CHAPTER **2**

Mapping the Past and the Present

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Abstract

Maps, map-related objects like topographic models and geographical visualizations are employed to map three-dimensional space plus time. The artefacts from mapping are used to locate, identify and analyse information not already known, and to verify the known. Mapping provides an encapsulated representation of geography that can be used by discipline experts as research tools and by the layperson as (geo-)informing objects. In the hands of experts they become the means for the virtual exploration of places and the objects for physically recording finds, observations, and informed speculation. Mapping provides the means to geo-locate places, objects, peoples, journeys, movements, and cultures.

This article provides an overview of maps, mapping and computer-generated visualizations. It illustrates how mapping artefacts have been used to record geography and the activities that have taken place within geographies. It also shows how these artefacts can be used to illustrate past and future activities in geographies, using maps and geographical visualizations that fuse together the past and present, showing past activities or found art objects in their actual location.

1 Introduction — Representing the Past and Present through Cartography

At the end of the last millennium a series of articles was published in the Melbourne, Australia, newspaper, *The Age*, in its magazine *Good Weekend*, entitled: "The Best of Everything from the Past 1000 Years." Top of the list was the humble threaded screw, which, according to journalist Rybczynski (1999), changed the world. He expounded that

> Without screws, entire fields of science would have languished, navigation would have languished, navigation would have remained primitive and naval warfare as well as routine maritime commerce in the 18th and 19th centuries would have not been possible. Without screws, there would have been no machine tools, hence no industrial products and no Industrial Revolution. (Rybczynski 1999: 33)

Included in the series of articles and included in the 'best of the last 1000 years' was the map. Battista Agnese's paper map of the world (Figure 2.1), produced in Venice in the mid-16th c. was described by Johnson (1999: 26) as something more than a beautiful and precise document, namely "a topography of the European mind in transition".

The map illustrated the new information gleaned from voyages of discovery by Columbus and Magellan, and was able to depict it more accurately due to the application of new scientific and mathematical advances and to make it more widely available with new tools provided by the newly available technologies. It was an illustration of human endeavour and revolutions in knowledge acquisition and depiction.

As well as being records of voyages of discovery, maps and nautical charts also became the tools of warfare (the very beginnings of topographic maps were as tools to assist accurate cannon fire). It is said that the English defeated the Spanish Armada not just with naval firepower, but also through better navigation, which relied on having accurate sea charts. In fact, accurate maps were deemed to be so important that they were classified as secret documents, and guarded closely by the powerful.

2 Using maps — 'Being there'

The basic premise of using maps and other (geo-)visualization artefacts is to build mental models of reality. It could be said: "It's what cartography does". Maps are ubiquitous. City guides are used in our cars to find streets, metro maps help us navigate through urban transportation systems, topographic maps give us an appreciation of terrain, and we draw 'mud maps' to explain routes or other geo-located information to others.

The maps we rely upon, use and draw are not just produced on paper. They are also produced on other media that complements printed paper maps. The following sections of this article provide an overview of how different media have been used to deliver geo-located information. The focus

