Catalyzing the Design Process: Search, Research, and Invention

RENÉE CHENG
University of Arizona

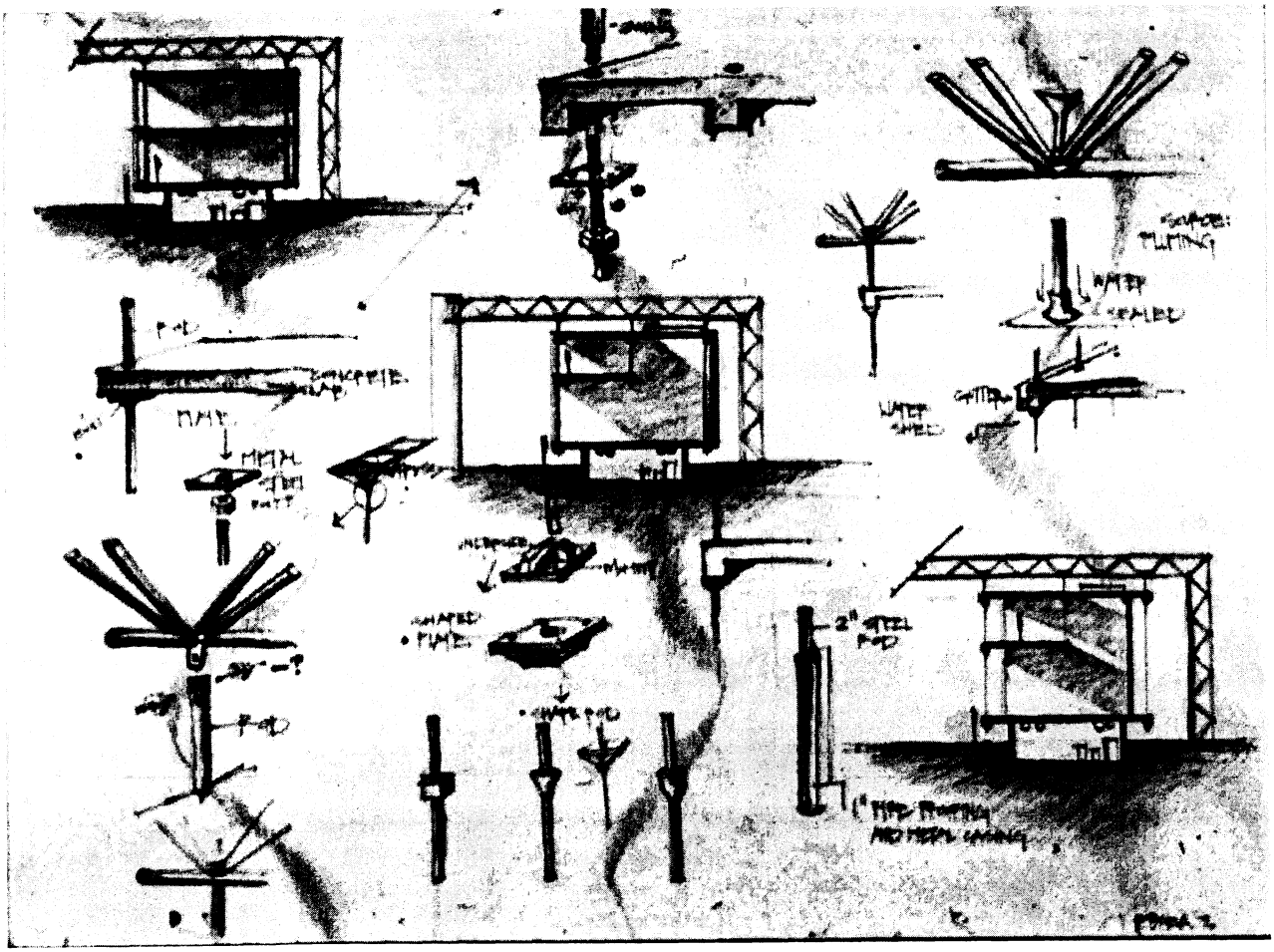

Fig. 1. Rebecca Saeva, design studies for studio project

"I never do a painting as a work of art. All of them are researches. I search incessantly and there is a logical sequence to this research. It's an experiment over time.[1]
Pablo Picasso

" try to love *the questions themselves* like locked rooms or like books written in a very foreign tongue. Do not now seek the answers live the questions.[2]
Rainer Maria Rilke

"When you have all the answers about a building before you build it, your answers are not true.[3]
Louis I. Kahn

The act of design is an inherently non-linear process. Unfortunately, the majority of a student's training prior to the design studio emphasizes a deductive approach toward a "correct" solution. In addition, the traditional, and often

most logical way that a building is explained is from the general to the specific: concept, plan, detail. What is seldom conveyed, and less often understood, is the importance of the constant cycling between program and inspiration, parts to whole, and form and experience. This constant tension between refinement versus reinvestigation is an essential part of creating a rich, fully realized architectural work.

