UNSTAKED TERRITORY:
Frontiers of Beginning Design

Proceedings of the 19th National Conference on the Beginning Design Student, Oklahoma State University, Stillwater, Oklahoma
April 3-5, 2003

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Challenging The Boundaries I
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Initial Terrain

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The Technology of Environmental Design Studio Production

O. JOHN SELFRIDGE
Kansas State University

The technology of studio production (tools, media, training, culture) used to record and present environmental design[1] ideas strongly influences the outcome. Give a first-year student five pounds of clay and the design solution(s) will likely differ from that when the technology is an ink pen with drafting film, or Basswood sticks and paper-covered foam sheets. Continued practice, experience, and an expanded database of precedents may narrow, or expand, the solution differences, or speed up the time-to-solution, but differences are likely to remain. It is not even unusual to see built examples, say of a building, where it is clear that the design work was done with a two-dimensional technology (drafting) showing evidence that there were conscious, perhaps careful, efforts at composition in elevation, but for which the three-dimensional considerations were not as well studied, or effective, as that which may have occurred if the design-process technology had included three-dimensional modeling.

This paper generalizes studio production technologies into three categories: freehand, drafting, and software. At one time, the third category may have been "digital computers," but the evolution (cost, functionality, availability) of personal computers is such that the current discussion is about the outcomes of given software, not the existence of computers. *Freehand* is the category in which marks are made with a free hand unassisted, except for the marking tool, by other drawing aids. Freehand is here also seen as "gesture," as in using a stylus on a pressure-sensitive tablet connected to a computer. *Drafting* is instrument-aided drawing through the use of t-squares, parallel rules, triangles, templates, drafting machines, pencils/ink pens, and the like. Drafting is here also considered as the drawing from computer-aided drafting (CAD) programs and thus overlapping with the category "software." *Software* is the means, the applications, whereby computers can do specific "work" and includes here visualization programs such as *FormZ, Maya, Rhino,* etc.

Out of all the objectives and topics that may, or should, appear in a first-year studio, here consider two: the drawing of shadows and the creating of perspectives. At one time the syllabus for the KSU first-year environmental design studios called explicitly for demonstration of awareness, understanding, and competency in communicating shade & shadow information. In support of this, our college has a fine teaching space, the Heliodon, a thirty-foot hemisphere with five rows of hourly sun-position lamps aimed at a table whose top represents forty degrees North latitude. In conjunction with the Heliodon, many of us use the solar-path diagrams such as those from *Architectural Graphic Standards* [2] to explain and teach shadow construction.[3] One conceptual difficulty with this approach is that although the resulting drawing is "accurate" enough, the drawing is only an instantaneous snapshot and fails to convey full information about the much larger dynamic process of sunlight. While such shadow construction is initially about geometry, sun position, and the appearances of objects in sunlight, I believe that the topic is a necessary and appropriate part of the first-year studio. I also believe that it is a good introduction to one element (the impact from our planet's sun) in the contemplation, analysis, and testing of proposed environmental

designs —and thus vital for evaluating the performance of a design and for considering the design's impact on future energy and other resource use (just to name two of many important considerations).

Perspectives are useful two-dimensional images illustrating the likely appearance of a not-yet-existing three-dimensional design. In environmental design, it is often some part, perhaps even a small part, of a larger proposal. I have long taught in first-year studios a perspective method built from (any) two parallel (horizontal) lines and a vertical line normal to them.[4] The technique allows for suitable accuracy in a quick (or finished) way on any drawing media, back-of-an-envelope to watercolor paper. When I meet with students in a fourth-year architectural studio, or observe the posted work of many upper-level environmental designers, I rarely see hand-crafted perspectives informing myself or others about the likely appearances and volumetrics of the design, or the progression of the design process. I do see a few renderings that I suspect are done after the design work has been completed and/or, for those using computers, elaborate scenes that envelope the design proposal.

