Social Science Research Methodologies

Cartographic design and exploratory mapping

Martin Dodge

Lecture 2, 2nd March 2005, 2 - 3pm

http://www.casa.ucl.ac.uk/martin/ss_methods/

the map is a help provided to the imagination through the eyes
Henri Abraham Chatelain, Atlas Historique (1705)

Course outline

- 23rd February
  - Visualisation for academic research
- 2nd march
  - Cartographic design and exploratory mapping
- 9th March
  - What is GIS and what is it good for?
- 16th March
  - No lecture. Time to work on the course assessment!

Defining maps and mapping

- cartography as "iconography of the geography imagination" (Richard Francaviglia, 1999)
- "maps are graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world" (Harley and Woodward, *History of Cartography*, Volume 1, 1987)
- mapping process - a way of thinking
- culture and technology is always changing the nature of the map of course

History

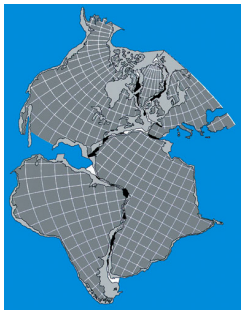
- mapping goes far back to the beginning of civilisation
- only a few fragments of earliest maps survive
- mapping impulse argued as universal
- mapping as old as the development of language and invention of mathematics
- power of maps for kings, governments, military through the ages
- much cartographic technology is 'militarised'

Maps and Spatiality

- geographical analysis is often about understanding and communicating spatiality
- spatial location, relationships & patterns
- can be hard to communication spatiality in written form or in numbers
- can be hard to understand and communicate from photographs or pictures or even film
- maps are one of best means for understanding and communicating spatiality [e.g. Sudan1 map?]
- good maps blend the scientific with the artistic to create unique visualisations

- practical tools, especially for navigation
- Information on location of things
- huge density of information stored in small space
- accurate and consistent retrieval of the information by third parties
- see connections and patterns that are not apparent down at ground level
- 'birds eye view'
- prosthetic quality of cartography, instruments that serves to extend the capacities of the human body.
  - Cosgrove (2003, 137) "Like the telescope or microscope, [maps] allows us to see at scales impossible for the naked eye and without moving the physical body over space. The thematic map allows us to know of the presence of phenomena that are beyond our normal bodily senses, for example a trend surface of property values or of air pollution."
- hopefully begin to see and understand the processes that produce the observed spatiality (e.g. plate tectonics)

The Bullard fit



good maps blend scientific with the artistic to create unique visualisations

What maps can do….

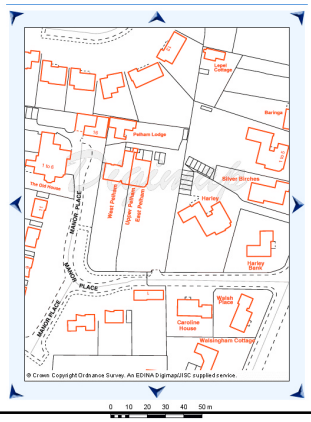
- "And this, essentially is what maps give us, *reality*, a reality that exceeds our vision, our reach, the span of our days, a reality we achieve no other way. We are always mapping the invisible or the unattainable or the erasable, the future or the past, the whatever-is-not-here-present-to-our-senses-now and, through the gift that the map gives us, transmuting it into everything it is not … *into the real.*"
  - Denis Wood, *The Power of Maps*, (1992, page 4)

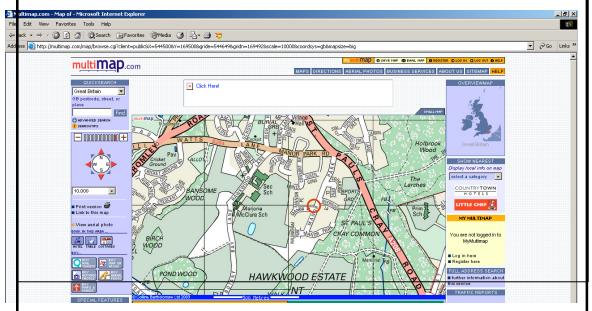
Why are map artefacts interesting?

- nice to look at, enjoyable to make
- tell stories, in a memorable way. (picture = 1,000 words cliché)
- historical value. show you what no longer exists
- maps as a form of material culture that can be analysed
- power of 'mapping' as a metaphor for ordering, organising and presenting information

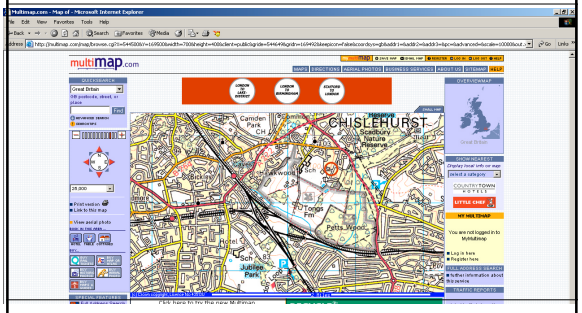
Power of cartographic visualisation

- scale changes
- with generalisation, not just zooming
- make intelligent choices of what is most appropriate level of abstraction of reality (level of realism in the map) for a given purpose