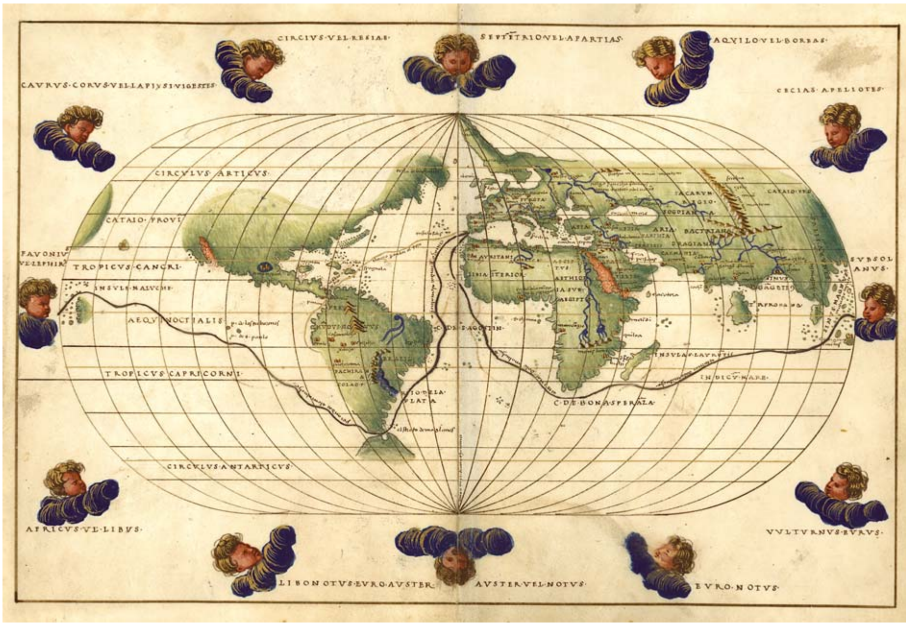


Figure 2.1 Battista Agnese's world map from the Portolan Atlas. Dedicated to Hieronymus Ruffault, Abbot of St. Vaast. Source: http://en.wikipedia.org/wiki/File:1544_Battista_Agnese_Worldmap.jpg Image is in the public domain.

on the examples provided is the delivery of information about historical information and artefacts via New Media or integrated media — CD-ROM, the Web and other computer-generated and delivered resources. But it begins with paper maps.

2.1 Paper Maps

Paper maps could be considered to be analogue Virtual Reality (VR) tools. They have provided the means by which armchair travellers could 'go' to places from the comfort of their lounge or study. It has been claimed that maps were in fact the first multi-media products,as they contain text, diagrams, graphics (as ordered symbols) and geographical facts.

Historically, maps have been used to provide information to users about places recently discovered or voyages completed to unknown worlds or hitherto seemingly impossible journeys. Ptolemy believed maps to be the means to "exhibit to human understanding … the earth through a portrait" (Crane 2003: 33). Take, for example, the map in FIGURE 2.2. It showed an eager English public the new information added to the world map after Francis Drake's circumnavigation of the world (1577–1580).

The map conveyed new information that the reader could fuse with the information already known. These paper maps, when compared with today's computerised systems, combined the database and the visualization on one document. When new lands were discovered, additional information was added to the map. The database was updated simultaneously with the addition of new graphics.

2.2 New Media/Integrated Media and Maps Cartography has always used and developed New Media/integrated media mapping tools. When map cartographers or publishers like Gerard Mercator applied printing to map production they used this 'New Media' (paper and the printing press) to facilitate quicker, more accurate and cheaper versions of their works. The quest for more speed, lower compilation and production costs, and an efficient communication system has led cartographers to embrace new technology. Before the application of printing to map replication, the rules that govern map design, production and consumption evolved over centuries. The methods of producing maps via the printing press have been developed by 500 years of experiment, development and application (Cartwright 1999).

Printing has been complemented and enhanced by precision machines, computers (at first for computational mapping applications and later as complete interactive publishing systems), optical storage media like videodisc, CD-ROM, DVD and their many configurations, efficient communications systems, such as intranets and the Internet, and interactive installations using hypermedia (for example Apple's *HyperCard* and the Philips/SONY interactive laserdisc). Different and innovative mapping systems have developed and products have been produced to show 2D, 2½D, 3D and 3D+time (4D), plus n-dimensional data elements. Recently there has been a digital convergence, and relatively inexpensive consumer electronics-delivered tools now provide a plethora of (geo-)information exploration, measurement and recording devices.

