Spatial Thinking Across the College Curriculum

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The nature of space, spatiality, and spatial thought are all near and dear to my professional heart as a researcher and teacher (I even ponder them when I’m off duty!). It is clear that these topics find their way into the materials of a broad array of college courses, typically implicitly. In the context of this Specialist Meeting, five issues strike me as particularly important and interesting:

1. Generality. What are the prospects for teaching spatiality explicitly as a distinct and general topic or skill as opposed to teaching it within the context of particular topic domains, such as physics, geometry, geography, and literature? Recent research documents that spatiality is found across the disciplines, including natural science and math, social science, humanities, and arts. Research has also been exploring the nature of spatial concepts and skills both within and across disciplines. Is there a modestly sized set of general spatial concepts and skills that transcend disciplinary and topical boundaries? Or are such concepts and skills inextricably bound up in specific topical or disciplinary domains? Is a hybrid approach optimum that identifies spatiality within domains but explores its generality across domains? For example, should we explore the meaning and use of the concept of “distance” within physics, economics, transportation, and sociology, and then explicitly compare it across these disciplines?

2. Scale. Are there spatial concepts and skills that are general across scale (size), treated either as discrete classes or a continuum? Montello and Golledge (1999), in their report on a Project Varenius Specialist Meeting, discussed minuscule, figural, environmental, vista, and gigantic spaces. They claimed that spatial cognition and behavior are at least partially distinct within these scales, and a variety of theoretical and empirical arguments provide some support for this idea. For example, humans interact with and apprehend spatiality at different scales with different sensorimotor systems, and some research finds that pictorial psychometric spatial tests do not measure environmental spatial skills (such as wayfinding ability) very well. Is spatial scale an important or even necessary basis for distinguishing types of spatial thinking in an educational context?

3. Geometry. Montello and Golledge (1999) further distinguished figural space as either pictorial or object space. How important is it to recognize distinct spatial concepts and skills as a function of the dimensionality of space? Also, spatial thinking is thinking about spatial properties, and those properties include both metric (or at least quantitative) properties like distance and direction, and nonmetric (qualitative) properties like containment and connection (technically, nonmetric geometries include not only topology but projective and affine geometries). How should the varying possible geometries be incorporated into spatial
education? Should we recognize that mathematicians might distinguish geometric properties differently than lay people do?

(4) Spatial vs. Visual. Historically, scholars from a variety of disciplines have tended to conflate “spatial” with “visual.” For example, one of the central dimensions of psychometric spatial ability is known as “spatial visualization.” As another example, people often conflate spatial thinking with mental imagery. But research is accumulating that “spatial” is psychologically distinct from “visual” or “imagistic.” It is likely that the role of spatial in some disciplines is primarily one of visual appearance. How should we treat this issue in the context of spatial education?

(5) Time. Finally, it is clear that temporality may be as ubiquitous and fundamental as spatiality is in reality and experience. Many researchers (for instance, in GIScience) repeatedly remind us of how fundamental time is, often going so far as to insist on terms like “spatio-temporal” instead of “spatial.” And don’t forget the insights of 20th-century physics. However, I see the conceptual clarity of an abstraction that recognizes stable spatiality (e.g., pattern) without dynamic change. True, unchanging reality might be nothing but an artificial abstraction, but that doesn’t mean it has no conceptual value. I think many applications of spatial thinking across disciplines are distinct from time and dynamics. Should this be recognized by those designing spatial educational curricula? Or should we insist on the involvement of time and dynamics at every turn?