The Bauhaus educator Josef Albers drew a distinction between "factual facts" and "actual facts".[4] Factual facts were finite and neutral compared to actual facts which were alive and likely to lead to more investigation. Actual facts were created by a combination of insight, critical understanding and "flexible imagination"[5] brought to bear on the factual facts. The design process that I seek to teach begins with the understanding the factual fact (1+1=2) is only the first step in the pursuit of actual fact (1+1 can look like 3 or more).

The series of exercises outlined in this paper demonstrates a process of design that is not about refining an idea towards an inevitable resolution, but embraces an ever-expanding search for questions. This process requires continuous integration of technical information with design ideas in a manner that may not be linear or systematic.

The potential of non-linear thinking is introduced by leading the students through a seemingly counter-intuitive process, moving from the specific (a building detail) to the general (that building's broader design idea). Studies are narrowed by focusing on one of 5 critical moments in a building: how it meets the ground, how it meets sky, the construction of the wall, how it turns a corner, the way an opening is made. Class lectures concurrent with the exercises are presented with the thesis that it is in these moments that intensely poetic architectural ideas become legible in their tectonic reality.

The exercises and lectures were developed for a construction class, but with the goal of closely following and informing the design process in studio. Students are asked to choose and study one building condition; examining its intricacies and possibilities from several perspectives throughout an eight week period. Each problem in the cycle draws from a different source: the pragmatic (a construction site), the sublime (a successful architectural work) and the poetic (their own work in progress).

Students identify the essential functional and aesthetic needs that the particular condition must address and find both conventional and innovative responses. For any given condition, the student has to describe the factual facts such as material tolerances, construction sequencing, weather proofing, and relation of structure to enclosure. After demonstrating a factual understanding, the student has to judge if actual facts are present: does the architectural form address the physical parameters in such a way that it supports or embodies the design idea?

The students' own studio project is used a testing ground to apply what was learned in each study. Returning to the studio project after a new set of information is gained is critical to forming a cycle of revision carried throughout the work.

EXERCISES

Exercise 1

The assignment is to make a measured drawing[6] from a construction site that the students observe regularly from the beginning of the semester. The goal of this exercise is twofold: to question assumptions typically made when making a drawing or using textbook information.

Here, the usual relationship of drawing and construction is reversed: the drawings are not a set of instructions for the built work, but documentation of what is real. Student begin to see the abstract nature of graphic symbols and drawing conventions when compared to the material reality of the construction site. Students are confronted with having to depict non-ideal field conditions: cavities blocked with trash, corners out-of-square, and mistakes caused by inadequate tolerances or construction sequencing problems.

Reference texts such as *Graphic Standards* and *Building Construction Illustrated* are used to identify and understand the assemblies observed. Only after the principles illustrated in these generic and "idealized" drawings are understood can the student interpret variations seen in the real life conditions. The students' frustration that the illustrations in the books do not match what is in the field is a useful demonstration that these are not "how-to" manuals but must be referred to as diagrammatic information.

The measured drawing is reviewed by classmates who must label or note each element and redmark the drawings for technique and content during an one hour "studio exchange" session. Drawings are re-submitted several days after the session, with the assumption that major revisions would occur.

Exercise 2

Using their own studio projects as the subject, students produce a drawing of comparable detail and resolution to the measured drawing in Exercise 1. In addition to the drawing, students submit a one paragraph written description of how the condition reflects the overall design intention and/or attitude towards material and construction in their entire project.

At this point in the cycle, the drawings are often näive and awkward. Most solutions are based on what will work functionally and often fail to achieve even this minimal goal. Configurations show major flaws in the logic of structure and enclosure and, more significantly, an ambivalent or uninspired attitude towards construction systems and materials. The problems with this initial attempt to design the detail are immediately apparent—illustrating the complexity of the task and number of issues remaining to be solved. The main goal of the drawing is to create a critical datum for the exercises discussed below. Instead of "correcting" the drawings, the studio exchange session focuses on diagram-

ming the design ideas and suggestions of how the diagrams might inform the design of the detail.

Exercise 3

In this exercise, students are asked to generate a drawing based on a published building. The choice of building is open, with the condition that a high level of technical information be available. In many cases, students find a built example similar to what they would like to do in their own studio project.

Students extrapolate an axonometric view by integrating information from several sources: two-dimensional drawings, photographed views, prose description and technical information. Graphic choices such as how the axonmetric is "exploded" should reflect an understanding of the construction hierarchy or sequence.

This drawing is reviewed in a "round-robin" format where students are grouped according to building condition and 6-10 professors rotate through the groups. Jurors with diverse interest areas ensure that the work is reviewed from a variety of view points: structural design, solar energy efficiency, design communication, historical context, etc.

Exercises 4 and 5

Exercise 4 returns to the study of the students' own studio project and the building condition begun in Exercise 2. Students are asked to produce a 1-1/2"=1'-0" scale study model that can be used to experiment with design options. Materials are kept abstract, and the models are frequently revised.

