Information Cartography

- The use of Geographic Information Systems (GIS) to visualize nongeographic data
- Utilizes Geographic Information Science to develop models and organize information--not an art form
- Used to build information maps. Information maps consist of a landscape (base map; substrate) and landmarks (information objects which have features)
- Involves representation: a set of objects with some relation defined or assumed between them, mapped to a different set of objects in a different context, where there is a one-to-one correspondence between the objects in each context, and where the relation holds in both contexts
- Interactive/dynamic utilizing spatial metaphors and navigation skills
- Vector-based points lines and polygons

Maps and Metaphor

Metaphor (a.k.a. analogy):

- explains our ability sometimes to see one thing -- or idea -- as though it were another Marvin Minsky (1981)
- Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphorical in nature Lakoff and Johnson (1980)
- "One should not think of analogy as a special variety of *reasoning*...analogy is *everything*, or very nearly so, in my view Hofstadter (1999)
- Spatial metaphors can be seen as vital to retaining possession of information and avoiding "memory leakage" or the effective "dismemberment" of one's information space Benking and Judge (1994)

Cognitive process

the semantic primitives that describe spatial associations (motion and location) are held to form a superset from which associations in any other semantic field can be described...It would follow that any given semantic dimension of computer-stored information can be represented in a spatial format, and that any computerised information space can be navigated using similar cognitive processes to those that would apply during the process of 'real world' navigation (Westerman, 2000, [Cognitive Processes]).

History

- First thematic map ("data map") 1686 by Edmond Halley (Tufte, 1983)
- Lambert and Playfair statistical graphs ("data graphics") 18th century
 - The invention of data graphics required replacing the latitude-longitude coordinates of the map with more abstract measures not based on the geographical analogy. Moving to statistical graphs was a big step, and thousands of years passed before this step was taken by Lambert, Playfair and others in the eighteenth century (Tufte, 1983, p. 43).
- Charles Minard 1861, map of Napoleon's 1812 Russian campaign.
- Authors as markers of "intellectual space" (White and Griffith, 1982).
- Science Citation Index Web of Science (Small, 1999)
- Information mapping late 90's
- Information cartography first appeared as a term 2000 (Brown and Laverty, 2000; Paling, 2000)

Minard Map



Data-Map Relationship



What is GIS?



What is GIS?



Spatial Operations

US Cities - elevation





Information Cartography

Mobile Homes "Elevation"



Mississippi Tributaries



Mississippi Tributaries



Figure 11. Catchment of the Mississippi River

Topological Mississippi



Figure 2 Relative position, minus location information, for the Mississippi and tributaries.

Information Map



Figure 19 Implementation of Figure 2 as a GIS information map



INDSCAL map of 75 'canonical' information science authors

Author Locations



Information Scientists - Cocitation Contours



Surface



Information Cartography

Information Scientists - Cocitation Surface - SD



Cumulative 3 Periods



Rate of Change in Co-Citation



ThemeScape Information Map



WebMap – information retrieval interface



"Spheres of Influence"



MDS plus Charts – four variables



Close-up of Roget's



RIT Overview



Lattice



Lattice in ArcViewIMS



Query in AVIMS



Child Abduction Recoveries-Indiana



Child Abduction Recoveries-Illinois



Child Abduction Recoveries-California



Abduction vs Recovery summary



MDS of Child Abductions





Information Cartography in Context	Fixed coordinate syster Real-world coordinates Coordinates generated Information data
Msualization	\times \times \times \times \times
Scientific Msualization	$\times \times$ \times
Medical Imaging	$\times \times$ \times
Information Msualization	XX
Geo-spatial Msualization	$\times \times \times \times$
CAD	$\times \times$ \times
Mrtual Reality	\times \times \times \times
Enhanced Reality	
Information Cartography	

IC Lattice



Figure 20B. Information Cartography concept lattice

Increasing Usability

What? and where? (landmark, landscape) is the role of all visual processing - Gazzaniga et al., (1998)

The cartographer may need to:

- Focus attention by drawing attention
- Provide interactivity so the user can adjust display parameters
- Highlight relevant from less irrelevant
- Increase figure ground contrast by icon type, size or color
- Establish landmarks -- achieved by color ramps or scaled symbols, pan, zoom, 3D rotation (rotatability), layering, transparency
- Reduce complexity and dimensions
- Represent data types with appropriate features
 - Nominal (objects, categories) color, texture, shape
 - Ordinal (relative position) density, color saturation
 - Quantitative (size) length, angle, slope, area, complexity, color ramps
 - Any data type location/position
 - Mackinlay (1999), Cleveland and McGill (1984), Xiong, R., and Donath, J., (1999)

Information Cartography Summary

- The use of Geographic Information Systems (GIS) to visualize non-geographic data
- Utilizes GIScience to develop models and organize information
- Landscape with landmarks
- Interactive/dynamic utilizing spatial metaphors
- Fixed but generated (artificial) coordinate system

References

http://ella.slis.indiana.edu/~jold/quals/references.htm