Visual Studies, Vol. 26, No. 1, March 2011

Routledge
Taylor & Francis Group

New Media Review

The lie of the land: Mark Monmonier on maps, technology and social change

How to lie with maps, 2nd ed., Chicago and London: University of Chicago Press, 1996 (first published 1991), ISBN: 0226534219, Price $17

Rhumb lines and map wars: A social history of the Mercator projection, Chicago and London: University of Chicago Press, 2004, ISBN: 0226534316, Price $25

Coast lines: How mapmakers frame the world and chart environmental change, Chicago and London: University of Chicago Press, 2008, ISBN: 0226534030, Price $26

Reviewed by Rob Walker, University of East Anglia

> We are largely unconscious of the centrality of maps in contemporary Western life precisely because they are so ubiquitous, so profoundly constitutive of our thinking and our culture. We are bombarded by maps in our newspapers, on our televisions, in our books, and in our getting around in the modern world. The cartographic trope is all pervasive. We talk of cognitive maps, mental maps, genetic maps, or of mapping the mind and mapping the human genome. Minds, languages, cultures, laws and environments are [all] described as maps. (Turnbull 2000, 93)

For contemporary social science, maps are not neutral sources of geographic information. It is true that we depend on the reliability of maps for many day-to-day routines and practices – maps on paper, maps on screens and maps in our minds – but we know too that maps lie. In these books, Mark Monmonier charts the wide range of errors, distortions, compromises and propaganda implicit and explicit in maps and map making and relates them to graphical necessities, media imperatives, social conventions and the history of civilisation itself.

Throughout his academic career, Mark Monmonier has written extensively about maps and map-making. These are just three of twelve books he has written – and his consistent message is that maps change in their intent and purpose and that they necessarily (and often intentionally) frame and distort the world. We need, at least, to become knowledgeable users if we are to avoid being hoodwinked by others or misled by our own ignorance. In the epilogue of *How to Lie with Maps*, he writes:

> White lies are an essential element of cartographic language, an abstraction with enormous benefits for analysis and communication. Like verbal language and mathematics, though, cartographic abstraction has costs as well as benefits. If not harnessed by knowledge and honest intent, the power of maps can get out of control. (1996, 186)

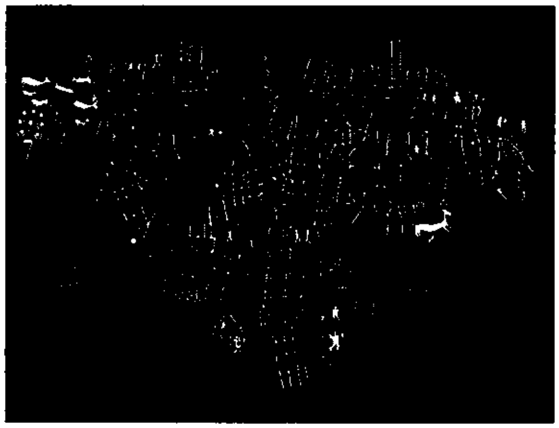


FIGURE 1 One of the earliest known maps: a Bedolina petroglyph from Valcamonica Italy, c. 2500 BC (from Turnbull 1989, 12)

Monmonier is both a cartographer and a critical analyst of maps. He draws mainly on US examples and sources and he knows about drawing maps, and about teaching students to draw maps. He has a sharp critical eye, but his primary purpose is constructive – he wants to make better maps and have us use maps more intelligently. He writes well about the history of maps because he can easily put himself in the mind of the map-maker and see things much as they saw them. His first thought is for practical problems; his admiration is for elegant solutions.

How to Lie with Maps provides an introductory text that maps the field. Writing in a clear, sometimes witty and almost conversational style, Monmonier leads us into the world of maps. He explains the conventions of map projections and the elements of map symbols. Much of this we normally take for granted, and it may be something of a surprise to be told that the roads on road maps are not strictly to scale (if they were they would be hundreds of metres wide on the ground, or so thin on maps as to be almost invisible). And that colours are seductively misleading:

> The greens used to illustrate lowlands, for instance, might suggest lush vegetation, whereas the browns representing highlands can connote

ISSN 1472-586X printed/ISSN 1472-5878 online/11/010062-9 © 2011 Rob Walker
DOI: 10.1080/1472586X.2011.548490

