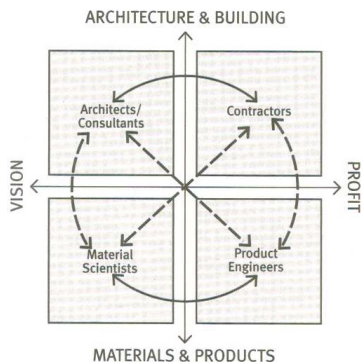


WORKFLOW - Designing Industry - Fall 2013

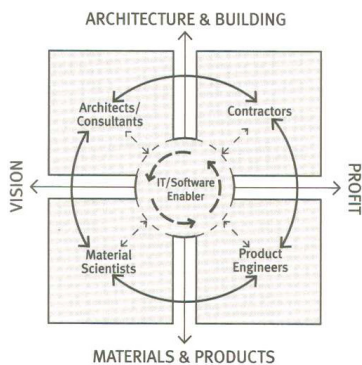
Technology Elective / Tuesdays 11-1

Instructor: Scott Marble

Columbia University GSAPP



Traditional Industry Relationships The four major disciplines need to cross the boundaries established by their traditional roles.



Enabling Collective Intelligence An entire new industry that produces communication / collaboration software has made it possible for the various parties involved in a project to have real time sharing of information. from *Refabricating Architecture*, Kieran & Timberlake



RPBW's Downtown Whitney Museum under construction.



RPBW's Jerome L. Green Science Center in Manhattanville.

Summary

This seminar is aimed at students who are interested in rethinking architectural practice. It is based on the premise that any significant change in the architectural, engineering and construction (AEC) industry will come through a disruptive shift in the culture of the industry driven by the next generation of architects...you. It is less about how practice and industry work now and more about how it could work in the future. Students will be exposed to the most current thinking on the structure of industry with an emphasis on the role that digital communication tools are having in its reorganization. Students will be encouraged to think creatively and critically about future options to architectural practice and its relationship to industry - in essence, how to design a practice.

The assimilation and synthesis of digital communications among architects, engineers, fabricators and builders is dramatically altering how we work and our relationship to the tools we use. New digital capacities are restructuring the organization and hierarchy of design from autonomous processes to collective workflows. The historical role of the designer as an author, a sole creator, is being replaced with semi-autonomous, algorithmically driven design workflows deeply embedded in a collective digital communication infrastructure. This is creating a number of pressures on the discipline of architecture to reorganize around the opportunities, and risks, of these changes. One of these changes is the role that design itself might play.

The Architecture, Engineering and Construction (AEC) industry is in a state of flux fueled by transformative shifts in technology and design. Financial incentives around new economics of production, increased efficiencies afforded by streamlined communication and the automation of labor-intensive processes are already underway. The suggestion of this seminar is that there is a momentary opportunity to give a direction to this shift that will set the foundation for the next generation of architects.

Special Case Study NEW THIS YEAR

Through an unprecedented partnership arranged through the GSAPP, this semester's seminar will have the unique opportunity to get behind-the-scenes access to the inner workings of the Renzo Piano Building Workshop (RPBW) as a workflow case study. This will include several site visits to two of their projects currently under construction in New York, The Jerome L. Greene Science Center on Columbia's new Manhattanville campus and the Downtown Whitney Museum. We will also have the opportunity to visit the RPBW NYC office to discuss the projects and their unique working methods with the design and engineering teams.

Class Structure

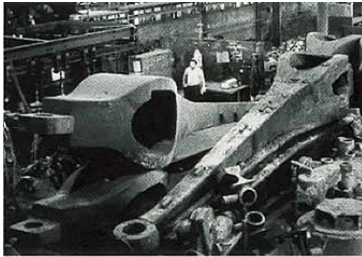
As background to the case study, the seminar will begin with readings and in-class discussions on new industry protocols developing around digital communication tools including BIM (Building Information Modeling), IPD (Integrated Project Delivery), CNC File-to-Fabrication processes, and other emerging workflows between architects, engineers, fabricators and other team members. Prior to each class, students are

WORKFLOW – Designing Industry - Fall 2013

Technology Elective / Tuesdays 11-1

Instructor: Scott Marble

Columbia University GSAPP



Renzo Piano's work has its foundation in craft and manufacturing. The Centre Pompidou (designed with Richard Rogers) utilized metal casting for building parts.