Environmental design has gathered some benefits (increase in productivity, increase in the speed of some communication, etc.) from the availability of computer products developed for broader markets, as in those for the ubiquitous "office" or for larger, perhaps more valuable, industries as in the entertainment business, the mechanical design documentation and fabrication for the aerospace industries, as well as in what has perhaps become a discipline in itself, geographic information systems. Computerization within environmental design fields has taken several paths.[5] The dominate path within design practice is that of automating an existing workflow by replacing hand-crafting skills, as in drafting and typing, through investments and training in CAD and the office products of word-processing, spreadsheets, etc. Whatever other computer paths design-education institutions have taken (again, see Andia's paper in footnote 5), the practice-dominated influence of CAD has had its influence. In the KSU Department of Architecture, for example, most students, but not all, in their fourth and fifth year studios work with AutoCAD. In spite of the steep learning-curve for this program, some students flourish in this media. Other students struggle to merely replace their hand-drafting output with digital drawings. In many cases, student designs do not seem to illustrate more extensive potential-solution studies, or provide more sophistication, or account for performance (energy, lighting, life-cycle costing, etc.)—subjects that many have held out as the progress which computer-use would bring to university design programs.[6]

Could it be that some computer paths are counter-productive regards design outcomes or process, or at least for those examples of pre-professional design that occur within educational settings, especially those settings that include the beginning design student? The origins of this paper have been in the struggle over computer use (anti-use, non-use, some-use, any-use, appropriate-use?) in university environmental design classes and curricula, especially for the beginning students. The first year in the KSU College of Architecture, Planning, and Design is, more or less, a common program for undergraduate students who will in their second year enter the professional programs in architecture, landscape architecture, interior architecture & product design, or interior design. Eight years ago I offered a first-year studio that explicitly utilized computers, not for design per se, but for writing, spreadsheets, etc. Having promised at the time not to "do design," we did use the language LOGO to teach computers to draw and thus

inadvertently to make designs. For example, one assignment was to use LOGO to make a dozen different solutions for a trademark. For those who were already using Photoshop and other more advanced graphic programs, the use of LOGO was thought to not be a step forward, although it did clarify for some students what computers were doing and how they were doing it. In the meantime since then, computer power, price, general availability, speed, etc. have changed--certainly in directions all the more favorable to use by beginning students. New versions of graphic programs have emerged and vastly more complicated visualizations are both now possible and available to many students. Given all that, I am convinced that the **one** most-important change that has occurred in the last eight years is the availability of computer programs that purport to be about designing. They are what Goldberg refers to as "preliminary design tools."[7] The report that follows is about one such "preliminary design tool," *SketchUp*,[8] that was used in a first-year environmental design studio in the Spring of 2002.

The design program for the final project, a studio house, in the second semester of the first year identified a client, a few modest requirements, and a flat, rural site in a benign, but unidentified, climate. In my studio section, we extended those requirements with more (student-determined) characteristics of each client (height, weight, mobility, "taste," sex, etc.); with other fixed studio-wide client preferences regarding food preparation, bathing, work and leisure habits/schedule, etc.; and with a more complicated sloping site in a specific geographic situation. As with other studios, five weeks of nine class contact-hours per week were allowed for the project. A computer-assisting design program, *SketchUp*, was introduced at the same time as the project and what computer training as needed accompanied the project development and final presentation. Half the class worked in two-person teams, others worked individually. Some students acquired eight-hour free versions for their own computers, but most computer work took place in the twenty-station college computer lab that was available during some studio sessions and occasionally in the evening or on weekends. A final presentation model was the one item not accomplished by students in this studio; this studio's final presentations involved a digital presentation accompanied by an 11X17 bound report.

Eight out of fifteen students had prior exposure to CAD programs; none were taking concurrent computer-centered courses. Only one student did not have access to a computer beyond the many university labs around the campus; of those fourteen with personal access to computers, four did not have the "ability/opportunity to add software programs" of their own choosing to their machines. All reported using word processing in that semester; almost all used computers for web browsing and e-mail. On a ten-point self-reporting scale of "beginner" to "really good," the response range was between "3" and "10" and the mode was the six responses at "6."

Some difficulties were encountered. For example, the post-project student assessment gave opportunity for the students to remind all that the computer lab was obsolete[9] with comments such as "frustratingly slow," "need more RAM," etc. As it happened to be at the time of the experiment, the five best computers were already four-years old, others were even more underpowered and inadequate relative to the personal computers already available to the students, or those used in previous training. Some students reported awkwardnesses in the application program [*SketchUp*] regarding erasure limitations, difficulty in snapping to points, etc. In an open-ended question, a

third of the students mused that next or future versions beyond the then version 2.0 would be “great.”

