Furniture Studio: A Heuristic Pedagogy of Poiesis

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INTRODUCTION

The purpose of this paper is to outline the curriculum and pedagogical intentions of the furniture design studio developed by Senior Lecturer Andris Vanags at the University of Washington over the past two decades. Following those aspects of reflection and experience outlined in John Dewey's 1916 treatise, *Democracy and Education*, it describes a pedagogy of incremental learning that synthesizes diverse areas of knowledge through the production of a piece of furniture. The studio is dedicated to providing students with the experience of seeing a design through to completion and serves as a primer on materials, construction techniques, time management and budget constraints, underscoring the interdependence of design and fabrication. Dewey notes that "those under instruction are too customarily looked upon as acquiring knowledge as theoretical spectators, minds which appropriate knowledge by direct energy of intellect" and remarks "how much keener and more extensive our observations and ideas would be if we formed them under conditions of a vital experience."[1] He suggests that practical ability and foresight are secured through the body's repeated contact with things and he praises craftsmen for having "undergone the discipline of experience to acquire the skill they have."[2]

Today the "discipline of experience" seems as quaint a notion as education by apprenticeship. It has been replaced by a regulated education that is technically focused yet offers students few opportunities to learn by doing.[3] Furniture Studio is predicated on the belief that both teaching and learning are best accomplished through diverse methods wherein physical understanding, skill acquisition, and material trials are valued as much as intellectual, conceptual and historical approaches. It seeks to unify varied modes of learning through a heuristic pedagogy aimed at grounding design practice in competence and concrete understanding. This paper will describe the studio's process in order to discuss the advantages of this manner of teaching as well as the problems that arise within it. It is an attempt to call attention to the vitality of hands-on education in a rapidly expanding landscape of digital fabrication and modes of representation that mediate students' contact with materials and tend to promote design and fabrication as separate and successive processes.

THE COURSE

Furniture Studio is a ten-week course in which students design, develop, fabricate and finish a piece of furniture. It is a complex and ambitious undertaking that requires a sizeable commitment on the students' part in terms of time, effort and resources. The course is offered to both graduates and undergraduates in the final year of their design education. As most students begin the course with little or no prior experience the curriculum is designed to allow them to become familiar with tools, machinery, and techniques through the process of developing and resolving their designs.

STAGE I: MODELING IDEAS

In the first week students are introduced to the 'Studio Furniture' movement and the work of such figures as James Crenov, Sam Maloof, George Nakashima and Tage Frid as well as work done previously by students of the course. The purpose is to give them a brief illustrated history that calls attention to the intimate association between the furniture and the shop in which it was built. The limitations imposed on a project by the context of production usually fall outside of the parameters of a design studio where the final product is most often some form of representation. The work reveals how these limitations influence design and sets the standard for the studio. It also serves as a catalog of precedents for students to draw upon and helps familiarize them with the lexicon of furniture making.

For the first session students are asked to bring models of two projects at 1/4 scale (3″ = 1′), which is large enough to accurately represent bevels, reveals and the negative space between elements. Together, the images and models provide a range of examples that facilitate discussions focused on the relationship between material behavior and the configuration of elements. Other issues such as the specific capabilities of the shop, lead-time and cost of outsourcing, fabrication techniques, assembly strategies, cost, and comfortable accommodation of the body are discussed where applicable. While allowances are made for students to discover new possibilities and propose alternatives, they are encouraged to resolve the issues in their piece and are strongly discouraged from proposing an entirely new project. Preconceptions about simplicity, difficulty, and stylistic traditions can deter students from a project they really wish to pursue and so we try to elicit responses from them regarding likes, dislikes, apprehensions, and what they hope to learn from the class. Very often we encourage them to develop a project they had already discarded or help them merge their educational ambitions with their design proposal.

