ED ALLEN'S TOPAZ MEDAL SPEECH

SOME COMMENTS CONCERNING TECHNICAL TEACHING IN SCHOOLS OF ARCHITECTURE

I believe that almost all students of architecture enter school wanting to acquire a broad technical competence in structures, materials and methods of construction, and environmental control systems for buildings. They want to learn to design elegant structures like those of Santiago Calatrava. They want to learn to use materials as creatively as Renzo Piano. They want to become masters of daylighting and natural heating and cooling.

By the end of their first year, we have educated this desire out of them. By the end of their first year, they believe that studio is important and technical classes are not.

photo: *Lisa Heschong*

Ed and Mary Allen savor a post-award ceremony dinner.

MAKING TECHNICAL SUBJECTS IRRELEVANT AND UNATTRACTIVE

How do we do this? How do we destroy students' desire to learn the technology of architecture? Let me count the ways.

1. It begins with how we set up our curricula. Based on the fuzzy, fallacious notion that architecture is a combination of art and science, we slice curricula neatly into two widely separated parts—art and science.

- The art we call "design," even though art and design are not synonymous.
- The science we call "technology," even though science and technology are not synonymous.
- We teach "design" in a studio, which makes sense; studio is indeed the best place to teach design.
- We teach "technology" in a classroom, which makes no sense at all because technology is not science; it is the *design* of useful things and is most naturally taught in a studio format just like the design of the form and space of a building.

2. Having wrongly divided the curriculum and wrongly decreed that technical courses be taught in a classroom format, we set about deciding which technical subjects to teach.

When a team of building professionals is assembled to design a major building, there are, in addition to the architect, engineers who are expert in foundations, structures, HVAC, illumination, plumbing, vertical transportation, and so on. Of the members of this team, the architect is expected to be *the* expert in just one technical area. That area is *detailing:* detailing of the building envelope, detailing of interiors.

Detailing is very important. It is the architect's sole means of turning dreams into built reality, the language by which we instruct workers in how to assemble a building to achieve the result we desire. Skill in detailing is also the architect's best insurance against getting sued for buildings that leak, crack, or otherwise misbehave. Do we design our curricula to feature courses in the theory and practice of detailing? *We do not.* Few ACSA schools teach detailing in any organized way. NAAB says nothing about teaching detailing. It seems that we spend so much time teaching our students about the technical specialties of other professions that there's no time left to teach the specialty of our own. So we teach courses in structures, HVAC, acoustics, illumination—*but not in detailing.*

3. Having decided not to teach the technical subject that is most important for architects, we then set about deciding what to teach within each remaining technical subject. I will take structures as an example.

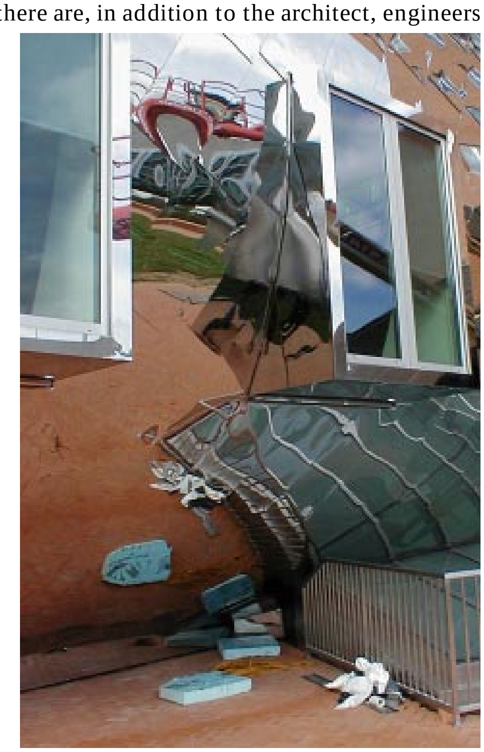

photo: *Bruce Haglund*

Fixing an insulation detail at Gehry's Strata Center.

If we make a list of all the steps in designing the loadbearing structure of a major building, it will start with explorations of site and soil conditions. It continues with choosing a structural material and a gravity-load framing system, laying out the framing system, adjusting the framing and floor plans to fit one another, designing and deploying a lateral load-resisting system, shaping long-span components, looking for opportunities to exploit the structural elements for architectural effect, and detailing the structure. It ends with checking assumed member sizes using mathematics to determine their adequacy. If we examine this list and identify the steps in which the architect is almost never involved, there is just one such step: checking member sizes using mathematics.