The following sections provide examples for the use of New Media/integrated media for recording historic information, as well as providing a tool for data access and interrogation. So as to provide a complete overview of the range of media that has been used to facilitate the storage and delivery of information and virtual artefacts, the coverage in this section includes

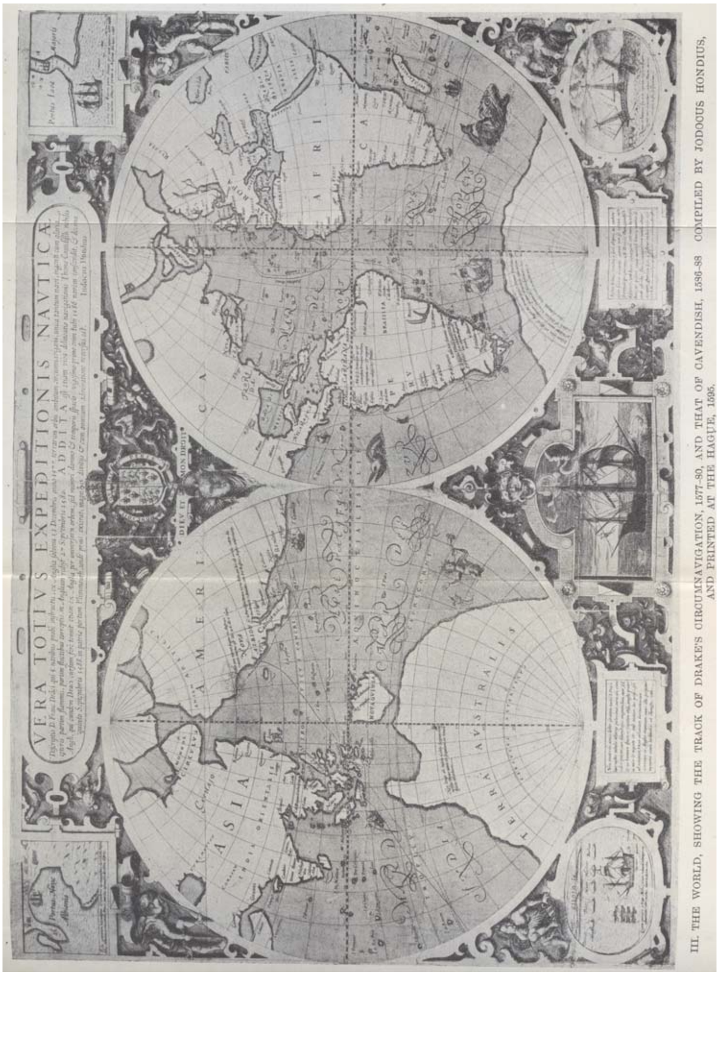


Figure 2.2 Map showing Drake's voyage around the world, 1577–1580. Source: https://commons.wikimedia.org/w/index.php?title=File:Hondius_Vera_Totius_Expeditionis_Nauticae_Francis_Drake_high.jpg

(a) *Queenscliff Video Atlas* initial interface (b) *Queenscliff Video Atlas* video 'surrogate walk'

Figure 2.3 The *Queenscliff Video Atlas*

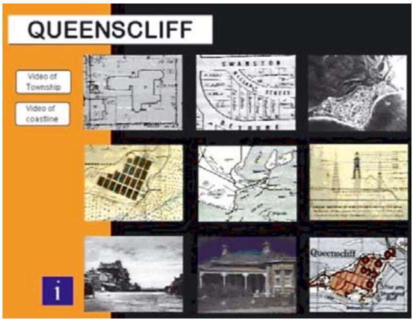


Figure 2.4 The *Queenscliff Video Atlas* CD-ROM prototype

Figure 2.5 The *Queenscliff Video Atlas* hybrid CD-ROM/Web prototype. Source: Cartwright 1998

methods that were developed in the early days of multimedia. It begins with examples of optical media storage (videodisc and CD-ROM) and ends with Web 2.0 and computer graphics examples.

