Spatial Thinking: Learning Outcomes and Spatial Meta-Concepts

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I have had the distinct pleasure of exploring and considering spatial thinking from both bottom up and the top down perspectives. The former has come in the form of my primary research interests in spatial cognition, spatial knowledge acquisition, navigation, and scale. The latter, has been a direct result of my role as leader of the twice yearly GIS Institute at Harvard and similar teaching experiences with university level students and above. The Institute has exposed me to the process that emerging scholars must pass through to effectively integrate a spatial perspective into their research. The challenges of each of these are unique with some interesting overlap that might offer an avenue to explore the primitives of space and building blocks of spatial thinking.

Learning outcomes and program goals are an effective mechanism in the development of curricula and teaching practices. As I will advocate later, integrating space into college, program, and course level learning outcomes is an important first step, but should not be the final goal. Identifying a common lattice, or set of lattices, from which spatial knowledge and spatial thinking can be developed is the logical extension that can ensure its deep curricular integration. The first step in this process is a better understanding of meta-spatial concepts that might serve as the lattice. Once such concept with which I am most familiar is scale, both as it defines the spatial extent of study and how changing scale can affect the nature of other spatial concepts.

As an educator I have worked with elementary school students, undergraduates, graduates, and faculty in the broad area of geographic knowledge and spatial thinking. I have developed undergraduate courses that are intended to knit together the central themes of geography (more than space and place, but I find those a good starting point) with a spatial perspective that employs GIS as the lens through which knowledge can be created. The experience of seeing undergraduate students from diverse backgrounds struggle with and eventually succeed in applying spatial concepts in an analytic research environment had a direct and positive influence on my later development of similar training for the already seasoned researcher.

The challenge of working with researchers with a well developed sense of their disciplinary epistemology poses both challenges and opportunities for scholars in fields with a sense of the spatial dimension (not just geographers). Other disciplines’ unique ways of creating knowledge forces those scholars to consider new ways of knowing (like taking a spatial perspective, spatial thinking, spatial analysis, and spatial communication) within the context of a well defined landscape. Finding common language is one of the first hurdles; fortunately one of the advantages of spatial language is that the naïve or lay definitions for certain terms is often not
that far from the formal definition of the term (cluster, dispersion, random, etc.). Bridging scholars from the naïve to the formal is a process that often has satisfying results. However, one of my biggest challenges in shepherding scholars on the spatial path is ensuring their spatial turn doesn’t dominate and that as the spatial “expert” I don’t dominate either.

In a shared search for knowledge it is often the leader, or teacher, who takes the dominant role; taking a step back and allowing the student to lead is an important step toward allowing space and spatial thinking to augment the process of knowledge development, not control it. Furthermore, this role reversal often leads to discoveries about spatial thinking and the nature of space and spatial analysis that are only revealed in context sensitive settings, some of which might have been previously unexplored from spatial perspective. In my own teaching I often use the concepts of “units of analysis” and “area of study” to help researchers develop an understanding of the spatial dimensions of their work. This is a useful bridge for researchers from a wide range of fields, despite the quantitative or statistical sound of the terms. Researchers from the humanities, social sciences, sciences, and engineering, understand the importance of scoping the work they are doing and clarifying how they will do their work. From a spatial perspective it gives them some solid ground from which to begin exploring the power of space.

Scale is also an effective tool for spatial thinking. Naïve learners, children, and seasoned researchers can all come to understand the importance of space through scale. Cognitive scientists have documented the role that spatial extent plays in the solution of common problems. Spatial search conducted on a desktop is quite distinct from spatial search conducted in a city. That the difference in those real world settings is manifested in how the problem is conceived, planned, and solved cognitively is a testament to the importance of scale and space to how we think spatially. Scale can change the way we use frames of reference, landmarks, and the cognitive mechanisms we employ when making spatial decisions (facing spatial problems).

Here scale is a useful tool to consider how we might link the seasoned researcher or college student with the child or naïve problem solver. The researcher might focus on the spatial extent of their study site and implications this choice has on data selection or relevant units of analysis. On the other hand using a variety of scales (spatial extents) to explore mapping or spatial arrangements in an elementary classroom can expose students to the role that space and scale have on how we think about the world around us. Exposing students to a broad range of spatial concepts and primitives is a laudable goal; enhancing this knowledge by reinforcing how the response to changing scale is equally important, more so if one of our goals is the development of flexibility in thinking and problem solving. Some concepts might be more or less sensitive to scale. A frame of reference essential in small spaces, like an egocentric frame, might be inappropriate at a different scale. The flexibility with which a person can adapt to changes in scale is one way to approach teaching and learning or to identify strengths and weaknesses in spatial thinking.
Considering scale, or other meta-spatial concepts, as structures from which we can organize and deliver training in spatial thinking and problem solving would be an interesting sub-goal of the workshop. It is important that we don’t assume we know how such meta-concepts affect other spatial concepts or learning goals. Identifying learning outcomes is a simple first step, but achieving such outcomes while reinforcing spatial knowledge should be a central goal of a community interested in the integration of spatial thinking across the college curricula. The importance of space to the community of scholars meeting in Santa Barbara in December is not in doubt. However the development of an effective strategy for deploying spatial thinking across the curriculum takes more than agreement; developing strategies that effectively emphasize the power of space for all disciplines is of paramount importance.