The Aleatoric Studio: Embracing Chance and Risk in First-Year Design

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INTRODUCTION: THE GREAT WIDE OPEN

Architecture education at the dawn of the 21st century's second decade, long removed from the constraints of Beaux- Arts traditions of craft, from the precision of the Bauhaus, and from the band saws of Black Mountain College; unmoored by digital technology, floating like a conceptual balloon into the pedagogical great wide open, confounds incoming students with an abundance of choices. First-year students are asked to formulate a multivalent decision-making process that embodies technique, precedent, and culture. They are asked to take a stand, but instead find themselves floating towards the ceiling; there is nothing to stand for, nothing to stand up against, and nothing to stand on. Today's digitally proficient students are no better than students ten or twenty years ago at making design decisions, filtering and editing information, and seeking productive pathways through studio problems. When students become paralyzed in the face of the simplest spatial exercise, things have gotten too wide open.

A typical first-year studio these days is recursive: it seems to include content from every studio course that has ever been taught, nested within content from every studio that has ever been taught, and on and on, like a reflection of a mirror within a mirror within a mirror. As content piles up in great heaps, the wide openness of the typical studio is accepted as natural evolution, its content simultaneously less grounded and more complex each year. The prevailing wisdom is that today's architecture students benefit from lots of choices, since they can make decisions more fluidly than students of previous generations. It's evident that today's students are *seemingly* skilled at doing many things at once: talking, twittering, typing, texting. They are rumored to be the digital citizens of the *game generation*, experts at processing a staggering number of choices, able to use alternative communication paths to arrive at solutions. It is said that they can fearlessly solve many problems at the same time, that they embrace trial and error, that they are less likely to get frustrated in the face of new, complex problems.[1] But in reality, today's first- year students are stymied by the ever-expanding number of choices created by both computers and improvised, indeterminist studio pedagogies; they are not happy and productive operating in the great wide open. The *aleatoric studio* attempts to re-ground students by replacing their computers with paper, pencil, and wood; replacing wide-open pedagogies with a firm foundation built on a network of constraints (of time, materials, and dimensions); and by encouraging students to discover the opportunities of *chance and risk*.

Aleatory is derived from the Latin *alea*, a root variously defined as *dice, chance*, or *risk*. Aleatory has been explored as a compositional variable within modern Classical music, most notably in the 1950s by Pierre Boulez. Aleatoric music is inherently different from free form, open improvisation (and different from John Cage's experiments in indeterminacy) in that aleatory depends on constraints, allowing chance and risk to occur only within a strict structure, with limited outcomes (as in the rolling of dice, the flipping of coins, the rifling of pages). When applied to fundamental architecture studio operations (drawing a line, folding a plane, measuring a wall, cutting a column) aleatory becomes a critical tool in first-year studio because it teaches students how to formulate a productive, fluid decision-making process imbued with chance and risk.

THE LIMITS OF CHOICE

Architecture studio problems represent a series of choices, and first-year students often arrive in their first studio course with problematic decision-making skills. Barry Schwartz, in *The Paradox of Choice*, describes two types of decision makers: *maximizers* and *satisficers*. Given the same number of choices, maximizers will insist on testing every option and thus are unable to make a decision in a reasonable amount of time, while satisficers tend to be happy with a good decision, allowing them to efficiently move on to the next problem and the next set of choices. Schwartz recommends limiting the number of options to be considered, and spending less time searching for "the perfect fit." Satisficing is ultimately more productive than maximizing because it allows for a series of quick (or relatively quick) decisions.[2]

Many first-year architecture students follow a meandering decision-making path, clearly falling into Schwartz's maximizer category. For the architectural maximizer, all options are equal and must be explored; every tangent leads to new tangents. Those students typically lose a lot of sleep, since they have to try every choice and can't decide what information is important to their project. Every outcome is an equal possibility, and they lack the ability to edit their own decisions. Architectural maximizers tend to get seriously stuck, to the point of paralysis. Too often their wandering decision-making process is mistaken by their instructors for laziness and they are simply told to put in more hours, with disastrous consequences: a repeating sequence of what Schwartz calls "choice overload," a downward spiral of frustration and lack of progress.[3]