Do we teach all the other steps, the ones in which the architect is involved? *We do not.* Typically, we teach none of them. Instead, we teach only the mathematics of checking member sizes, the one step in which the architect is seldom involved. The saddest aspect is that after a student has been force-fed structural mathematics for the required number of terms, he or she is not only turned off structures forever, but still doesn't have an arsenal of mathematical techniques sufficient to do a complete job of engineering a major structure. The time spent learning the math has been wasted.

To summarize what has been said so far: Based on a misconception of what architecture is (more on this shortly), we have wrongly divided the curriculum into "design" and "technology." We have settled on the wrong technical areas to emphasize in our teaching. Within these areas, we teach the wrong stuff. Kafka himself could not have planned a more frustrating, ludicrous curriculum. Thus it should come as no surprise that most students dislike most technical courses. They quickly lose their desire to become technically adept. Their dreams of possessing the skills of Calatrava and Piano are soon forgotten. It's a great loss, both to students and to society.

MAKING TECHNICAL COURSES RELEVANT AND ATTRACTIVE

What can be done about this situation? What a difficult question. The Kafka-esque curriculum has accreted over an extended period of time into a rigid, unyielding structure. It is deeply embedded in the culture of the ARE and the requirements of the NAAB. It is ossified in the composition and preferences of the faculty members who teach technology at each school, most of whom are trying sincerely to do a good job, but who are not eager to change the way their subjects always have been taught. These are political problems that lie beyond the scope of this talk, and that will not be solved easily in many cases. Let us see what we can propose as first steps to implementation.

We need to begin by realizing that architecture is neither art nor science. It belongs instead to a third realm of intellectual endeavor called *design*. Design has it own distinctive goals and methods that are unlike those of either art or science. Its goal is to produce new products to solve human problems. Its methods involve venturing into a void in search of good-enough solutions to problems for which there is no single best solution, but many that will suffice, any one of which might be developed into an inspired piece of artisanry. The method of the designer is that he or she synthesizes and represents a potential solution to a problem, then applies simple tests and critical evaluations to determine whether the proposed solution is good enough or not. This cycle of synthesis and analysis is repeated innumerable times, exploring new paths, re-exploring old ones, combining, discarding, and adapting until a sufficiently good solution has been reached. *All of architecture is created by this method, including the technical subsystems of buildings.* (It may be contrasted with the "Scientific Method" and the self-involved creative process of the painter, poet, or composer, who works only to satisfy himself or herself.)

photo: *Tisha Egashira*

Ed demonstrates the magic of 'thinking inside the box' at the 2005 SBSE retreat.

A momentary, but important, digression: The academic world generally recognizes as scholarly fields of endeavor only art and science. This view has always posed problems for practicing architects and engineers who also teach. In order to build a case for tenure or promotion, many a designer has tried to become a researcher, an artist, a philosopher, or an historian. It's usually a bad fit. The method of the designer is an exquisite intellectual exercise that is fully equal to that of science or art, and we owe it to ourselves to enlighten our university administrations on this point. Designers ought to be able to qualify for academic advancement solely on the basis of their design work. (The failure of the world at-large to recognize the nature and importance of design raises other important questions that do not belong in this discussion and must be addressed in another forum.)

Returning to our argument, if we accept that the technical systems of buildings must be designed, then it follows that technical courses ought to be taught as design courses, preferably in a studio format, perhaps done as part of a "regular" architectural design studio, as a secondary studio taken concurrently with a regular studio, or as one or more design projects undertaken in a classroom course. In any of these situations, the most important principle is that mathematics and science should play supporting, not starring, roles. *Math and science cannot generate good forms for things,* they can only serve in the analytical phases of the design process to test proposed forms to see how well they conform to the criteria that have been adopted for the project.

The technical curriculum needs to be re-thought with the intention of offering the skills that the architect needs most: materials, detailing, selecting and configuring structural and mechanical systems, and managing the process of creating buildings. In each subject area, we must consider how much math and science is necessary to support the functions that an architect must perform, then include this amount and no more.

At the level of our individual course offerings, which is where a single teacher can make unilateral decisions and effect change in what we teach, let us look at a handful of examples of ways to make technology teaching more effective and attractive.