2.3 Videodisc The *Queenscliff Video Atlas*, which was produced in 1987 (Cartwright 1988), is one of the few interactive videodiscs produced in Australia. The videodisc formed part of the Royal Melbourne Institute of Technology's display in the Science Fair, held at Melbourne's World Convention Centre in 1993. This research prototype was formalised through the concept of a "GeoExploratorium" that enabled users to understand geography by exploring geographical space using metaphors that were userdriven. The interactive multimedia product included surrogate walks—via still images and videos. Images from this product are provided in FIGURE 2.3.[1]

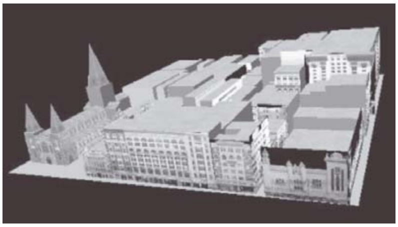
2.4 CD-ROM The *Queenscliff Video Atlas* was migrated to CD-ROM and a second prototype developed (Cartwright 2006b). At the heart of the discrete unit (FIGURE 2.4) is the access matrix. This consists of a page of images that link to specific sections of the discrete package by clicking 'hot spots'. The nine icons lead to information as site plans/house information, cadastral maps, air photographs, historic plans, historic maps, historic artifacts, archival photographs, house photographs and videos of seven township blocks. Videos of both the township and the coastline can also be viewed. Information about the package can be accessed by clicking the information or icon.

2.5 The Web By the mid- to late-1990s the Internet, and more particularly the use of the World Wide Web, became the focus of interactive multimedia developers. Discrete media was pushed aside somewhat in the move towards the communication system that changed forever how we access information, including geoinformation. The availability of the Web meant that the discrete CD-ROM *Queenscliff Video Atlas* could be extended as a distributed product using the World Wide Web. This is shown in FIGURE 2.5.

The discrete multimedia component, operating off a hard disk or CD-ROM was accessed by clicking the map at the centre-right of the screen. At the left of the screen are links to Internet-delivered resources that extend the discrete unit.

2.6 3D Web The Web can also deliver 3D products. For example, using Virtual Reality Modeling Language (VRML) products can be built and provided through a standard Web browser, with a plug-in added. The example illustrated here is *The City As It Might Be* VRML prototype, developed for appreciating 'lost' city buildings for the Melbourne central business district These lost buildings were demolished in the heady redevelopment days of the 1960s and early 1970s. These buildings were iconic examples of grand buildings built in the late nineteenth c. with the wealth that

[1] These images are photographs from the screen and thus are slightly distorted and show some reflections.



(a) Composite VRML world of existing and 'lost' heritage buildings in a part of Melbourne, Australia. Source: Cartwright 2006a

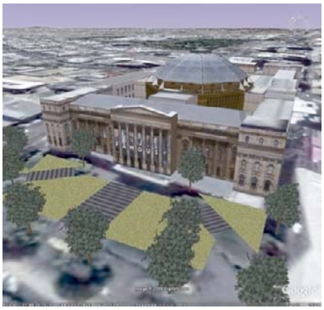
(b) The model — looking towards the southwest from the northeast corner of the study area. Source: Cartwright 2006a

Figure 2.6 *The City As It Might Be*— VRML prototype

flowed from the gold discovered and mined in the State of Victoria. This golden age of building construction gave the name 'Marvellous Melbourne' to the city. Once demolished, the buildings were replaced with more contemporary buildings, which, in turn, have already been demolished and replaced in many instances.

The City As It Might Be prototype provides the means for surrogate travel through a cityscape that no longer exists. The prototype product combines existing heritage buildings with the 'missing' buildings of the city (Figure 2.6; cf. Cartwright 2006a). The initial prototype model covered two city blocks. These blocks were chosen, as they are typical insofar as they contained a number of significant buildings that had not been removed in the haste for redevelopment and had a number of 'holes' that needed to be filled with sourced, historical photographs. The model works as a tool to illustrate how the study area would look if all significant buildings remained. Whilst perhaps appearing odd initially, the black and white model allows the city buildings to be adequately visualized. Buildings still standing are easily recognised and their 'rebuilt' neighbours provide information that was hitherto unavailable in a composite model. It was evaluated to ascertain its usefulness for historians, architects and the general public.

