PROCESS AND WORKFLOW IN ARCHITECTURAL EDUCATION Jason Montgomery, *Assistant Professor*

Vitruvius tells us that architects must be multifaceted professionals, with skills and knowledge of a range of topics including draftsmanship, science, mathematics, philosophy, law, music, medicine, and astronomy.[1] While architectural practice today continues to demand this capability to address a broad range of issues due to the inherent complexity of architecture, on occasion one aspect of practice rises to a dominant position in architectural and urban design culture such that it is treated as the central concern of architecture. The effect of this is to undermine the balance of concerns that are omnipresent in architectural practice. The track record of these moments of imbalance in architecture are mixed, but often they have resulted in experiments gone wrong. Any single building that rises from an imbalanced architectural culture may be innocuous. But when these imbalanced moments in architectural and urban design culture manifest themselves at the urban scale, serious consequences become apparent. Examples include urban and building designs that ignore their impact on neighborhoods, streets, and urban space (such as the typical public housing estate in New York City), suburban sprawl resulting from a car centric planning model as well as a "best of both world's" aspiration, and the urban destruction, displacement and alienation resulting from urban renewal and the rejection of traditional urban structure.

These moments of undermined balance in practice are amplified in the academy. Experienced practitioners potentially have experience and wisdom stretching across the evolution of architectural culture as a strong basis to resist the seduction of a dominant concern of the moment or to bring that concern into balance. Students of architecture, however, have neither the experience nor the wisdom to recognize this imbalance. As students lack this perspective, educating future architects is a project that must be closer to the Vitruvian ideal than any alternative. A well-rounded architectural education provides one of the strongest bases for creative problem solving and critical thinking skill development. These are the very skills that are routinely identified in research on education as the foundation for success in any career. Architectural education has always offered the potential for a broad and in depth development of problem solving and critical thinking skills. It achieves the development of these skills in large part through its emphasis on process.

Process is a non-linear, loosely defined activity that aids the investigation and discovery of design ideas and their refinement. Process starts with the effort to identify the underlying problem of the project, to cull out of the richness of the context the critical issues that need to be addressed. Then process guides the development of potential solutions followed by the challenging and testing of the validity of the potential solutions. Process is an incubator for broad critical thinking and creative problem solving. Process is agnostic to architectural cultural movements; its very strength is its guidance in balancing the multiple and diverse concerns of the architectural project including but not limited to: site, climate, sustainability, context, culture, history, society, neighborhood, hierarchy, code, form, space, structure, safety, finance, artistry, aesthetics, and meaning. All of these concerns can be identified, analyzed, and synthesized through process.

The evolution of process has evolved with the added complexities and technologies of architectural practice. Today, however, process itself is under threat from the potential imbalanced prejudice towards a singular dominant concern in architectural culture: form making. Form making is growing to dominate in the academy and in practice, resulting in the diminution of other concerns. While the emphasis on form making has been a long lived, favored concern in the academy and to some degree in practice, today's cultural elevation of parametric modeling and the workflow associated with it gives form making an even more dominant position.

Parametric modeling, based on algorithms, has an attractive quality at a base level: it is form generation based on input data. The algorithms are operations that manipulate input data and produce output that can be the genesis of architectural geometry. As stated above, there are many concerns in architectural practice, including some that can be quantified. For example, heat gain and heat loss can be modeled based on quantifiable data. Any of the concerns that are quantitative and reducible to the compatible data format can be scripted in the algorithm. Many concerns, like culture, history, context, neighborhood, however, are not cleanly quantifiable. Thus, the input data in parametric modeling can be inclusive of some but not all of the concerns of the architectural project.

In parametric modeling, the geometries and forms generated by the algorithm have a sense of mathematical and even scientific justification. There is a sense of rightness based on the unadulterated facts of geometry that result from the algorithm. Further, the algorithm can deliver wonderful geometric complexity that is difficult to generate by analog methods. It generates new forms, which are inherently exciting and seductive by their very

uniqueness and newness. This form making links the architectural project to the mode of operation of the sculptor, an artistic act with the gratification and indulgence of an individual or team's unique aesthetic vision. But different from the analog sculpture, this form has a mathematical basis, thus resulting in a justified and unassailable product. The sense of mathematical and scientific justification of the resulting complex form is a powerful incentive, so much so that it can be seen by many as a motive to supersede design process. The precise definition and linear step-by-step programming of an algorithm is growing to overshadow the non-linear, loosely defined process. And as it does so, it tends to further buttress form making's dominate position among the concerns of the architectural project.

There is a clear logic to the elevation of form making in the academy: architectural form is the first quality apparent to the observer. Indeed, faculty often flatter the students' performance in form making, lauding unique and creative forms even when they are window dressing for projects that lack depth in terms of the complexities and breadth of concerns pertinent to the project. While sustainability is the one concern that finds most compatibility with parametric modeling, others are often missing from the equation. Function is frequently disconnected from this approach to form making. Structure is often an afterthought. Context and culture rarely enter into the equation. Sectional development exhibiting the design of the sequence of space of these forms is rare. In the urban context the unique forms demand attention to themselves in a similar manner to a room of young children tugging at the same time on their teacher's leg. Each form is conceived as the new critical work, irrespective of its position in the urban hierarchy. Cities become assemblies of unique, unrelated forms. The big picture is lost in the indulgence of this unbalanced approach.

Further, the language and terminology of parametric modeling culture also pose a threat to process. The language of complex geometry and the mathematical or pseudo-mathematical terms are specialized and thereby focused. As its concerns are broad and multifaceted, process requires a language and terminology that is less focused and more inclusive. Language is a key to culture, and the emphasis on workflow, borrowed from industrial and software design, is a telling keyword of the current form making culture. Workflow is an effort to pre-define a series of steps and options to make any activity more efficient and reliable with accountability. Workflow clearly has its usefulness and place in the making of

things, but it is not a replacement for process. It is a specialized term specific to the activity that it seeks to enhance. In the eyes of a student, however, in a culture that gives imbalanced emphasis to form making, workflow seems to be a technological superseding of process.

The deterioration of process in the academy will likely result in the narrowing of the capabilities of the architect to address the breadth of concerns of architecture, exasperating a specialization phenomenon. Thus, this issue is also part of the generalist versus specialist debate. While specialists are a critical part of every society and workforce, the architect is a uniquely trained generalist who keeps the big picture in view and has responsibilities beyond the creation of a product or intriguing form. Therefore, the challenge we have in front of us in the academy is to maintain a balanced culture where the full complexities of architectural practice are presented and explored through the teaching of process. Workflow and parametric modeling provide wonderful new tools that can play a role in process, but they must not be elevated to a position that results in the deterioration of the critical role of process in an architect's education.

[1] Vitruvius. On Architecture. Trans. Frank Granger. London: Heinemann, 1955. Print.