Contemporary Map Products and Their Origins

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Abstract

Recent technological developments coupled with the publics widespread and emergent interest in maps online has seen a number of large, traditionally non-spatial IT companies enter the commercial mapping arena. The paper presents an appraisal of the plethora of mapping products, and their origins, either commercial or government, currently available on the World Wide Web (WWW).

The authors critically analyse the rapidly changing landscape of online mapping brought about primarily by the introduction of new, and significant, commercial players into what was initially a government domain. The authors discuss how the current online mapping environment has evolved and pose possible future directions.

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INTRODUCTION

What impact has the Web had on the perceived accuracy, quality, currency and value of commercial maps and spatial imagery? This question is addressed by the authors of this paper through focussing on three topic related areas; forecasters commenting on general aspects of the Web such as advertising revenue, human perception and interface design; spatial applications provided by commercial and government bodies currently online; and recent discussions from academics, cartographers, and industry regarding the current mapping climate and emerging future trends.

THE INVESTIGATION

“Perhaps what distinguishes cyberspace, and in particular the Internet, has been the speed of diffusion and growth; it is widely acknowledged that the World Wide Web is the fastest growing communications medium in history” (Dodge and Kitchin 2001).
To attach some figures to this theory: the worldwide number of Internet users surpassed 1 billion in 2005—up from only 45 million in 1995 and 420 million in 2000. The 2 billion Internet users milestone is expected in 2011 (C-I-A, 2006).

The Internet as a whole is becoming an important player in the world economy. The global Internet economy accounts for 2.3 million jobs (Kraak & Brown 2001) and has generated more than $300 billion in revenue in the United States alone (BBC, 2006).

The web is a unique medium that differs from traditional media in many ways. According to (Berthon, Pitt et al 1997) some of the key differences are:

- Interactivity: the ability to interact both with and through the medium
- Availability: 24 hour-a-day presence
- Facilitation and flexibility: it supports informing, advertising, online transactions, distribution of products and services, customer support and customer feedback
- Non–intrusive: the customer must seek out the marketer rather than vice versa, to a greater extent than is the case with most other media (Anderson, 1995). This renders the medium unique from a marketing perspective.
- Cost: initial web presence is relatively easy and inexpensive to establish
- Reach: any business or organisation that has a web presence can reach an international audience
- Equality: the web provides a more or less level playing field for all participants; access is equal regardless of size.

These features offer a unique opportunity for marketers to reach a vast global market. Despite Berthon et al's assertion that it is an inexpensive and equitable medium, the amount of money invested in a website, its data and functionality, and associated advertising, will significantly tilt the playing field. As will be explored in greater detail, the equality of access is also contentious. Positively, "the Internet provides tremendous opportunities for new web-specific brands to quickly develop rapport" (Mitchell 2000).

Advertising

Interestingly the Internet and the WWW did not start as commercial undertakings (Peterson 1999) but rather as a means to transfer scientific documents. This would explain why so many products are offered free of charge. But are they really free? Barker (1998) argues "many users fail to realise that although they believe they are receiving a "free service" they are in fact paying dearly with their time and attention, rather than cash".
Online advertising spending this year on video and rich media, such as podcasts, is expected to be about $1.8 billion, roughly equal to text advertising, according to a July report from Jupiter Research. By 2011, video and rich media ads are expected to hit $4.9 billion, dwarfing the $2.9 billion expected for text ads (Benderoff 2006).
Apart from the more obvious commercial advertising on the Web, there is also the increasingly prevalent and lucrative practice of collecting and trading individual user information; "owners of websites make money by selling the personal data they collect from WWW users, with all the related problems of privacy and security" (Kraak & Brown 2001).

These significant figures are not lost on the number of large IT companies that have recently become online map providers. Along side the displayed map is advertising; as more maps are viewed, more ads are viewed. It is in the map publishers interests to not only increase the number of users accessing their web site, referred to in the

Internet world as *eye balls*, but also to lengthen the amount of time users spend accessing the site (Mitchell 2000).

Market Share

This philosophy is reflected in the rapidly developing market of online maps. Following is current figures for the numbers of users accessing maps online in 2006:

MapQuest 43.7 million users per month
Yahoo! Maps 20.2 million users
Google Maps 6.1 million users
Microsoft MapPoint 4.68 million users

(ComScore Networks 2006)

Maps

The demand for maps online cannot be underemphasized. According to Peterson (2005) maps are now second only to weather information in the number of WWW search requests. He estimates the number of maps distributed through the Internet on a daily basis is over 200 million. MapQuest is the best known interactive web mapping site and the largest provider of maps on the Internet; more than 20 million MapQuest maps are created and downloaded each and every day (Peterson 2003).
Recent innovations in web site technology (which will be discussed in more detail later in the research) have revolutionised map data displays. This has been further fuelled by free satellite imagery being made available to the media and the general public by satellite image companies such as Digital Globe and Space Imaging, and GIS vendors such as ESRI & Google. Recent global GIS awareness has been heightened by environmental impacts such as the South East Asia Tsunami and Hurricane Katrina. The media, both television and newspaper copied GIS imagery from the Internet and rebroadcast it to hundreds of millions of worldwide viewers (Tsou, 2005). Together, these factors have promoted the adoption of mapping functionality by large IT companies that traditionally were not GIS focused.
The demand for maps online is growing exponentially, as the Web has become the medium of preference in accessing geospatial products; "accessing maps via the Web has become perhaps the 'first stop' for the general public when they seek geospatial information. And, it could be argued, that providing maps on the web has made them more accessible than ever before" (Cartwright, 2003). So powerful is this medium in transmitting spatial information, that cartographers and the industry cannot overlook it; "creating (possibilities for) maps on websites is becoming a new specialisation of cartographers ands cartographic companies now have to adapt to making available their cartographic products and services through the WWW" (Kraak & Brown 2001). The fact that the public now expect maps to be attached to everyday products such as the White Pages, illustrates their spatial awareness and perceived value of geospatial products in daily life. It seems that maps have never been so contemporary; recently they have received consistent exposure in society, through media, culture and technology; "Maps are everywhere: on our cell phones, in newspapers, in art galleries, on television, in books, and obviously on our computer screens" (Peterson 2003).

