete* (…) (Texts & Documents. Santa Monica, CA: Getty Center for the History of Art and the Humanities, 1995): pp. 94-95, 100, 103-113, and 122-123.

Ulrich Pfammatter, *The Making of the Modern Architect and Engineer: The Origins and Development of a Scientific and Industrially Oriented Education* (Basel; Boston: Birkhauser-Publishers for Architecture, 2000): pp. 103-205.

Katherine Romba, "Aesthetics and the Professional Identity of the Modern German Engineer," in *Proceedings of the Second International Congress on Construction History* (Cambridge [Eng.]: Construction History Society, 2006): pp. 2727–41.

**Week 7_March 6** – *Variable continuity:* Vittorio Giorgini as a Pioneer in the Use of Surface Topology for Building Design (I)

Robin Evans, *The Projective Cast: Architecture and Its Three Geometries* (The MIT Press, 2000): pp. 277, 295-314, and 323-334.

Vittorio Giorgini, *Spatiology: The Morphology of the Natural Sciences in Architecture and Design* (Milano: L'arca, 1995): pp. 7-9, 16-17, and 157-177.

"Frederick Kiesler 1923-1964," *Zodiac* no. 19 (1969): pp. 6-49.

*Recommended:*

Stanley Abercrombie, *Ferrocement: Building with Cement, Sand, and Wire Mesh* (New York: Schocken Books, 1977): pp. 134-140.

Stephen Barr, *Experiments in Topology* (New York: Crowell, 1964): pp. 1-39, and 120-121.

**Week 8_March 13** – *Variable continuity:* Vittorio Giorgini as a Pioneer in the Use of Surface Topology for Building Design (II)

Vittorio Giorgini, *Spatiology: The Morphology of the Natural Sciences in Architecture and Design* (Milano: L'arca, 1995): pp. 27-70.

Jean Petitot, *Morphogenesis of Meaning,* trans. by Franson Manjali (Bern; New York: PLang, 2004): pp. 9-36, and 51-77.

René Thom, *Structural Stability and Morphogenesis; an Outline of a General Theory of Models*, 1st English ed. (Reading, Mass.: W. A. Benjamin, 197): pp. xxvi-xxxiv, 5-10, 12-15, and 151-154.

*Recommended:*

Greg Lynn, "Probable Geometries: The Architecture of Writing in Bodies" (1993) and The Folded, The Pliant and The Supple" (1993), in *Folds, Bodies & Blobs: Collected Essays* (Bruxelles: La Lettre Volée, 1998): pp. 78-94, and 109-133.

**Date TBD: Mid-Term Presentations**

**(Spring break_March 20)**

**Week 9_March 27** – *Differential repetition:* Michaël Burt in the Context of Architectural Morphology (I)

Maria Bottero, "Editorial," *Zodiac* no. 22 (1972): pp. 238-239.

Michaël Burt, *Spatial Arrangement and Polyhedra with Curved Surfaces and Their Architectural Applications - Doctoral Thesis* (Haifa, Israel: Technion, Israel Institute of Technology, 1966): pp. I-II, 1, 36-40, 98-104, and 128-135. Browse through images and drawings.

Michaël Burt, "Saddle Polyhedra & Close-Packing," *Zodiac* no. 22 (1972): pp. 162-171.

Alfred Neumann, "Morphologic Architecture," *Zodiac* no. 16 (1966): pp. 136-139.

Peter Pearce, *Structure in Nature is a Strategy for Design* (Cambridge, MA: MIT Press, 1978): pp. 4, 28, 38, 40, 45, 50, 87, 107. Browse through images.

*Recommended:*

Gianfranco Caniggia, *Architectural Composition and Building Typology: Interpreting Basic Building* (1979) (Firenze: Alinea, 2001): pp. 43-76, and 105-117.

**Week 10_April 3** – *Differential repetition:* Michaël Burt in the Context of Architectural Morphology (II)

Maria Bottero, "Technological Research and Architecture," *Zodiac* no. 21 (1971): pp. 229-232.