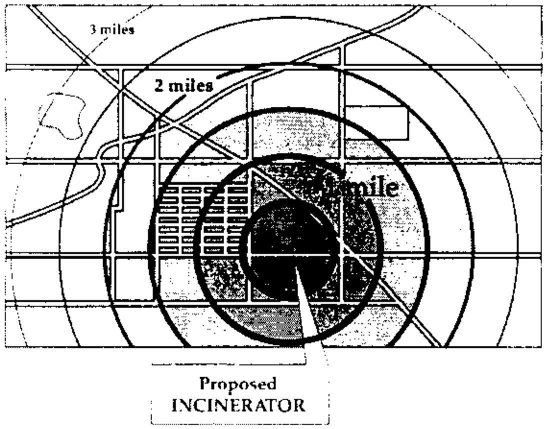


FIGURE 2 Red area symbols connoting increased danger near the site of a proposed incinerator strengthen the message of a monochrome environmental propaganda map (Monmonier 1996, Figure 7.19).

barren land – despite the many lowland deserts and highland forests throughout the world. (1996, 24)

Intellectually we know this – but the symbolism of colour persists, and perhaps more insidious are the selections of colours showing zonal distances from a proposed incinerator. Shaded in graduated neutral tones (as here), they imply one meaning; coloured in traffic light colours (red, orange and green), they imply quite other meanings and carry other messages.

We need to remember, Monmonier tells us, that maps are drawn with an intended purpose. We recognise that the London Underground map and its many derivatives make journey planning easier than a map that is more strictly accurate in terms of directions, distances and locations. Maps lie, Monmonier tells us, because they are made to help us understand and act in the world:

> A good map tells a multitude of little white lies; it suppresses truth to help the user see what needs to be seen. Reality is three-dimensional, rich in detail, and far too factual to allow a complete yet uncluttered two-dimensional graphic scale model. Indeed a map that did not generalize would be useless. But the value of a map depends on how well its generalized geometry and generalized content reflect a chosen aspect of reality. (1996, 25)

These selections are not just pragmatic; a map, as Tufte (2006), Rose (1993) and Turnbull (1989) all point out, necessarily embodies a theory, for each map is made by making selections from an infinite number of possible maps. Decisions are made that give shape (and scale and

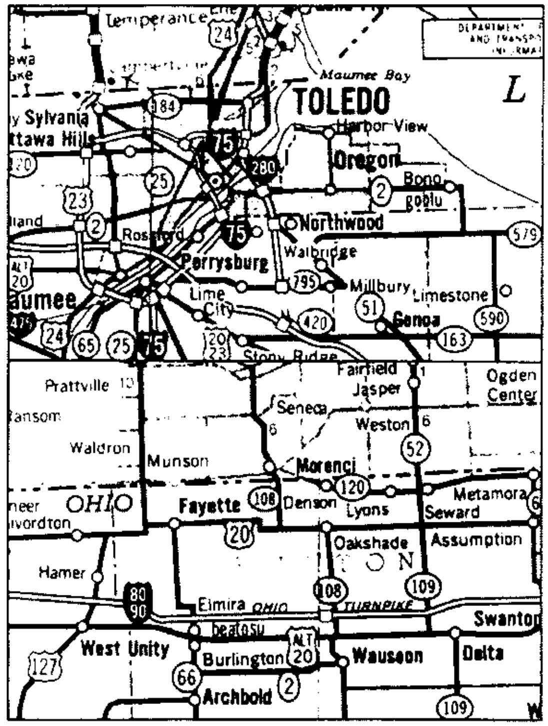


FIGURE 3 Intentional design may include subversion. Fictitious towns 'goblu' (above, to the right, below Bono) and 'beatosu' (toward the bottom, above Burlington) on the 1979 Michigan highway map reflect an unknown mapmaker's support for the University of Michigan football team (the Blue) over its traditional rival Ohio State University (OSU) (Monmonier 1996, Figure 4.4).

colour) to the world and, once made, as David Turnbull goes on to say, maps too become part of the world.

Maps may present themselves as objective mirrors, but central to map-making (and map-using) is an authorial voice. The selections and interpretations that the map-maker makes from extensive sets of facts, and the ways in which these selections are amplified, attenuated and diminished, placed on the page, symbolised and connected are, in Monmonier's view, best represented as an act of intentional design.

For visual research, this relationship between data and theory starts to sound like a familiar story. For in visual research we face similar problems in making sense from a multiplicity of emergent meanings. Whether we work with images, with image hybrids like video, with text or with numbers and measurements, we too are entangled in theory, sometimes unknowingly or unawares. For the writer this means keeping imagination disciplined by the evidence, and for the reader it means looking behind the interpretation to see where we are being drawn away from some ways of seeing the world and led to seeing only others.