2.7 Earth Viewers Earth Viewers are computer-delivered geographical exploration tools that provide information to a user via an interface that resembles a globe. The user is able to move the globe, zoom and pan and then view or interact with additional information through the



(a) State Library of Victoria model, viewed in *Google Earth*

(b) Former Queen Victoria Hospital and State Library of Victoria model, viewed in *Google Earth*

Figure 2.7 Melbourne State Library and Queen Victoria Hospital

manipulation and interrogation of the interface, which is a virtual globe. The most popular current product is *Google Earth*.

To explore the potential of using an Earth Viewer to deliver historical information related to prominent buildings in the City of Melbourne further work on the city model was undertaken using Google *Sketch-up* and *Google Earth*. *Sketch-up* is the free software provided by Google for developing 3D models that can be 'inserted' into *Google Earth*. The examples in Figure 2.7 show the Melbourne State Library (still standing) and the former Queen Victoria Hospital (demolished in the early 2000s to make way for a multi-storey, multi-building residential/retail/business complex in the heart of Melbourne's central business district). Models of these two buildings were developed with *Sketch-up* and subsequently imported the *Google Earth* viewer.

Another example of using the *Google Earth* viewer is the combination of historical maps 'linked' to the imagery in *Google Earth* to provide a composite image that allows both historical and contemporary cities — in the example shown in Figure 2.8, London — to be viewed simultaneously. The London example was developed by University College London's Centre for Advanced Spatial Analysis (CASA).

2.8 Web 2.0 Relatively recently, maps have been published on the Web by user/producers using a process called 'mash-ups' involving Web 2.0 and social software. Web 2.0 is the use of the Web by individuals and groups of individuals to provide and share information, including

Figure 2.8 CASA project for viewing historical maps of London in *Google Earth*

Figure 2.9 Example of a map produced using *Google Maps*

geographical information. It provides a new model for collaborating and publishing. Users are able to develop their own 'marked-up' maps by appending their overlay information as an additional layer of information, usually using the default symbology provided (and usually map pins are employed), to self-publish their maps via the Web.

The example shown in Figure 2.9 was produced by the author in a matter of minutes using a map base provisioned by *Google Maps*. This simple procedure allows the user to become the producer. However, there is a proviso that must be noted — without real cartographic expertise awful and, in many cases, unusable maps can result. As with any mapping product good design is essential and form should not follow function.

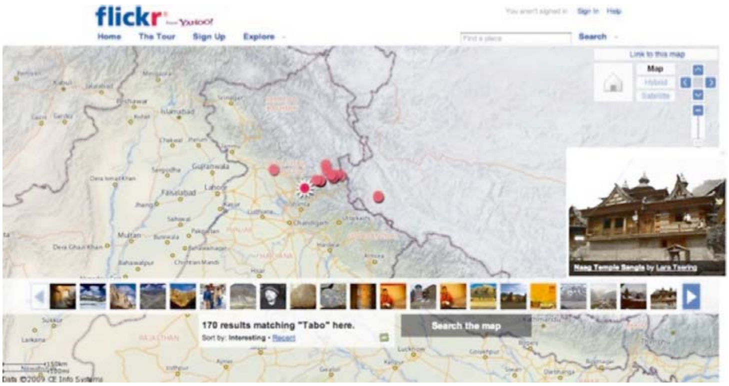


Figure 2.10 Map from *Flickr* showing the location of geo-tagged images (http://www.flickr.com)

Web 2.0 can also be used to find and view geo-tagged images. For example, the *Flickr* personal image repository Web site (http://www.flickr.com/) provides the ability to search for images according to their location. Where image contributors have uploaded geo-tagged images, users are able to search for images based not just on just content but also on the location of where the photograph was taken. These geo-tags can be just a place name or the actual latitude and longitude of the location of the image. For example, a simple content search for photographs using the terms 'monastery' and 'India' resulted in the delivery of a selection of images. But, by adding the place name 'Tabo' a map illustrating the locations of available imagery was provided (Figure 2.10).

