

## Business, Governments and Technology: Inter-linked Causal Factors of Change in Cartography

This paper is in response to Michael Goodchild's "Cartographic Futures on a Digital Earth" that appeared in the previous issue of CP. It argues that he has focused too extensively on the technological changes in map-making. It is claimed here that an understanding of what has happened and might happen in the future can only be achieved through much greater consideration of the role and interests of business and of governments.

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### Backcasting is easy: can intelligent people forecast accurately?

Like Professor Pickles, I too (sadly) found many things to agree with in Professor Goodchild's keynote speech. Evidence for my consistency of view can be seen in the key points I made to the 1993 ICA conference in Cologne (Rhind 1993) where I predicted that:

- cartography will be hugely affected by changes in technology,
- customers will dominate,
- globalisation of commerce will change 'the map business,'
- consistent mapping and geographic information will increasingly be needed for the whole world and for major regions, and
- standards will become crucial.

As a result, I will concentrate here on the things on which we differ, acknowledging that we may well all be wrong<sup>4</sup>. In a recent major publication, Messrs. Longley, Goodchild, Maguire and Rhind (1999, p.11) confessed that in their previous, extremely successful first edition of the 'bible of GIS,' they had totally failed to anticipate the changes wrought by the advent of the World Wide Web only a year after its publication! This 'error' does not compare with many others found in the literature about the impact of technology. I set out below two examples from the UK, but there are many others from most other nations (see, for instance, <http://www.startribune.com/stonline/html/digage/forcast.htm> and <http://www.foresight.org/News/negativeComments.html#loc048>).

The Americans may have need of the telephone, but we do not. We have plenty of excellent messenger boys.

*Sir William Preece, Chief Engineer of the British Post Office, in 1876*

If the current growth in use of telephones continues, by 1950 we shall need all of the women of working age as telephone operators.

*Sir William Preece, (still) Chief Engineer of the British Post Office, 1886*

*"The message is clear—the future will not be a linear extrapolation of the past."*

The message is clear—the future will not be a linear extrapolation of the past. We should also recognise that not everything changes. Shapiro and Varian (1999), for instance, point out that the principles of the economics of trading on the Internet are little different from those in more traditional commerce. Some things also go back to what they were—the *Economist* leader (cited below) pointed out that we are now back to the low levels of privacy typical for the vast bulk of the populace in agrarian societies. Despite all this, much *has* changed and will go on changing.

### Some things wrong with the Goodchild thesis

In specifying eight characteristics of a map (a visual representation, flat, exhaustive, uniform in detail, static, generic, precise and slow to produce) Mike Goodchild implies that this is how mapping has to be. It does (and is) not. There are examples where mapping of information collected in the field can be speedy (such as routine delivery to customers within 24 hours of data collection) *and* tailored to particular needs. I agree of course that this has only become routinely possible with the advent of 'new technologies' ('new' in practice only; many of the concepts were defined in the nineteenth century).

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A speedy reading of the Goodchild paper might also lead the unwary to believe that we all already live in a digital world. This is manifestly not so nor is it totally certain that this will occur everywhere as a single construct. Consider for example the following quote:

If the world were reduced to a village of 1,000 people: There would be 584 Asians, 124 Africans, 136 from the Western Hemisphere (both North and South America), 95 Eastern/Western Europeans, and 55 Russians. 520 would be female, and 480 would be male. 650 would lack a telephone at home. 500 would never have used a telephone. 335 would be illiterate. 333 would lack access to safe, clean drinking water. 330 would be children. 70 would own automobiles. Ten would have a college degree. Only one would own a computer.

Source: <http://www.ntia.doc.gov/ntiahome/speeches/ntca120198.htm>

Perhaps echoing John Pickles, I also believe that the wider aspects of these technological changes have not been emphasised enough in the Goodchild treatment. These have crucial indirect impacts. Consider, for example, the following quotation:

*"... I also believe that the wider aspects of these technological changes have not been emphasised enough in the Goodchild treatment."*

Remember, they are always watching you. Use cash when you can. Do not give your phone number, social security number or address, unless you absolutely have to. Do not fill in questionnaires or respond to telemarketers. Demand that credit and data marketing firms produce all information they have on you, correct errors and remove you from marketing lists. Check your medical records often. If you suspect a government agency has a file upon you, demand to see it. Block caller ID on your phone, and keep your number unlisted. Never use electronic toll-booths on roads. Never leave your mobile phone on - your movements can be traced. Do not use store credit or discount cards. If you must use the Internet, encrypt your email, reject all 'cookies' and never give your real name when registering at web sites. Better still, use someone else's computer. At work, assume that all calls, voice mail, email and computer use are all monitored.