Audience & Users

So, we know that the online map audience is clamouring, in their millions for geospatial information. But who are they? What do they want? How much do they know about cartography and / or GIS? (Plewe 1997) This we don't know. When cartographic products are widely distributed over the web, it is very difficult to determine who the "users" are (Taylor 2005). It appears that little research has been conducted to determine the online user group:

"The problem is that we hardly know anything about how people use web maps, or more generally, how people use the WWW to retrieve geographical information. Perhaps we also do not know enough about who is using web maps. The user profile is becoming more and more diversified and we need to know more and more about the different needs and different characteristics of the different user groups" (Kraak & Brown 2001).

Traditionally, maps were generally sought for a specific purpose, by users with some knowledge and understanding of geospatial information and its representation. However, with the public nature of the Web, users may have no real knowledge of, or experience with maps. "Most Internet mapping users may lack sufficient cartographic training to manage or interpret the dynamic representation of geospatial information" (Tsou 2003).

Research

As the Internet expands, there will be a greater need to understand how Internet maps are being used (Peterson 2003). The cartographic academic community seems united in the view that very little research has been conducted into online users of geospatial products. The National Academies of Sciences (2003) (in Taylor, 2005) primarily disagrees, but acknowledges that the inclusiveness of current research is incomplete:

"To make any significant progress in geospatial applications, the research community must adopt an integrated, interdisciplinary approach. One of the greatest hindrances to benefiting from the massive amounts of geospatial data already being collected is the fragmented nature of current research efforts. Most of the research in the accessibility, analysis, and use of geospatial data has been conducted in isolation within single disciplines" (National Academies of Sciences 2003:1).

In light of how integrated geospatial products are in everyday products and services, it seems that to take a multi-disciplinary approach in capturing user information would be the only reliable, inclusive and indicative method.

Accessibility

Search engines are like a window to the web. This is how most web pages are found on the web from the billions of pages that are available (Peterson 2003).
While Berthon, et al, established equality as a characteristic of the Web, *accessing* the Web hardly seems equal. In general terms "search engines are more likely to

index the more popular sites that have more links to them and in international search engines there still is a bias towards commercial sites based in the United States" (Kraak & Brown 2001).
Apart from international bias, there is also the commercial aspect. Cartwright (2003) makes the observation "when using almost any Web search engine, whereby, along with the results of the search, 'linked' or 'partnered' sites are delivered first and their screen locations take prominence over other elements".

The top four Internet search engines (respectively) are Google, Yahoo, MSN, and AOL (eBranz, 2005). Let's compare that with the map market share companies listed earlier:

Map Product	**Company**
MapQuest	AOL (wholly owned subsidiary)
Yahoo! Maps	Yahoo
Google Maps	Google
Microsoft MapPoint	MSN

The four most popular search engines are also four of the predominant map providers. Coincidental? That is highly unlikely. Is this affecting the geospatial options were are provided with? One proposition is that the enormous profit generated by these companies allows for significant investment in data and technology to produce superior geospatial applications; which is a reasonable assumption. However, it would be naïve to assume that the initial points of entry to accessing these products do not signlificantly determine which products users ultimately find. Kraak and Brown (2001) pose the question "How do users find the maps or geodata they need on that overwhelming WWW?" It is somewhat rhetorical, as, along with research into user profiles, this is largely unknown; however it is a crucial issue. Mitchell (2000) observes most first time users tend to locate services via major portal sites (i.e. www.yahoo.com). The Internet is intangible and often the only aspect with which a user can identify is the actual brand associated with particular services. A fact not lost on many major providers. Search engines provide a portal to the wealth of information available on the World Wide Web. Unfortunately, like other mediums before it, such as television and radio, the political and commercial motives of its operators are inescapable. However, the 'public' persona of the Internet means that a substantial number of users are unaware of just how pervasive this actually is. While completing this research, RMIT Library staff were approached for instruction on how to effectively search online for relevant sources and information. There is currently no such course available. The Web is still relatively new. But with exponential growth, its prevalence demands education incorporate Internet learning into the curriculum (without compromising traditional core learning). Just as VCE teaches students to critically analyse the media and its messages; users must adopt the same approach to the Internet. A major issue for RMIT, along with every other tertiary institution, is plagiarism; yet there is no formal training in how to properly find and source information. Perhaps some basic education in web practices will help users to understand and respect that information online, despite the web's public nature, still belongs to someone else, and its credibility needs to be evaluated accordingly. Without digressing too far from the issue, the point is that users seeking geospatial products are in the same category. Kraak and Brown suggest that users try to find an answer to their geographical questions at websites that were made known to them by other users before and that are revisited time and time again;

"This may lead to an exponential growth of the number of "hits" on such a website, whereas in the meantime perhaps another website exists that may give a more effective answer to the geographical question at hand. It is rather difficult to accept, for instance, that the enormous growth of the number of maps generated on the MapQuest site is brought about solely by the effectiveness of these maps" (Kraak & Brown 2001).

This can also be attributed to the user's sense of trust. According to Kahn et al (2000) "online interactions represent a complex blend of human actors and technological systems. In light of this complexity, with what or whom can we meaningfully speak of building trust relationships? The system? Its developers? Web site designers? Online organizations? Other users? Many researchers agree that consistency in product delivery is a key component. The quality of any online service varies significantly and end users tend to remain loyal to those services from which they receive consistent results. (Mitchell 2000).

This raises another important issue; quality of online mapping applications. Is distribution a true indication of quality? How do we rate quality?

Quality

"There are more maps being generated today than ever in history . . . and many of these maps are not being formally created by cartographers. The result has been an increase in the quantity of maps and geographical information on the web, but says little of the "quality" of information and understanding about the world attained by users. There is certainly greater access to data and knowledge, but one must also ask questions as to whether current practices and modes of delivery are helping to generate better meaning and understanding of the world" (Monmonier 2005).