Maps are intriguing for research because they provide a form that deals with complexity. As Monmonier says, maps have a language, a language that needs to be learnt if we are to become competent users, but maps are not just passive forms of presentation; they *have* a language but also they *are* a language. Maps tell us about the world (and help us both re-imagine it and act within it) in distinctive ways. They are tools for exploration, for exploitation, for subjugation, for trade, for claims to ownership, for social justice and, perhaps not least, for science.

For visual research, we can think of a map as equivalent to what qualitative research calls a case record, a bounded collection of evidence for the exploration and interpretation of phenomena in terms of instances, events and locations. The term 'case record' was adopted by Lawrence Stenhouse in developing educational case studies (1980). Drawing inspiration from historiography, he developed three levels of conceptualisation for thinking about the case-study research process. He separated what he called 'case data' – what Monmonier refers to as facts and data – from the 'case record' – the 'lightly edited' collection of material relevant to the case; and then the 'case study' itself – the interpretative selection of material from the case record assembled to argue a case, present a point of view or explain complex phenomena. Just as with maps, a case record can generate many different case studies according to selections and points of emphasis made. A case study (like a journey or a territory or a resource distribution drawn on a map) is a particular performance generated from a script.

Though interpretation is central, implied in this model is an underlying empiricist view, for behind the maps, in Monmonier's view, lie sets of facts and databases. But this world view too can be seen as a deception. David Turnbull, for instance, has looked at the rather different maps of Polynesian and North American First Nations navigators, the knotted strings of the Inca, the songlines of Australian Aboriginal cultures and the early maps of European navigators in the sixteenth century. I suspect he would not disagree with Monmonier's view that interpretation is central to map-making, but he takes a more sociological view of interpretation itself, resisting the separation of the empirical from the interpretive, the 'facts' from their use and their users. Rather, he sees the 'facts' as social constructions themselves, tied to multiple social purposes. Drawing on the language of actor-network theory, Turnbull treats human acts, social conditions and the material and spiritual worlds as closely interconnected. He sees maps as socially produced 'assemblages' that bring together resources, power, different interests and points of view in order to motivate and animate social purposes (particularly colonisation, exploration and trade):

> . . . the connections that maps establish with the social life in which they are embedded are . . . not natural or self-evident and have power effects that pervade the whole society. Indeed, it is through the social work of creating assemblages that science and society co-produce each other. (Turnbull 2000, 101)

In the second book reviewed here, Monmonier covers some of the same ground (the pervasive trope again!), but here he puts the tools he described in *How to Lie with Maps* to critical purpose. *Rhumb Lines and Map Wars* is less an introductory text and more an argument in which he provides an account of 'the social history of the Mercator projection', which was first developed in the sixteenth century, but the use of which persists to the present day.

Monmonier explains that the 'map wars' he refers to in his sub-title derive from the publicity given to Arno Peters' well-known 'Peters projection', which has been heavily promoted since the 1970s as providing an antidote to the implicitly colonial assumptions of the Mercator projection. The Peters projection severely distorts shape once you move away from its 'standard' (true-scale) lines at 45° N or S Line but, unlike Mercator's projection, it preserves relative area. (Mercator is infamous for grossly exaggerating the size of countries as you move to the poles – thus Europe, Russia and North America are made to look much larger then they are on a globe, and Greenland looks larger than Africa – a Eurocentric view emphasised by the fact that the Greenwich meridian is invariably centred on the page – unless you have an Australian corrected map which places Australia at the centre top!)

The Peters projection has frequently been adopted by the international development community because it is seen to be 'fair to all peoples', as Peters claimed, and so has been used in promotional literature among NGOs and the international development community, and even, Monmonier notes, made an appearance in an early episode of *The West Wing*.

Tracking the story back to its origins, Monmonier describes how Gerard Mercator developed his maps over a period of time in which he experimented with different graphical ideas. Though having many interests, his principal craft was engraving, and one of the problems he faced was how to engrave maps on flat metal plates that could later be printed onto a papier-mâché globe. He was not alone in wrestling with this problem of translating from three dimensions to two, but it was his name that came to be used in referring to the projection and its later modifications.

The Mercator projection became significant mainly because of its usefulness in navigation. A straight line (a Rhumb line) drawn on the map equates to a bearing that will navigate you from point to point. It may not necessarily be the fastest or most direct route (which, for long distances, is a great circle), but it has the advantage that it remains constant, whereas on a great circle route the bearing has constantly to be updated and adjusted as you move across the curved surface of the earth.