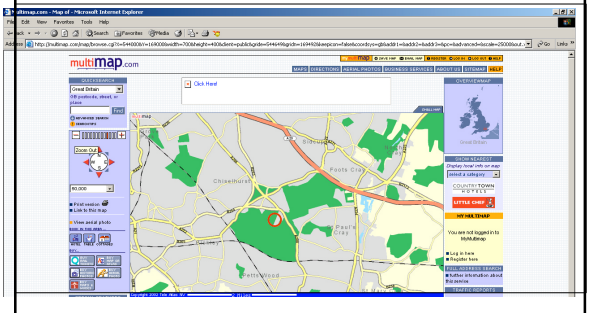




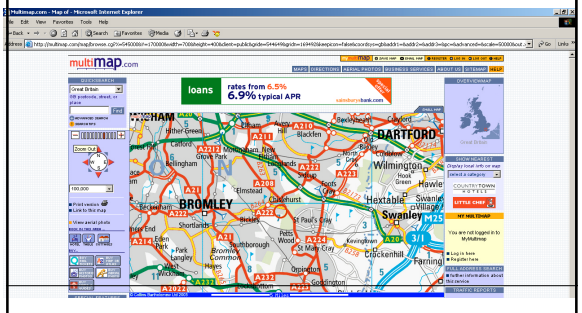
1:10,000



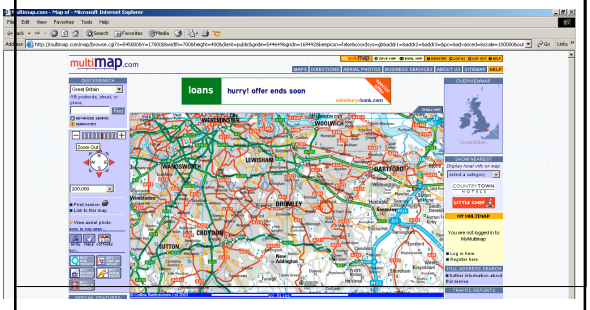
1:25,000



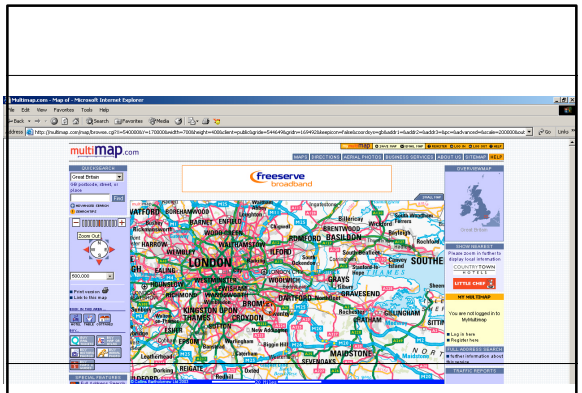
1:50,000



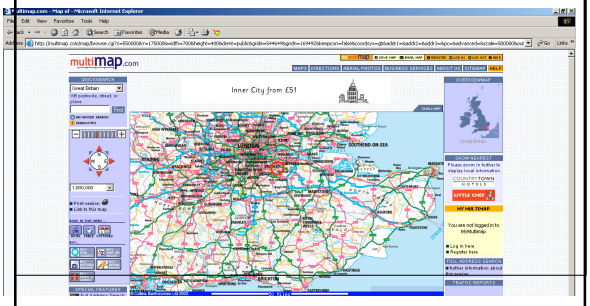
1:100,000



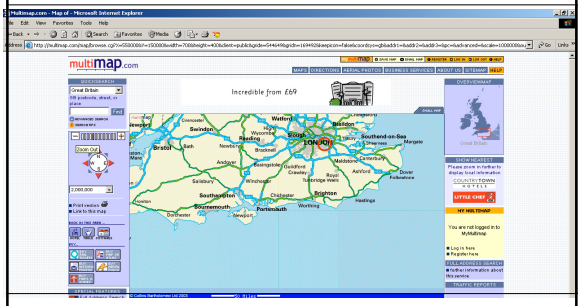
1:200,000



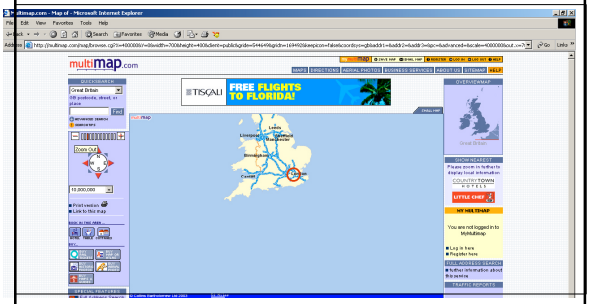
1:500,000



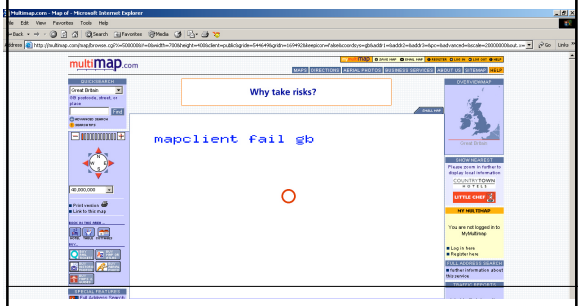
1:1,000,000



1:2,000,000

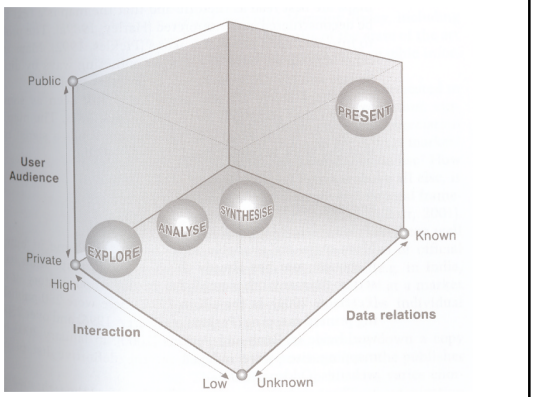


1:10,000,000



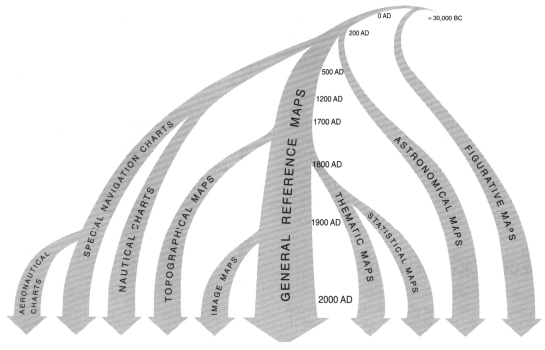
Map types

- trying to build workable, comprehensive typologies of map is a tough task
- look at content, purpose or form (scale)
- in terms of purpose maps can be (very) broadly grouped into
  - general reference
  - thematic
- who made the map? why? what interest is served by the map?



Alan MacEachren's 'cartography cubed' concept (source: Perkins 2003)

