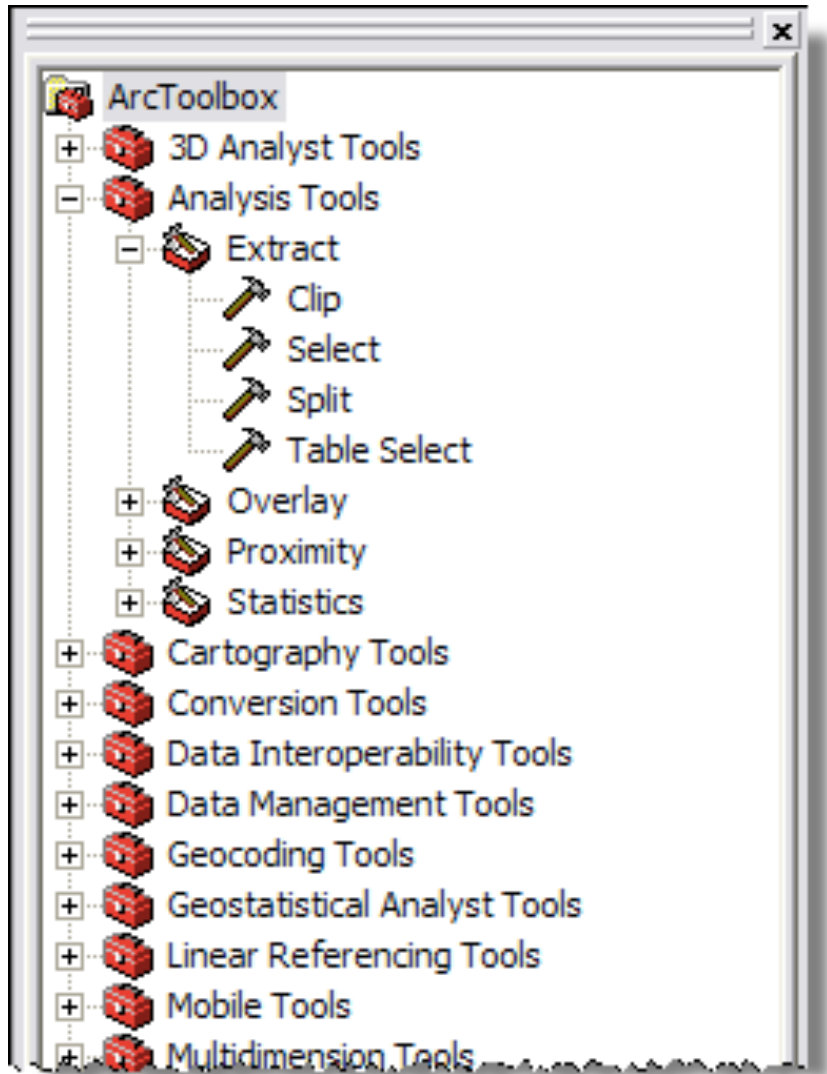


# Thinking about Spatial Computing



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# Spatial Computing is Too Hard



Does this support  
"critical spatial thinking"?



# Compare GIS to Databases

**select** desired attributes

**from** one or more tables

**where** condition about tuples holds

Databases are simple to use thanks to Codd's theoretical work:

1. his insight that **tables are a core concept** of (non-spatial) information
2. his **formalization** of table operations as relational algebra.

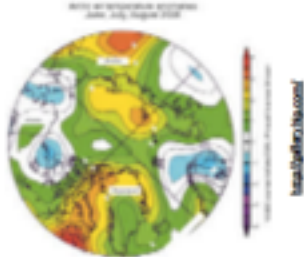
# Proposed Theory of Spatial Computing

1. Built on core concepts of spatial information, which were derived from concrete GIS data types (point, raster, vector, network, surface,...) by asking “what spatial concepts do these data express?”
2. It gets informed by research on
  - spatial thinking e.g., spatial reference frames
  - computational thinking e.g., abstract data types (ADT).

# The 7 Core Concepts of Spatial Information



**location**



**field**



**object**



**network**



**event**



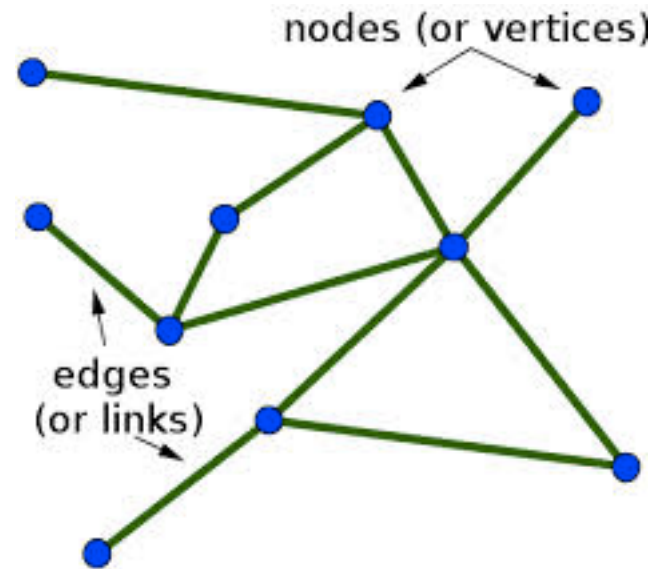
**granularity**



**accuracy**

for more information: see the COSIT 2015 Poster by Sara Lafia et al.