There seems to be two recurring themes in this discussion. Firstly, the Internet provides a means of providing more information that ever before, perhaps too much; an 'information overload' (Tsou, 2003). The second is that users are more geospatially inexperienced than ever before; Cartwright (2005) aptly suggests "geographical information delivered through the use of New Media is seen as a part of popular media, rather than scientific documents". Therefore it is being viewed by a general public with often little or no geographical or mapping knowledge.
Everyone may now define and construct maps and disseminate them through the WWW. . . even without having the necessary cartographic knowledge or background (Kraak & Brown 2001). Equally, everyone can also view cartographic products without sufficient knowledge. Without 'dumbing down' spatial applications, adequate education and assistance must be provided to ensure the product is meaningful; "in the hands of an inexpert or novice user, such [geospatial] systems may only provide a "basket" of data and information, with no real way for understanding of what is contained within that basket or its relevance. There is a need for New Media-enhanced cartographic products to provide the means of acquiring knowledge and not just voluminous amounts of information" (Cartwright, 2005).

What is the quality and reliability of the geographical information transferred through cartographic displays on the WWW? (Kraak & Brown 2001) According to Brodersen (2003) this is inherently subjective; the user judges the user quality completely by themselves. The user decides, therefore, which map possesses a reasonable user quality. It is therefore vitally important that users are armed with necessary skills in evaluating the quality of products. One advantage of the Web is that with the plethora of mapping products online, users can compare products of various

companies. "In theory, on the web, any map can be accessed from anywhere on earth by any user. This exponential increase in map accessibility makes cartographic information more democratic and more ethical" (Peterson 1999).

Accuracy & Metadata

As has been discussed, many users are unfamiliar with spatial products, so, they are often either unaware or under false impressions of the accuracy of the data being viewed. For instance, when Google Earth was released, many users believed it to be a satellite-fed image in real time. In actual fact, it is a mosaic of various commercial data sets, not all captured at the same time, but generally current to within three years (Wikipedia, 2006). In this way, perception of accuracy is linked to expectation. Technology is advancing so rapidly, and popular culture, such as movies and television, have been promoting technological concepts ahead of our time. Users *expect* that this technology is already widely available. "The widespread representation of cartographic, navigational and location technologies in popular texts have created cultural expectations that far exceed the current technical limits of mapping tools" (Greenspan 2005). Similarly, users are largely unaware of the subjectivity of maps. Krygier and Peoples (2003) suggest the public "uncritically accept maps and geographic data as authoritative representations of reality". This is further perpetrated by the use of the Web for transmission; maps on the Internet tend to be more technology oriented and look more scientific. . .the boundaries between the reality and the image created in map form become even blurrier with the Internet (Pequet & Kraak 2002). If it is online, it is often accepted as fact; "new map users are not necessarily aware of the power of the map rhetoric. They often don't even challenge the neutrality and the objectivity of the map" (Taylor and Caquard 2005). Perhaps, the reason users are so indifferent to data accuracy and currency is due to inadequate information supplied by the data provider. For example, Google Earth's latest release brands all satellite imagery with a '2006' watermark, giving the impression that the data is current. On closer inspection, the exclusion of recently built structures provides a telling timeline of the data. Similarly, maps, while subject to the cartographer's bias bear no explanation of these; on one hand cartographers are widely conscious that their maps cannot be true "representations" of reality, on the other hand, they have not developed techniques to inform the user of this lack of objectivity (Taylor and Caquard 2005). This raises an important issue of metadata. If users are expected to be aware of the limitations of the data, then surely the data's limitations need to be transmitted and transparent. If the data provider fails to provide this information they are endorsing inaccurate perception:

> If access is denied to support information, that is information that supports how to get data, data standards, data systems, data providers, and data depiction conventions, then the mapping system user is denied a true picture of geographic reality (Cartwright 2005).

Users can only define what is real when provided with all of the relevant information. Informing map users of the constructed dimension of maps is particularly vital given the exponential production of maps via the Internet (Taylor and Caquard 2005).

NEW COMPUTING TECHNOLOGIES FOR INTERNET GIS

While the Internet initially offered a promising new medium for vast distribution, some technical limitations hampered early products. Initially, resolution was a key

factor. Despite the ease of publishing online, resolution on par with printed maps could not be achieved; a typical high-resolution printer can display between 1200 to 3400 dots per inch. In contrast a computer monitor can only display about 65 -120 dpi. The computer monitor is also limited in size, typically only 14" to 21" in diagonal measure. Printed maps can be much larger (Peterson 2003). The other major factor was slow response time relating to client / server communications. Together these issues limited data image sizes and display capacity (Tsou, 2005).

Two new computing technologies have revolutionised these constraints. The first is commonly referred to as Ajax: Asynchronous JavaScript + XML. Ajax is the combination of several technologies, which operate in powerful new ways. It comprises standards based presentation using XHTML and CSS, dynamic display and interaction using the Document Object Model, data interchange and manipulation using XML and XSLT, asynchronous data retrieval using XMLHttpRequest, and JavaScript binding everything together (Garrett, 2005). The revolutionary part of this technology is that the Ajax engine communicates asynchronously with the server, on the user's behalf so "the user is never staring at a blank browser window and an hourglass icon, waiting around for the server to do something" (Garrett, 2005).

The second development is an image tiling technique. This concept carves a geographical area up into equally sized tiles and determines which tile is required by a user request. It can then return this region without bringing the entire image into computer memory. Therefore the user only sees part of the image on the fly, but it prevents unnecessary processing of off-screen sections. This prevents memory overload, decreases processing and bandwidth requirements and makes it possible to move quickly from one section of the image to another. Figures 1 & 2 are examples of the first commercial product on the Web to utilise Ajax and tiling technologies, [map.search.ch] which allows the user to view Switzerland in its entirety and zoom in to cities such as Zurich, with virtually no wait time.