In architecture studio courses, there exists an additional type of problematic, Schwartzian decision maker: *minimizers*. The opposite of maximizers, minimizers follow an overly deterministic decision-making process. While maximizers allow too many choices to infiltrate their decision- making, minimizers limit themselves by not considering *enough* options. They insist on building fully formed, preconceived, finished ideas, and their models and drawings tend to become fixed and conceptually emaciated, unable to accept additional layers of information. Theirs is a closed process; they tend to arrive at a solution almost before the project even begins. Minimizers tend to be very difficult to teach, as any criticism is seen as a threat to what is, essentially, a "done deal" from the beginning. Each phase of the project is presented as complete and finished, impervious to change or conflicting information. An early warning sign of this kind of decision-making is when a student says, with complete confidence, "I know exactly what I'm going to do!" as soon as they are given an assignment. Minimizers also tend to be the ones who throw up their hands in the face of repeated criticism and either withdraw further into a creative box, or dramatically announce, "I'm starting over!"

The aleatoric studio helps both maximizers and minimizers: maximizers benefit from the imposition of a network of constraints that provides the structure their decision-making process lacks, while minimizers are allowed to discover chance operations within constraints, providing them with an entire world of possibilities they hadn't considered. An abundance of choice is at the heart of both the minimizers's and the maximizer's dilemmas. Both decision-making processes are based on fear of risk: maximizers are afraid to let choices go untested; minimizers are afraid to consider more than one choice. Schwartz's satisficers, meanwhile, usually do well as architecture students, since they are able to make decisions quickly and decisively, allowing them the time and space to objectively see the whole problem instead of just the problem's parts. Satisficing may be the ideal decision-making process, but except for occasional exceptions, students don't usually arrive in their first studio with those multivalent skills. Instructors can, however, teach students to be satisficers. The aleatoric studio requires the instructor to closely monitor each student's decision-making processes, and requires that maximizers, minimizers, and satisficers work together in constant collaboration.

THE IMPORTANCE OF COLLABORATION

Collaboration is critical to the success of the aleatoric studio. Students work in close quarters around a central table. The collective table is where group decisions happen and where group projects are constructed. Individual desk crits and individual workstations are deemphasized in favor of group discussions, sharing of information, and blurring of boundaries between projects. Reviews are organized not with students presenting one after another, patiently and nervously waiting their turn before the jury, but rather as a group discussion between students and invited critics. Collaboration removes the students, physically and psychologically, from their creative boxes, forcing them to see their decisions in a wider context, and thus reducing the stress they often feel about always making the *perfect* decision.

Collaboration is also difficult; instructors must closely monitor teams so that students don't get stuck when they disagree. Conflict, when understood as an opportunity, can be useful; collaboration necessitates constant negotiation. In a studio problem, negotiation can be physical (my operations don't agree with your operations, but the misalignment formed a space), emotional (I lost but I gained), and liberating (our work is no longer precious). Choice both expands and contracts within a collaborative process, and collaboration embodies the risk inherent in aleatory. One of the most productive decision-making processes a first-year student can engage in is one *filled* with chance and risk.

THE ROLE OF CHANCE AND RISK IN MUSIC

Chance operations, with their inherent acknowledgment of the author's fallibility, do not fit comfortably into the traditions of architectural studio education. But in music, chance has been a focus of inquiry for at least sixty years.[4] In the 1950s both John Cage and Pierre Boulez, among other modern composers, experimented with chance as a component of composition. Cage wrote that "chance operations are a discipline" as opposed to open improvisation, which lacks a controlling, organizing structure.[5] Aleatory is "determined in its framework and flexible in detail."[6] Cage's use of chance operations tended towards the literal (flipping coins, for example, to determine the sequencing of parts of a composition). When used in the formulation of architectural decisions, chance and risk become a means of accessing, critiquing, and dissecting preconceptions that arise during the design process.

Both Cage and Boulez rejected free improvisation.[7] Cage believed that when performers were given liberty to improvise during a piece, they tended to fall back on their muscle memory, using well-rehearsed scales and relationships, playing what they already knew they liked. Boulez, in search of actual aleatory composition, found that true chance was hard to come by. In *Le Marteau Sans Maitre* (1953) Boulez created passages of intersecting patterns of woodwinds and drums that sounded as if they were created aleatorically: the *simulation of chance*. In 1957, Boulez's three-part *Improvisations sur Mallarme* allowed progressively more chance to enter the composition: in the first segment no changes were allowed; in the second segment performers were allowed to change tempos; in the third segment they were allowed to change the melody at intervals, discard vocal parts, or play alternative passages.[8] Other composers have experimented with aleatory segments within highly structured compositions. Arnold Schultz, for instance, conducted one piece in which pages of the score were intentionally left blank; when the blank passage came up, he simply looked at his orchestra and shrugged.