'evolution' of maps



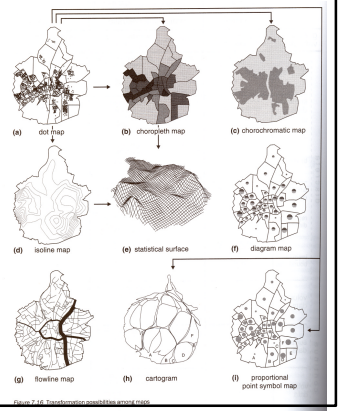
(Source: Robinson et al., 1995)

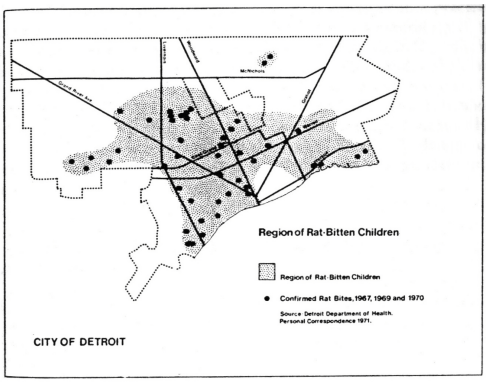
General reference maps

- national topographic maps
- show lots of things, with no particular emphasis
- street map, town centre maps
- specialised reference: aero-charts, hydro charts, road atlas
- answer specific 'fact' type queries (location, distance, directions, etc)

Thematic maps

- focus on a single theme
- many types of univariate maps
- tend to be static, 'one-off' finished map
- often used as illustrations in reports, newspapers, academic papers, etc
- often made by professional map-makers



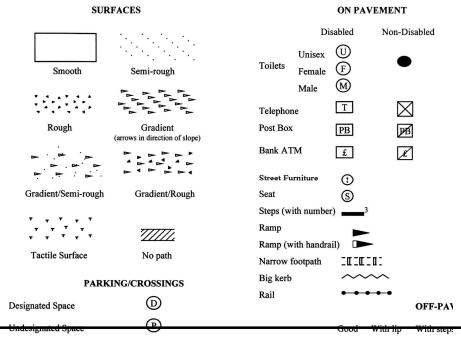


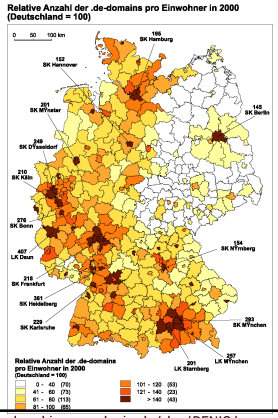
William Bunge, (1975) "Detroit humanly viewed: the American urban present". In Abler R., et al (eds.), *Human Geography in a Shrinking World*