... Anyone who took these precautions would merely be seeking a level of privacy available to all 20 years ago ... Yet ... all these efforts to hold back the rising tide of electronic invasion will fail ... Faced with the prospect of its [privacy] loss, many might prefer to eschew even the huge benefits that the new information economy promises. *But they will not, in practice, be offered that choice.* [my emphasis]

Source: *Economist* 1 May 1999

This neatly introduces my main point: both Goodchild and Pickles almost totally ignore two of the key factors in how our world is being re-shaped—business and government (as table 1 shows). I now address these points, with particular reference to cartography.

### **It's all about money, stupid!**<sup>5</sup>

Almost all of the changes to our world are being made through the actions of business and government. It is, of course, true that much of this is underpinned by new science and technology which are driving significant fractions of the Anglo-Saxon economies. Some of this originates in universities; some in government research laboratories. But increasingly, much comes from private sector bodies, notably the pharmaceutical and defence companies—and spin-offs from them like Space Imaging.

The growth in the big players of capitalism in the last decade, especially the funders of new developments, has been staggering; BankAmerica for instance has increased its market capitalisation by a factor of 22. Such growth enables ever-greater global reach and, in turn (assuming no serious errors in investment policy), still greater accumulation of resources for investment in new business activities. Thus major new developments like high resolution satellites are being introduced on the basis of business cases that are predicated on selling imagery and related services across the whole world, leading to substantial predicted profits for the investors—especially for those early into what is seen by its proponents as a potentially huge market.

We are then seeing the globalisation of certain businesses, including some aspects of cartography with a growth in multi-nationals trading in almost all markets. The most obvious of these are the oil companies, software firms (notably Microsoft, but many others exist), banks and retail businesses. Despite many small local enterprises, a very large and growing fraction of the GIS and mapping market is supplied by Autodesk, ESRI, Intergraph, MapInfo and Microsoft. Indeed, more maps per day are probably made by a 100,000 or so sub-set of the 2 million or more users of AutoCad than by all trained cartographers; the former group have perverted the use of tools designed and bought for other purposes to map-making (V.V. Lawrence, Pers. Comm. March 1999). It also seems likely that the greatest (but unknown) number of maps of any kind plotted daily are those in encyclopaedias such as Encarta. Do-It-Yourself cartography is now commonplace.

One key to the world as we now know it has certainly been the 'massification' of cheap computer resources. But the reason why these developments have occurred and been important is not because they are desirable ends in themselves – their importance is predicated upon other, more generic business drivers. The key drivers have been quite simple: the advantages which come from the exchange of business-critical information, the ability to make elegant presentations in order to persuade bosses and peers, and the need to examine at least the financial consequences of different actions through 'what if' scenarios implemented on spread sheets. From these tools and, just as important, from the organisational procedures, knowledge and societal norms emerging from their use have spawned quite different ways of operating in many disciplines.

	Goodchild	Pickles
Cartography	12	24
Money	0	0
Business	0	1
Government/governments	3	1

Table 1. Incidence of key words in the Goodchild and Pickles papers (excluding references).

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*“One key to the world as we now know it has certainly been the ‘massification’ of cheap computer resources.”*

*“There have also been significant commercial developments at the micro-scale which have impacted upon cartography.”*

*“One particularly important aspect of all this is the nature of Intellectual Property Rights . . .”*

*“. . . we in academia and in cartography have almost all been ‘bit players’ in an unfolding historical drama.”*

As Mike Goodchild rightly says, there has been a move towards regarding GIS (and cartography as a sub-set of it) simply as another branch of the IT industry. The driver for this is that the greatest business benefits can not arise without destruction of the idiosyncratic and separate nature of the GIS (and to a less visible extent, the cartography industry). To integrate the geographical information dimension permits business-beneficial links between technical and customer files; it externalises the need for software expenditure and it minimises the risks of having a clutch of technical experts who can influence organisational business policy.

