Ordering Systems
The Code of Context

The *Hunch* derived from an assessment of the Comprehensive Design Studio, taught at the graduate level in a 4 + 1.5 accredited school of architecture, with the question of how do we define and evaluate "comprehensive". The definition of comprehensive is 1: covering completely or broadly: INCLUSIVE, 2: having or exhibiting wide mental grasp <knowledge>: COMPREHENSIVENESS, and 2a: the act or action of grasping with the intellect: UNDERSTANDING. This studio includes the learning outcomes defined by the National Architectural Accrediting Board (NAAB) criteria in Realm C. This realm requires that students "demonstrate that they have the ability to synthesize a wide range of variables into an integrated design solution". The 2014 Conditions for Accreditation by NAAB define this in a number of ways that all center around the comprehension of complex systems and an architects ability to synthesize a multiplicity of variables "into an integrated architectural solution". The "synthesizing of variables from diverse and complex systems" requires that architects look beyond the building to its larger implications to society and the environment. The following questions were asked to define a path for evaluation of the curriculum. If we are expecting students to do more than make a technically feasible building and move towards a holistic design that includes a triple bottom line approach to the implementation of the built environment, what skills do they need? What do they need to know to engage and manage the complexities of the world such that they can manifest architectural space? If we are expecting students to evaluate and integrate complex systems, then a systems theory approach to design must be foundational to their education.

Over the past few years David Coleman and Stefanie Sanford, president and chief of global policy for the College Board, have been examining and revising the SAT college entrance exam. In an interview with Thomas Friedman they stated their fundamental question that prompted these changes. Which is the most important skill or knowledge correlated to success in both college and life? Their response was "Two Codes", computer science and the U.S. Constitution. The reason for this is that if one is going have agency and an ability to make change, one must understand how these systems work. They argue for an ability to understand the logic of the systems and the ordering of relationships and causality and to be able to master the principles of basic coding. In short, the "Two Codes" model empowers those who understand the logic of how a system or set of interconnected systems work to operate within contemporary society and industry.

Fundamental to a designer's ability to create something, to intervene and make an impact, is the ability to comprehend the ordering systems that have created the context they are working within. One must understand the logic of the code to know how the system works to determine where opportunity lies. As we exist in a dynamic environment, seeing the code allows one to engage and manage the complexities of the world such that we can manifest architectural space. Seeing the ordering systems reveals the opportunity for intervention that leverages the existing systemic

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conditions to do more than the client or brief asks. Furthermore, it has the potential to be generative in nature by providing opportunities within undervalued or misunderstood conditions. By understanding the code of the site, one can reveal latent potential and engage in opportunistic architecture that is not constrained by conventional evaluation. This approach gives agency to constituents allowing for emergent design, expanding the potential impact architecture can have.

In order to do this one must engage in the investigation of sites, conditions or programs through a systems lens documenting the ordering systems or code. Design must be informed by an understanding of the existing conditions, be they physical (terrain, environment, structures, people, species, etc.) or virtual (laws, policies, perceptions, desires, etc.), and their interconnectedness and causality. This is nothing new in the fields of planning and landscape architecture that manage complex infrastructures and have an ecological underpinning. The scale and medium of this work requires one to think at different time scales and long term implications of growth and future variables that may not be easily quantifiable. The documentation of design in the drawing set is years, if not decades, in the future and is more a guide than an absolute. The building plan will exist at the conclusion of construction, but the planting plan will only manifest itself over time and will evolve. The clearest examples of this are landscape succession plans documenting the evolution of a site over time through an understanding of ecological causality. However, the use of systems logic in architecture tends to be limited to aspects of engineering and sustainability as discrete pieces of the overall project. It has potential to inform all aspects of the design and create more relevant work that is holistically sustainable as it engages an evolving future. Through a synthetic mapping of the existing conditions potential is revealed to define the parameters of design intervention within the systems, expanding the capacity of space making.