Participatory Action Research, disability access map

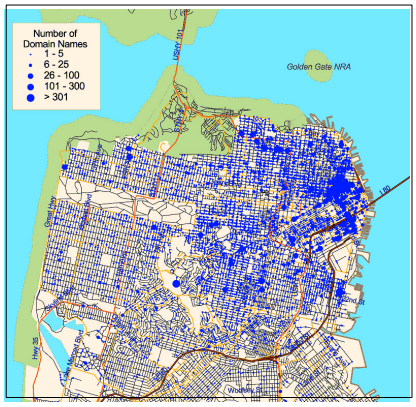
Rob Kitchin's study in Newbridge, Ireland

www.may.ie/staff/rkitchin/newbridge.htm

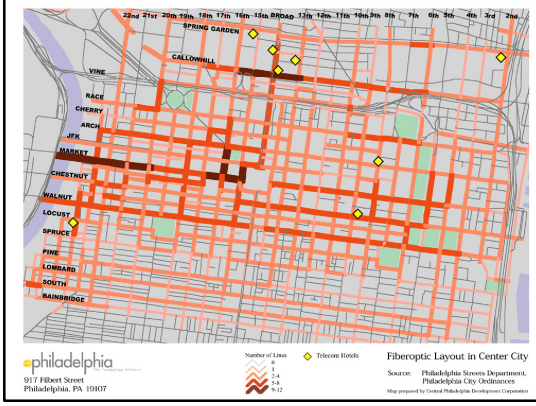




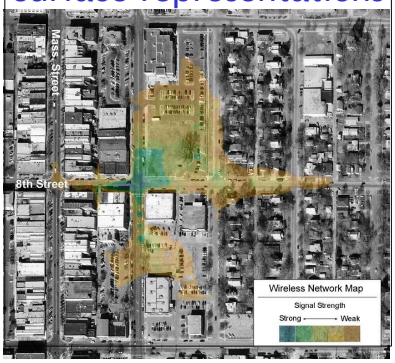
(Source: Mark Krymalowski, www.denic.de/doc/DENIC/presse/stats2000.en.html)



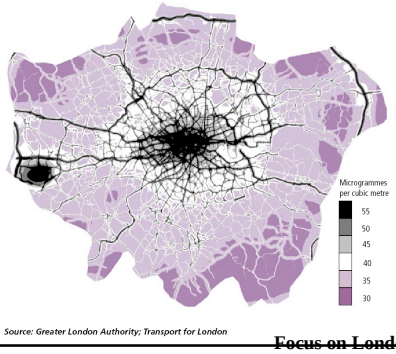
(Source: Matthew Zook, University of Kentucky, www.zooknic.com)



Surface representations

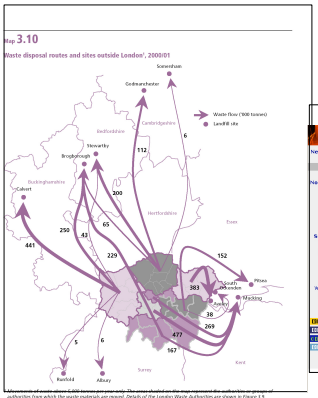


(Source: University of Kansas, www.ittc.ku.edu/wlan/index.shtml)



