

Building Advanced Spatial Thinking Capacity into Transportation Engineering Education and Research

6th FIG Regional Conference
San José, Costa Rica

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What is spatial thinking?

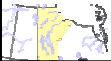
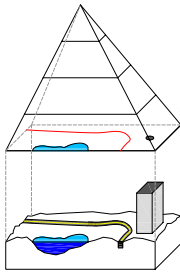
“...spatial thinking is based on a constructive amalgam of three elements: concepts of space, tools of representation, and processes of reasoning.”

Source: *Learning to Think Spatially*
National Research Council, 2006



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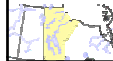
What is spatial thinking?



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Building spatial thinking capacity

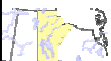
- “...an approach to people-centred development.”
Source: Eade, 2003
- Quantity and quality
- Undergraduate program
 - Fundamentals of geomatics engineering
 - Transportation engineering
- Graduate program
 - More advanced applications
 - Technical and social implications
 - Research collaboration



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Educational principles

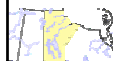
1. Evolution of spatial thinking
classical surveying → geomatics engineering
2. Basic geospatial theory
3. Geospatial technologies and software
4. Need for visualization



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1. Evolution of spatial thinking

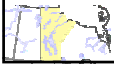
- “Where am I?”
 - “Where am I now?”
 - “Where will I be?”
- Spatial reference system reversal



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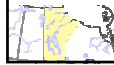
2. Basic geospatial theory

Topic	Learning objectives	Pedagogical approach
-Classical surveying -Basic geodesy -GPS -Coordinate systems, datums, projections -Data formats, interoperability - Topologies, network density, LRS, routing		



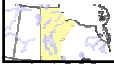
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3. Technologies and software - GIS



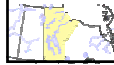
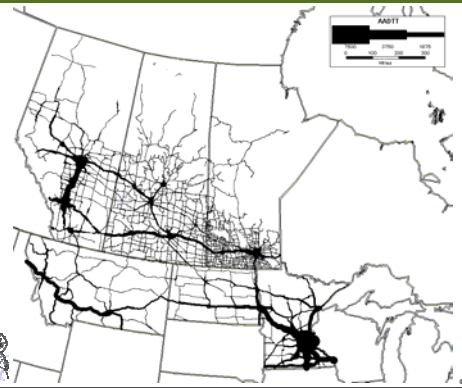
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3. Technologies and software - GIS



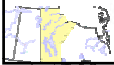
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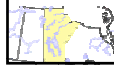
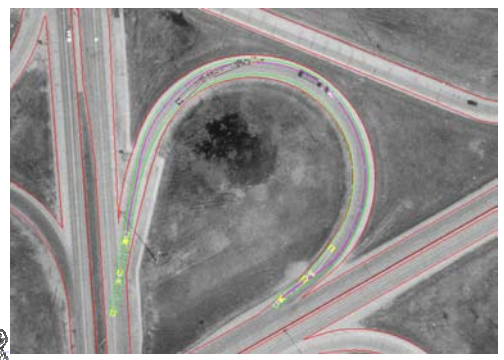
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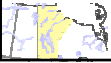
3. Technologies and software - CAD



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3. Technologies and software - GPS

- Use and selection of different GPS grades
 - Handheld
 - DGPS
 - Real-time kinematic
- Integrate “messy” data into CAD and GIS
- Application to real problems

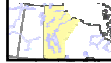


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4. Visualization - virtual reality



Source: Han et al., 2005

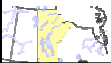


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4. Visualization - virtual reality

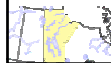
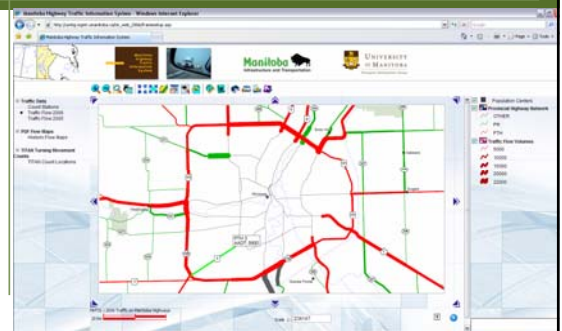


Source: Han et al., 2005



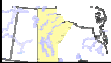
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4. Visualization - web mapping



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4. Visualization - web mapping

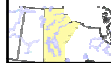


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Concluding remarks

Spatial thinking technologies and applications...

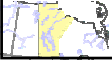
- ...change the way we think
- ...change the way we educate
- ...change the way we engineer
- ...change the world's expectations of us



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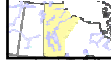
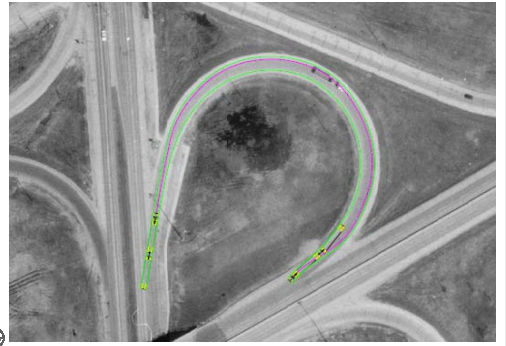
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3. Technologies and software - CAD



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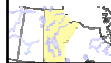


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Outline

- Introduction
- Spatial thinking in transportation engineering
- Educational principles
- Concluding remarks



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