This approach is especially important within the foundation design studios as it establishes a student's evaluation methodology for future studios and their career. After evaluating the overall curriculum, the *Hunch* was to begin addressing Comprehensive Design starting in the first year. At Montana State University the first year studio is split into Fall and Spring, allowing for each semester to have a focus on the systems that define both the natural and constructed environment. The fall semester focuses on physical systems, primarily those that are natural. As an introduction to this type of analysis, the natural ordering systems are easy to identify and the causal relationships are clear and quantifiable through existing research. For example, identifying a certain type of flower in one area and not another can be explained through the difference in growing conditions. The spring semester focuses on those that are virtual, primarily related to policies. These systems are not as easily identified as the same policy can manifest physical patterns in different ways within the same region. For example, within this context, the pattern of flowers can be explained by land ownership and maintenance / weed control procedures based on an individual or municipal value. Both semesters utilize the same context, the connected streams and rivers within the region, allowing the students to revisit the same context and see it through the multiple layers of ordering systems that create the physical environment.

Critical to this methodology was to create a process that did not start with a problem solving objective but one based on research without a predetermined agenda allowing students to focus only on the code's logic. The objective here is to establish a way of working that clarifies decision making, allowing students to understand how a system works without the burden of subjective influences like aesthetics, right and wrong, or good and bad. To do this, students were tasked to look at patterns in the environment that were a result of the ordering systems. They observed their site and documented these patterns by natural and virtual systems supported by research. Their documentation was a re-presentation of the site through a synthetic mapping of the conditions. They are given no objective or program beyond documenting the complexity of the site. They must identify the interconnected relationships happening on the site and causality / feedback loops. Through identifying the patterns in the physical environment and their causality through research, the students demonstrate the ordering systems through quantifiable research. They are not allowed to speculate or assume a reason for the pattern, but evidence their research to support their documentation of the site. This structure allows the review of their findings to be purely quantitative, eliminating subjective evaluation by critics.

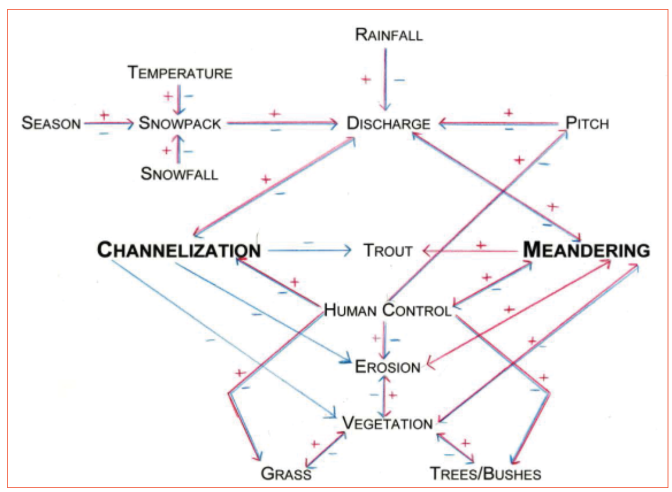

Figure 1. Ordering Systems Diagram, Taylor Streit

As the students examined the complexity of the systems related to their site they began to realize the vastness of the system and its connection at a global scale. For some students this became overwhelming and they were paralyzed with the scale of influence on their small site. Two strategies were evaluated to guide students:

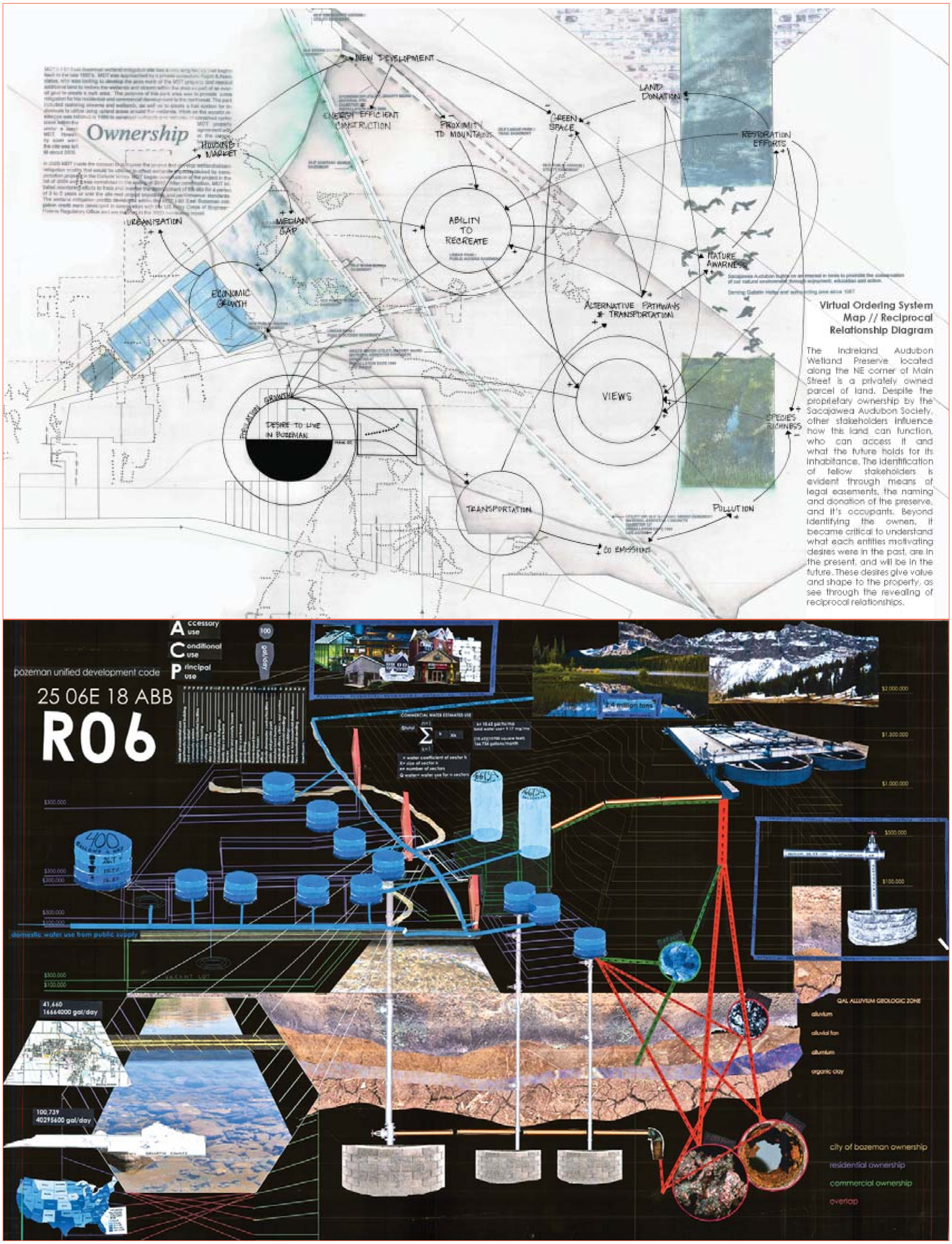

Figure 2. Synthetic Mapping of the Systems, Ann Domenico and Ryen Dalvit

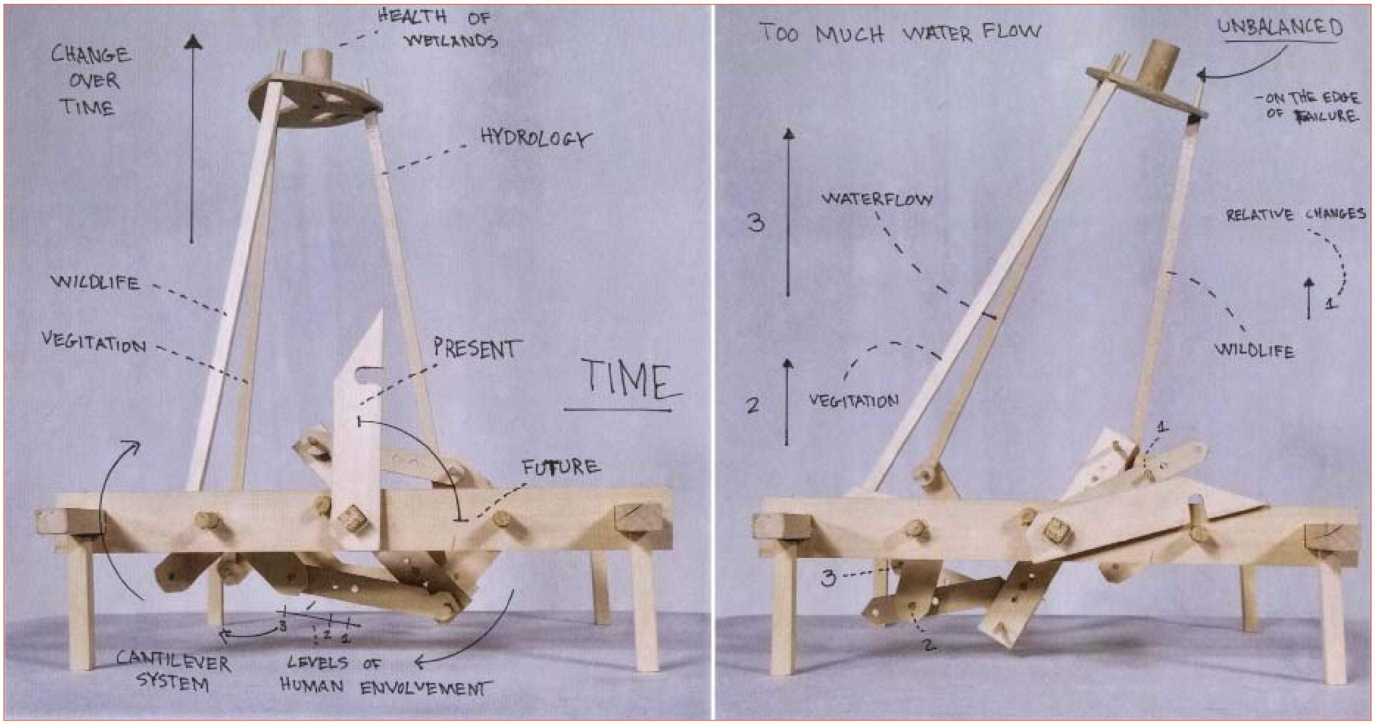

Figure 3. Parametric Model, Logan Madsen

let them get to that point and give them a strategy to understand the complexity or limit the extent of the system at the beginning to make it accessible. Given the size of the studio and time available (30 students per faculty member meeting three times a week for two hours) the first did not prove successful as it required much more individual time working with students to comprehend the system. The later allowed the students to grasp the complexity at a smaller scale and build confidence in their ability to approach design through this methodology. The vast scale of the complexity of the systems was reserved for later in the design process.

Once students had an understanding of the interconnected systems that informed their site, they were tasked to test the parameters of the site utilizing a leverage point or points. Students tested the capacities of the different systems and how changes to intensities or inputs would impact the overall dynamics of the place and context. To do this, they created physical parametric models utilizing materials that embodied the characteristics of their systems. Portions of the system that are more malleable were modeled with materials like piano wire and thin museum board. Rigid conditions utilized thick basswood, while thinner basswood allowed for some manipulation where the conditions had minor ability to be changed. These models allowed the students to manipulate one or more of the site parameters to reveal its influence on the rest of the system. In this process they were determining which inputs had more influence and which required significant effort for little change. The models were photographed in their different states and annotated to document the influences and changes to the ordering system(s). The parametric models became a tool for them to evaluate the site and their future intervention.

This process allowed the students to develop individual evaluation criteria generated by their research. This was done through diagramming and writing in parallel with the mapping and parametric modeling. The diagrams articulated the systemic relationships on the site with their inputs, outputs and feedback loops. The writing synthesized the reasoning for the systems in a quantitative capacity. They were limited in the number of diagrams and writing to prioritize the most important elements. Eventually they created a single diagram and no more than 250 words to articulate the context of the site, the systems, and their evaluation criteria. Knowing that they could evaluate their work based on a set of clear criteria they had established created a peer review culture within the studio supporting their design development. Students were comfortable presenting and commenting on other's work because the evaluation was not the sole responsibility of the faculty member. This was important in giving students confidence in their formal reviews, something many first year students find intimidating.

Finally, the students were tasked with identifying a space of opportunity within the system(s) where an intervention could leverage the latent capacities that engaged the complexity of the larger system. This space of opportunity and its capacity is only visible because of their understanding of the system(s), both physical and virtual, that inform the site and context. Their intervention was not to make something better, worse or solve an issue. The intervention was to be a catalyst for larger change within the context and should inform and be transferable to other sites with similar conditions. In the end, their designs were the result of quantitative research, were performative and were evaluated on the criteria they established.