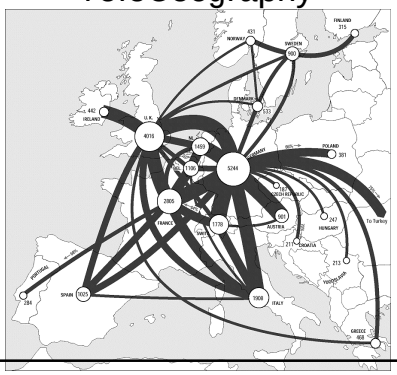
Focus on London, 2003

Flowline maps



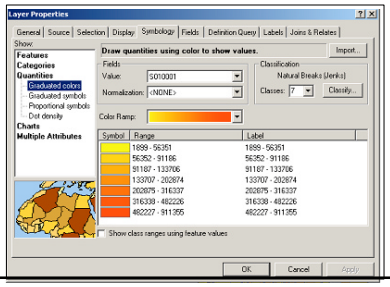
Focus on London, 2003

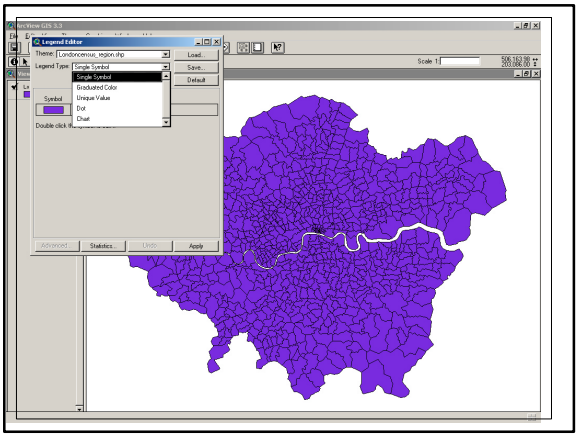
TeleGeography

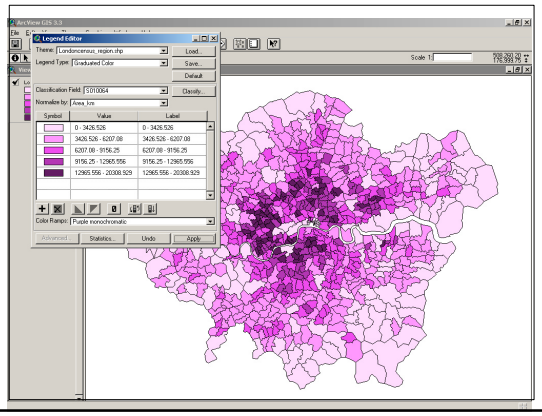


Typical thematic maps in GIS

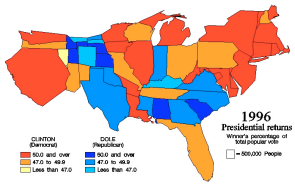
- e.g. GIS from ESRI
- ArcMap options



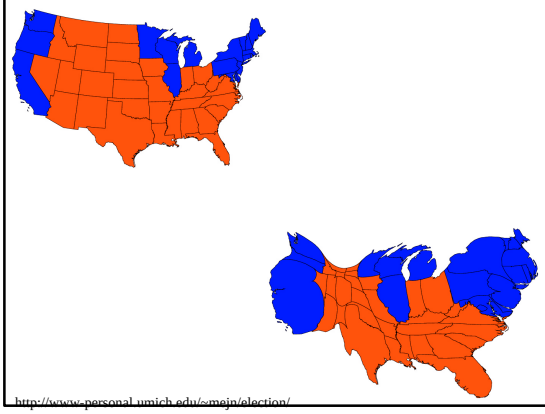




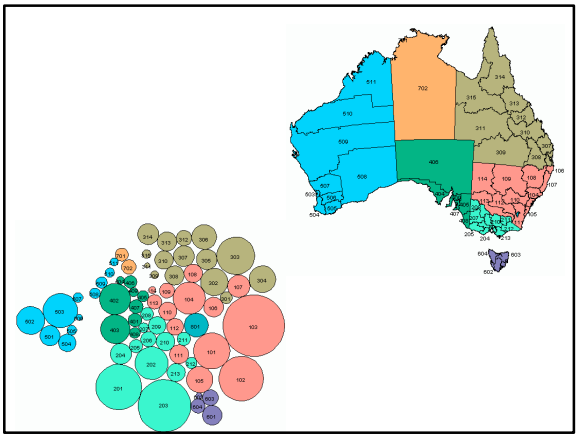
Cartograms



- misleading effect of area
  - large areal units draw attention
- cartograms
  - change the layout to reflect size other than area
  - population size, variable magnitude
  - 'fairer' view of social data
- respect topology (spatial arrangement)
- continuous and non-continuous
- ~~problems of unfamiliar shape and interpretations~~

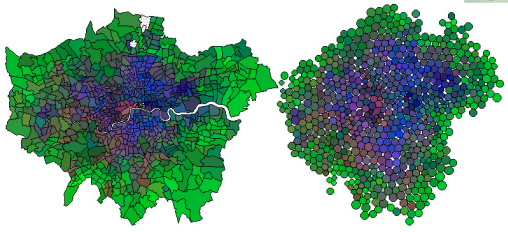


http://www-personal.umich.edu/~mejn/election/



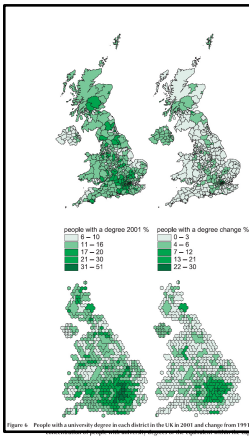
Jason Dykes, City University

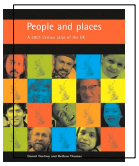
http://www.soi.city.ac.uk/~jad7/



employment structure that shows an strong radial pattern:

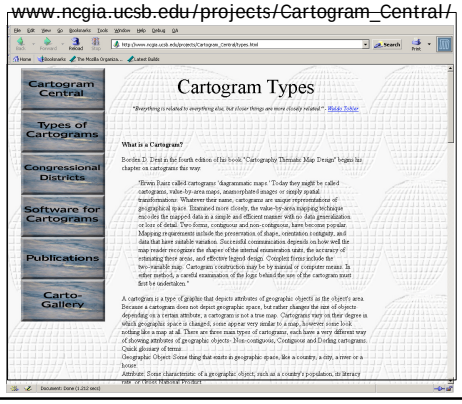
- %Females Full-Time Employed
- %Females Part-Time Employed
- %Females Unemployed

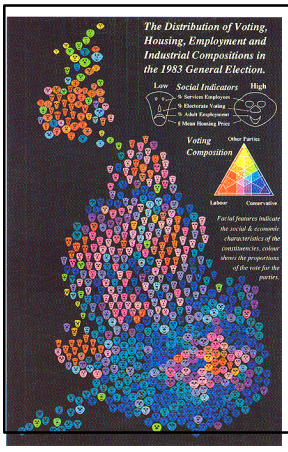




Dorling D., Thomas B. (2004) *People and Places: A 2001 Census Atlas of the UK* [GEOGRAPHY QUARTOS J 50 DOR]

www.ncgia.ucsb.edu/projects/Cartogram_Central/





alternative representations - Danny Dorling's notable work

See Dorling, D. (1995) *A New Social Atlas of Britain*

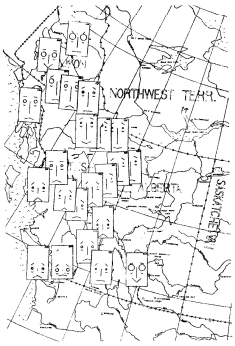
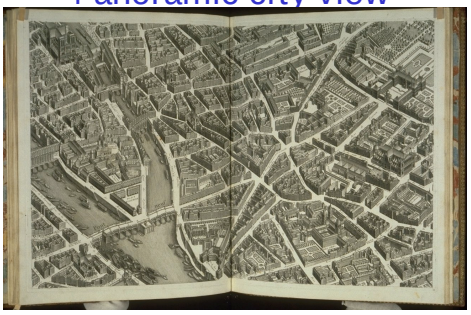


FIGURE 9. The annual growth rhythm of *Pinus contorta* in Canada, after M. Hagner in *Studia Forestalia Suecica* **81**, 1970, p. 12. Nose, lignified cells (%) (|, low; |, high); eyebrows, dry matter (%), (⌣, low; ∨, high); eye diameter, shoot length (%) (·, low; ○, high); mouth, bark colour (∧, green, ∨, brown); eye wrinkle, seedlings with terminal bud (%) (⌣, low; ∨, high).