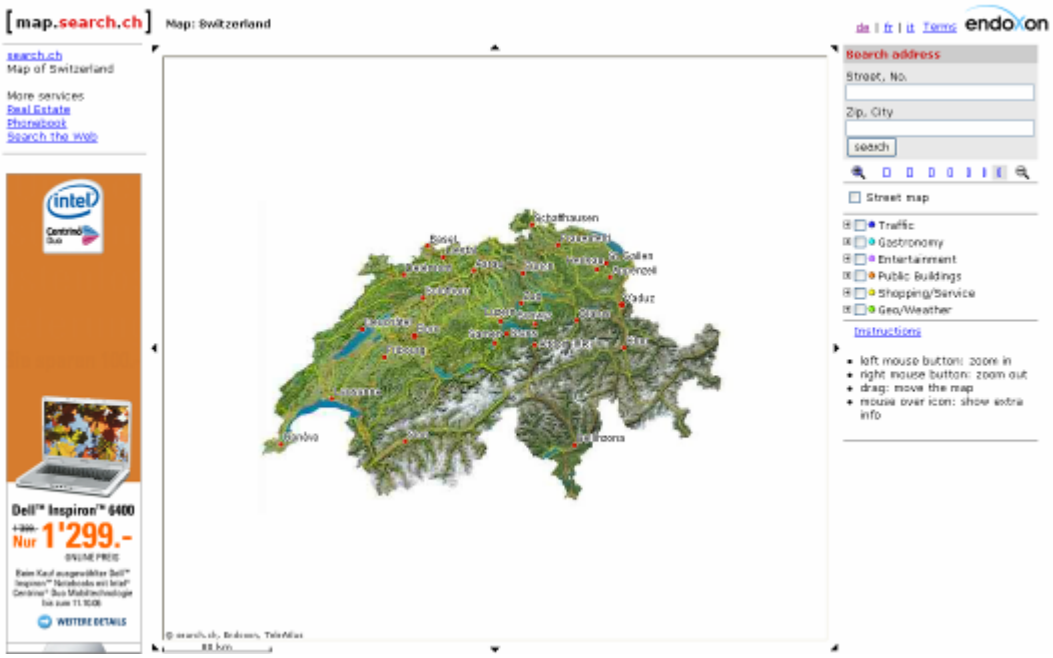


Figure 1. [map.search.ch] Switzerland

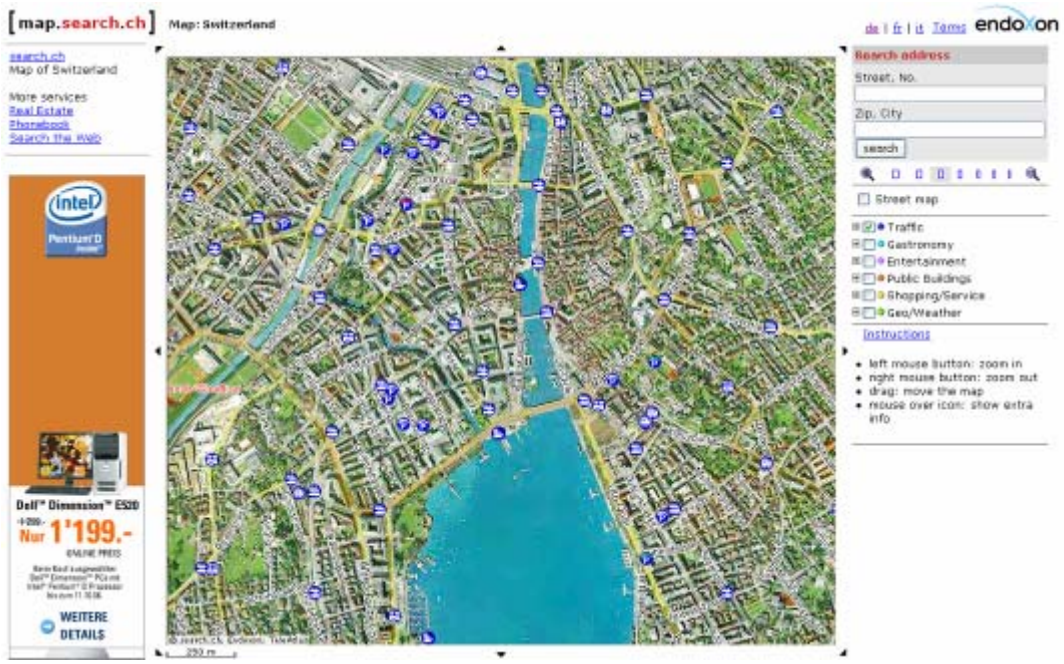


Figure 2. [map.search.ch] Zurich

Real Time

Recently, GPS enabled devices, such as mobile telephones have been linked to online products to provide data in real time. Tim Hibbard, a U.S. developer, has a GPS enabled mobile device installed in his car which is linked to his website "Where is Tim Hibbard?" Powered by a Google base map, his car feeds his constant position to the website so that users can see where Tim is at any time of day. Figure 3 shows Tim is at a residential address, probably fast asleep, as the website was accessed during the early hours (U.S.). The website also allows viewers to send SMS messages to Tim's mobile phone. It is exhilarating to think we may be the first generation to produce 'live' maps where people or objects may be moving pins. It also raises serious issues about privacy if we can track an individual's movements. Hibbard believes it is a privacy versus benefits trade-off; if we feel the services that this technology affords, such as real time traffic updates; friend proximity alerts, automated sales based routes, and targeted advertising, are beneficial to our lives, we will willingly forfeit our privacy. This technology can be applied to business, in transport and logistics, and socially, in networking and contact applications. A core issue is user awareness and consent; "the person being tracked must always have full control over who can view their location and when their location is broadcasted" (Hibbard, 2006).

Figure 3. Tim Hibbard's real time website linked to a GPS enabled mobile device

IT companies are also developing products relaying user positioning. Microsoft offers a Location Finder, a client sided application that integrates with MSN Virtual Earth. A standard laptop or PC can use Wi-Fi access points to pin point a user's location and display it on the interface.

Real time imagery displayed in programs such as Google Earth raises numerous security issues. Many governments object to the current display of sensitive areas such as government buildings, national security organizations, and nuclear facilities. Figure 4 shows one such example; President Bush's residence. This issue is particularly topical with current terrorism threats. Producing this imagery in near real time would certainly have serious ramifications.