There have also been significant commercial developments at the micro-scale which have impacted upon cartography. We have seen many small ‘start-ups’ in cartography focussed often on market niches and exploiting standard software and hardware through innovative use of traditional skills. More generally, the advent of niche player ‘start ups,’ often highly flexible in market positioning and carrying low overheads, has been a feature of many European, North American and Australasian economies. The shift to out-sourcing many activities, with much work being contracted out to smaller firms or the self-employed, has played a significant role in fostering these new small businesses. In cartography as elsewhere this reduces overheads, minimises the need for tying up of capital and minimises social costs in the event of an economic slowdown. In short, it can reduce business risk.

One particularly important aspect of all this is the nature of Intellectual Property Rights since these influence how much money can be made under conditions of fair competition within the ‘knowledge industries.’ Such IPR is important to business and governments alike. The US federal government’s global commitment to eradicating unlicensed use of software and ‘pop’ music—markets currently much larger than cartography ones—demonstrates that national commercial interests are high on politicians’ agendas. There is nothing new in this: it is, for example, alleged that the apparently altruistic ‘open skies at all resolutions’ stance of the US government in the crucial 1966 UN debates actually reflected both political and nascent commercial advantage to Americans as one of the two countries with sophisticated surveillance technology.

Academic inputs have only had a modest influence on the digitally-based developments in cartography, these—as argued above—being mostly business-driven. What changed our world was not Waugh’s creation of GIMMS (Rhind 1998) in the 1970s or the work at the Harvard Computer Graphics Lab (Chrisman 1998). The advent and successful selling of ARC/INFO—the most astonishing marketing success of the 1980s in our field—was far more important. Arguments about whether these earlier academic developments influenced the latter are little more than pedantry; what made the difference was the expansion of the market and the ‘routinisation’ of the tasks. Goodchild has cited the recent burgeoning of new map or image websites as evidence of the importance of our field – yet the bulk of the ones he cites are from the private sector.

I conclude, with some reluctance given my own career history, that we in academia and in cartography have almost all been ‘bit players’ in an unfolding historical drama. Much of this has been business-driven but one other set of entities has played a key role. I can introduce this by an example: my signing of the British government’s National Interest in Mapping Service Agreement on one day in 1998 was far more important to the mapping world than the cumulative impact of 200 plus published papers and articles in the rest of my career!

### I'm from the government and I'm here to help you

Governments remain the major employers of cartographers world-wide, at least as can be determined from available sources of information. In the European Union, for instance, it seems likely that no less than 45,000 staff are employed in official national and state mapping agencies. This figure swells by a factor of about three if cadastral enterprises are included.

This commitment to and interest in mapping is not surprising: cartography—or at least Geographic Information—underpins many government activities. Thus, as Ratia (1999) reports:

When the European Commission invited representatives from the ministries in charge of mapping in member countries to a meeting in Luxembourg, at least the following ministries were represented: Ministry of Environment, Ministry of Agriculture and Forestry, Ministry of Housing and Physical Planning, Ministry of Finance, Ministry of the Interior, Ministry of Defence, Ministry of Justice. This shows how mapping and geographic information issues cover all the sectors of administration and it is in many cases a matter of taste which is the most natural ministry for these issues.

But even—perhaps especially—within government, dramatic changes have occurred in recent years. Some of this is usually attributed to the effects of technology, e.g., the diminution in Ordnance Survey staff from 3,500 in 1979 to almost half that 20 years later. The real reason for such changes is, however, much more complex, especially when the much higher levels of certain kinds of skills now needed are factored into account (in Ordnance Survey, the work force now has ten times as many graduates as 20 years ago). The interacting factors include:

- 1) *Changes in societal attitudes towards governments*, with decreasing trust in the ability of central governments to act effectively. This has evolved alongside a widening recognition that individuals can only prosper by taking more responsibility for the future of themselves and their families, rather than leaving it to the state;
- 2) A growing unwillingness on the part of the citizenry to pay for increasing government expenditures (Foster and Plowden 1996); and
- 3) *Changes in government's own views of themselves*, typically evolving from a 'doing' role to one of facilitating, enabling and regulating – 'steering not rowing' to paraphrase Osborne and Gaebler (1991). Thus effectiveness and efficiency have joined probity, propriety and equity of treatment in the lexicon of governments such as those of Australia, Canada, New Zealand, Sweden and the UK.