Nonetheless, we persevered; the project was completed. Students reported further:

“…the program itself is [not] as important as the flexibility that we learned in dealing with the design process…”

[*SketchUp*] “allows us, as architecture students, to focus more on our actual design, and less on relatively pointless things like hatching, lettering, etc., because in the future such tasks will be done by computers anyway.”

“There were times during the project where I felt guilty as I was not in the studio room & the computer was much faster. Overall though, I feel that it was a beneficial experience as it allowed alternate routes of design.”

“The program itself has a very low learning curve and anyone wanting to learn will be able to gain enough skill to fulfill the demands of the syllabus. Apart from the usual human frustration with computer programs, I found the program to be simple and easy to use. In fact I don’t think that the worries in the class were as focused around the program as much as the fact that all the other studios were doing something else…”

“It is good for those without CAD experience.”

“The work was tons less tedious, but the final project came out looking as good, if not better.”

“I think all of the studios should use the program on at least one exercise.”

In response to the question “Now having a month of experience with the current version of *SketchUp*, would you recommend that future first-year studios use such a computer program,” sixty-nine percent of the students marked “yes,” thirty-one percent marked “maybe,” and no one marked “no.” Even the student who rated the “experience relative to the outcome product” as a “5” on a “satisfied” to “unhappy” 1 to 5 scale, voted to recommend that future studios use this software.

The survey was anonymous and not read until after the grades for the semester had been reported to the registrar. I do hope that the responses were a fair reflection of the actual student experience/belief and not overly influenced by the bias, perhaps even an explicit enthusiasm, of the instructor toward the project and the use of the software.

I observed the following from the project and class experience utilizing this particular “design” software in a first-year environmental design studio:

Unlike CAD and other drafting software programs, *SketchUp* has a sufficiently short and shallow learning curve such that it can be introduced and effectively used in a five-week project and 1) still have the design goals and objectives be met and 2) not have the course appear, or feel like, a computer-instruction class. Students, I suspect mostly those with prior CAD exposure, were generating simple examples and creating shadow animations within twenty minutes of being introduced to the new software. Students

generally had few questions by the start of the next class session. Students were informed of the more than thirty tutorials/demonstrations/explanations that were available both on the computer lab server and from *SketchUp*'s web site. I believed these tutorials would be excellent teaching modules in lieu of a manual or some other guide. However, seventy-five percent of the students reported looking only at "five or fewer" tutorials, twenty-five percent reported looking at "6 to 10" tutorials, and no one reported looking at more than ten. If nothing else, there appears to be a generational gap in how one learns and/or uses software since I looked at them all, some more than once.

Students were asked for specific diagrams or illustrations, but were not told exactly "how to" solve for those needs. Students were able to think or hack through to effective solutions, many of which were novel. In turn, that information self-distributed itself throughout the class—or at least to those who asked other students (or the instructor after a solution had already been discovered or invented by an intentive student). For example, the drawing requirement list included a "section/elevation" and a "section/perspective." There were a variety of solutions to this requirement. Especially interesting were those that presented the cutting section plane and the building interior beyond the cut together as a perspective. This is contrary to some conventions, but given the ease at which it could be obtained, the diagrams were instructive as to what was transpiring in the proposed design. In addition, a pair of students discovered that the cut material sections could be made a selected color. This led to transverse section cuts being one color, longitudinal sections being another color, and both planes with their respective colors being shown as cutting through a small perspective image of the whole object. Soon thereafter, others in the class utilized the same technique.