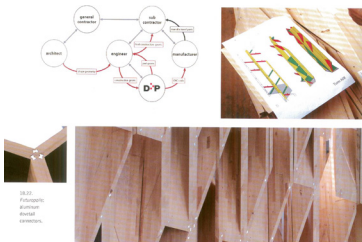
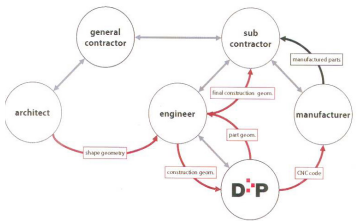
required to post responses for each of the readings on the class website. These posts will form the basis of the class discussion, which will be in the form of brainstorming sessions. During these discussions, we will quickly review the themes, identify the problem(s) that constrain innovation and then collectively develop possible scenarios to address the problem. After the class, students are then required to reply to another students post.

Each student will also be required to develop two workflow diagrams during the semester: one that describes the workflow of RPBW and one that describes the workflow of a future practice, which you design. These diagrams will be thought of as a design problem with the same level of commitment and imagination that you would apply to a building design. They will be evaluated on both the content and the graphic design. There will be a mid term and final presentation by each student. Examples of student posts and workflow diagrams can be viewed on past websites:

gsappworkflow2010.wordpress.com

gsappworkflow2011.wordpress.com

gsappworkflow2012.wordpress.com



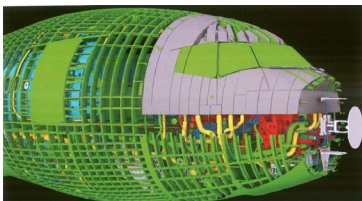
designtoproduction, Organizational Diagram. designtoproduction is a digital fabrication consultancy that mediates between architects and fabricators on complex projects. They have developed a file-to-fabrication workflow that takes geometry from design models and generates fabrication files for CNC manufacturing.

Topics of discussion will include the following:

- Positioning Architects in an Integrated Industry
- BIM and the Organization of Information
- Integrated Project Delivery (IPD)
- Rethinking Authorship within Collaborative Workflows
- Integrating Design and Production through File-to-Fabrication
- Automation, Optimization and the Commodification of Design
- Metrics and Contingencies
- Expanding Practice: New Models of Network Practice
- Managing Complexity through Parametric Workflows

Key Questions for the class will include:

- How is the increased amount of specialized information relevant to architectural projects today influencing design process and the composition and dynamic of design teams?
- The use of computation systems in architectural design range from direct representation where the computer is used to visualize a design, to abstract coding where custom algorithms are developed as a design system that generates architectural outputs from numeric inputs. In either case, the tools serve to extend the capabilities and imagination of designers. How are these processes utilized in contemporary work and how do design teams determine when to use which of these techniques.
- With the increasing need to automate design in the name of efficiency, what is the future relationship between qualitative and quantitative design criteria?
- How does the relationship between architectural design and construction details get redefined in the context of digital file-to-fabrication processes?
- How are CNC processes changing the traditional workflow between architects, fabricators and builders in contemporary practice?



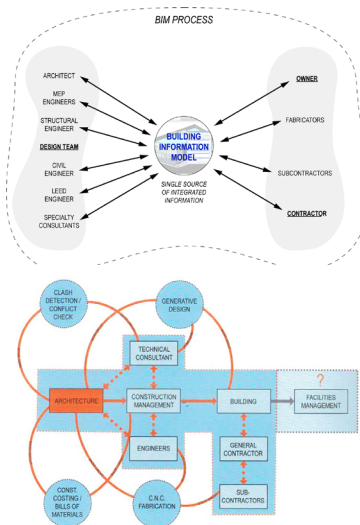
Boeing 777 Because of the capabilities of Catia to simulate a virtual prototype, the 777 was the first passenger jet to be designed without a full scale mock up. 5000 Engineers in 26 countries collaborated on the design of the project.

WORKFLOW – Designing Industry - Fall 2013

Technology Elective / Tuesdays 11-1

Instructor: Scott Marble

Columbia University GSAPP



BIM Organizational Diagrams. Architects have begun to design new industry organizations and design information workflow in an effort to position new techniques like BIM and Integrated Design as instruments of innovation as well as efficiency.