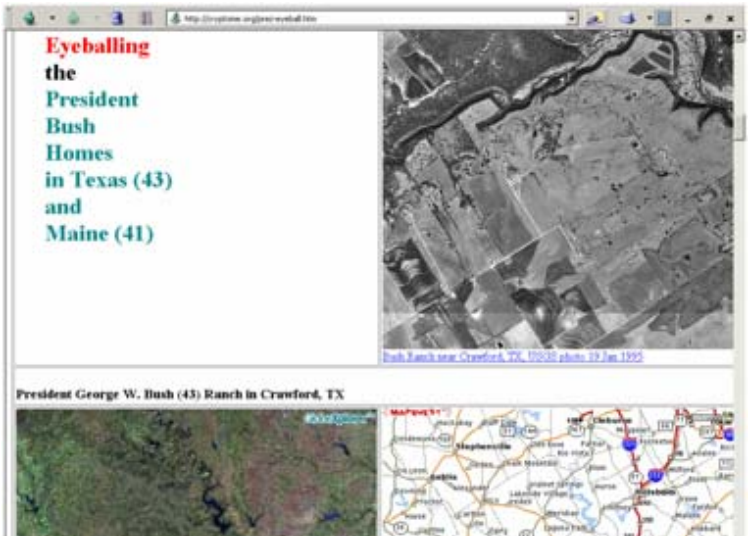


Figure 4. President Bush's residence

Emerging Platforms

As the technology for producing mapping applications advances, so too, do the platforms of display. So far, the focus has been of mapping applications on PC's, however the choice of platform is diversifying. With wireless networks, laptop and tablet usage is increasing. In the next decade many Internet users will be supplementing PC Internet usage with Smartphone and mobile device Internet usage. In developing countries many new Internet users will come from cell phone and Smartphone Internet usage. (CIA, 2006). Mobile telephones and personal digital assistants (PDA's) look to be a major growth sector in web based services. The provision of location based services is particularly pertinent to geospatial products as users can have access to real time information relevant to their location, for example, traffic updates and service finders.

Figure 5. Various platforms for displaying mapping applications

GOVERNMENT AND COMMERCIAL PRODUCTS

The release and success of commercial mapping products such as Google Earth and NASA WorldWind has increased both the expectation and scrutiny of government produced products.

Essentially commercial companies have a financial stake in the mapping product; it must generate revenue. Therefore they tend to be much more user focused; "in the world of geo communication, the possibility of making a profit is directly linked to the user quality at the end-users end, with the implication that 'user quality' is the key word (Broderson 2003).

Commercial map producers know that they must provide a product that encourages repeated usage. According to Garrett (2003) "For the users who do come [to your website] you must set out to provide them with an experience that is coherent, intuitive and maybe even pleasurable – an experience in which everything works the way it should". Apart from delivering an agreeable overall experience, users must also be provided with useful and relevant services: "Services and their maps, like

every other ‘product’, should be standardised and tailor made for use. The producer has to be an expert who finds out what the user needs and puts the service together” (Broderson 2003). Google Earth is a prime example. Whether Google engineers are geospatial ‘experts’ is debatable, however Google are experts in knowing and providing what the user wants. Google Earth is extremely user friendly, by design. The practice of creating engaging, efficient user experiences is called user - centred design. The concept of user - centred design is very simple: Every step of the way, take the user into account as you develop your product (Garrett 2003). Google has determined what the user wants; namely plenty of awe-inspiring satellite imagery made accessible through easy to use, intuitive tools.

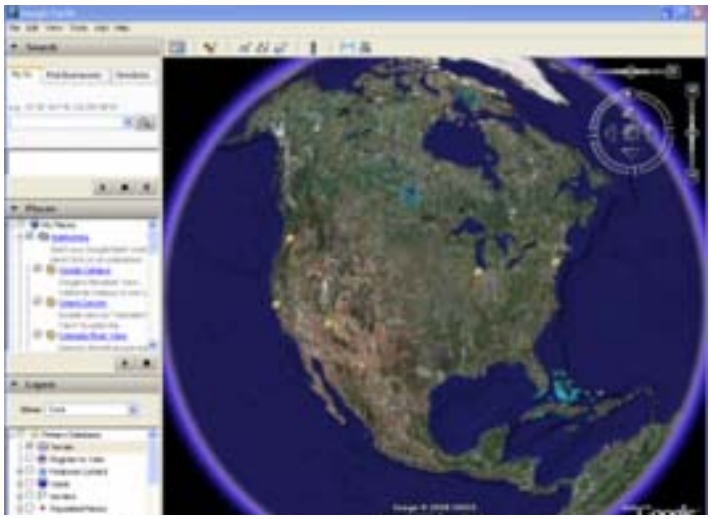


Figure 6. Google Earth

Determining the user’s needs is an important step in establishing the company focus, it provides structure and direction for the project and it’s purpose. This is a key point of difference between commercial and government map producers. The Victorian Land Channel Interactive Maps website is a fitting example. The site allows users to zoom in on to any region of Victoria, displaying suburbs, street names and property parcels. Specific property parcels can be selected by point and click, which will display a street number and name, along with suburb and postcode. In the example in Figure 7, the parcel on the corner of Swanston and LaTrobe was selected and returned the address:

330-334 SWANSTON ST
MELBOURNE 3000

Figure 7. Victoria's Land Channel website

This address is part of RMIT University. However, the address provided fails to indicate this, as does the map face, which, is generally uninspiring. The presentation of web maps forms the key instrument in providing an appropriate interface to these National Mapping Organisation tasks. In this respect the design of suitable web maps is crucial (Selwood and Tang 2003). Is this product providing a useful and coherent user experience? Aesthetically, the map is very basic; if the information it does display is insufficient, how is this product of value and what information can the user obtain from it?

Perhaps to supplement this shortfall, a street directory base layer can be added to the map. The Melways, in paper format, has been scanned, at poor resolution, and floated under the existing maps suburb names, that are poorly sized and coloured, and lost amongst the imagery. In Figure 8 below, 'Melbourne' has been highlighted to illustrate this. Another method to access street directory imagery requires the user to enter the map number and grid number to view a particular page. This requires the user to have a paper copy of the Melways on hand. If this were the case, what purpose would accessing a low resolution, limited sized, identical image on a computer screen serve, when in possession of the hardcopy? Developers have tried to patch together a Web application by supplementing it with paper maps that are not effective on this medium. It appears the overall purpose of this product is very unclear, while its value is questionable.