THE NECESSITY OF CRAFT

Any creative act, whether in music, architecture, sculpture, painting, or writing, that uses chance as a component of the design process requires a high level of craft; a "reservoir of motor patterns."[9] In the case of first year studio, students must be instructed in a solid foundation of skill in drawing and model making. The potential trap in the use of chance operations is reliance on design moves that have become second nature. Just as a violinist might fall back on a familiar, diatonic scale when asked to employ chance operations in a performance, an architecture student asked to embrace chance may simply employ the tried and true, what he or she knows will work well and please the instructor (the slightly angled corner, the folded plane, the overlapping grid). Chance in architectural design can easily become a simulation, just as Boulez discovered in *Le Marteau Sans Maitre*.

Craft is the central component of aleatoric decisions. Without craft, students are left with chance operations for the sake of chance operations; ones that are ultimately conceptually and physically empty. Boulez understood the danger inherent in the unstructured, imprecise use of chance when he wrote that chance operations can "conceal a fundamental weakness in compositional technique, [curing] creative suffocation with a more subtle disease [by destroying] the smallest embryo of craft."[10] The composition's structure, what Boulez calls the *network*, must be meticulously chosen. In the case of architecture design problems, the network must be constructed with detailed, clearly articulated constraints. If the network is not rigorously operated and controlled, chance operations in a first-year design studio can become an excuse for sloppy projects.

The aleatoric studio begins with a four- week precedent study, in which students collaborate on the research and construction of a series of Frank Lloyd Wright's Usonian houses. The Usonians, analyzed collaboratively as a series, are productive examples of variation within a controlled system, and offer students the opportunity to master the craft of drawing and model building in a comfortable, directed decision-making process.

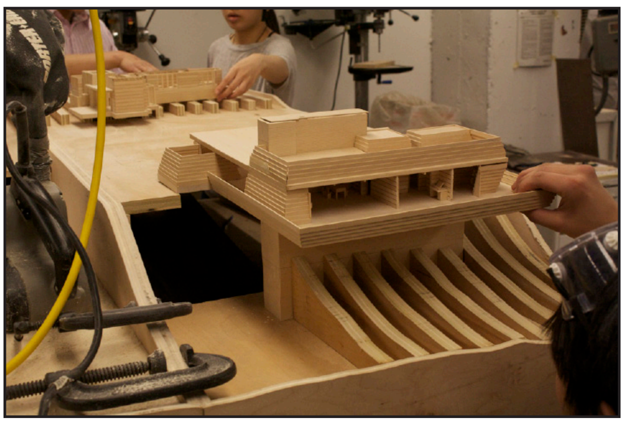

Figure 1: Working in the shop on the precedent study.

The first week of the semester is spent producing a full set of analytic drawings with pencil on bond paper. Wright's concepts of the folded plane, plasticity, continuity, and infinity, the relationship between exterior and interior space and between ground and structure, are studied and discussed in depth. Models are then constructed in wood over the next three weeks. The precedent study, through tightly controlled methods of research, drawing, and modeling, produces a startling level of craft not usually associated with groups of first-year students [Figure 1]. The precedent study provides a solid foundation for the production of work in the studio.

Students reach a predetermined result and in so doing develop organizational and analytical skills in a collaborative environment. Momentarily isolating decision-making along one deterministic path allows students to forget "choice overload" and focus their energy towards one common goal. Their next project, the Spatial Sequence, allows students to explore decision-making within a network that includes chance and risk.

THE SPATIAL SEQUENCE PROJECT: ESTABLISHING CONSTRAINTS

Incoming first-year architecture students tend to separate design as an *act* from design as a *product*. They design first, build second. Models and drawings are problematically understood as the finished representations of completed ideas. That "eureka" tendency is further complicated by the traditional studio structure of individual projects and individual desk crits. The stress caused by the burden of thinking everything through prior to the act of building leads students to get caught in "minimizing" or "maximizing" decision- making habits. The Spatial Sequence project describes both a physical and conceptual path along which students collaboratively make aleatoric decisions within a network of constraints based on three categories: time, materials, and dimensions.