The current culture in Architecture leads many students to hold novelty as a core value and they adopt an uncritical preference for the *avant garde*. The unfortunate consequence is that proven design principles are frequently disregarded or overtly rejected. This of course, is nothing new. We need only recall T.S. Eliot's 1919 essay "Tradition and the Individual Talent" where he laments the "tendency to insist, when we praise a poet, upon those aspects of his work in which he least resembles anyone else."[4] For Eliot, tradition was never self-evident and already given to the poet but something "earned by great labour." Dewey echoes Eliot's sentiment in writing "Only silly folk identify creative originality with the extraordinary and fanciful; others recognize that its measure lies in putting everyday things to uses which had not occurred to others. The operation is novel, not the materials out of which it is constructed."[5] The course is dedicated to helping students understand that innovation and originality do not follow from a wholesale rejection of tradition, but rather in relation to or as a development of something that came before. By presenting the genealogy of precedents and their relation to material properties and fabrication strategies, they cease to be seen as the stylistic affectations of a by-gone era and are appreciated instead as knowledge hard won through the evolution of techné.

Students modify their designs and present new models in the two proceeding sessions. Their formal ambitions and the configuration of elements narrow the field of suitable materials and fabrication strategies. If for example, a student desires flush connections and coincident elements we might recommend the use of steel, as welded joints don't re-intersect each other. If the student has a preference for wood construction then we would recommend offsetting elements to prevent tenons from coinciding and we would suggest modifying flush conditions by incorporating kerfs and chamfers that anticipate the dimensional movement that occurs with seasonal moisture cycles. We try to dispel some of the misconceptions surrounding the comparative strength of wood and steel. In terms of the ratio of strength to weight the two are essentially equivalent and using the students' models as well as scraps of wood and steel we can demonstrate the degree to which the geometry and the orientation of the cross-section influences strength. Students begin to understand why objects fabricated from sheet metal have creases or folds that make an otherwise flexible material stiff, or why table legs are often larger at the top where joints typically occur. They also begin to notice and understand things around them, noting modes of construction and the factors that influence them.

By addressing such issues in relation to the students' proposals they are able to understand, in very real terms, the impact each decision will have on structure, form, time and cost. It also provides a way to introduce fundamental characteristics of

Figure 1: formal model review

isotropic and anisotropic materials in a manner that, by virtue of its relevance to their own projects, is both useful and engaging. Through lectures alone it would be impossible to effectively convey so much information in such a short time but in the context of critically reworking a project it is quickly assimilated. There is a tendency, in design studios for students to defer decisions by proposing numerous alternatives. The demand that fabrication places on the project encourages students to make decisions quickly so they can focus on the issues that follow from them. By the end of the first week students are asked to commit to a project so that they will have as much time as possible to test and develop ideas.

By the beginning of the second week students have incorporated feedback to redesign or reconfigure their projects and a professional furniture maker is brought in for a formal review. The professional begins by presenting his or her own work. They share anecdotes about their design process and failures, noting unseen elements such as jigs and moulds and the influence of both employees and clients on a design. It gives the students exposure to the factors that influence production runs and the economic viability of certain designs over others. It also gives them a chance to ask questions and provides an opportunity to articulate their burgeoning understanding of materials and processes.

The course is organized in stages that repeat with increasing sophistication. This allows students to learn incrementally through tasks that provide an opportunity to test and apply new information.[6] At the outset, the amount of information that must be assimilated is daunting, but as the students work through each stage of the project they acquire skills and their confidence grows. Dewey writes that "a large part of the art of instruction lies in making the difficulty of new problems large enough to challenge thought, and small enough so that, in addition to the confusion naturally attending the novel elements, there shall be luminous familiar spots from which helpful suggestions may spring."[7] The success of the studio is owed to its orchestration of 'challenges' and 'luminous spots.' The demand it places on the students is matched by the degree to which they become empowered and able to meet them.

STAGE II: MOCKING UP

Following the formal review students begin working at full-scale. Over the course of the proceeding four weeks they produce two mock-ups, which are presented for formal review. The mock-ups are constructed from 2 x 4's (glued up to form larger members where necessary), particleboard, plywood and steel. Wood members are assembled with mechanical fasteners so they can be disassembled and modified. Planar elements are often joined with biscuits, which are stronger and allow students who have casework to get acquainted with using a plate joiner. Steel elements are welded to get an accurate sense of flex in a piece and to provide novice welders an opportunity to practice. Special joints, mechanisms for moving parts, jigs and forms are also developed and refined in this stage. Students learn how to cold-mold and vacuum-form irregular members and the mock-ups let them test their molds and help them determine the minimum number of laminations needed to give members adequate strength. We try to use the least expensive materials available that will still give students an accurate indication of the structural integrity of their design. Keeping the cost as low as possible encourages them to test a wide range of design options. It's not uncommon for mock-ups to have two different pairs of legs, multiple edge profiles and variations in drawer fronts in order to compare and elicit better feedback.