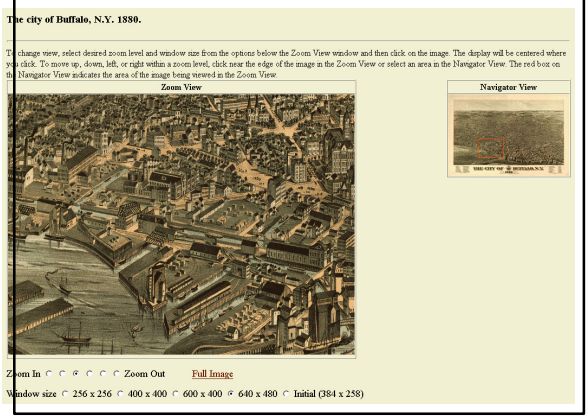
Landscape views, 2.5d 'maps'

- change the map perspective to get very different type of geographic visualisation
- maps are generally planar perspective. i.e. they are 'flat' and the viewer is above looking straight down
- change the observation angle slightly and you get oblique views

Panoramic city view

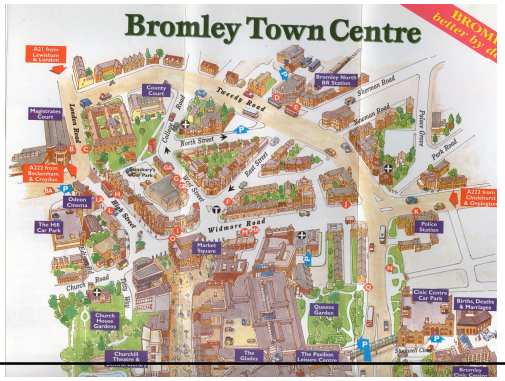


• For example, Michel Turgot's famous Plan de Paris, from 1739. Turgot was the 'pay master' and actually drawn by Louis Bretez. uses an axonometric projection

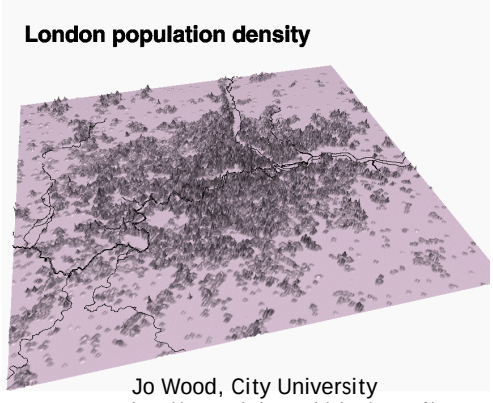


http://memory.loc.gov/ammem/pmhtml/panhome.html

3d city tourist maps

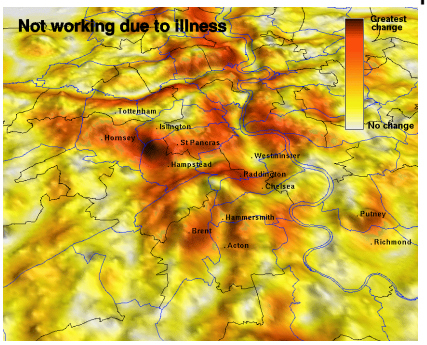


London population density



Jo Wood, City University
http://www.soi.city.ac.uk/~jwo/popsurf/

Social surfaces - human landscapes



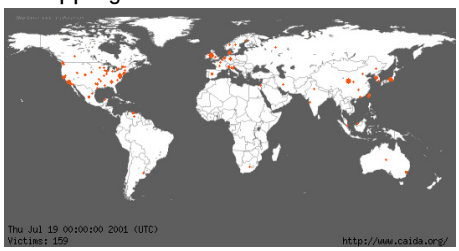
(source: Wood, J.D., et al. (1999) The use of the landscape metaphor in understanding population data. *Environment and Planning B: Planning and Design* 26, pp.281-295)

‘New media’ maps

- multimedia atlases (integration of maps, with pictures, text, sound, etc)
- animated maps
- ad-hoc, interactive maps for EDA
- interactive 2.5d landscapes, 3d fly-thrus (3d GIS, CAD models)
- online, on-demand mapping
- augmented reality