Time constraints are critical to productive decision-making in first-year studio. Many students become trapped in a studio culture of endless all- nighters, suffering from a kind of charrette disease. Going without sleep does not, contrary to myth, produce great work. Even one sleepless night causes decision-making processes to slow down, and students staring at their models and drawings for hour upon hour slowly lose their objectivity. They get too close to their work and can't self- critique; their projects become their *pet projects*. Time constraints force students to move ahead and produce work quickly; they begin to accept a degree of imperfection in the act of designing.

The Spatial Sequence project begins with a one-hour drawing session, in which each student produces a series of twenty generative sketches on 12" x 12" bond paper. Each drawing is a timed exercise ranging from five minutes to thirty seconds in duration. After the first hour, the students pin up their drawings and marvel at the 240 drawings on the

Figure 2: Detail of collaborative drawing revealing overlapping systems.

wall. Each student then picks a favorite drawing and links it on its short side to their classmates to form a single, linear drawing one-foot wide by twelve foot in length. The students then collaborate on the linked drawing for thirty minutes, working according to rules of pencil marks they began to develop while making their first twenty drawings [Figure 2].

In the drawing exercise, time acts as a constraint that intentionally limits choice, allowing for rapid, aleatory decisions to happen within a framework. The exercise embraces risk and accepts mistakes as a natural part of the process. The exercise unleashes tremendous energy in the students as they quickly devise systems for marking the paper. Encouraging each other as patterns began to emerge, some students use erasers to edit each other's work. The final collaborative drawing produced from this session has amazing spatial depth, with the ability to be read in plan and section and to operate as a map from which to build a collaborative model. *Material constraints* for the project are simple: paper and charcoal for the drawings, basswood and plywood for the model. When left with wide-open choices, first-year students often get stuck in selecting materials. Limited material possibilities at the beginning of first year help students develop their spatial understanding by reducing texture, weight, and color so that patterns of structure and space can emerge.

Figure 3: Collaborative decisions in close quarters.

The Spatial Sequence model is constructed in one week by all twelve students working simultaneously around the studio table in a series of one-hour work sessions [Figure 3]. *Dimensional constraints* for the model consist of prescribed site boundaries (48 feet wide by 1,152 feet long by 48 feet high, at a scale of 1/4” = 1’0”: actual model dimensions were 1 foot wide by 24 feet long by 1 foot high) and structural size and quantity limits. Structural dimensions of planes, beams, and columns are as follows:

Thickness x Height x Length:
(6) Planes: 1/4” x 2” x 11”
(6) Planes: 1/8” x 2” x 11”
(8) Planes: 1/4” x 1” x 6”
(8) Planes: 1/4” x 4” x 8”

Depth x Width x Length
(6) Beams: 1/4” x 1/8” x 11”
(6) Beams: 1/4” x 1/8” x 8”
(8) Beams: 1/4” x 1/8” x 6”

Square Thickness x Height
(6) Column: 1/4” x 6”
8) Column: 1/4” x 10”
(8) Column: 1/4” x 12”

Once the given structural pieces are used, students can make their own sets of structural components, using their own systems of measuring and cutting. The system begins to transform in the hands of the students. The structural systems devised by the students are fantastic examples of aleatory at work: new pieces, variations within the composition, of the same logic but transformed into mutations of the originals (sprouted, stretched, multiplied, folded, cut). The results are spatially and structurally sophisticated. Architectural solutions, of course, *should* be more complex than the outcomes produced by simple flipping of coins and rolling of dice.

Chance operations in the aleatoric studio revolve around the installation of a kind of repetitive, meditative working environment that encourages students to loosen their control over decisions. Since control has already been well established by the constraints imposed on their processes, students can find room within those limits; they can relax and act creatively without completely losing control. Chance operations become a kind of mutation within the genetic code of the constraining network [Figure 4]. Examples might include overlapping lines that form an unintended space; a void revealed between two “unfinished” bass wood planes; two lines of charcoal that are drawn over and over by multiple students, strengthening an axis; a stray mark left by one student that becomes a central feature for another; one student’s L-shaped basswood planes that overlap with another student’s system of columns, leading to a structural pattern more complex than either intended. Chance operations in the Spatial Sequence reach a level of complexity that transforms the original problem, leading to enriched results never intended or imagined by the instructor.

