Parametric Thinking

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Digital tools are currently being used in design schools across the country. This paradigm in both education and practice of architecture is continually changing the profession, from the way in which design is conceived, represented, documented, and fabricated. Parametric design can be defined as a series of questions to establish the variables of a design and a computational definition that can be utilized to facilitate a variety of solutions. Parametric thinking is a way of relating tangible and intangible systems into a design proposal removed from digital tool specificity and establishes relationships between properties within a system. It asks architects to start with the design parameters and not preconceived or predetermined design solutions.

Traditionally, architectural curricula are formatted as an aggregation of individual cells, representing courses to be taken, which align in a grid fashion to map a student’s trajectory through the program. This paper suggests that parametric thinking might yield a curricular diagram more reflective of the relational dynamics of the contemporary education, harvesting the synergies between courses and content. This diagram would simultaneously address the small scale of an individual course, as well as the overall structure of the degree.

Can this method of thinking also allow faculty a fresh perspective on curricular structure as well as NAAB’s student performance criteria, seeing them as a set of relationships and parameters to be established early on in the students’ journey?
Situating Parametric

“...one must make the encounter with relations penetrate and corrupt everything, undermine being, make it topple over. Substitute the AND for IS. A and B. the AND is not even a specific relation or conjunction, it is that which subtends all relations, the path of all relations, which makes relations, shoot outside their terms and outside the set of their terms, and outside everything which could be determined as Being, One, or Whole”. \(^1\)

Parametric design can be defined as a series of questions to establish the variables of a design and a computational definition that can be utilized to facilitate a variety of outcomes. Parametric design sets up measurable factors of rule-sets to determine behavior. Within architecture, these rule-sets can be; program, site, exposure, views, floor to floor heights; or in the position of this paper, can be a curricular diagram. Within each rule-set, parameters are established and a bandwidth of outcome is introduced. No single rule-set typically regulates until the author gives authority to one over the other. These rule-sets can be either co-dependant or isolated from each other. The more overlap and co-dependency that exists the more integrated the outcome. Throughout this paper we will situate the parametric processes as a series of questions and not a formal driver or generator. This methodology establishes an emergent set of relationships removed from preconceived notions.

In an era of rapidly adapting and evolving processes, educators, architects, and designers must adopt emerging ways of thinking and making. Parametric thinking is a way of relating tangible and intangible systems into a design proposal removed from digital tool specificity. It asks architects to start with the design parameters and not preconceived or predetermined design solutions. Parametric thinking pushes back on the conventional architectural design process and negotiates multiple variables that define a series of rule-sets. It asks architects to operate quicker, more nimble, and smarter, juggling multiple systems with speed and efficiency. Situating a design or a curriculum around a series of questions and variables enables the proposal to be controlled within a certain range based on the performance of the constituent elements. It is a “part to whole” approach, focusing on the behavior at the component level enabling results at the aggregate level.

Parametric thinking offers a significant change to the current paradigm in academic and professional practice. By framing projects and curricula from the beginning as parametrically derived, it puts less pressure on the designer to generate the right design and more pressure on them to ask the right questions. Asking relevant questions and establishing the series of rule-sets with associative variables will enable a generative design process and curriculum to emerge.

Parametric thinking “gives relations another direction, and puts to flight terms and sets, the former and the latter on the line of flight which it actively creates.”\(^2\) The “multiplicity which constantly inhabits each thing” is expressed through the overlap or relations between the activities. It sets into motion a way of relating activities and thinking processes across curricular years to maximize student potential. Parametric thinking asks the curricular diagram to be thought about as a part and a whole at the same time. The diagram should consider multiple paths through the curriculum where by the collection of pieces is greater than the individual parts (1+1+1>3). Throughout this paper we will situate the pedagogical benefits for thinking parametrically and position a series of questions towards setting up a responsive, dynamic curriculum.

