A Design Perspective on Spatial Thinking for Spatial Thinking Across the College Curriculum

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In a recent NY Times op-ed piece, architect Michael Graves (2012) wrote, “Drawings are not just end products: they are part of the thought process of architectural design. Drawings express the interaction of our minds, eyes and hands.” That interaction between the minds and hands is an expression of the commonly held belief in undergraduate design education that drawing and designing are fundamental to developing spatial thinking. Whether studying 2-dimensional representations or working to better understand 3-dimensional space, architecture and landscape architecture students spend a tremendous percentage of their time in college improving their spatial cognitive skills. As accredited degree programs, design curricula are often structured around a larger credit load and higher faculty contact time, and even higher time commitment for student work compared to other undergraduate curricular approaches.

At the heart of design education is the design studio. This is an intense problem-based learning environment (Tulloch and Graff 2007), known on many campuses for its late nights and long weekends of work. Bearing in mind the underlying fundamentals of spatial thinking behind even basic design exercises, design studios require students to rapidly advance their spatial skills through an immersion in the studio environment. Aside from the rapid immersion and problem development, this environment is also characterized by the applied problems that constitute the core of most studio instruction and result in formative approaches to spatial problems requiring interventions. Because of the learning curve and broad knowledge required, about half of the undergraduate LA programs in the US are offered as 5 year degrees, adding greater depth to the immersion experience. In the same way that geometry and geography are clearly different, but both inform spatial cognition, spatial design, particularly landscape architecture, has a very large portfolio of unique experiences and lessons that should be integrated into any serious study of spatial thinking in higher education.

Sensory learning
In studio settings, some commonly used preliminary exercises with this impact include: freehand drawing of forms, freehand drawing of negative space, rapid construction of small-scale models, rapid construction of large-scale models, measured drawings and field work. The effect is that, collectively, these lessons create a deep awareness of space and spatial relationships for many of the students, and they do it through a wide variety of sensory connections. Many of these exercises might only work in fairly specific settings, but they represent a large realm of educational experiences that warrant fuller exploration for spatial education.
Drawing exercises and courses represent a large category of these sensory exercises. Freehand drawing places an emphasis on creative viewing of our personal environments. As students explore edges and surfaces, they often engage in a freehand technique called contour drawing (decidedly different than contour mapping). To better develop a sense of space, they will also draw the “negative space” between complex, overlapping objects.

Measured drawings (i.e., mechanical drafting) might begin with traditional blocky forms, reduced to 2-d or represented in 3-d axonometric representations. Cross-sections and elevations are also among basic spatially-oriented drawing exercises. For a deeper experiential memory, some classes use early exercises of measuring and drawing existing landscape features based on field measurements. This might mean a detailed cross-section of a city street, capturing each change in material and surface. Or it might be a full-day effort to construct a measured quadrat drawing of a single tree. Taking these experiences a step further is the development of built scale models of both built spaces and natural landscape forms. While some of these skills are formally taught, many are simply learned through frantic immersion into a project with specific needs.

Perhaps more than other design fields, landscape architecture relies heavily on the field trip as a spatial education experience. Our program uses annual 4-day program-wide trips to pack our students’ sensory memory bank with experiences linked with spatial lessons. When visiting the FDR Memorial in Washington DC the muffled or reflected sounds of planes leaving Ronald Reagan National Airport create multiple opportunities in space and distance. The amazingly long, but relatively narrow, reflecting pool at Boston’s Christian Science Plaza allows students to compare plans with experience, to pace off a large object in the field. Students (and eventually professionals) find these memories of spaces to be tantalizingly vivid years later when they need to imagine a parallel space or experience or distance.

Design studio
The design studio is one of the most identifiable icons of design education. These are commonly treated as required core classes for anywhere between 5 and 10 consecutive semesters, with one class sometimes being 6 credits for 12 contact hours over three days a week. While the formats vary somewhat, they often revolve around studio classrooms spaces that are accessible 24/7. For many, the entire semester might build on a single extended design project, employing methods sometimes described as problem-based learning, to address a spatially-explicit problem. With relatively limited introductory instruction in map-reading, students are quickly immersed in the process of using, drawing, and imagining space and form in ways that will take years to master.