One problem with the Mercator projection, Monmonier points out, is that maps that were ideally suited to the navigation methods of the time later became generally used for other purposes for which they were less appropriate, like displaying geopolitical distributions or weather maps. Monmonier does not see deliberate distortion in this, but rather unthinking error:

> . . . much of the projection's misuse reflects a mix of comfortable familiarity, public ignorance and institutional inertia. No one was hawking the Mercator brand, at least not overtly, but no one had to – many people who grew up with the map apparently believed this was how a flattened earth should look. How else to explain the ascendancy of an utterly inappropriate perspective and widespread resistance to superior substitutes? (2004, 14)

As always, Monmonier is concerned with practicalities, and he writes about the craft skills of cartography directly, vividly and with clarity. He draws on historical scholarship, giving references (and detailed notes) where needed, but he does not over-burden the reader with them, and he tells great stories. Here he is writing about 'portolan charts', a form of medieval map derived from the records of ships' logs, in an account that gives the reader a wonderful visual, tactile (and almost visceral) insight into the process:

> Inked on treated animal skin called vellum, portolan charts withstood rough handling at sea better than paper navigation charts, which did not become common until the eighteenth century. Animal hides were especially suited to the Mediterranean's pronounced east-west elongation. After splitting the calf's or sheep's skin along the stomach, the vellum maker removed the appendages and head but kept the neck, which formed the noticeably narrowed end of a large oblong drawing surface. The typical portolan chart is drawn on a single skin with the tapered end pointing west, to

FIGURE 4. A much-reduced view of coastal features, rhumb lines and place names on a Mediterranean chart in a 1544 Portolan atlas by Battista Agnese. From Agnese *Portolan Atlas* image nine (Monmonier 2004: Figure 2.2)

> accommodate the Mediterranean's reach toward the Atlantic. The flesh side of the skin provided a smooth writing surface; younger animals, with fewer scars, were preferred. Treatment included soaking the hide in lime, scraping off hair and flesh, stretching over a drying frame, rubbing with pumice to smooth the surface, and massaging with chalk to create a neutral, off-white background. (2004, 20)

While it sets out as a historical account of Mercator's projection, *Rhumb Lines and Map Wars* picks up on another story line which concerns the history of technology and its connection to maps and mapping. Mercator's projection was clearly a significant innovation, but it was not instantly adopted – in fact, it did not become the standard map for many navigation purposes until the eighteenth century. This was partly because its use was resisted by mariners, who 'trusted tradition more than science' (2004, 79), but also because science too mistrusted it. The charts only became extensively adopted when use of them established their superiority, and this early adoption was led by the Navy. Monmonier tells how the American Captain Matthew Maury (1806–73), who in 1842 was appointed superintendent of the Navy's Depot of Charts, recommended a round trip route from Baltimore to Rio de Janiero which cut 17 days off a journey that normally took 55 days. This demonstration of efficiency quickly spread from the military to the merchant navy.

This relationship between military and civil usage appears again in the 1890s when the French developed long-distance field guns. These guns marked a significant advance in military technology and were used by several armies (including that of the USA) through to World War II. Monmonier's account of the interaction of maps, technology and gunnery classically describes what actor-network theory would call an 'assemblage'. The new gun, like the aeroplane TSR-2 described by John Law (2002), brought together a collection of human and material resources to create a new weapon and new circumstances for its use. According to Monmonier:

> The mobile, rapid-fire 75-mm cannon depended on an innovative hydropneumatic recoil system that absorbed kickback and returned the gun to its original position. With a trained crew, the 'French 75' could stay aimed at a target whilst firing five to thirty rounds per minute. Artillery pieces that matched its five-mile radius were not so quickly reloaded because the gun crew had to stay clear of the recoiling cannon, which often had to be re-aimed after a few rounds. Reloading time and firing rate were crucial because the longer the firing period, the more vulnerable a gun was to detection and attack. When hidden the quick-firing French 75 offered few clues to its location. (2004, 99)

The longer ranges of artillery developed at this time meant that gunners were more often than not aiming at targets that they could not see. Their aim depended on telegraphed reports from observers who were stationed in more advanced positions. These reports had to be triangulated in order to assess how close they were to the target. Using the methods of analytic geometry and trigonometry coupled to grid lines drawn on maps,

