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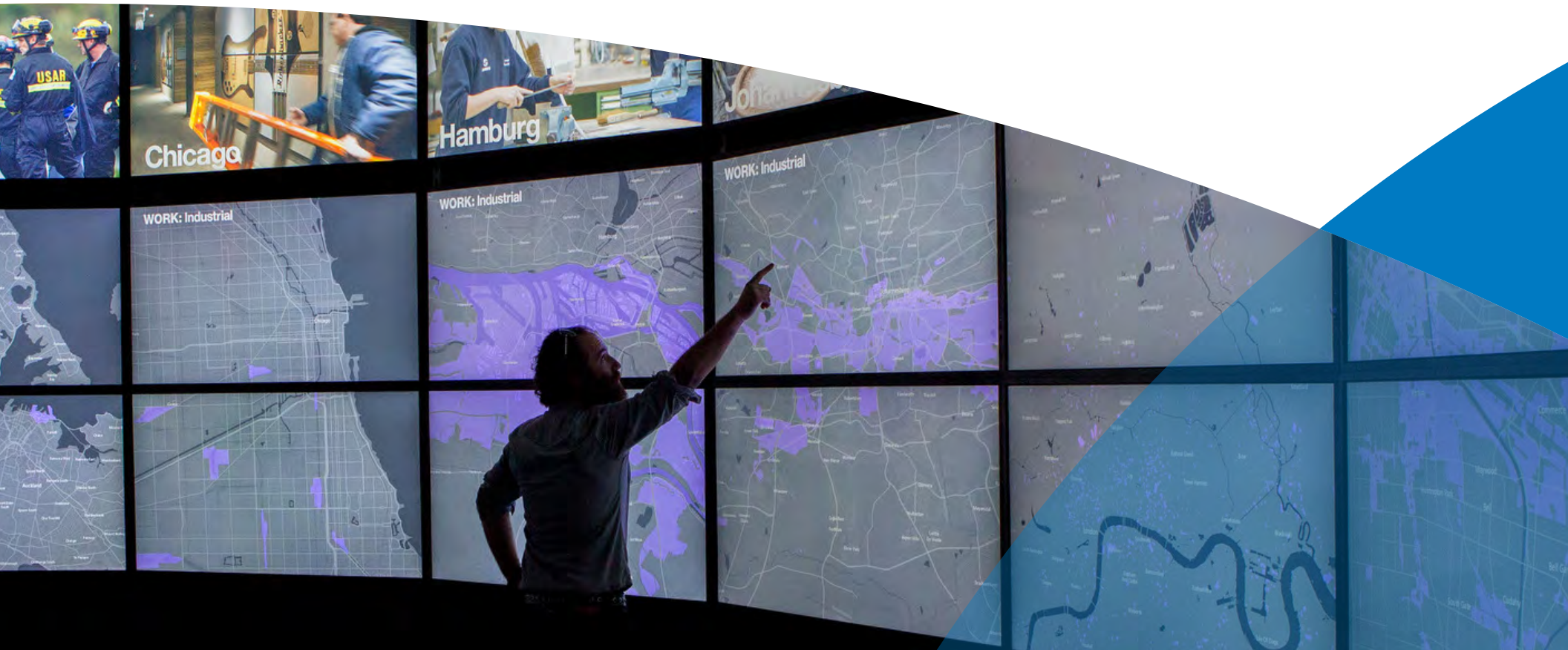

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There's More to Spatial Thinking Than You Think

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If you are a geography educator or GIS professional, you might say that "spatial thinking" is a way of reasoning about the world, facilitated by maps. However, if you are a science educator whose students need to make sense of 3-D molecular models or of cross-sections of a plant, "spatial thinking" is likely to mean something quite different. So, too, for cognitive psychologists who employ experimental methods to understand how people learn.

A recent Specialist Meeting on "Spatial Thinking across the College Curriculum" highlighted these different perspectives. The meeting's purpose was to "identify the current state of our understanding of spatial thinking, identify gaps in our knowledge, and identify priorities for both research and practice in educating spatial thinkers at the college level." Forty-three thought leaders were invited to participate, including those from Geography and GIScience, cognitive and developmental psychology, research librarians, and science education, history, landscape architecture, philosophy, and political science.

We were honored to represent Esri at the event. Our interest in a comprehensive approach to spatial thinking in education follows from the Esri Education Team's mission to *cultivate the next generation of GIS users and spatial thinkers*. As we pointed out in our recent essay "Envisioning the Spatial University," no college or university to our knowledge has included spatial thinking among its overarching objectives for general education, despite compelling evidence of its value. We approached the Specialist Meeting with high hopes that a consensus could be reached about how to realize spatial thinking in higher education. Ultimately, little consensus emerged about the broad nature of spatial thinking or about strategies for advancing it in higher education.

Why consensus eludes us

Why does consensus about spatial thinking remain elusive, seven years after the National Research Council's landmark publication of *Learning to Think Spatially*? We suggest at least four contributing factors:

1. Spatial thinking is a transdisciplinary habit of mind. Kindred disciplines span a dizzying range of scales, from subatomic to human to cosmic, as illustrated so effectively in the animation "The Scale of the Universe." Spatial thinking means different

things at different scales, and within different academic disciplines.

2. Academic disciplines are frequently based on different theories and constructions of knowledge. At times, social scientists may be content with anecdotal efficacy of GIS in fostering spatial thinking. Other disciplines marshal longitudinal research to demonstrate the relevance of spatial abilities to STEM careers. Still others are satisfied with nothing less than controlled experimental results.

3. Spatial thinking seems to be contested territory. Several disciplines vie for authority over its research agenda and curriculum design. Although geographers like Roger Downs have played pivotal roles in highlighting the relevance of spatial thinking across the curriculum, others note geographers tend to conflate spatial thinking with a subset of "geospatial" thinking skills.

4. A compelling value proposition for a discrete spatial thinking curriculum is elusive. No one at the meeting was able to satisfactorily address Bob Kolvoord's thought experiment, "what happens if we do nothing?"

Now what?

Many geographers are already convinced by recommendations of the *Learning to Think Spatially* report. We feel a sense of urgency about advancing geospatial thinking in higher education. Ambitious efforts to encourage geospatial thinking across the curriculum are underway at a few bold universities, including the University of Redlands, Harvard University, the University of California at Santa Barbara, and the University of Southern California. Esri encourages and supports these and related efforts elsewhere.

Do you see value in spatial thinking across the college curriculum and what role should GIS play in advancing (geo)spatial thinking at universities? We invite your comments, and hope you'll join us in continuing the conversation.

Thanks to Tom Baker, who co-authored this post.

About David DiBiase

David DiBiase leads the Education Team within Esri's Industry Solutions group. The Team promotes and supports GIS use to enrich teaching and learning at all levels, in formal and informal settings, domestically and internationally. Before joining Esri, David founded and led the Penn State Online GIS Certificate and Masters (MGIS) degree programs.

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