Animated maps

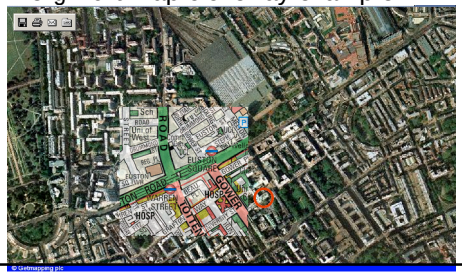
mapping virus diffusion - Code-Red



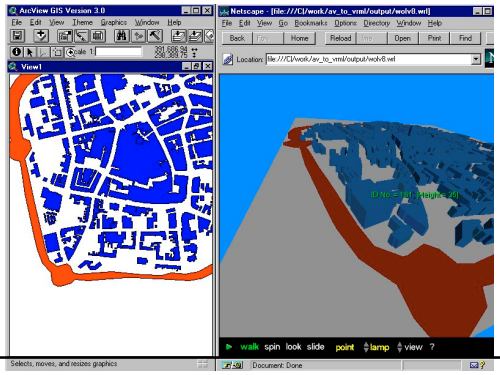
(source: Caida, www.caida.org/analysis/security/code-red/)

Interactive combination of photography and map

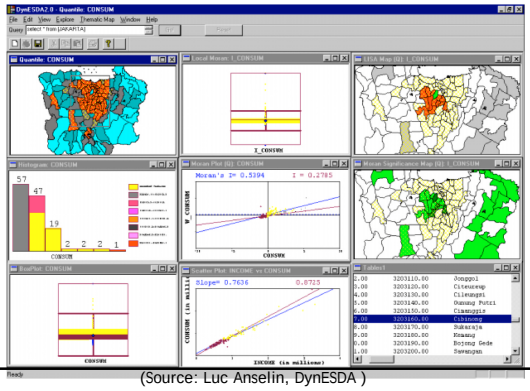
- e.g Multimap’s overlay example



3d map models



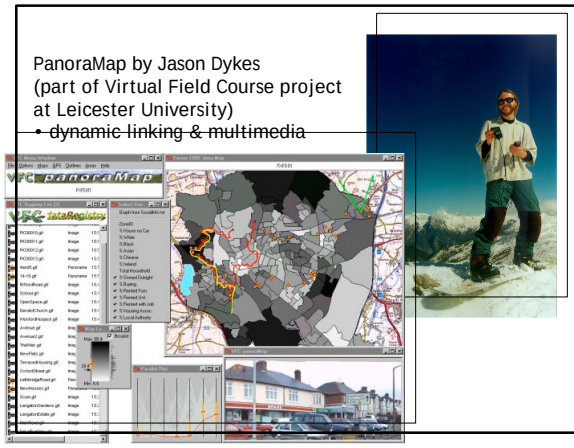
Multiple views and dynamic linking



(Source: Luc Anselin, DynESDA)

PanoraMap by Jason Dykes
(part of Virtual Field Course project at Leicester University)

- dynamic linking & multimedia



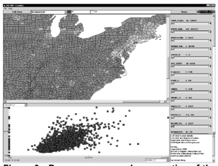


Figure 9: Dynamaps zoomed on counties of the northeast

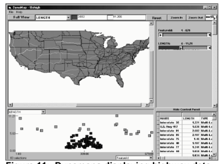


Figure 11: Dynamaps displaying highway data

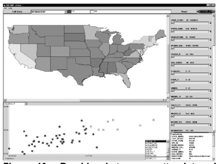


Figure 10: Brushing between scatterplot and map reveals high income, highly educated states are in the northeast

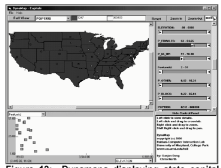
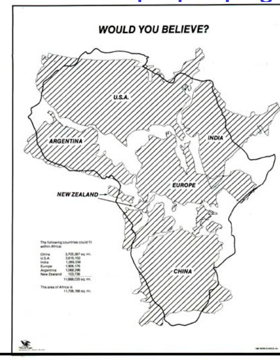


Figure 12: Dynamaps displaying state capital cities

Maps as propaganda (but are all maps propaganda?)



maps produce spatial knowledge, not simply represent the terrain

- Crampton (2004) "Maps are stories we tell about ourselves, but they are stories with a political payoff. The question for map criticism is then to expose the who is getting the payoff and how it is achieved."
- powerful tools for thinking
- power of 'mapping' as a metaphor for ordering, organising and presenting information

problematic maps

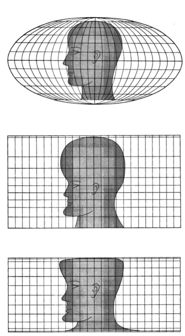
- who makes the maps? and what do they want to show and choose not to show?
- all maps are authored, subjective frames of space
- maps as interfaces to cyberspace are very powerful
- examine more their social implications
- what are the ethics of the maps, the map-maker and their mapping practices
- is it ethical to record and map someone's web surfing and email interactions?
- ethics of the maps that you make?

