Spatial Thinking in Undergraduate Research

DAVID O’SULLIVAN
School of Environment
University of Auckland—Te Whare Wānanga o Tāmaki Makaurau
Email: d.osullivan@auckland.ac.nz

This meeting comes at an opportune moment for me, as I take on the role of “GIS” program(s?) director at my university, and as a result I am keen to attend. The “GIS program” at the University of Auckland finds itself at an important crossroads in its development. This is brought on in part by local circumstances, but more significantly by changes in the meaning of a “GIS education” in the last 5–10 years, which are driven by (i) a need to consider what it means to think spatially in (quantitative) geography, (ii) the changing relationship of disciplines other than geography to GIS and allied technologies (GIS&T), and (iii) changes in the technological context.

Thinking spatially in geography, or: back to the future (again)
In the contrarian fashion of a native of Belfast(!), it is a (rather informal and underdeveloped) pet theory of mine that the emergence of GIS from the mid 1970s into the 21st century has been to the detriment of a “thinking-person’s quantitative geography.” By contrast, I am constantly surprised at the rich seams of elegant spatial thinking that underlie earlier developments, in the pre-GIS heritage of geography. For all our present embarrassment of riches in data and toolsets, it is to Abler, Adams and Gould’s Spatial Organization (1970), or Tony Gatrell’s Distance and Space (1983), and the work of Tobler, Haggett, Golledge, Wilson and others that I turn for inspiration, when I consider what classes in “spatial thinking” might look like! Even allowing that the passage of time is required for “classics” to mature, this is a little strange! More optimistically, now that a geospatially-enabled world exists, and interested communities have time to step back from the details of designing and implementing the tools that now surround us, it seems like the stage is set for new classics in that earlier vein. I am therefore keen to be involved in thinking through what spatial thinking means both for tertiary education across the board (and for the analytical tradition in geography more specifically).

An idea that may hold some attraction in this context, is a pattern language for spatial thinking, drawing on the same general concept in architecture and software engineering, and building on the notion of “building-block” spatial models presented in my forthcoming co-authored Spatial Simulation: Exploring Pattern and Process.

The changing relationship of disciplines outside geography to GIS&T
Any attempt to focus more narrowly on the pedagogic challenges within my own discipline, quickly redirects attention back out toward the “spatial turn” in disciplines ranging from Sociology and Economics to Archaeology and Zoology. For undergraduates in these and other disciplines, spatial thinking has become a critical component of their degree training. There is an urgent need to deliver appropriate learning opportunities to develop, both in a broad sense,
spatial thinking, and more narrowly, skills with tools that can enable such thinking (i.e., GIS&T). Yet relatively few academic staff in these varied fields are equipped to provide the grounding in modes of thinking and reasoning that this situation demands.

Most universities have struggled to handle the transdisciplinary scope of the spatial turn. With a few prominent North American exceptions (such as UCSB) there is rarely a critical mass of research-informed teachers to deliver the ambitious curricula developed variously by NCGIA and UCGIS. The more commonplace experience is of small groups of staff struggling to deliver cut-down versions of those curricula, while running the risk that their teaching is perceived as merely a “service” to colleagues in their own department or more widely. The widespread recognition of the importance of the spatial perspective across many disciplines offers a possible escape from these dilemmas, and I am keen to explore what it would mean to offer training in spatial thinking, both as a point of entry to more technical programs in GIScience, and as a service to other disciplines that could build on such a resource to provide more discipline-specific training in the particular facets of spatial thinking that are most important for them.

The technological context: teaching spatial thinking without GIS?
The maturation of GIS software has made “lecture and lab” style courses in GIS increasingly difficult to deliver. The leading software package in the field has evolved from a single user desktop package into a large corporate network integrated platform. In this context, providing students from diverse, (often) non-computational backgrounds with more than a superficial exposure to available tools (“what button do I press?”) is challenging, if the industry-leading platform is adopted. Other tools (many of them free) are an attractive alternative, but bring their own difficulties, and may encounter student-resistance, given students’ understandable desire to develop marketable skills with industry-standard tools.

As recently as 15 years ago (when I completed my own Masters in GIS&T) the inadequacy of standard packages worked to their educational advantage! A limited range of interesting tasks could be accomplished with off-the-shelf packages, and study beyond entry-level required students to learn scripting, and as a seeming “by-product” to acquire spatial thinking (and technical) skills. Today’s tools are enormously more capable, but present the difficulty of finding an appropriate entry point, that focuses not on which toolbox to use or button to press, but on the critical spatial thinking skills that underpin those choices. Deciding what are the best current tools and environments to use to develop spatial thinking skills in the classroom and the lab, and more importantly, what principles underpin those decisions so that we can update those choices over time is a key challenge.

In recent years I have been evolving the courses I teach in spatial analysis to incorporate new tools (such as the R spatstat package, and GeoDa) rather than GIS packages, and it would be interesting and valuable to share those experiences with others facing similar concerns.