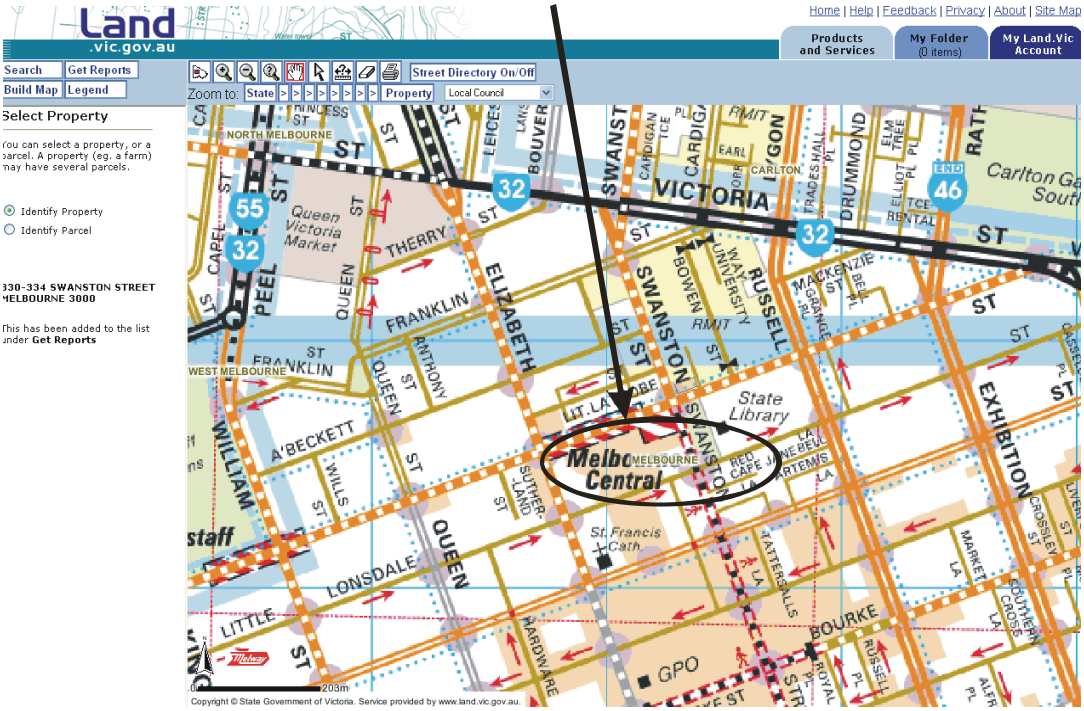


Figure 8. Land Channel's website with Melways base map

Naturally, cost and allocation of resources are a major aspect of product development, and these are significant issues for government organisations; Rhind (1997) states that most National Mapping Organisations are in the midst of dramatic changes. These changes are guided by new technology, by government decisions (financial cut backs, less directed influence, more finances from the private sector) and competitive market demands (Kraak & Brown 2001). However the government often have access to data, and to technology, but are lacking in know- how to deliver quality products. It is not unusual to find cases where government offices have acquired hardware and software with totally inadequate conceptual support for their applications. As a consequence, the technology is often used only for map reproduction and often the projects as a whole do not fill the expectations (Reyes and Martinez 2005). The utility of government mapping products is more demanding than ever. With online mapping, governments are now required to provide more flexible and less traditional products across a range of mediums:

"In addition to one supply driven and centrally controlled set of highly accurate, hard copy products intended for multiple uses, there is a growing demand for separate, single use sets of products at differentiated accuracy levels – determined by the appropriateness of the available electronic tools and purpose of use. These products can be derived as hard or soft copy, derived form one or more electronic databases, serving specifically stated purposes" (Kraak & Brown 2001).

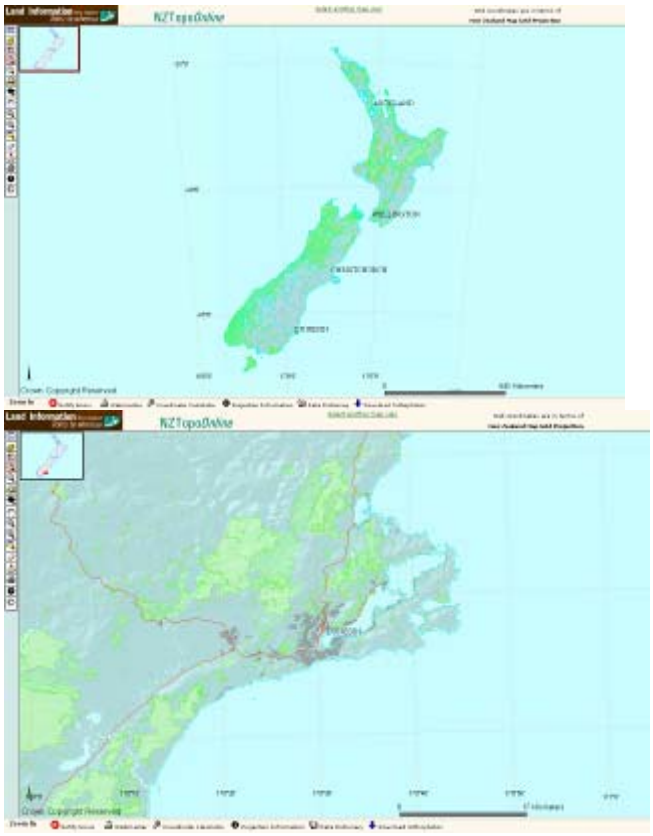
The New Zealand government provides an excellent example through their Land Information New Zealand (LINZ) product. Developed with ArcIMS technology, it is designed to target the largest possible user group, providing a simple and intuitive user face, accessible through a standard web browser. The product displays the entire country and can be viewed
at any scale. LINZ gave careful consideration to their targeted user audience and their geospatial skills

recognising “that many would not have special cartographic or design training, and might need help to ensure the maps produced retained a reasonably high standard. As a result, LINZ worked on establishing a new set of rules for scale dependent rendering that would enable meaningful maps to be generated at any scale” (Selwood & Tang 2003).