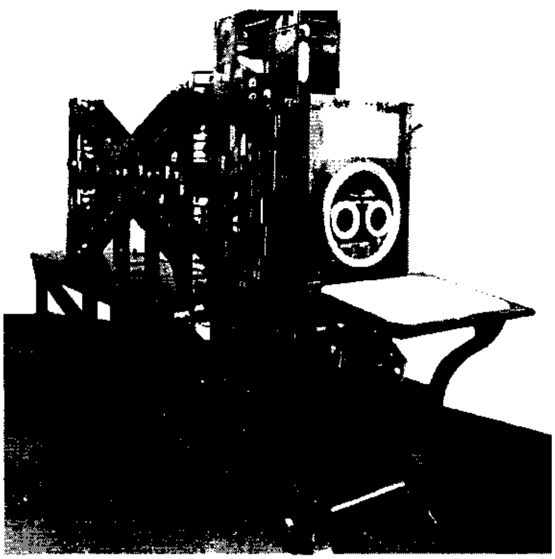


FIGURE 5 Front view of US Coast and Geodetic Survey Tide-Predicting Machine No 2. The crank is to the left of the operator's desk, above which dials indicating the day (outer), hour and minute resemble a giant face (From the National Oceanic and Atmospheric Administration (NOAA) Center for Operational Oceanic Products and Services website http://tidesandcurrents.noaa.gov/images/mach1b.gif (Monmonier 2008 Figure 2.4)

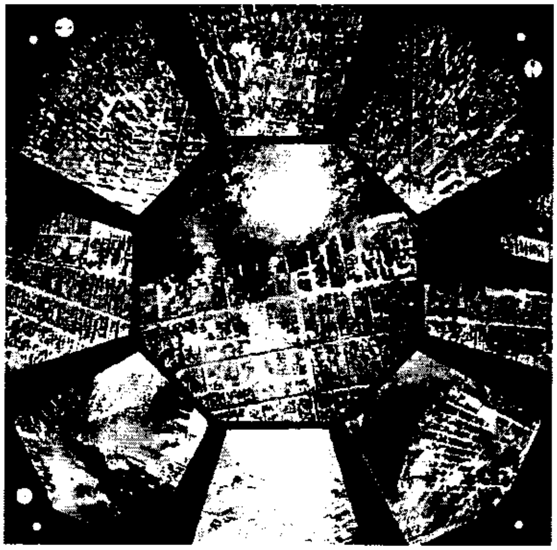
gunners could more accurately hit targets by 'indirect aim'. 'Map firing at unobserved targets,' Monmonier observes, 'increased the importance of reliable maps and soldiers who could read them' (2004, 100). The shift in map-making from an emphasis on navigation to one on long-range artillery changed the way that maps were made and used. The development of the grid was especially significant because it was the use of grid lines that enabled trigonometric calculation. The standard maps of the UK may not be much used for gunnery these days, but they are still published by an organisation that calls itself the 'Ordnance Survey'.

In the twentieth century, the problems of direction and distance were scaled up, as long-distance air travel raised new problems for navigation, and later as satellite tracking against ground maps created a new set of puzzles for cartographers. Variants of Mercator's projection continued to be used in these contexts, while criticism grew of their continued use in mapping land use, geopolitical boundaries, weather maps and resource distributions. From the 1940s on, atlas publishers favoured projections that more faithfully represented shape and relative area, rather than direction and distance. In navigation, map projections that had worked well for land-based travel were less than ideal in plotting long-distance flight as, increasingly, computer-based systems took over from humans and hand-driven calculation.

The third book, *Coast Lines* (2008), brings the story of maps more directly into the present. Its topic, how to 'capture on paper a highly irregular land-water boundary perturbed by tides and storms and complicated by rocks, wrecks and shoals', continues Monmonier's fascination with maps and mapping (even when he is on vacation in Maine), but it also describes the impact of satellite technologies – not only satellite images, but also location data (GIS and GPS).

Monmonier is always quick to relate maps not just to technological affordance, but to social purpose, and here his concern is with environmental issues – with climate change and its consequences, with environmental hazards and with their impact on coasts. He gives an eloquent account of tidal phenomena and their variability along coastlines, bringing theory, case studies and anecdote into neat juxtaposition. He weaves into this account Lord Kelvin's mechanical device designed to predict the tides. Built in 1873, this precisely engineered brass instrument deserves to be better known in the history of computing.