# Core Computations, e.g. on Networks

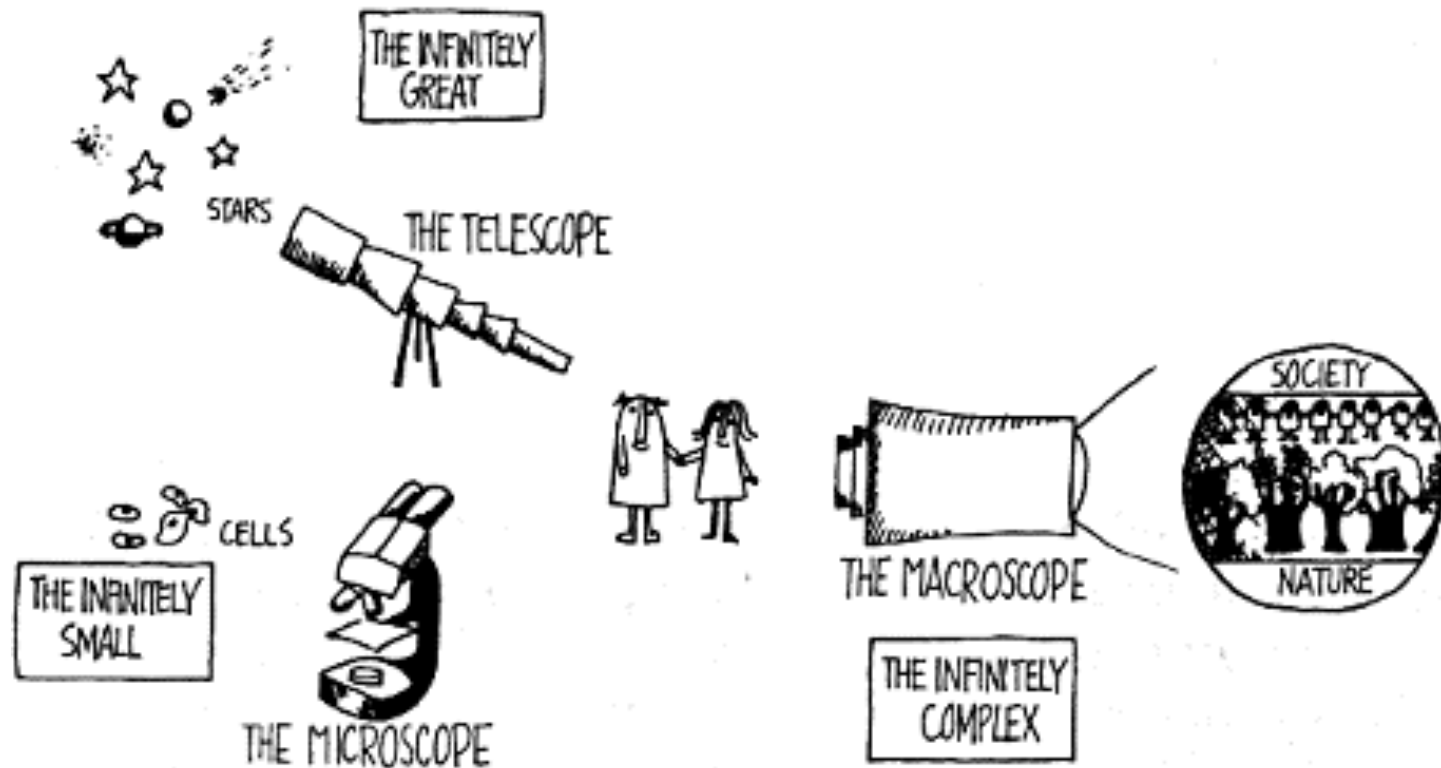


1. a set of **objects**: nodes
2. a binary **relation** on them: edges
3. **constructors**: new, split, merge, ...
4. **observers**: nodes, edges, connected, shortest path, centrality, ...

# Summary of the Argument

1. Teaching spatial thinking from interdisciplinary perspectives needs to **include computational thinking** (and vice versa: not only GIS commands).
2. We are working on a theory of spatial computing. It is built around **core concepts** of spatial information and formalizes the **core computations** on them.
3. This theory suggests designing **“lenses” on geographic spaces**, to simplify spatial computing (just like SQL does as a “table lens”).

# GIS as a “Macroscopic” for Complex Systems Analysis (?)



Joël de Rosnay, The Macroscopic, <http://www.appreciatingcomplexsystems.com/wp-content/uploads/2011/05/The-Macroscopic.pdf>