The consequences of all this have been dramatic: Ordnance Survey, for example, now does more with far fewer human resources, thanks to the combination of digital databases, business-like management, contracting out and market imperatives. Technology may have been a necessary factor but it has been far from the only driver of the change in map-making.

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### Globalisation of cartography

*“... we are still in a dire situation in regard to the quality, availability and accessibility of mapping in many parts of the world.”*

Mike Goodchild quotes with evident approval Al Gore's vision of a digital earth (unsurprising since he had some hand in forging that vision). In one sense, achieving this vision is already well-advanced. We can safely anticipate the advent of detailed imagery of many (but not all) parts of the world delivered to us in near-real time. We can now move maps and other information around the world at the press of a button. But we are still in a dire situation in regard to the quality, availability and accessibility of mapping in many parts of the world. On the best available estimates, only about half of the world is mapped at 1:50,000 scale, much mapping of sensitive areas is unavailable, and what is available is often 20 or more years out-of-date. And, even where mapping is available and up-to-date, the nationally-based nature of the mapping, so far as datums, content and depiction are concerned, render cross-border analyses, monitoring or business application a difficult and costly matter.

*“Yet so far as most governments are concerned there is little real incentive to expend considerable financial sums on . . . regional or even global activities”*

There are two different approaches to remedying this situation. The first is for nations or business enterprises to collaborate in creating consistent, coherent, comprehensive and current mapping. This has already occurred in the commercial domain, with the creation of consortia to create and market road information for car guidance systems. Much discussion has also occurred within and between governments, in forums such as the European Union and the UN. Binding treaties such as Agenda 21 contain commitments to improving the quality and availability of environmental information—which necessarily includes mapping. Yet so far as most governments are concerned there is little real incentive to expend considerable financial sums on recreating mapping (which already broadly suits national needs) onto a basis which facilitates regional or even global activities.

The two obvious exceptions to this statement both involve the United States. Almost alone, the government of that country has the need for and the capability to acquire high quality global mapping. The National Imagery and Mapping Agency (or NIMA), the geographic intelligence information arm of the US military (<http://www.nima.mil/>) has made clear its determination to secure the best available information in support of any activities of US and NATO forces. Lencowski (1997) has summarised some of the military's strategies to achieve 'the information edge.' It is important to note that some low resolution digital geographic information is already made available to the public by the military; but the idea that 'best available' information is made generally available is counter to any sane military strategy. NASA, however, has made clear its commitment to collecting detailed global topographic information and disseminating it widely in the interests of science. There may well be some policy conflict in these two different approaches.

### CONCLUSIONS

*“... money and politics are embedded in decision-making . . .”*

You can not sensibly consider what has happened and what might happen in cartography without considering the interests and express needs of business and government. It is not clear just how these interests will be manifested over the next few years – feasible alternative scenarios exist and the reality may well differ in different countries. But money and politics are embedded in decision-making within both of these sectors and these decisions impact upon the lives of all people, including cartographers. Technology is not a 'given' which changes the world in a predictable fashion: human beings change the world when they have the necessary incentives, skills and technologies. That is as true in cartography as it is anywhere else.

I have long enjoyed working and arguing with Mike Goodchild; his paper stimulated these thoughts. I also found John Pickles' paper thought-provoking and enjoyable (though, for reasons given above, I am confident both he and Mike have been blinded to the most important factors relevant to our debate!).

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2. 'Cartographic futures on a digital earth' Michael F Goodchild, presented to Ottawa ICA Conference, 1999.

3. 'Cartography, digital transitions, and questions of history' Rejoinder to M.Goodchild by J.Pickles

4. Appropriately, I too will use the first person in this provocation.

5. The title of a brutal but effective cameo article on drivers of the GI industry by Lobley (1999)

## ACKNOWLEDGEMENTS

## REFERENCES

## NOTES