- Arguably, geometric complexity has been a significant driver of the evolution of CNC technologies in architecture through the need to rationalize this complexity in response to the constraints of materials, manufacturing and cost. Are there other potentials of this technology that might drive design innovation?
- How can new organizational models expand the capabilities of architects to embed the role of design in all aspects of realizing a building?
- What are the potentials for architects to reposition themselves by taking a more influential role within the current restructuring of industry? Does the fact that digital technology will play a central role in this restructuring give an advantage to architects?
- What are the new models of collaboration in the context of increasing specialized information? Does this lead to a consolidation of expertise into fewer, larger conglomerate firms or to a dispersion of expertise into smaller, more agile and networked practices that come together on a per project basis?

WORKFLOW – Designing Industry - Fall 2013

Technology Elective / Tuesdays 11-1

Instructor: Scott Marble

Columbia University GSAPP

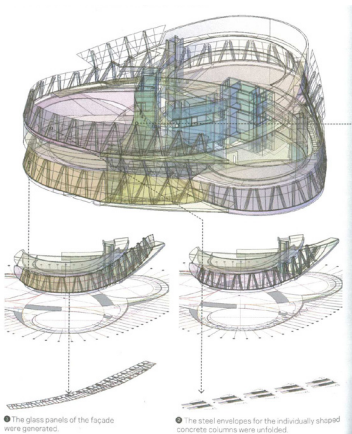
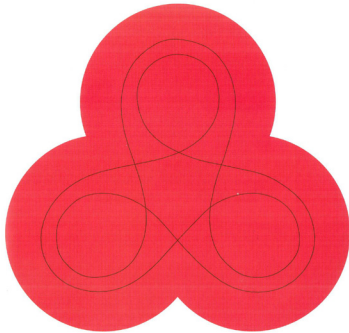
Excerpt from *Digital Workflows in Architecture: Design, Assembly, Industry*

The logics of digital workflows in architecture have begun to structure the way that architects design, the way that builders build, and the way that industry is reorganizing. These workflows have generally developed around three themes, largely independent of each other, and are now beginning to coalesce into an integrated system

The first, Designing Design, is a procedural issue and considers how professionally divided design processes are being redefined as integrated design systems. Vast amounts of information, both descriptive and analytical, are now instantaneously available to help define and assess design options. Much, if not all, of this information is filtered through software that, by extension, structures the digital environment in which architects design. Architectural design has become a complex workflow in which geometric, spatial and technical information is filtered through simulation, analysis and optimization processes, with the aim to form integrated, parametric building information models that can generate an array of output ranging from energy usage to manufacturing instructions. Designing Design poses design as a design problem itself and foregrounds the ways in which architects are beginning to consider the “design space” in which they work.

The second theme, Designing Assembly, is a material issue and addresses how digital production and material properties influence design concepts. This centers on the development of digital fabrication as an extension of the design process, giving architects a direct link to the tools and techniques used in the manufacturing of building components. Through CNC technologies, architects can reposition design strategically within fabrication and construction processes such that design information extends beyond the representational to include highly precise sets of instructions used to drive manufacturing processes. Moreover, these instructions can embed the logic of building assemblies into the manufacturing processes linking design to a new definition of detail that reestablishes the role of craft in the design process.

The third theme, Designing Industry, is an organizational issue with a drive towards integration, where input across multiple disciplines can be collected, modeled and efficiently managed. The amount of relevant and available information for any given architectural project has expanded faster than our ability to process and incorporate it into existing working methods. The range of expertise required to incorporate this information into the design, fabrication and construction of new buildings has led to large multidisciplinary and highly specialized teams that require new organizational models. While this is certainly a logistics issue that is being addressed with new technologies like Building Information Modeling (BIM) and integrated project delivery systems, it is also a design issue in that any organizational system has inherent biases that either support or obstruct the potential of a creative collaboration.



Mercedes-Benz Museum, UN Studio.
The parametric model for this project not only described the geometry of the design but also was used to produce fabrication information for many parts of the building. It was also used during construction to manage and update associative parts when changes were made to help coordinate the work of all trades.