If a student is asked to make a perspective drawing, the time-investment required to complete the exercise depends upon the skill/knowledge of the student, the complexity of the object, and the use to which the image will be put, or the audience for which it is intended. Since even a student's time is valuable, I hesitate to ask a student to create a perspective drawing that will be distorted, i.e., will be outside a "normal" range of acceptability for environmental design, just to prove a point as to what really is "distortion" in linear perspective. Yet there is something to be learned with "good" and "bad" examples. *SketchUp* solved my dilemma. As part of the final presentation, I asked for examples of images with cones-of-vision set at 10, 20, 30, 40, 50, 60, 90, and 120 degrees. Once a station point is located, these images are but a key-stroke away. Some students acknowledged "distortions." Other students adjusted the station point, orientation, or view selection in order to produce "acceptable" views for each cone-of-vision. Either way, I believe an important lesson was learned/seen beyond what had hitherto been the gains from reading, say the perspective chapter in Ching's *Architectural Graphics*,[10] or from the happenstance of "errors" produced by a class doing some perspective exercise.

The project program asserted that the poet/writer client wrote in bed from 6:30 until 10:30 every morning when in residence. To meet this requirement, students needed to identify appropriate writing resources and the ergonomics of such a workstation. To reinforce the value of this situation, students were asked to provide perspectives of the view-from-the-bed as would be images captured by wide-angle (15mm), normal (50mm), and telephoto (135mm) lenses on a 35mm camera. Once a student figured out the client's eye-height and orientation when sitting at his/her writing station, the choice of lens can

be specified in *SketchUp* and the image produced. This completed a circle of teaching/learning that began earlier in the semester with free-hand sketching and the parallel-line perspective method (it uses trigonometry to locate the ground line and thus the picture plane), followed by actual 35mm camera and lenses to "prove" the perspective method (again with trigonometry), and ending for the semester with the replication via *SketchUp* of images within the student's proposed design as if photographed.

The contribution from *SketchUp* of an individual student's design process was in her/his ability to do a walk-through the whole design, to check views, and to test volumetric relationships at every step. What can be seen inside and out from that very chair? What happens at the top of the stair? What is the visual "feel" to the hallway? Questions such as these can be asked. Fortunately, beginning students can seek answers readily in *SketchUp*. Professionals can know about such questions and answers, but by and large because of their experience. Students are short on experience. *SketchUp* gives even beginning students some tools to visualize designs and test them at a faster pace through digital simulation that they, and their upper-level colleagues, are inclined to do by hand in design studios.

At twenty minutes into the introduction to *SketchUp*, some students were making shadow animations for a day and at a place of their choosing. If you determine the day-of-year (any day, not just the twenty-first of a month) and save (properly) the designed image with the shadow-casting turned on, say at 8:05 AM; then set the time of day to noon, save image; set the time to 5:16 PM (or whatever end-time one chooses) and save—the result will be an animation the shadows cast by and around the design for the whole time-period. Although the animations did not make it into the final presentations (that turned out to be just outside the skill-level at the end-of-semester rush), shadow studies were used by most students in coming to their recommendations for this project.

If the heights and foot-prints were given for, say, a dozen buildings surrounding a downtown property scheduled to be a park/open space, an "average" beginning-student (with the current KSU typical entering-student computer expertise) could produce a massing study in a half-hour to one hour after one class session with *SketchUp*. In the next hour, the student could make an animation of the shadow patterns impinging on the site for a whole year. This could be a sample of one day per month, two standard times per day, for twenty-four saved images at a generous two minutes per image plus some time to decide how to separate the days. Then the student, and any others interested, could run the animation over and over as part of the site analysis. Later, study proposals could be added to the animation to test them—for the whole year. I believe the ability to quickly illustrate this aspect of the dynamic qualities of daylight is a rewarding investment in time and a considerable improvement over the single-day, single-hour method, and even more so over doing no shadow analysis at all.

I conclude the following from this teaching experience:

I am pleased to find there is at least one computer software program[11] that will allow beginning students to concentrate on design, spatial volumes, and the performance of their environmental designs throughout their own design process and into mid-crits and final presentations.

With this experience with a new class of design software, I am convinced that our attention to drafting, including CAD, is misplaced. My slogan has become *Drafting is not*

equal to Design. I believe that we would best serve our students and the environmental design professions if we would concentrate on free-hand communication and on using *design* software for the beginning student and throughout the respective curricula. Upper-level students would carry the preliminary design arrived at within software programs such as *SketchUp* into more advanced visualization programs without a detour into CAD. And their abilities to express themselves directly with free-hand media will enhance not only the design processes (including input into tablets and other devices), but also the final products in place in the environment.