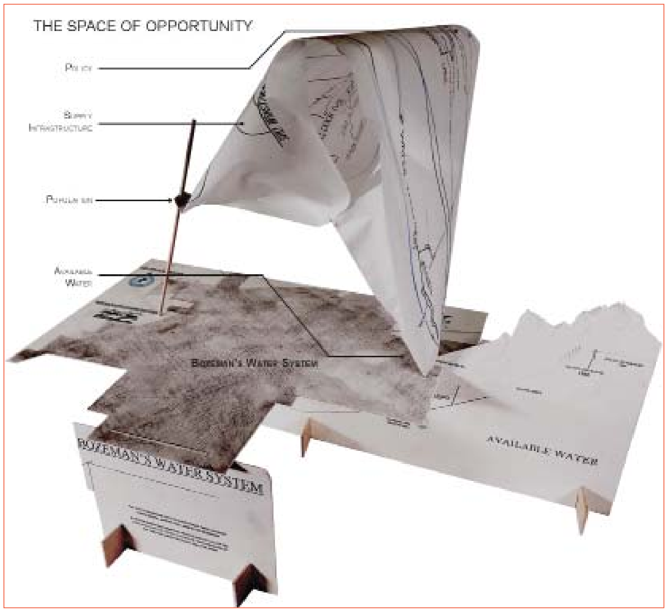

Figure 4. Space of Opportunity Construct, Taylor Gilkeson

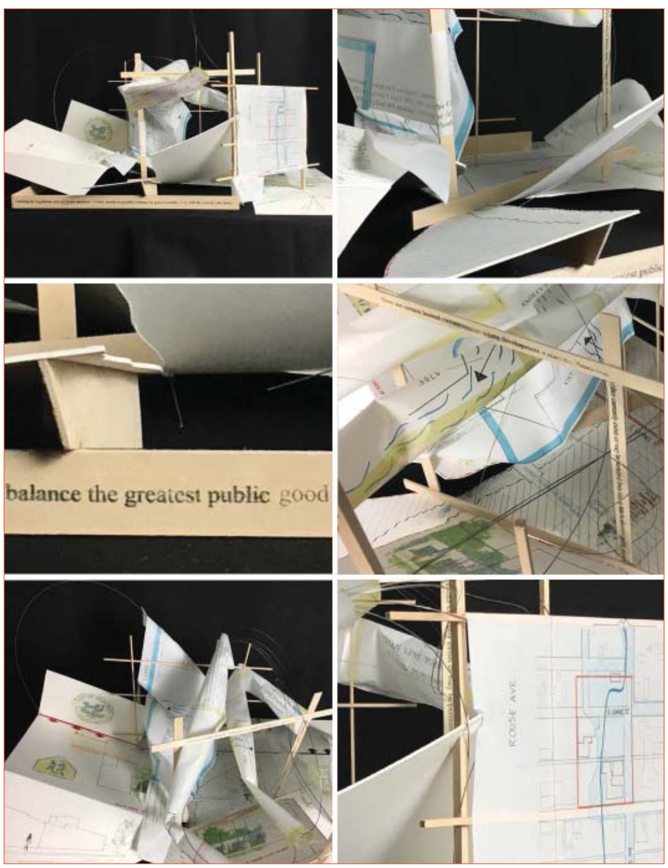

Figure 5. Space of Opportunity Construct, Polly Sinclair

Fundamental to all of this is that the students maintain a constant immersion within their project and process. They must constantly refer to the coding of the site for their evaluation and not rely on opinion or personal preference. To do this, the systems are embedded within the work. All of the elements of their design development include the systems in a tangible way. Whether this is working with materials that embody the characteristics of the natural phenomenon or constructing their site model laden with the policies in a physical manner, the systems provide a resistance to arbitrary decision making. Through a multiplicity of techniques, the students engage the systems at every step further reinforcing the overall studio pedagogy.