Online, interactive mapping applications have virtually unlimited possibilities for government organizations. The Canadian government acknowledged this, justifying their recent investment in geospatial programs:

“We want to exploit the vast potential of integrating information from maps, satellite images, statistics and other sources into geospatial data infrastructures. These data infrastructures are opening up a whole new way of understanding our world” - Goodale, 1999 (Pulsifer & Taylor 2005).

Undoubtedly, there is significant investment required; establishing and maintaining such systems can be complex and time consuming, and can require significant investment in data, systems and staff resources (Selwood & Tang 2003).



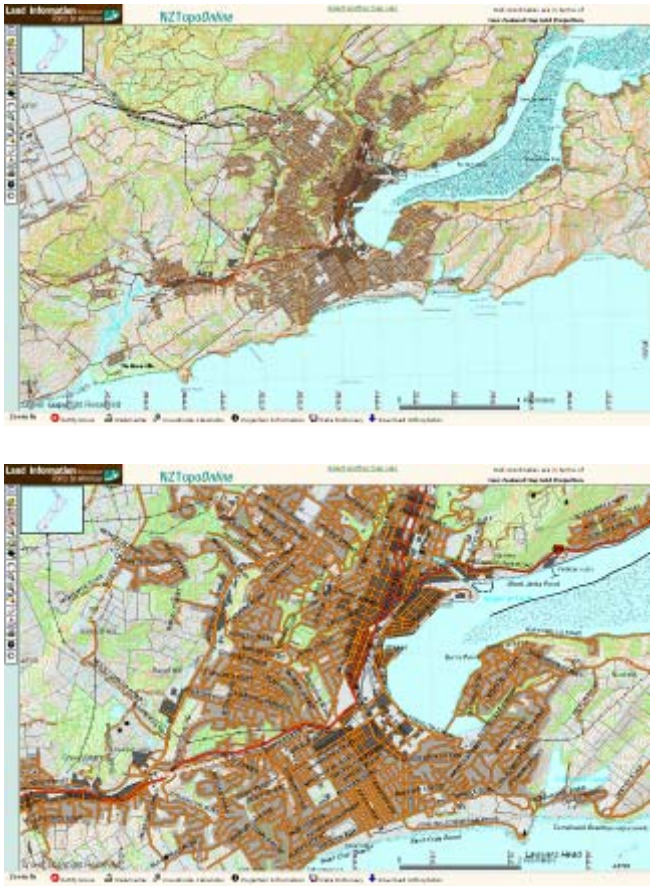


Figure 9. LINZ displays New Zealand, and Dunedin

Therefore governments need to demand a return on their product, by developing applications that can reduce administration and processing costs. The City of Geelong's EView GIS enterprise GIS service is a prime example. Currently it runs on the council's intranet and is utilised by council employees in responding to information requests from residents. If such a system could be distributed through the Internet, then administration, training and management overheads could be sizably reduced.

To summarise, government departments could benefit significantly by adopting a more commercial outlook; designing products with a strong user focus will provide a clearer purpose and more effective framework for development. Governments should also be focusing on the flow-on benefits to the organization, and how to capitalise on their investment. In achieving this they should seek research partnerships with academic agencies and the private sector to collaborate on project development (Pulsifer and Taylor, 2005).

FUTURE DEVELOPMENTS

Cybercartography

Cybercartography is defined as "the organization, presentation, analysis and communication of spatially referenced information on a wide variety of topics of

interest to society in an interactive, dynamic, multi-sensory format with the use of multimedia and multi-modal interfaces" (Taylor 1997). There are some excellent examples on the Web which are utilising multimedia to produce rich and dynamic geospatial products. The UK's SuperHigh Street site (in Figure 10), is an interactive shopping site where users can digitally 'walk' the shopping district around Oxford Street, in London. Incorporating live weather reports and web cams, the product also includes a Google-driven overview map which pin points the users precise location. The site also operates in conjunction with retail outlets along the strip by providing electronic access to 'enter' their stores via websites.