The move to full-scale is motivated by two pedagogical ambitions; the first is to get the students working in the shop to build experience and confidence. Students are given a thorough introduction to the equipment in the shop that addresses the direction of forces, the direction of rotation of various cutters and the composition of blades and knives. This helps them understand how best to feed and control the material to get an accurate cut in the

Figure 2: evaluating a full-scale mock-up

safest way. Learning how to control chipping, and blowout in wood or how to clamp and tack steel before welding gives them a somatic understanding of material properties. Dewey describes learning from experience as making “a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence.” The process of making is like an experiment; by doing students are trying and testing while at the same time undergoing an experience. Together this trying and undergoing “becomes instruction—discovery of the connection of things.”[8] At this stage the students naturally begin to work collaboratively, helping each other with set-ups and assembly, catching or controlling large material and getting feedback on the comfort of their pieces. Students discover that they learn a great deal from their classmates’ projects, which together incorporate a broader range of fabrication techniques than just those required for their own piece. This is also when leaders emerge, as students begin to teach and assist each other and offer advice learned from their own trials and mistakes.[9]

The second pedagogical ambition is to teach visual literacy by helping students to understand the dynamic three-dimensional relationship between the body and an object and the impact it has on visual and spatial qualities. The natural tendency stemming from previous design studios is to design elevations from an idealized perspective, but at full-scale they see almost immediately that a coffee table on the floor, viewed from a seated or standing position has far fewer visible elements than a coffee table represented in models or orthographic projections. Likewise, legs often seem surprisingly large at full-scale as they are seen most often from an oblique angle where the diagonal dimension is read, rather than the width of a single face. Dewey notes that “the qualities of seen and touched things have a bearing on what is done, and are alertly perceived; they have a meaning.”□ The body is less agile than sight at moving between varied scales of experience. Scaled-down models diminish the legibility of subtle relationships, which makes them more suited to the broader strokes of design. Once a project becomes more refined the models must be scaled-up. Even at the grand scale of a building, detail models and full-scale prototypes are often used in working out a project for the very reason that they can be accurately assessed through experience.

Students learn to read solid-void relationships and develop an eye for the relative proportioning of elements. They begin to make decisions based on concrete experience; the thickness of a stretcher or an apron is determined not only relative to its length and width but also in relation to its proximity to other members and the vantage from which it will be seen. Members that are lower or below a projecting plane must be scaled up if they are to maintain a visible presence. By the same principle structure can be made to disappear by pulling it in or tucking it under another element. Dimensions determined abstractly begin to shift from whole and half numbers to more nuanced dimensions determined by eye. Initially, students are surprised to discover that altering the form or scale of one member has a noticeable impact on the entire piece and often requires minor adjustments elsewhere as well. Through the course of refinement, they begin to understand their piece as a unified whole, in which all the major and minor elements work in concert to preserve its visual continuity.

In addition to refining the structure, form and comfort of their pieces the students must also develop strategies for construction and assembly. Their ambitions have to be reconciled with the equipment available to them and the material they plan to use. For example, our shop has a sander and a planer that can accommodate 25” pieces but our jointer maxes out at 16” and our re-saw bandsaw can’t split anything wider than 15”. As a result, tops for large dining room tables are usually made from a narrower board that is re-sawn and either book or slip matched to get the full width. More often the governing limitation is the species the student has selected rather than the shop’s capabilities. It is rare to find cherry boards of considerable width and even in narrow stock one almost always has to contend with sapwood, which is lighter in color and somewhat softer than the adjacent heartwood. The design implications of cherry are quite different from a species like mahogany, where wide slabs with no sapwood are far more common. These factors figure largely in decisions and students discover that a design may only be suited to a narrow range of species, or that it must be adapted if a particular species is desired. Some species are much better for designs that require hand shaping while others hold crisp edges better or are more stable and require less understructure. Some species are more forgiving and less likely to add frustration to a beginner’s project.