The new software gives opportunity to revisit curricula for beginning students, to actually compare and test different approaches as to effectiveness in realizing designs, and for retention and reapplications of prior learning in new and the next more challenging project. I, for one, am busy designing the new teaching resources appropriate for exploiting the opportunities made possible by the emerging software keyed to environmental design.

In addition to research into content and pedagogy that we should be doing anyway as the *scholarship of teaching*, I see that, because design-not-drafting software is not following the CAD and visualization trajectories of prior computer revolutions in environmental design, there are new and additional opportunities here to study innovation,[12] the steps and process whereby changes are brought about, in this case, in environmental design fields.

Notes

1 Here, "environmental design" relates to curricula for those students seeking professional degrees in architecture, landscape architecture, interior architecture, interior design, and/or planning.

2. Robert Packard (ed), Ramsey/Sleeper architectural graphic standards (NY: John Wiley & Sons, 1981) 80-81.

3 Other faculty teach the 45/45 drafting technique as a means to create shadows on orthographic drawings. Some students have had no exposure to shadow-drawing techniques. In both cases, students come away with no information about the location of the sun, nor is there resulting drawing evidence that the particulars of a specific place has impacted their design proposals.

4 See Nicholas Dines, Landscape perspective drawing (NY: McGraw-Hill, 1990) for an excellent exposition on this technique, including its mathematics and varieties.

5 See Alfredo Andia, "Reconstructing the effects of computers on practice and education during the past three decades," Journal of Architectural Education (2002) 56(2):7-13 and Scott Johnson, "The slow and incremental revolution," in the same number, pages 49-54.

6 Scott Johnson, "The slow and incremental 'revolution'," Journal of Architectural Education (2002) 56(2):49-54.

7 Edward Goldberg, “New digital design tools spark your creativity,” Cadalyst (June 2002) 19(6):24-29.

8 *SketchUp* is a product of @Last Software, Inc. All rights reserved. Information is available at <www.sketchup.com> .

9 At the time of this use, five of the machines were 500MHz Pentium IIIs with 256MB RAM and Diamond Viper V550 video cards, five were 266MHz Pentium IIs with 128 MB RAM and ATI video cards, and ten were 166MHz Pentiums with 32 to 64MB RAM and Matrox Millennium video cards. The good news for us is that they have now all been replaced with 2GHz Pentium IVs with 256MB RDRAM and Abit 128 video memory. Go to <www.sketchup.com/tech_specs.php> for information about current requirements and recommendations for SketchUp on Windows or Mac OS X machines.

10 Francis Ching, Architectural graphics (NY: John Wiley & Sons, 2003) 87-124.

11 Autodesk’s *Architectural Studio* is another program that Goldberg lists as a “preliminary design tool.” I have not used that program and cannot review it, or compare it to *SketchUp*.

12 See, for example, E.M. Rogers, Diffusion of innovations (NY: Free Press, 1995).

Bibliography

Andia, Alfredo. “Reconstructing the effects of computers on practice and education during the past three decades,” Journal of Architectural Education (2002) 56(2):7-13.

Ching, Francis D.K. Architectural graphics (4th edition). NY: John Wiley & Sons, 2003.

Cuff, Dana. “Digital pedagogy: An essay,” Architectural Record (2001) 189(9):200-206.

Dines, Nicholas T. Landscape perspective drawing. NY: McGraw-Hill, 1990.

Goldberg, H.Edward. “New digital design tools spark your creativity,” Cadalyst (June 2002) 19(6):24-29.

Impelluso, Tom and Tina Metoyer. “Virtual reality and learning by design: Tools for integrating mechanical engineering concepts,” 30th ASEE/IEEE Frontiers in Education Conference, 18-21 October 2000, Kansas City, MO.

Johnson, Scott. “The slow and incremental ‘revolution,’ Journal of Architectural Education (2002) 56(2):49-54.

Packard, Robert (editor). Ramsey/Sleeper architectural graphic standards (7th edition). NY: John Wiley & Sons, 1981.

Rogers, E.M. Diffusion of innovations (4th edition). NY: Free Press, 1995