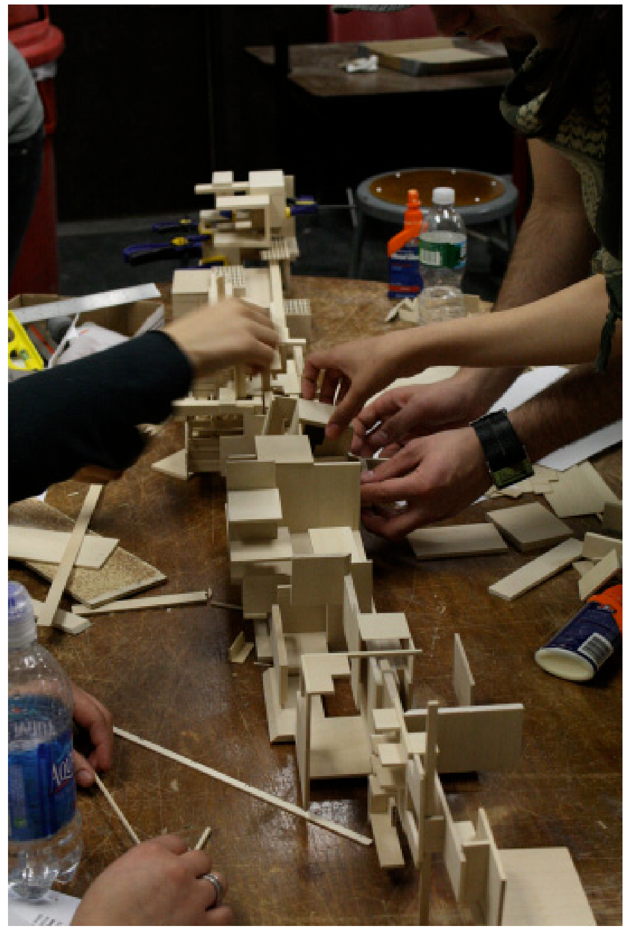

Figure 4: Chance operations leading to mutations within dimensional constraints.

CONCLUSION

The aleatoric studio depends on a final analysis phase of the Spatial Sequence project. After the first week of generative drawings and the second week of collaborative model construction, a third week is spent measuring the model, cutting sections, and producing meticulously drafted drawings that represent a definite product and mirror the research and analysis skills learned in the precedent

Figure 5: Group discussion and analysis, with invited critics.

study. The project concludes with a group discussion augmented, but not controlled, by visiting critics [Figure 5]. Without that final analysis, the Spatial Sequence could easily be filed away as a fun tangent, with no real use for the students as they move ahead to their next project. After the Spatial Sequence project, students are more comfortable working with each other, making quick decisions, and producing volumes of finely crafted work. Systems of structure and space then carry over into the next project, a weather station (a controlling mechanism that measures chance and risk within a chaotic system) where students use the Spatial Sequence as a kind of catalog of decisions; a spatial encyclopedia that is used as a reference for design.

Aleatory happens within the conceptual space left between constraints. Time, material, and dimensional limits give students some wiggle room while the instructor provides and monitors the necessary structure to guide decision-making. Collaboration allows chance and risk to enter the process as students lose the preciousness of individual decisions and begin to act upon each other's work. The process has been especially successful in helping marginal students get over the hump at the beginning of their experience in architecture school. Students become both more productive and more relaxed during their first year because of the aleatoric studio, and have been consistently astonished at the level of work they are able to produce.

ENDNOTES

1 Goknur Kaplan Akilli, "Games and Simulations: A New Approach in Education?" in *Games and Simulation in Online Learning*, edited by David Gibson, Clark Aldrich, and Marc Prensky, (Hershey, PA: London, UK, Idea Group, Inc., 2007), 3.

2 Barry Schwartz, *The Paradox of Choice: Why More is Less*, (New York: Harper Perennial, 2004), 78.

3 Ibid., 3.

4 (...or even longer ago than sixty years: Mozart himself supposedly used dice to determine the order of some passages.)

5 Sabine Feisst, "Losing Control: Indeterminacy and Improvisation in Music Since 1950." *New Music Box*, March 1, 2002.

6 Ibid., 5.

7 Ibid., 1.

8 Ibid., 6.

9 Ibid., 7.

10 Pierre Boulez, Stocktakings From an Apprenticeship, (Oxford University Press, 1991), originally published in 1957, 26.