Studio’s high contact time is meant to allow one-on-one interactions between faculty and students (desk crits). Since students are often asked to quickly display their current unfiltered spatial abilities, instructors can address some shortcomings individually rather than with the entire class. It is a much less rules-based and more needs-based approach to spatial learning, with clear shortcomings and benefits.

One of the most notable differences between design studios and lecture classes are the decisions that students make throughout the class. Confronted with an assigned problem, they
acquire knowledge of the site and the problem, develop alternative solutions to address the problem, and ultimately choose and refine a preferred solution. Since these are spatial problems, the exploration is also spatial. On large projects they may use GIS to develop inventory and analysis materials, but on smaller sites designers may rely more on personal observation and sketching. Landscape architects synthesize these complex spatial patterns and information (whether digitally or mentally or both) to inform their decisions. And those decisions, or designs, often require iterative development of alternatives. After 6 semesters of this, students have accomplished an impressive amount of spatial learning and yet find themselves far from the level at which practitioners often operate.

**Evaluating spatial thinking talent versus skill**

With such specialized facilities and specific accreditation requirements, a number of the undergraduate design programs employ either a program-specific admission process (often in the guise of other names like “limiting enrollment”). The approaches vary widely. One architecture program offers a 1-day “exam” which tests both spatial thinking and creativity with unusual drawing exercises and construction paper puzzles which are then blind-reviewed by faculty. A student untrained in drawing may struggle with some exercises, but shine on others. At the same institution, the landscape architecture program relies mostly standardized test materials that test both visual and spatial acuity. Still others require a semester or more of instruction at their institution, which not only tests their spatial abilities but also tests their ability to learn spatial thinking.

These processes are based on a key set assumptions that are relatively untested. Are spatial cognitive skills inherent and testable without preparation? Are they universally learnable? Decades of design instruction have led a number of design programs to believe that, in some cases, spatial perception and thinking is demonstrable in a way that should change the course of students’ academic careers.

**Overlap between geography and design**

It is not news that landscape architecture and geography overlap. But, reflecting on that overlap may highlight new areas of investigation. For instance, there has been a growing area at the intersection of these and other fields called geodesign. As geodesign has emerged (with a 4th annual meeting planned for January 2013), it has explored the shared territory and the key differences. An interesting divergence that came up at one of these meetings was that the two fields describe different scales using the same words but with opposite meanings.

An historic example of this shared experience is the spatial software innovation hub that was the Harvard Computer Graphics Lab from the mid-1960s to the early 1980s. This lab, housed in Harvard’s Graduate School of Design, benefitted from the depth of spatial theory in geography and the creative approach and goal-based needs of planners and designers in creating some of the most important spatial software in the world.
Spatial education lessons and questions (as if they are different)

These different approaches from landscape architecture all highlight a significant value in active learning. The self-guided explorations, coupled with tactile experiences, potentially lead to much deeper memories of the specific spatial lessons. And yet, the design approach is time consuming and difficult to justify in other curricula. While a well-trained geographer and landscape architect both have clearly demonstrable spatial abilities that have been learned, it remains unclear how similar their understandings of space and scale and dimensionality are or whether (as a group) they have similar abilities to analyze and synthesize spatial information in similar ways. Still, there may not be a more rapidly applied or more deeply-based immersion approach to spatial education, than what we see in studio.

We still don’t know much about these approaches to learning spatially. From the time they commit to design, landscape architecture students have committed to interventions and what Graves calls “formative actions” while non-design disciplines start with more open inquiries and explorations. Does a focus on decisions and interventions alter a student’s perspective on space? Do the realities of professional practice impose an urgency that forces clarity or carry a burden that limits critical spatial thinking? Ultimately, do the less literal exercises add or detract from spatial education?

Finally, there is merit in asking whether all students (or at least a substantial subset) should be required to complete a first-year class in spatial awareness. But an examination of design adds the possibility that some groups of geographers/cartographers might progress more rapidly after beginning with a drawing class or immersive design studio.