"how to lie with maps"

- maps claim to be objective
- most obvious being through
- data selection/omission
- 'theory of silences'

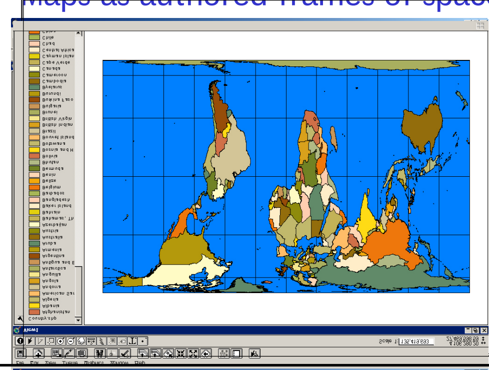
(Brian Harley)

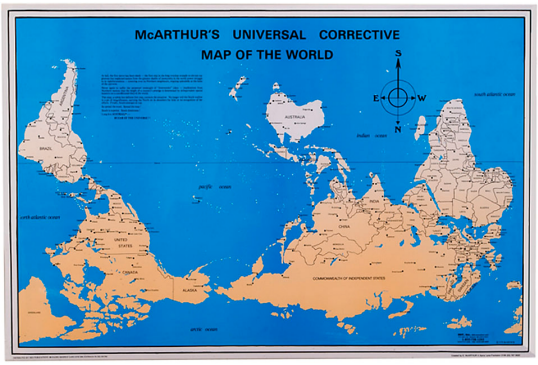
- projections
- how are maps of deceiving?
- many ways to project 'reality' onto a map



A head drawn on the Mollweide projection (top) has been transferred to Mercator's projection (center) and to the cylindrical equal-area projection with standard parallels at 30° (bottom). Just because the profile looks most natural on Mollweide's projection, that projection is not necessarily "better." The natural profile could have been drawn on any projection and then plotted on the others.

Maps as authored frames of space





Ethics and responsibilities

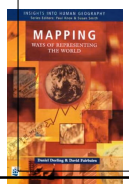
- Monmonier (1993, p. 185) notes:
- "… any single map is but one of many cartographic views of a variable or a set of data. Because the statistical map is a rhetorical device as well as an analytical tool, ethics require that a single map not impose a deceptively erroneous or carelessly incomplete cartographic view of the data. Scholars must look carefully at their data, experiment with different representations, weigh both the requirements of the analysis and the likely perceptions of the reader, and consider presenting complementary views with multiple maps."

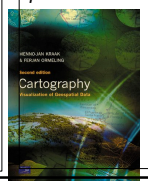
Maps as material culture

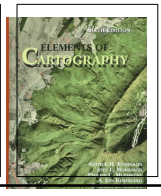
- maps tell you about the people who made them
- maps can be used as primary sources that reveal the perceptions, priorities, conventions and aesthetics of a people
- maps try to be objective, but are inherently subjective representations
- cultures differ across time and space, hence the wide variety of maps produced
- differences in culture are reflected in map form, content and design, e.g. details shown, symbols used, places names, orientation, etc

Further reading

- general map reference books
  - Arthur H. Robinson, *et al.*, (1995) *Elements of Cartography*, 6th edition
  - Danny Dorling and David Fairbairn, (1997) *Mapping: Ways of Representing the World*
  - Kraak M.J. and Ormeling F.J., (1996) *Cartography: Visualization of Spatial Data*

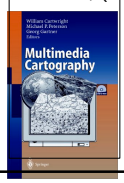




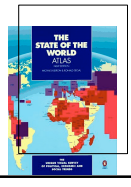


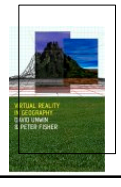
Further reading

- cartographic visualisation
  - Danny Dorling, (1995) *A New Social Atlas of Britain*
  - Hilary Hearnshaw and David Unwin, (1994) *Visualization in Geographical Information Systems*
  - William Cartwright, Michael P. Peterson, and Georg Gartner, (1999) *Multimedia cartography*



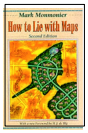
- Peter Fisher and David Unwin, (2001) *Virtual Reality in Geography*
- Kidron, M. and Segal R., (1995) *The State of the World Atlas, fifth edition*
- Keith Harris (1999) *Mapping Crime: Principle and Practice* (http://www.ncjrs.org/html/nij/mapping/)

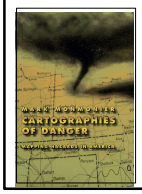


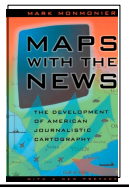


- Mark Monmonier

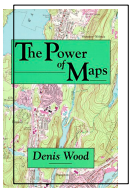
  - *How To Lie With Maps*, 2nd edition (1996)

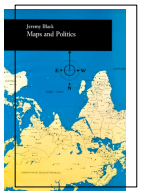






- Political & cultural critiques of mapping
  - J.K. Wright, (1942) "Map makers are human: comments on the subjective in maps". *The Geographical Review*, 32, pp. 527-544 (on JSTOR)
  - Denis Wood, (1992) *The Power of Maps*
  - Jeremy Black, (1997) *Maps and politics*
  - Paul Laxton, (2001) *The New Nature of Maps: Essays in the History of Cartography*





References

- Cosgrove D, 2003, "Conclusion: Historical Perspectives on Representing and Transferring Spatial Knowledge" in Silver M, Balmori D (eds), *Mapping in the Age of Digital Media* (Wiley-Academy) 128-137
- Crampton J W, 2004, "GIS and geographic governance: reconstructing the choropleth map" *Cartographica* 39(1) 41-53
- Francaviglia R, 1999, "Walt Disney's Frontierland as an Allegorical Map of the American West" *The Western Historical Quarterly* 30 (2) 155-182 [Jstor]