Michaël Burt, Menachem Kleinmann, and Avraham Wachman, *Infinite Polyhedra*, 2nd ed. (Haifa, Israel: Faculty of Architecture and Town Planning of the Technion, Israel Institute of Technology, 2005). Browse through images and drawings.

Alfred Neumann, "Architecture as Ornament," *Zodiac* no. 19 (1969): pp. 90-98.
Nina Rappaport, "Deep Decoration," *30/60/90* no. 10 (2006): pp. 95-103.
Moshe Safdie, "New Environmental Requirements for Urban Building," *Zodiac* no. 19 (1969): pp. 180-182.

**Week 11_April 10** – *Concomitant orders:* Cecil Balmond and the Problem of "Integrity" in Structural Design (I)

Cecil Balmond, *Informal* (Munich: Prestel, 2002): pp. 10, 13-15, 111-123, 146-147, 219-227, 244-245, and 371-391. Browse through images and drawings.
Cecil Balmond, "New Structure and the Informal," *Lotus* no. 98 (1998): pp. 76-83. Browse through images and drawings.
Cecil Balmond and Toyo Ito, "Conversation - Cecil Balmond and Toyo Ito: 'Concerning fluid spaces'," *A + U: architecture and urbanism* no. 5 (May 2004): pp. 44-53.
Jacques Monod, *Chance and Necessity; an Essay on the Natural Philosophy of Modern Biology*, 1st American ed. (New York: Knopf, 1971): pp. xi-xiv, 3-44, 99-122, 160-180.
*Recommended:*
Ilya Prigogine, *Order Out of Chaos: Man's New Dialogue with Nature*, 1st ed. (Boulder, CO: New Science Library, 1984): pp. 79-102, 189-221, 257-290.

**Week 12_April 17** – *Concomitant orders:* Cecil Balmond and the Problem of "Integrity" in Structural Design (II)

*Cecil Balmond*, Architecture and Urbanism special issue (Tokyo: A + U Publishing Co, 2006): pp. 17-19, 22, 24, 64-67, 124-127, 130-133, 136-149, 172-173, and 240-245. Browse through images and drawings.
Cecil Balmond, *Crossover* (Munich; London; New York: Prestel, 2013): pp. 315-322. Browse through images and drawings.
Cecil Balmond and Pablo Lazo, "Why Cecil Balmond never says no [interview]," *Log* no. 4 (2005): pp. 65-77.
David Ruelle, *Chance and Chaos* (Princeton Science Library. Princeton, N.J: Princeton University Press, 1991): pp. 3-19, 26-33, 66-79, 136-149 and 162-166.
*Recommended:*
Christian Janot, *Quasicrystals: A Primer*, 2nd edition (Oxford: Oxford University Press, 2012): 1-52, 324-346.

**Week 13_April 24** – The Subversive Disciplinarity of the Late 20th-Century Hybrid Designer as a Medium to Rethink Architectural Form

Bill Hillier, *The Social Logic of Space* (New York: Cambridge University Press, 1984): pp. 1-25, 33-51 143-163, and 198-206.

Museum of Modern Art (New York, N.Y.), *Seven Structural Engineers: The Felix Candela Lectures* (New York: Museum of Modern Art: Distributed in the United States and Canada by D.A.P./Distributed Art Publishers, 2008): pp. 49-65. Browse quickly through essays by Nordenson, Anderson, Isler, and Billington.

Nina Rappaport, *Support and Resist: Structural Engineers and Design Innovation* (New York: Monacelli Press, 2007): pp. 7-11.

Patrik Schumacher, *The Autopoiesis of Architecture, Volume II: A New Agenda for Architecture* (Chichester: Wiley, 2012): pp. 42-140.

*Recommended:*

Bill Hillier, *Space Is the Machine* (New York: Cambridge University Press, 1996): pp. 13-30, and 65-91.

**Date TBD: Final Presentations**