3 Conventional Approaches vs. Ideas (from Outside Cartography)

The examples shown thus far have basically been developed in the 'world' of cartography. The tools used have come from outside the discipline area, but they were still influenced by cartographic practices. It is worth considering other products that have been developed to show reconstructions of ancient worlds and buildings. In many cases innovative products have been developed for museum installations, usually atop of a precise cartographic foundation, which is the result of rigorous surveying, photogrammetric or remote sensing data collection, analysis and model derivation. The imagery development relies entirely on the innovative and accurate

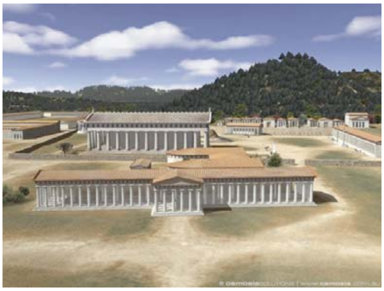


Figure 2.11 Virtual reconstruction of the Temple of Zeus. From the CD-ROM for the exhibition *A Virtual Tour of the Ancient City of Olympia*. Image © Powerhouse Museum, Sydney, Australia. Source: http://www.osmosis.com.au

representations that can be generated through the endeavours of these professions.

The results of these reconstructions form the basis of many museum installations, discrete media products (CD-ROM or DVD) and presentations. In many cases museum attendees are offered companion media products that can be used later, after the formal viewing in the museum has taken place. The three examples outlined in the following sections illustrate the potential of such systems to inform.

3.1 1000 Years of the Olympic Games: Treasures of Ancient Greece To coincide with the Sydney Olympics in 2000, Sydney's Powerhouse Museum commissioned an exhibition—*1000 Years of the Olympic Games: Treasures of Ancient Greece*. The exhibition included a historically accurate 3D model of Olympia as it was in 200 B.C. As well as the exhibition a Web site (http://www.phm.gov.au/) and a companion CD-ROM was produced.

The image shown in Figure 2.11 is from the CD-ROM developed as a companion to the exhibition "A Virtual Tour of the Ancient City of Olympia", developed for the Powerhouse Museum in Sydney, Australia. The CD-ROM was produced for distribution to Australian secondary schools. It contains the museum exhibit and the research documentation and reference material (Osmosis Solutions 2009a).

3.2 Virtual Ayutthaya Another product from Osmosis Solutions produced through collaboration between the company Osmosis and Cliff

(a) Wat Ratchaburana and its surrounds (b) Throne hall in the Royal Palace

Figure 2.12 Wat Ratchaburana. Source: http://www.osmosis.com.au

Ogleby at the University of Melbourne was *Virtual Ayutthaya*. This computer graphics solution reconstructs the ancient Thai capital of Ayutthaya, the Golden City. Accurate stereo photographs were taken at the site and these images, plus written records, were used to reconstruct Wat Ratchaburana and its surrounds (figure 2.12(a)). The great Throne hall in the Royal Palace (figure 2.12(b)), which was destroyed by fire, was also reconstructed. The Throne Hall images are also augmented with 'live' footage of traditional dancers (Osmosis Solutions 2009b).

3.3 Dubrovnik in 3D Dubrovnik in 3D was produced at the University of Washington. It used the software package PhotoSynth, which stitches together images sourced from many Web repositories. The outline of the buildings is used to identify the locations where each contributed image to the montage should be placed. FIGURE 2.13 shows a frame grab from a YouTube video that illustrates the project.

4 Imagery Generated from Remote Scanning

In many instances buildings and monuments are hidden by dense vegetation that has engulfed the constructions of ancient civilizations. This is especially true in tropical climates, where the jungle quickly reestablishes itself. This makes it almost impossible for archaeologists to uncover large tracts of land without extensive and intensive ground clearing, which can be economically not viable. 3D images of one of the largest Maya cities, in