Though an iterative series of projects examining the site, students developed an understanding of large system connections and the micro-conditions of a specific site as agents for architecture. Students defined programs for the sites as a result of analysis rather than being given a required program or a problem to solve. The programs leveraged latent potential and engaged emergent capacity, reducing the investment in design for greater impact. This understanding of

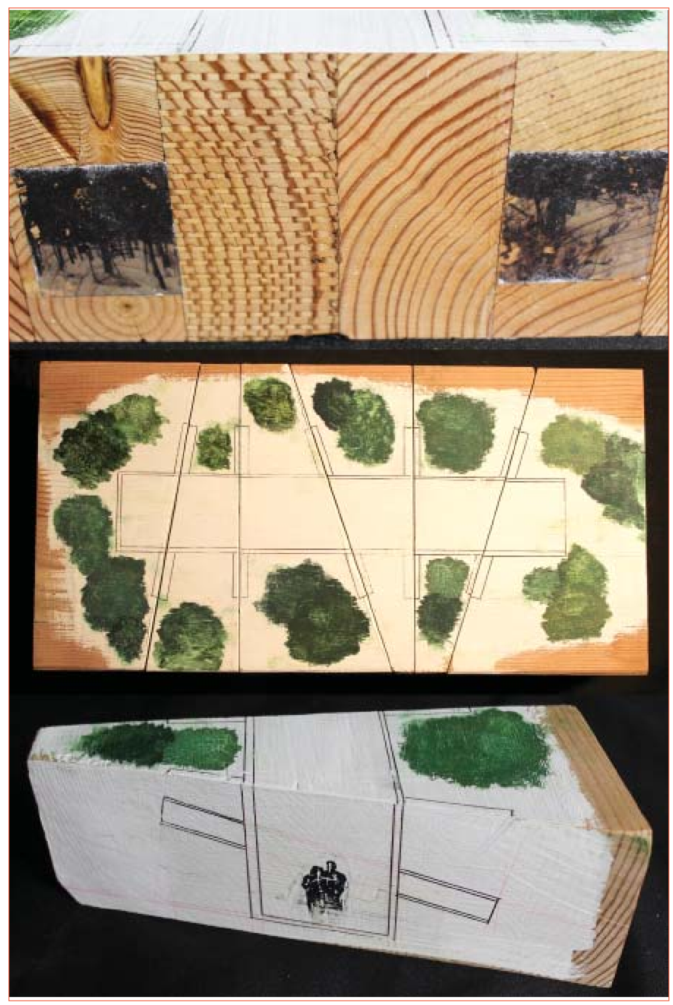

Figure 6. Design Intervention Model, Finn Loftesnes

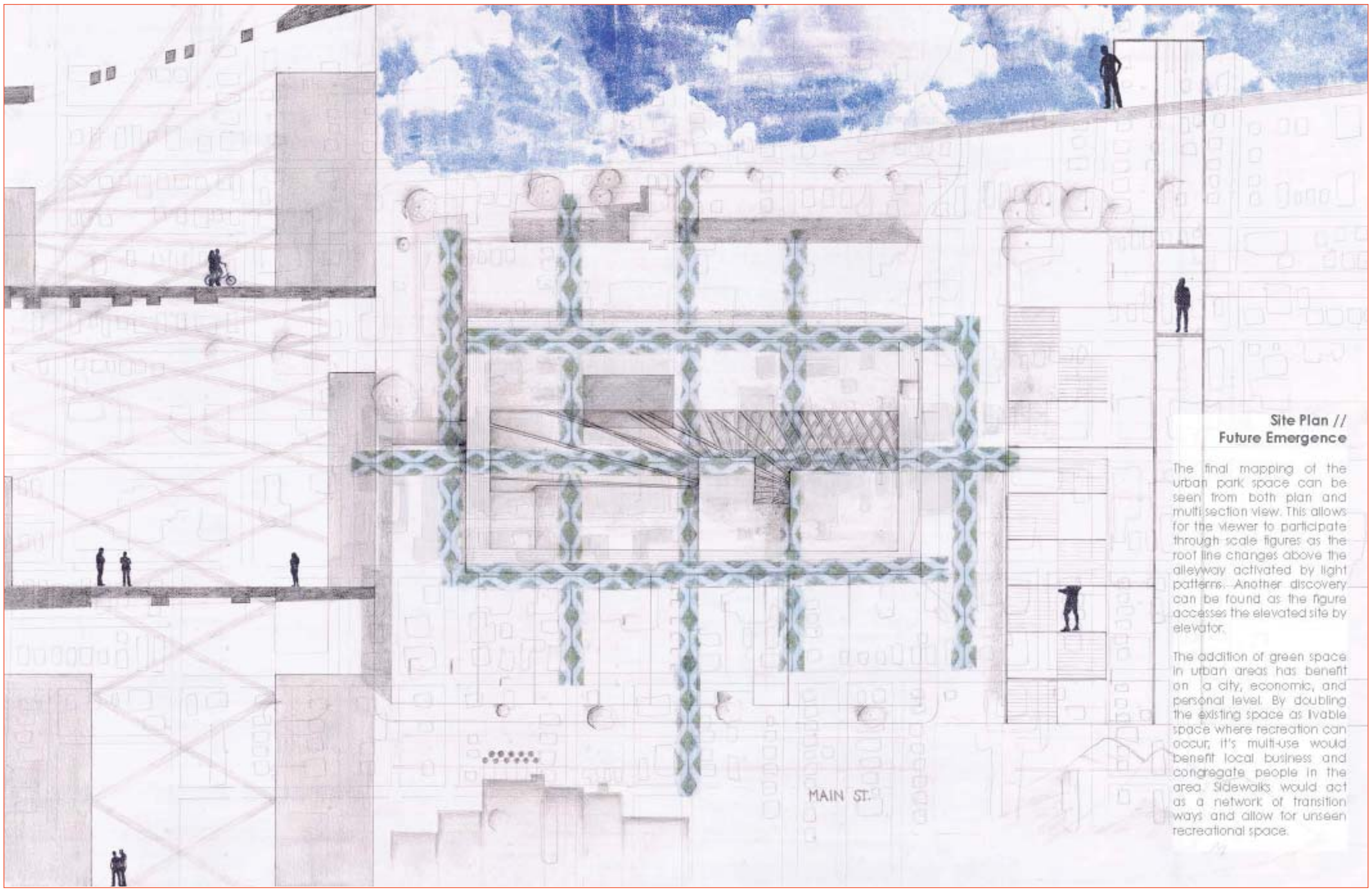

Figure 7. Intervention and Catalyst Drawing, Ann Domenico

system integration and program as an active condition informs the larger agenda of architectural education and the future of these particular students. This type of thinking moves program from a list of spaces to one that is a set of performative criteria not bound by formal critique.

Within the context of a school of architecture where new skill sets are introduced, iteration of the methodology through several projects utilizing different media and forms of communication is necessary to build a language of resources. Similar to any early design studio, students must continually be challenged to be critical of their work and establish strong agendas within an agency of research expressed through different forms of visual communication. It is too easy to resort to knee-jerk preconceptions of the context and site as something we see rather than part of a complex and integrated system that furthers design. The engagement and leveraging of the code of the context creates a space for architecture to go beyond the building as object. It creates an architecture that is dynamic, responsive and adaptable through a clear understanding of the interconnected relationships of the ordering systems. The students are constantly asked to go back to the criteria as a basis for evaluation ensuring that they are working with the parameters of the site and context. Through an iterative documenting of the code and a multiplicity of permutations, students realize their agency as designers within the world as being more than the making of buildings, but the makers of performative spaces.

This way of systemic thinking is an absolute necessity in our dynamic world. Projects that can understand the implications of their existence in a larger, rapidly changing context are more responsible and realistic. They are able to understand their potential impact and provide valuable space that is performative. Similar to our influence and response to global warming - sometimes proactive but more often reactive - design can overlook the small aggregate pieces that make the larger picture. By objectively examining the site and context to determine its code, students are able to make design decisions that are proactive, not relying on a prompt from a professor or client, and even expand the role they can have as a future architect working further upstream in the process.