The description and diagramming of architectural curricula

The delivery method for an education in architecture is an ongoing discussion in most schools, and most pointedly today, in the academy as we determine the most effective methods for preparing students to enter the practice of tomorrow. Historically, these discussions have been supplemented by, or resulted in, a diagrammatic expression of the curriculum and a student’s anticipated trajectory. Curricular discussions tend to separate the issues of content, usually structured around the National Architectural Accreditation Board’s (NAAB) Student Performance Criteria (SPC), from the methods (studio,
lecture, analog, digital, design/build, etc.). Pivotal to the discussion is the questions being asked and how they are manifesting a framework for the curriculum. We ask, what should the diagram of today’s student look like? Should it be static in the form of a printed document, or only digitally-interfaced to retain dynamic and current properties?

Arguably, the most recognizable curricular diagram for an architectural education is the 1922 Bauhaus model consisting of concentric circles focusing from the outer circumference, preliminary courses, to the center, architecture. Radiating from the center out, the graduate architect was seen as the epicenter, being supported sequentially by materiality, methods, compositional strategies, integration methods, and initial contextual content. This model attempted to describe the movement through the curriculum while the diagram represented a viewpoint on the education as a whole.

A similar expression of a diagram of educational delivery, exemplified during the Enlightenment Period, manifest itself through the form of a school floor plan. The plan of this schoolhouse, in the shape of a circle divided from the center out, was established to overlay control and supervision on the students and supported the disciplinary nature and training intent of inaugural schools. Thomas Markus in his book Buildings and Power suggests that this diagram was appropriated from Jeremy Bentham’s Panopticon prison design of 1791 not only in shape but also in the ideological intent for which it was designed. Michel Foucault contended “the major effect of the Panopticon [was] to induce in the inmate a state of conscious and permanent visibility that assures the automatic functioning of power” and suggested that it was meant to contain “a madman, a patient, a condemned man, a worker or a schoolboy.” One can make the assertion that although a built edifice, this plan served as a diagram and suggested an intentional relation between a shape and the intent of the delivery of educational content.

As a culture and a profession, we employ the steps of analysis and synthesis as a way to better understand something which resists being easily defined. Analysis is defined as “the separating of any material or abstract entity into its constituent elements.” The typical curricular diagram represents this attempt to gain control over a large moving target, the education of an architect. We suggest that it is a moving, dynamic entity because most times in any program of architecture, one can find at least two different student groups moving through with varying degree requirements based on changes made at the program, department, college, or university level.

Most contemporary curricular diagrams take the form of a grid, illustrating hierarchical relations through separation and stratification. The resultant strata are typically labeled as year levels and focus areas such as design, practice, technology, history, theory, and electives. In this configuration, the only place that relational thinking is manifested is through course prerequisites, which clearly draw correlations between the cells and, in turn, its content. The results are a diagram that separates, divides, and classifies an entity (the education of an architect) as a means to gaining an understanding of it. While this may assist in identifying the constituent parts of the whole, the cellular diagram fails to allow for recognition of its highest potential. Generally speaking, by pulling the whole apart, we kill it and, upon reassembly, end up with a version of Frankenstein’s monster. Is the analysis phase, where the whole is dissected, the best point to describe the education of an architect?

A new curricular diagram

“The diagram has seemingly emerged as the final tool, in both its millennial and desperate guises, for architectural production and discourse. Operating between form and word, space and language, the diagram is both constitutive and projective, it is performative rather than representational.”

Synthesis is defined as “the combining of the constituent elements of separate material or abstract entities into a single or unified entity, or a complex whole formed by combining.” Currently, the synthesis of curricular content
happens, we hope, in the mind of the student. We make assumptions that the student is drawing correlations between the content and not compartmentalizing it. Obviously, there will be varying results based on the diversity of the students matriculating through the program, but is the student’s mind the first place we should test the synthesis of the content into a dynamic entity?

This paper suggests that parametric thinking might yield a curricular diagram more reflective of the relational dynamics of the contemporary education; harvesting the synergies between courses and content. This diagram would simultaneously address the small scale of an individual course, as well as the overall structure of the degree. While this diagram still utilizes the technique of separation (course, student performance criteria, etc.), none of the constituent parts are allowed to exist independently. Rather, they are always dynamically linked into the aggregation and are constantly referencing the whole. Can architects design a better way of describing the education of an architect as opposed to using appropriated diagrams that look no different than departments such as Mathematics, English, or Business, even though the content and pedagogical methods are vastly different?