Students should *design* structures in every term of study, including the first. By bringing back the nineteenth century discipline of graphic statics, we can provide students with the tools to find form and forces for long-span structures: cables, arches, trusses, and cable-stayed structures. Statics teachers who have adopted this approach often have their students design their first long-span structure in the first week of class. By the end of the term, students produce final design projects that are elegant, practical, and exhilarating. They are hooked on the excitement of designing structures. They also understand structural behavior much more intimately than students who have learned structures through numbers.

We should be teaching students how to choose framing systems and design framing layouts for buildings, which are crucial skills for architects. We should also take up with our students the architectural implications of structural elements and systems, such as the many potential space-defining roles of columns, beams, and shear walls.

Many structures teachers hold fast to the idea that calculations represent the "fundamentals" of structural design. In fact, calculations serve only to check the adequacy of member sizes, not to explain structural behavior or indicate how to configure a structure. Furthermore, a long, intensive emphasis on the mathematics of structures has proven to be a very effective deterrent to the development of any interest on the part of students in the design of structures. Calculations have their role in architectural education, but it is not a fundamental one.

Ove Arup, one of the greatest structural engineers of the twentieth century said, "[Structural] design is not a science; it is a creative activity, involving imagination, intuition, and deliberate choice." The extent to which we teach creative activity, imagination, intuition, and deliberate choice in our structures classes is a measure of the appropriateness of our teaching.

Turning to Materials and Methods of Construction, my other area of teaching: Must we teach only the dry science of materials? There is so much more than the bare physical facts about materials and construction techniques that is important to the architect: color, patina, tactile qualities, texture and its interaction with light, thermal qualities, and fabrication and construction techniques. As with structures, students should be given design problems to solve, such as designing something as simple as a roadside produce stand, complete with dimensioned plan and sections, material selections, and details. Typical wall sections for studio projects, drawn at large scale, are also good exercises. Hands-on exercises, such as building a brick dome or framing a small building, create a tactile knowledge of materials and an awareness of building processes. It is also a tremendous motivator for students to learn the subject.

It's important to show and discuss actual projects in technical classes, especially buildings that you have designed and built. Students appreciate learning the thoughts and intentions that went into a project, how these were translated into materials, details, and structure, what went wrong, what went right, and how a given result was achieved. They can visualize themselves in the same situations and say to themselves, "Yeah, I could do that."

The technical curriculum should emphasize detailing in both structures and materials classes for the reasons given earlier. It's good to show students how an inspired detail, such as the open connection in Fay Jones' Thorncrown Chapel or the multiple columns in Helmut Jahn's United Air Terminal at O'Hare Airport, can make the difference between a good building and a great one.

CREATING MAGIC

In the final analysis, the most important thing about building technology is how to use it to create architectural magic. We may be able to visualize magic in our heads, but unless we have the ability to use materials and structure to make the magic real, we will fail to produce architecture. That's the major reason that good technology teaching is so important.

The biggest mistake we've made in our schools is to divide architecture and the architectural curriculum into "design" and "building technology," leaving a huge gulf between the two. Architecture is all one thing: Space, form, materials, structure, details, and environmental control systems all have roles to play in the making of a magical building. All must be designed, and all are designed by the same process. Therefore, for the sake of our students, we *must* learn, *we must learn*, to teach technology as design.

– Edward Allen, FAIA,
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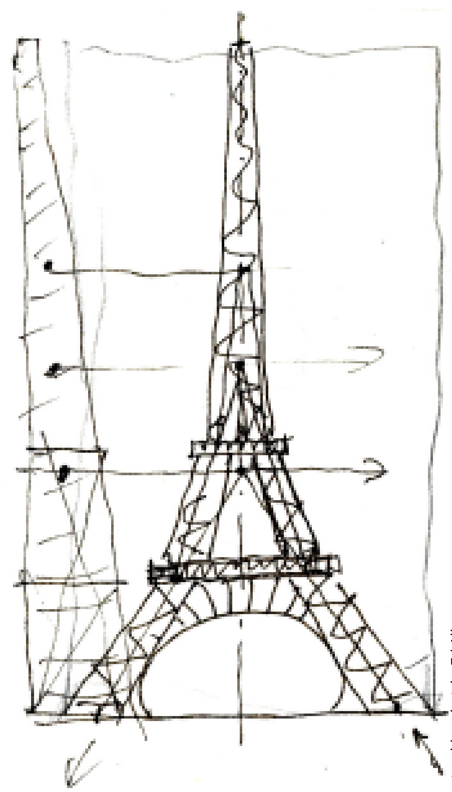

The Eiffel Tower was designed from force diagrams.