The US Coast and Tide Predicting Machine No 2 was made in 1912. Based on Lord Kelvin's earlier machine, this 2500-pound device is 11 feet long, 2 feet wide and 6



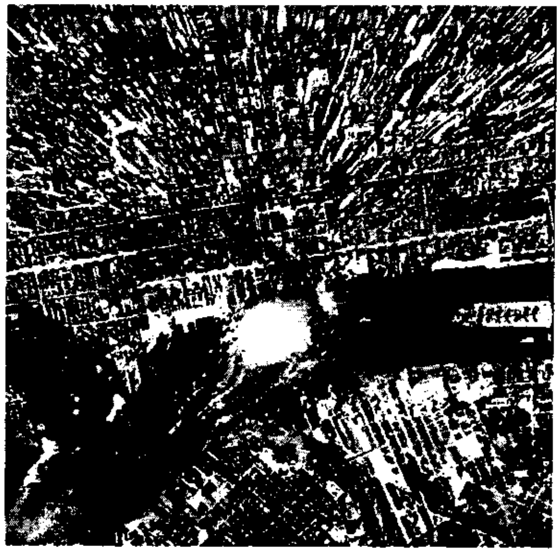


FIGURE 6. A 'transforming printer' converted the single vertical and eight oblique images (*left*) captured simultaneously by the Coast and Geodetic Survey's nine-lens camera into a single composite image with the geometric properties of a vertical photo (*right*). Taken over New York City at a lower than normal altitude, these images illustrate the printer's prowess in reconstructing Manhattan's rectilinear street grid, noticeably distorted in the oblique views. From NOAA Historic Coast and Geodetic Survey (C&GS) Collection, 1938 (Photo credit: Association of Commissioned Officers) (Monmonier 2008, Figure 5.2)

feet tall. Monmonier writes that it predicts tides based on up to 37 tidal harmonics and was 'more flexible and accurate than its predecessor'.

He explains too the dilemmas of cartographers moving from one scale to another, explaining how two small islands off the Maine coast become 'more accurately' mapped as one island at smaller scales. At what point, he asks, do we distort the map to retain the truth that there are two islands, not one, and when do you erase them altogether rather than exaggerate their size in order to note their existence?

Coast Lines picks up a theme from *Rhumb Lines and Map Wars* and adds a new twist to the story. I had not realised, until Monmonier told me, that accuracy in measuring angles is easier than accuracy in measuring distance. The key technologies in this new phase of mapping were the chronometer (in order to locate oneself by longitude) and the theodolite, which provided a means for precisely measuring angles between coastal features. For cartographers, the emphasis in the eighteenth and nineteenth centuries shifted from a perspective derived from plotting long journeys over open oceans to one that allowed for accurate plotting of shorelines.

Taking his story of maps into the twentieth century, Monmonier moves on to look at aerial photography. The aerial photograph opened up new possibilities for mapping coasts, in part because of its speed; where a map might take years to make, aerial photographs could be processed rapidly enough to be used for military reconnaissance or land-use surveys. But, Monmonier points out, aerial photography does not replace map-making.

Commenting on an aerial photograph of Manhattan (2008, 62–3), he writes:

> As the Manhattan skyscrapers in the transformed vertical composite illustrate, an air photo is a perspective view, not a map. Lines of sight converge toward the lens, and tall buildings appear to lean away from the center of the photo, which makes some people feel queasy, as if they were looking out a gaping hole in the bottom of an airplane. A larger, more detailed print might show the top corner of a building displaced outward from the corresponding bottom corner, and a vertical flagpole, if you could find one, would also appear to lean. All displacement is along lines radiating from the photo's center (if it's truly vertical), and the degree of displacement increases with distance from the center and difference in elevation.

While this seems at first sight a disadvantage, this perspective provided the basis for using stereographic images, which in the 1930s and 1940s became more and more important, in military surveillance as well as in land-use surveys, agriculture, forestry, archaeology and other more specialised areas – uses that are now increasingly derived from satellite imagery.

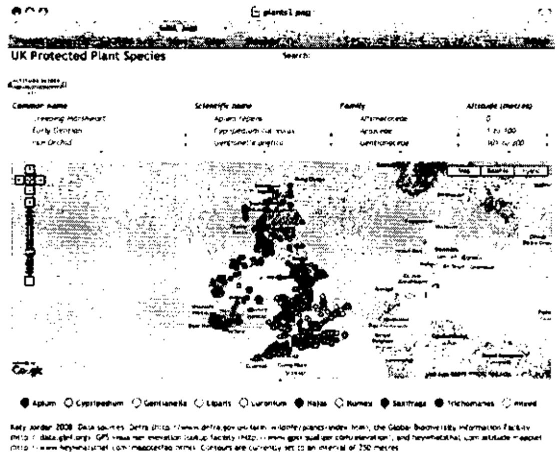


FIGURE 7 Rare plant distribution maps: United Kingdom protected plant species. This is a screen shot of a map developed by Katy Jordan for Ensemble. It shows how different data sources can be brought together into an interactive map. It is interactive in the sense that the user can select species, altitude and map scales to investigate particular aspects of distribution. Reproduced courtesy of the 'Ensemble' Project and Katy Jordan.