The diagram’s diversity is intended to respond to the range of students emerging from of schools of architecture every year. Whether their interests are the design of architecture/urban space, or the development of business practice models, or preparing for the reciprocal training of future architects, this diagram can describe how the parameters of the curriculum might be adjusted, combined, overlapped, or removed. The diagram is set up by asking the right questions and allowing for variable change to occur within it. The diagram is loose and agile, it can adapt to specific classes as students move through the curriculum. This new diagram proposes relational concepts such as; can overlapping required and elective courses provide a learning environment that is more holistic (ex. should a structures course be combined with a studio)?

Using a combination of the performative aspects of parametric software definitions combined with the intent of montage (French for “build, organize”) theory, the conception of a curricular diagram may be developed. Montage theory states that “collisions of shots were based on conflicts of scale, volume, rhythm, motion.” Aside from theoretical underpinnings and associations with late 20th century theory, this is at one level parametric and relational, relying upon variables within a definition (“scale, volume, rhythm, motion, context” + “disciplines, requirements, electives”). The adjustment of these parameters has the potential to yield varying results in the pedagogy and thus the educational output.

**Bottom-up approach**

The organization of the six-year curriculum at University of Nebraska at Lincoln College of Architecture is established into three two-year groupings. The beginning design program is labeled as the “what”, followed by the “how” in the middle two years and ending with the “why” in the final two years. This organizational arrangement charges the beginning design program with laying the foundation and delivering the premise for their education. It also enables the beginning design program to set into motion a way of thinking about space and the environment parametrically. By establishing a critical yet broad way of parametric and relational thinking methods the student body will be positioned to make a positive impact in all phases of the architectural community.

Generative thought processes are essential to the development of a design process in the beginning design student. With the focus of parametric thinking residing in the framing relevant questions, project development becomes less end-focused and more process oriented. This approach requires a suspension of disbelief on the students’ part as they move through the design process, in turn requiring a critical eye to evaluate the products generated. Students continually oscillate between the framing of parameters and the evaluation of results.
Mediator

The fall semester of 2010, at the University of Nebraska at Lincoln, marks the beginning of establishing a new program in the second year design studio, which collects students from the Architecture, Interior Design and Landscape Architecture programs. After moving through the visual literacy program in the freshman year, the second year studio is the first discipline specific studio course in these programs. This new curriculum offered a pilot to introducing parametric thinking as an organizational device and pedagogical intent.

“Mediator” is a project developed as a part of the introduction of this new curriculum. This project is intended as a transition from the visual literacy program, which is not discipline specific, into the culmination of the pre-professional program (second year design sequence). Pedagogical focus is on an iterative, phased design process that eludes the ability to anticipate the project terminus, forcing the student to stay in the moment. The project was also structured to allow for slight shifts to maintain the element of surprise from year to year thus maintaining the “now” focus within the design process.

Out of this developed a layered system to organize the entire 2nd year curriculum of the 2 year beginning design program. These layers allow for change in scale, volume, rhythm, and motion in the same manner as montage theory, while overlaps in content present design process as a dynamic, multi-faceted entity. This pedagogical approach requires students to develop an opinion and results in students attaining keen perception and an analytical eye. It also pushes the limits of learning and learning styles by asking the students to think, operate, and negotiate multiple ranges of thinking.

Conclusion

Throughout this paper we have positioned the role of parametric thinking towards a new curricular diagram. The diagram is conceived of as a series of questions related to design, student performance, individual courses, and the entire curriculum to better advance student performance/learning. By asking questions at multiple scales and academic levels we are able to set into motion a series of controlled yet unknown outcomes. This diagram positions classes sequentially and in parallel with each other in order to maximize student performance and cross course dialogue. This new curricular diagram keeps pace with the contemporary student and generates unique opportunities for advancing student learning.

References

2 ibid, 57.
3 ibid, 57.
5 ibid, 200.