Modes of Spatial Thinking

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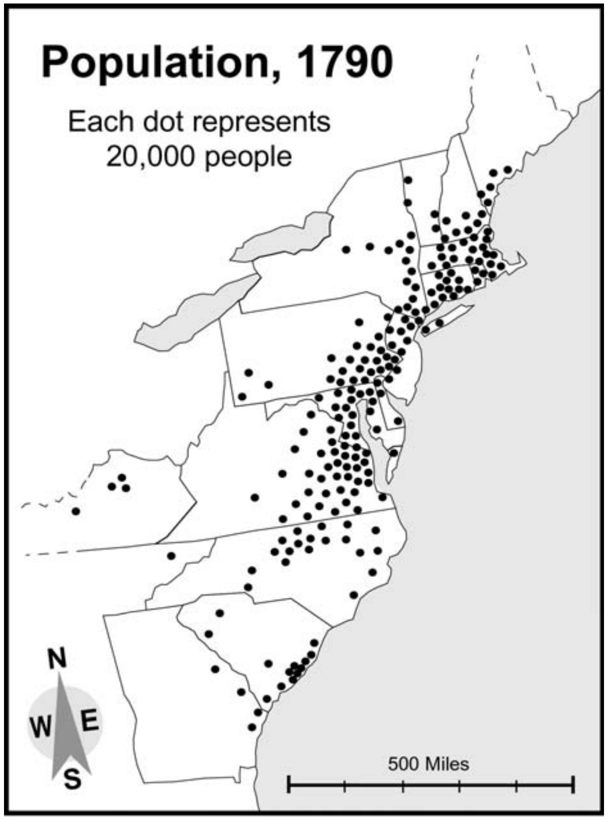
Recent research seems to indicate that the human brain has a number of distinct areas that are structured to do specific kinds of spatial thinking. This list of spatial-thinking questions is based on a review paper that was published in the December 2006 issue of *Research in Geographic Education*, which in turn was adapted from a discussion paper commissioned for a report entitled *Learning to Think Spatially* (National Academies Press, 2006).



Location – Where is this place?

a. **Conditions** (Site) – What is at this place?

b. **Connections** (Situation) – How is this place linked to other places?

Aspects of Spatial Thinking

1. **Comparison** – How are places similar or different? How can we compare them fairly?
2. **Aura** (Influence) – What effect(s) does a feature have on nearby areas?
3. **Region** – What nearby places are similar to each other and can be grouped together?
4. **Hierarchy** – Where does this place fit in a hierarchy of nested areas?
5. **Transition** – Is the change between places abrupt, gradual, or irregular?
6. **Analog** – What distant places have similar situations and therefore may have similar conditions?
7. **Pattern** – Are there clusters, strings, rings, waves, other non-random arrangements of features?
8. **Association** (Correlation) – Do features tend to occur together (have similar spatial patterns)?

Spatio-temporal thinking – How do spatial features change through time?

Change – change in conditions (e.g. climate, military control, land use, etc.) at a place over time
Movement – change in position of something (e.g., train, hurricane, border, etc.) over time
Diffusion – change in extent of something (e.g., disease, urban area, rumor, etc.) over time

Exceptions – Where are places that do not seem to follow an observed "rule"? A map of exceptions, in turn, can be subjected to spatial analysis in order to discern regions, patterns, etc.

Other recent research seems to support the idea that memories are more likely to last if they involve links among multiple brain regions that "collaborate" to solve an intuitively important problem. This conclusion has profound implications for curriculum design, because it lends further support to the idea that students are more likely to become proficient in the so-called "foundation skills" of mathematics and reading if they work with topics and materials that are designed to engage multiple parts of the brain, including those that are structured to do spatial thinking. The conclusion about long-term memory also has implications for student assessment that should be explored, as people try to refine the role of high-stakes testing in educational policy and reform.