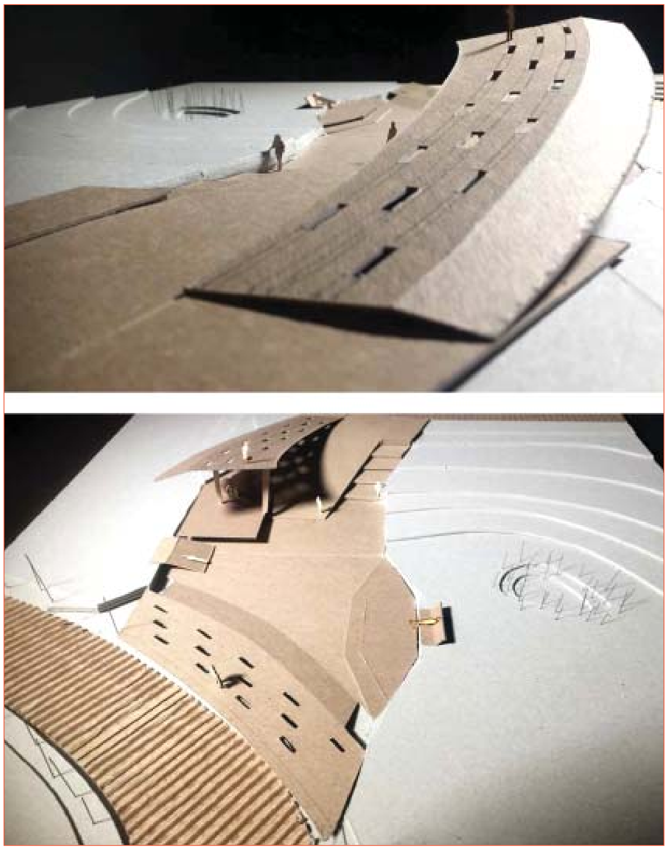

Figure 8. Design Intervention Model, Taylor Streit

Notes

1. National Architectural Accrediting Board, Inc., 2014 Conditions for Accreditation, July 18, 2014. During the period of this pedagogical development, the 2014 Conditions were the standards in place. At the time of writing this paper, new standards were being developed, but not yet finalized and published. The 2014 Conditions for Accreditation published by the National Architectural Accrediting Board, Inc (July 18, 2014) identify the following learning objects in Realm C: Integrated Architectural Solutions as follows. Graduates from NAAB-accredited programs must be able to demonstrate that they have the ability to synthesize a wide range of variables into an integrated design solution. Student learning aspirations for this realm include: Comprehending the importance of research pursuits to inform the design process. Evaluating options and reconciling the implications of design decisions across systems and scales. Synthesizing variables from diverse and complex systems into an integrated architectural solution. Responding to environmental stewardship goals across multiple systems for an integrated solution.
2. Thomas L. Friedman, "The Two Codes Your Kids Need to Know," New York Times, February 12, 2019. Below is an excerpt from the article that introduces the logic for the Two Codes: A few years ago, the leaders of the College Board, the folks who administer the SAT college entrance exam, asked themselves a radical question: Of all the skills and knowledge that we test young people for that we know are correlated with success in college and in life, which is the most important? Their answer: the ability to master "two codes" — computer science and the U.S. Constitution. Since then they've been adapting the SATs and the College Board's Advanced Placement program to inspire and measure knowledge of both. Since the two people who led this move — David Coleman, president of the College Board, and Stefanie Sanford, its chief of global policy — happen to be people I've long enjoyed batting around ideas with, and since I thought a lot of students, parents and employers would be interested in their answer, I asked them to please show their work: "Why these two codes?" Their short answer was that if you want to be an empowered citizen in our democracy — able to not only navigate society and its institutions but also to improve and shape them, and not just be shaped by them — you need to know how the code of the U.S. Constitution works. And if you want to be an empowered and adaptive worker or artist or writer or scientist or teacher — and be able to shape the world around you, and not just be shaped by it — you need to know how computers work and how to shape them. With computing, the internet, big data and artificial intelligence now the essential building blocks of almost every industry, any young person who can master the principles and basic coding techniques that drive computers and other devices "will be more prepared for nearly every job," Coleman and Sanford said in a joint statement explaining their initiative. "At the same time, the Constitution forms the foundational code that gives shape to America and defines our essential liberties — it is the indispensable guide to our lives as productive citizens."