Figure 3: acquiring material

STAGE III: MATERIALS & FABRICATION

At the beginning of the fifth week we take the students to purchase their material. In preparation they are introduced to some fundamental information about wood. We begin with the anatomy and growth of a tree and the milling methods of both soft and hardwoods. Then we examine at length a cross-section of the tree to show how various cuts in specific areas of the section will reveal a particular figure. We also show them samples of a wide range of species, discussing their similarities and differences in broad terms and calling attention to the unique or notable traits one can expect to find. We discuss at length what figure is most desirable for legs vs. aprons or tabletops and where they can expect to find it in a typical slab. We discuss cutting strategies that make the most efficient use of a board while taking best advantage of its visual characteristics. Students are taught how to estimate the material needed for their project in board/feet and what to look for and avoid as they are choosing a slab. They are asked to sketch an “ideal board” with a layout of all the elements of their project. This allows them to estimate the total number of board feet they need and the rough dimensional requirements of quarter sawn, plain sawn and vertical grain material.

Figure 4: fabrication of final piece

At the lumberyard they begin by checking potential boards for cupping, bowing and twisting, marking all of the defects with chalk. If the board passes this examination they scrape the paint off of the ends of the slab so they can read the end-grain and anticipate the figure they will find. Then they start chalking out where each piece will be cut, to be certain that the board will provide enough material with the desired figure. If more than one board is necessary they have to determine which pieces will come from each one, making sure that like elements, such as legs or sections of tops all come from the same board. It is a long day that is both physically and mentally demanding. It requires informed decision making to ensure the best outcome for their piece and sound use of the money they commit to the project. The day is a crash course in applying a range of considerations to the material available and by the time we return to the shop with their boards the students are both exhausted and triumphant.

The material must be left uncut with uniform air circulation for at least 24 hours so it can acclimate to a heated space. After it is surfaced and cut into rough dimensions it must rest again to allow for movement to occur and checks to appear before being cut to final dimension. As the students' cut into their boards the consequences of case hardening, internal stresses, moisture content and dimensional change play out in a vivid display that shows just how dynamic a material wood actually is. It demonstrates in concrete and sometimes dramatic terms, the design principles and material properties the students had to account for as they designed their pieces. While their material rests they continue to work on their mock-ups, finalizing dimensions and making adjustments to highlight an aspect of their material or to avoid or hide a flaw. It is quite common for pieces to undergo changes at this stage because the material is no longer hypothetical but rather a particular board with specific traits. Tabletops are often shortened or extended to take best advantage of the figure. Sometimes doors conceived as solid are made into stable panels so that a desirable feature may be stretched over a greater area as veneers. It is important for students to maintain a degree of flexibility in terms of design so they can recognize and remain open to the opportunities that cannot be anticipated in earlier stages of the project.

Figure 5: assembly

Over the course of the remaining weeks students must plan tasks, estimating time and determining an order of operations that will keep them on track to finish and allow them to work around shop hours and competing demands for equipment. They are asked to make a calendar showing all remaining tasks. These are almost always too generalized and we go through each one, unpacking phrases like "make tenons" into a list that describes each step; "joint stock, cut to width, plane to thickness, round edges, cut to length." Students are surprised to see their lists expand so dramatically but it makes them better able to estimate and allocate time. The closer they get to finishing, the more costly mistakes become, but students come to understand that by maintaining a degree of flexibility, most problems are easily solved and can even result in solutions that, although unanticipated, are highly successful. Recognizing that the job of a designer is to design solutions as problems arise requires a mature perspective that places the success of the project ahead of artistic vision. Dewey asserts "When an activity is continued into the undergoing of consequences, when the change made by action is reflected back into a change made in us, the mere flux is loaded with significance. We learn something."[11] Persistence is the mechanism by which even accomplished designers continue to grow and learn from their work.