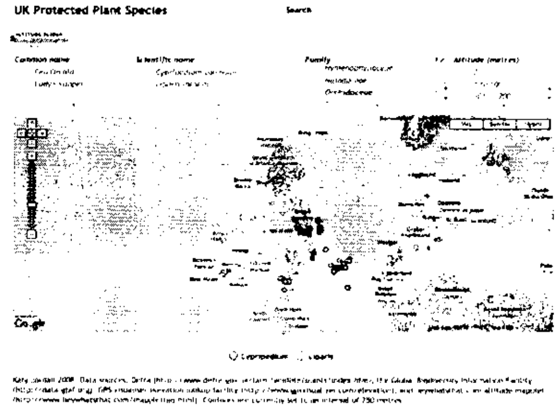


FIGURE 8 This second map is derived from the data by selecting only the orchids. Reproduced courtesy of the 'Ensemble' Project and Katy Jordan. Note that a dynamic version of the map is available as a demonstration at http://tinyurl.com/rareplants

The last sections of *Coast Lines* focus on environmental change and in particular on the issue of rising sea level as a consequence of global warming. This includes some discussion of the effects of Hurricane Katrina, which notes that flooding could have been worse if the wind had not changed at a vital moment. These chapters are of general interest, but for readers of *Visual Studies* it is more appropriate to return to the final section of *How to Lie with Maps*, because here Monmonier adds a chapter on multimedia and what he calls 'graphic narratives'.

One of the affordances of multimedia is that the single image, whether a map or an aerial photograph, can be incorporated into a sequence. This is something like the shift between the photograph and video, where the point of view becomes more dynamic and driven by a timeline. This is the basis of the 'graphic narrative' and it is in some ways the natural form for displaying satellite images. We encounter these most often in the form of weather maps, which show cloud formations moving and changing as they cross the globe. But they can be applied too to other maps – for example, in plotting spatial changes in population growth, in showing changing land use and in displaying economic and social data.

As we move into this world of Web 3.0, maps become more interactive, for they can be generated on the fly from databases (for example, from census data). They can be scaled and targeted on a particular region (or more local site) as the reader chooses. The consequence is that to some degree the user becomes the map-maker; time scales can be manipulated and colours used to sharpen breaks in data that might actually be more continuous than they look.

All this reinforces many of the warnings that Monmonier has given us about interpreting more conventional maps. It is easy to make mistakes, and the naïve map-maker will make more (and more serious) mistakes than the professional cartographer. In a current project ('Ensemble'), we have been using semantic tools to generate maps using data from various databases. Our aim is to develop computing tools that support learning in 'complex, controversial and rapidly-evolving fields where case based learning is the pedagogical approach of choice' (Ensemble: Semantic Technologies for the Enhancement of Case-Based Learning, http://www.ensemble.ac.uk)

This is a screen shot of a map developed by Katy Jordan for Ensemble. It shows how different data sources can be brought together into an interactive map. It is interactive in the sense that the user can select species, altitude and map scales to investigate particular aspects of distribution.

This second map is derived from the data by selecting only the orchids. This in turn suggests a question: why does *Liparis* appear in separate locations on the east and west coasts? This is a question that can be followed up by further exploration of the databases. (Note that a dynamic version of the map is available as a demonstration at http://tinyurl.com/rareplants.)

Magnifying the *Liparis* distribution showed plants growing off the coast of South Wales rather than on coastal margins. When we checked we realised that the location data in the database were given in kilometre-square intervals – which meant that at some map scales these locations were misleadingly plotted in the corners of the grid squares, leading to some appearing to be off-shore rather than in coastal margins, where they belonged.

Monmonier spotted this kind of problem long before digital technologies created it in this form. In 1854, the physician John Snow was caught up in treating people during a cholera epidemic in London. Plotting the residences where people had died on a street map, Snow realised that the deaths were clustered around the Broad Street water pump. The pump handle was removed and the death rate declined dramatically. Re-analysing John Snow's maps, Monmonier showed how the source of the cholera epidemic might not have been identified if, instead of using point data, a different mapping method (for example, frequency by area) had been used (1996, 155–7). It should be added, though, that Edward Tufte's later elegant analysis of this case raises several other questions; not least, he noted that by the time the pump handle was removed, the epidemic had already peaked and many residents had already fled the area. Cases are always complex!