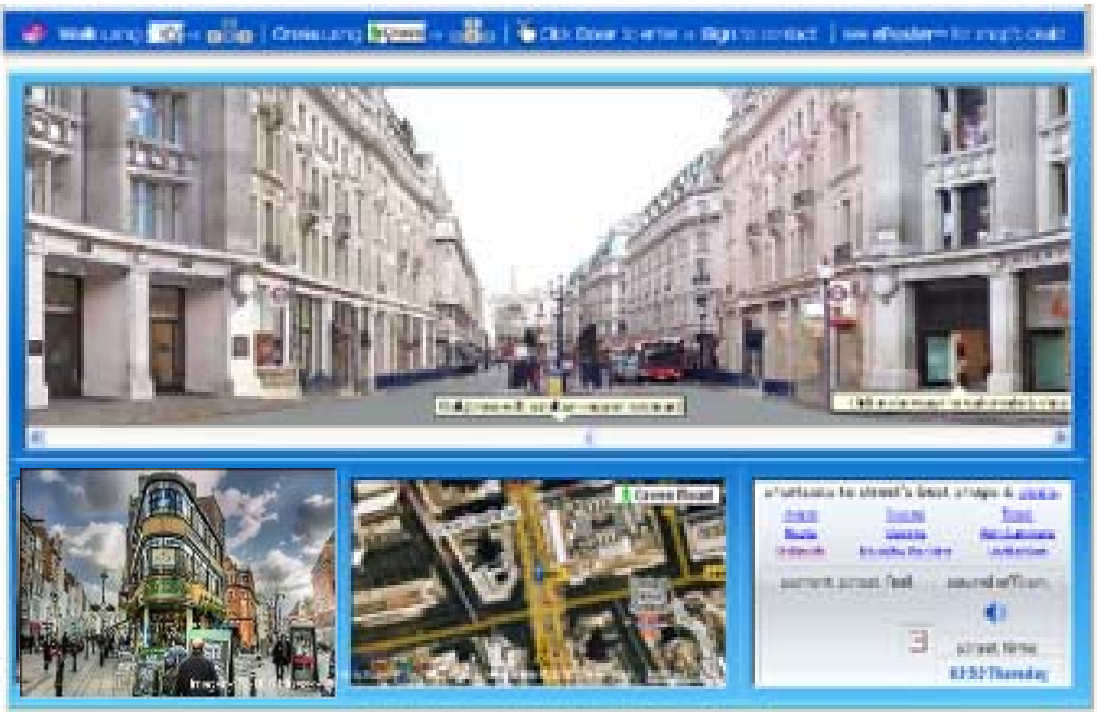


Figure 10. SuperHighStreet

In the future, products like these will be further developed with cybercartography, to provide real time access to geospatial information. Sound will play an important role; narrative elements will provide live information, and allow users to interact and communicate with experts. Audiovisual footage will also greatly enhance the user's connection with geographical regions. Touch and the use of tactile facilities will also provide valuable services for the visually impaired. Cybercartography is designed to "provide a diversified and engaging experience of the world" (Taylor & Caquard 2006) and research indicates that multimedia applications have the potential to enhance learning capacity as compared with information presented in a single medium (Lindgaard, Brown et al 2005).

The diversifying collection of elements in cybercartographic products means product development will involve the collaboration of many different disciplines.
Developing these products will provide much greater insight into how users relate to interactive elements:

"Cybercartography . . .consider[s] how users interact with , and navigate through, virtual space from a wider perspective. Human factors psychology, cognitive psychology, and studies in language and literature, such as those on hypertext, are used to give new insight into these important processes and to develop new products in an interactive fashion" (Taylor 2005).

Monmonier (2005) states that "perhaps the single most pervasive impetus for cybercartography is the maps uncanny ability, starting with the humble line printer in the 1950's, to piggyback on the circumstance of whatever electronic display becomes available". In the current and coming digital age there is, and will be, a plethora of multimedia tools available for enhanced mapping applications.

Technology, mergers and partnerships

As the possibilities of interactive multimedia applications emerge, companies will forge strategic partnerships to procure the services needed to enhance their products.
One of the most significant developments will be the merging of television, movies and the Web. Audiences are shifting away from traditional televised timeslot broadcasts in favour of flexible viewing with greater interaction. Television networks are being forced to restructure their business to maintain their audiences. Channel Seven in Melbourne, is a prime example, joining forces with Internet giant Yahoo. In the credits following each prominent television series, a voiceover and visual display encourages readers to visit the website for clues, sneak previews, interviews and discussion with other viewers.

Figure 11. Channel Seven on Yahoo Website

Real time streaming and live maps will increase in use as technologies develop. Web developers will create alliances with GPS providers to provide access to real time information. While this will certainly attract business, social networks may provide a large market share, if, for instance, MySpace were to offer consumers real time GPS locations of friends and family.

The advancement of new technologies, such as laser television (Figure 12) superseding plasma and LCD screens, will also filter through to other platforms such as PC, laptop and mobile devices, increasing resolution and development possibilities.

Figure 12. Laser television

CONCLUSION

The web is young and continues to develop at an exponential rate;

“The future of the web is almost certainly not the web as we know it now, but a more fluid networked environment. Barriers collapse: between reader and publisher, between media, between digital and physical, between synchronous and asynchronous, between space and screen” (Dix and Clarke, 2001).

All of these factors represent extraordinary possibilities for mapping products, which are being realised and developed. In the future we will see dynamic cybercartographic products rich with multimedia elements; video and enhanced imagery, sound and immersion, touch and smell, providing access to real time information. These products will also be accessible across a variety of platforms:

“As the web has matured static pages have given way to interactive sites that change depending on world event, that animate, that react to what we do. As access to the Internet moves out from the computer to mobile phones, television and games consoles, we are forced to constantly re-evaluate the nature of 'the web' and

what it will become. Sometimes it seems that the progress of technology is outstripping our understanding of it".

(Dix and Clarke, 2001)

In this way, ongoing research into users and how they interact with digital applications is essential;

"Changes in the relations between people and technology have highlighted a need to understand people's experiences. Indeed, this ability to engage with what is happening for people as they surround themselves with technology is increasingly perceived as a vital part of being able to design digital products and services" (Light 2006).

Recent technological developments have caused a major paradigm shift in the delivery of geospatial data; "the provider of the future may not simply be a provider of maps but instead of data and the tools with which the user can create maps from the selected data" (Kraak & Brown 2001). In this way users have acquired control to personalise significant space and take ownership of community representations.

Many academics also believe the practice of mapping will be applied to non-geographical entities in managing the ever-growing repositories of data that the Internet represents:

"Mapping as a process may also take on new functions and could become the key organising concept and mechanism of the information era by the utilisation of graphic interfaces and the organization of data and information in a spatial framework" (Taylor 1997).

Commercial products will continue to provide innovative new approaches to mapping, while the integrity of products will require monitoring, to ensure that advertising does not determine geospatial content; "maps with commercial sponsors may encourage users to drive through particular shopping areas" (Taylor & Caquard 2005). Providing users with sufficient metadata and education may also help to make map users more critical of both the subjectivity of products and the methods of locating relevant products.
Government products have unlimited potential for providing timely and useful geospatial products to the general public. By adopting a more commercial outlook, with a strong user focus, governments can harness the potential of geospatial products in management and administration. To achieve this, collaborative development with academic organizations and the private sector is essential.

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Images

Figure 1 & 2: [map.search.ch]

Figure 3: http://www.timhibbard.com/wherestim/

Figure 4: http://www.cybergeography.org/maps/

Figure 5: Powerpoint (Microsoft) Clip Art

Figure 6: Google Earth download

Figure 7 & 8: http://services.land.vic.gov.au/maps/interactive.jsp

Figure 9: http://www.nztopoonline.linz.govt.nz/website/nzmgtopo/viewer.htm

Figure 10: http://superhighstreet.com/Oxford-Street-London/index.shtml

Figure 11: http://au.yahoo.com/lost/

Figure 12: navegante2.elmundo.es/…/2006/14.html