The knowledge that students gain through the course is broad and addresses history, structure, ergonomics, material properties and behavior, visual literacy, perception, skill acquisition, time and resource management, collaboration, design and craftsmanship. Knowledge builds through tasks that repeat in cycles of increasing complexity and risk. As skills are acquired and understanding grows the projects become more sophisticated and refined. Design and fabrication are mutually informative and the play between them continues throughout the entire quarter. The greatest possibility for success is when they occur simultaneously and adjustments can be made as possibilities and challenges present themselves. The course is deliberate in providing an opportunity for students to make decisions and respond in the context of that dialogue.

CONCLUSION

The kind of knowledge that is critical to the competent and ethical practice of architecture is multivalent; it is physical and intuitive as much as it is analytical and rational. In taking a project from an idea to a built reality students gain intimate insight into the implications that their designs have for fabrication as well as the implications that materials, processes and technology have for their designs. By grounding their design work in the particular conditions of the project a context of value is established and through the negotiation of limitations and possibilities, unforeseen opportunities are disclosed. Students gain a fresh perspective on history, seeing it as a source of inspiration that is capable of giving their work value through cultural connections. They come to appreciate precedent for its ability to inform and improve their own work and by taking up what they learn from it they participate in a tradition.

Furniture Studio champions the long-term thinking that takes sound design as the best insurance of longevity and knows that longevity contributes more than any other aspect to an object's sustainability. Making imposes a degree of violence upon nature by consuming and transforming resources. This makes it an ethical concern and places a burden of responsibility on the designer. As educators, our responsibility is to design exercises and provide opportunities that frame architectural problems as cultural and ethical concerns, grounding practice in an ethos of inquiry and competent practice in order to "point the way towards a meaningful synthesis [of planning and making], by asking the right questions at the right time."[12] At the end of ten weeks, the students have a well-crafted piece of furniture that stands as a testament of the knowledge gained, the effort expended and the thought, care and collaboration put into its production. The students' gratitude, for the experience and for each other is always overwhelming. They leave the course with a strong sense of accomplishment and are, without exception, more confident and more capable designers.

ENDNOTES

1. Dewey criticizes an overemphasis of language in education because he felt that it led to the substitution of words for ideas. For him theory would remain lifeless and mute if not vitalized by significance through experience and experimentation that requires "us to use judgment: to hunt for the connections of the thing dealt with." See John Dewey, *Democracy and Education*, Kessinger: Whitefish, 2004, pp. 114-117
2. Dewey, *Democracy and Education*, p. 212
3. "In schools, those under instruction are too customarily looked upon as acquiring knowledge as theoretical spectators, minds which appropriate knowledge by direct energy of intellect." Dewey, *Democracy and Education*, 114
4. T.S. Eliot and Frank Kermode, *Selected Prose of T.S. Eliot*, "Tradition and the Individual Talent", New York : Harcourt Brace Jovanovich,1975. p. 37
5. Dewey, *Democracy and Education*, p. 130
6. See Donald Schön's Presentation "Educating the Reflective Practitioner" delivered to the 1987 meeting of the American Educational Research Association inWashington, DC
"Reflection-in-action is tacit and spontaneous and often delivered without taking thought, and is not a particularly intellectual activity. And yet it involves making new sense of surprises, turning thought back on itself to think in new ways about phenomena and about how we think about those phenomena. And examples lie in ordinary conversation, making things, fixing things, riding bicycles…"
7. Dewey, *Democracy and Education*, p. 128
8. Dewey, *Democracy and Education*, p. 114
9. "The first stage of contact with any new material, at whatever age of maturity, must inevitably be of the trial and error sort. An individual must actually try, in play or work, to do something with material in carrying out his own impulsive activity, and then note the interaction of his energy and that of the material employed." Dewey, *Democracy and Education*, p. 125
10. Dewey, *Democracy and Education*, p. 116
11. Dewey, *Democracy and Education*, p.114
12. Alberto Pérez-Gómez, "Architecture as Embodied Knowledge," *Journal of Architectural Education (1984-)*, Vol. 40, No. 2, Jubilee Issue. (Winter, 1987), pp. 57-58.