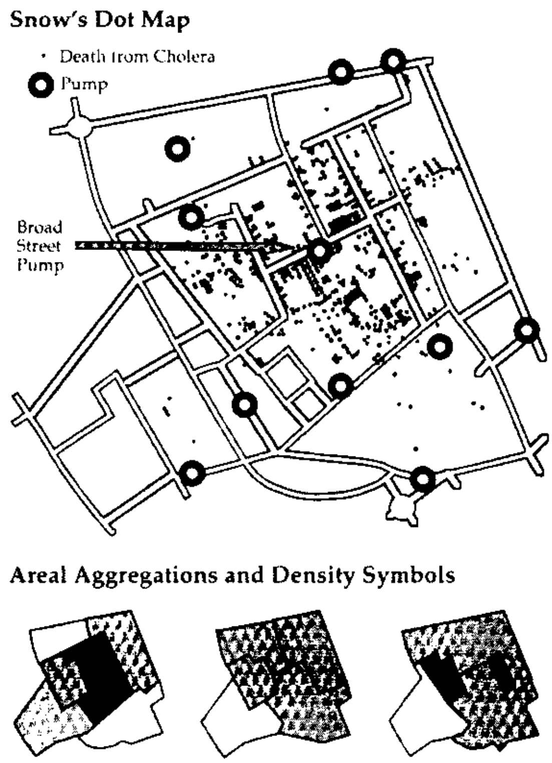


FIGURE 9. A reconstruction of John Snow's famous dot map of cholera (above) and three choropleth maps (below) produced by different areal aggregations of this part of London (Monmonier 1996, Figure 10.9).

Monmonier brings us to the edge of a new turn in the world of maps as the Internet moves us from a situation in which there are few cartographers and many readers, to one in which we can all, to some degree, interact with maps and make them our own. The web page of the Commission on Maps and the Internet describes the current context neatly:

> The Internet has redefined how maps are used. No longer restricted to paper, maps are now transmitted almost instantly and delivered to the user in a fraction of the time required to distribute maps on paper. They are viewed in a more timely fashion. Weather maps, for example, are updated continuously throughout the day. Most importantly, maps on the Internet are more interactive. They are accessed through a hyperlinking structure that makes it possible to engage the map user on a higher-level than is possible with a map on paper. Finally, the Internet is making it possible to more easily distribute different kinds of cartographic displays such as animations. The Internet presents the map user with both a faster method of map distribution and different forms of mapping. (Commission on Maps and the Internet, http://maps.unomaha.edu/ica/)

What the Commission calls 'a hyperlinking structure' is crucial in current developments. On a day-to-day level we need only to look at how people use Google Maps to plot a route to a place that is unfamiliar, and then switch to the photo view to see how the journey would look as we approached the site. Or the emerging mobile technologies that augment reality – allowing us to view a street scene using the video-capture capability built into most mobile phones and then call up relevant information on the same screen that tells us about the history of the buildings, what time the museum opens, where we can get coffee and where the bus stops (http://layar.com/).

It has become clear that multimedia has become more than the sum of its parts, providing us not only with access to information displayed in multiple forms, but to the capability of moving (more or less fluently) between media. 'Maps' become an environment we can travel around inside, their landscapes drawn from multiple databases, often in ways that are intuitive rather than intentional. This makes new demands on the user, especially as the information comes to us through channels that may not be immediately obvious. A good example is the educational environment Savannah (http://www.futurelab.org.uk/projects/savannah), an augmented reality environment based on the BBC Television series *Big Cat Diaries*, which consists of documentary films that record the behaviour of lions in the wild. In Savannah, children venture out onto the school playground while looking at mobile screens that recreate the immediate environment as the African grasslands, and using dynamic maps (linked to GPS tracking), they act as lions – protecting their young and hunting for food. The rather bizarre scene that this creates for an observer (a video is available on the Futurelab website) shows children walking around the school playing field carrying backpacks and gazing at screens that have imaginatively transported them to a quite different environment – and, as Monmonier would say, transported them into a novel graphic narrative.

Given the further development of examples of this kind, the future of maps is in our hands as much as it is in those of reference sections of libraries. It will soon be time for another Monmonier book.

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