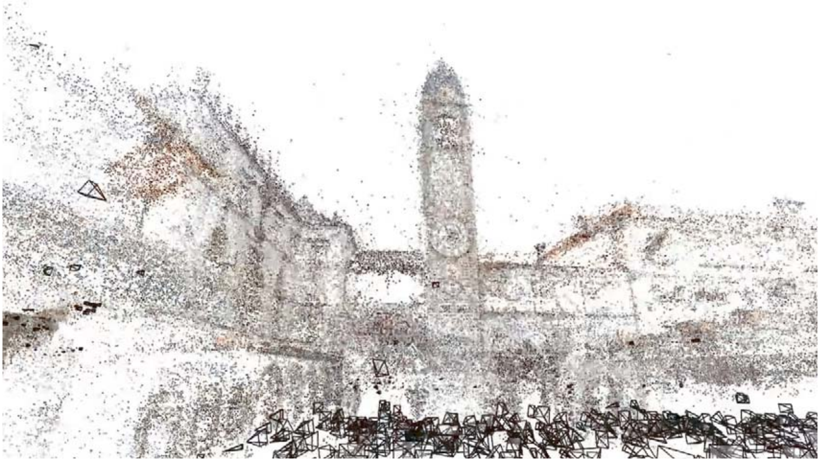


Figure 2.13 Dubrovnik in 3D: University of Washington. Source: http://youtu.be/sQegEro5Bfo

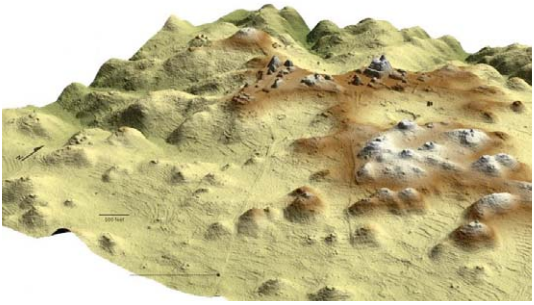


Figure 2.14 3D image generated from LIDAR — the site of the ancient Mayan city of Caracol, Belize. Source: http://www.nytimes.com/2010/05/11/science/11maya.html

Central America — the city of Caracol, in Belize — were developed using the light detection and ranging (LIDAR) scanning system. This system uses airborne laser that can penetrate jungle cover and then is reflected from the ground beneath the jungle cover (Wilford 2010). This method of image generation has been acknowledged by Parcak (2009) as a most useful tool for archaeology in the rainforest areas. An example of the results of this process is shown in Figure 2.14.

Figure 2.15 Virtual landscape created in Half Life. Source: http://www.wiiwii.tv/wp-content/uploads/2007/04/garrysmod.jpg

Figure 2.16 Detail from *Virtual Queenscliff* (Germanchis and Cartwright 2003)

5 Computer games software

Landscapes can be developed using 'Serious Games' software like *Half Life* (Figure 2.15). If the weapons are removed from the package the virtual landscapes can be used to illustrate real geographies. As computer games software can be purchased relatively cheaply and subsequently developed imagery can be navigated using computer games controllers, they offer the opportunity to create impressive and navigable terrains.

Another example of the use of computer games was the development of *Virtual Queenscliff* by (Germanchis and Cartwright 2003). The township of Queenscliff, the focus of previous CD-ROM and Web applications by Cartwright (1988, 2006a). Germanchis used a games package and 3D software to develop a virtual landscape using the game Unreal Tournament. An example of the package is shown in Figure 2.16.

6 Conclusion

This article has provided a synopsis of how technology, communication systems and computer graphics have been employed to represent and visualize geography. Cartographic representations have their roots in paper maps and non-map representations like topographic models. These precise scientific documents provide the tools for exploration and discovery, are accurate tools of warfare, as well as records of new lands and settlements, depictions of communications and national development and artefacts for tourists and conveyances for armchair travellers. They are useful, accurate, and powerful information provision tools.

The examples provided in the article were chosen to illustrate the development of cartographic representations through the application of technology — from optical media like videodisc and CD-ROM, to the Web and Web 2.0 applications, to 3D computer graphics simulations and computer games virtual landscapes. Cartography is able to provision discipline experts undertaking explorations and assessing collections with powerful tools that are underpinned with geo-located information.

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