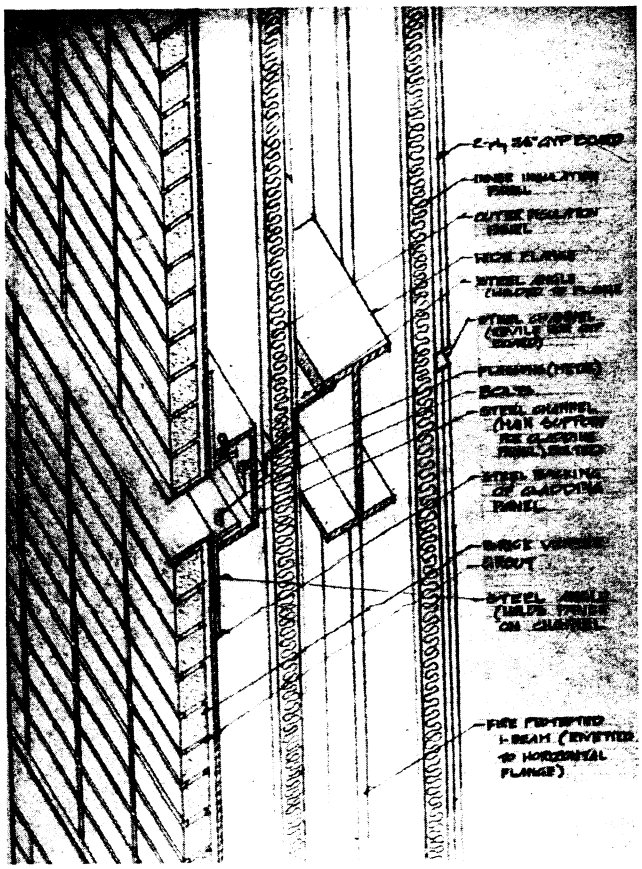

Fig. 2. Zachary Burns, drawing from IRCAM Building, Renzo Piano Building Workshop

The assignment for Exercise 5 is to build a final model based on the studies from Exercise 4 and to make necessary revisions to the drawing from Exercise 2. By timing this final submission four weeks after the study model and six weeks after the drawing, last-minute charrettes are minimized and time is allotted for thoughtful revision.

The work from this part of the exercise cycle shows the most marked improvement. Many students change from arbitrarily chosen materials and structural systems to strategies that utilize construction and materials to support a design intention. These changes affect the plan, section or massing of the overall project. In the most successful cases, students develop cogent ways of ordering their detail that inform their architectural language throughout the project.

Studio instructors, teachers from structures or mechanical systems areas, and — for the more resourceful students — manufacturers, find themselves called upon as "consultants" to provide information on the feasibility of a proposal and to offer alternatives. Students have ideas of architectural form that are far more sophisticated than their knowledge, a situation that creates the ideal condition for learning: the need to know.

CONCLUSION

In each of the exercises based on studio work the students are forced to address issues before they feel ready. The most commonly heard complaint is that the higher level of resolution required by the exercises is not possible because their "plans aren't set yet." The students' stubborn belief that design proceeds from the general to the specific is directly challenged by asking them to jump scale and shift focus. The discovery that decisions made during the design of the detail can actually help resolve plan or section problems is a revelation to many.

By locating the particular and tangible questions to be solved, these exercises set "boundaries for a task of free imagination."[7] Informed by sources that solve pragmatic problems and inspired by sources that elevate tectonics beyond mere problem solving; students understand not only the relationship between detail and idea but the framework in which their own invention can begin. The success of these exercises is measured in the students' ability to identify questions at many scales simultaneously, that is not the only aim; the goal of these exercises is to instill a love of questions through a cycle of search, research and invention.

NOTES

[1] Picasso, Pablo, "Interview with Alexander Liberman", in Dora Ashton ed., *Picasso on Art* (New York: Da Capo Press, 1972), p. 72. The interview was first published in Vogue Magazine in 1956.

[2] Rilke, Rainer, *Letters to a Young Poet.* M. Norton trans., (New York: W.W. Norton, 1962), p. 35.

[3] Kahn, Louis, *Light is the Theme* (Fort Worth: Kimbell Art Foundation, 1975), p. 53.

[4] Albers, Josef. *Search vs. Research* (Hartford: Trinity College Press, 1969), "One plus One Equals Three and More: Factual Facts and Actual Facts", pp. 17-23

[5] Albers, Josef. "One plus One...", p.19

[6] Drawings for all of these exercises were axonometrics drawn at 1/2"=1'-0" scale and were generally evaluated on demonstrated understanding of the assembly and clarity of graphic communication.

[7] Albers, Anni. "Work with Material", Bulletin 5, Black Mountain College, 1937. The context of the quote describes her belief - shared with Josef - that material studies should be used to train artist instead of encouraging artistic expression in art education. The inherent laws of materials...introduce the boundaries for a task of free imagination. This very freedom can be so bewildering to the searching person that it may lead to resignation if he is faced with the immense welter of possibilities; but within set limits the imagination can find something to hold to. There still remains a fullness of choice but one not as overwhelming as that offered by unlimited opportunities. These boundaries may be conceived as the skeleton of a structure. To the beginners a material with very definite limitations can for this reason be most helpful in the process of building up independent work.