

49 The world of the Vikings: An interactive video project

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49.1 INTRODUCTION

49.1.1 Project aims

The York Archaeological Trust and the National Museum of Denmark have collaborated to produce a laserdisc entitled *The World of the Vikings*. Using 2,500 still pictures and 25 minutes of video the disc summarises what is known about the Viking world. It is as comprehensive a survey, within the limits of available time and finances, as possible. It communicates a balanced picture of life in Scandinavia, Britain and the other regions in which the Vikings were active, from Newfoundland to Kiev.

The World of the Vikings also attempts to redress the stereotyped images of war and plunder. Great emphasis is placed on technical knowledge, industrial technique, acceptance of foreign influences, daily life and art. The project leaflet deliberately takes for its inspiration a domestic whale bone plaque; the male warrior is a single, rather over emphasised, symbol of the Viking age.

The information contained on this laserdisc is intended to be made as widely accessible as possible. To achieve this the project has been structured with three diverse and distinct user environments in mind: academic research, education and the home.

As a research archive, the disc is targeted at all major museums, colleges, universities and libraries. Although particularly relevant to those countries in which the influence of Viking culture was greatest, *The World of the Vikings* will also have wide appeal in the USA and Japan where both the educational and the domestic laserdisc markets are flourishing. In the United Kingdom more and more schools, especially in Scotland, now have laserdisc players, due partly to government or multimedia industry initiatives.

An additional method of achieving a large international audience is to employ the same

laserdisc in an interactive exhibition that is capable of unsupervised public operation in the museum gallery environment. Despite the fears of museum curators, studies suggest that interactive computer software on a gallery does not adversely effect the museum visitors' experience and may in fact enhance it (Hilke *et al.* 1988).

Such an exhibition system relies on computer technology and touch sensitive screens to control the laserdisc and provide the visitor with a comprehensible front-end; this is interactive video.

49.1.2 Why laserdisc?

Laserdisc is still the only interactive medium capable of storing and delivering large quantities of high quality moving video and sound. Until other formats, such as CD-I, are able to improve their data transfer rates (Fox, 1991) laserdisc will continue to dominate in multimedia applications requiring substantial amounts of video. Other advantages of laserdiscs are their robustness and fast image display time; this can be as little as one second between non-adjacent, full colour frames.

As an analogue medium, however, laserdisc technology still depends on local television standards and requires a dedicated interface card to manipulate information in the delivery system. With the US and Japanese audiences in mind, the disc will be pressed in PAL on one side and NTSC on the other.

The «Which multimedia technology?» decision might at first seem complex, but often it can be reduced to the nature of the application, its intended audience and shelf-life.

49.1.3 The laserdisc market

The production of laserdiscs by Europe's first independent multimedia company, Futuremedia, remains at its highest level for nine years (Copeland 1992:57). Current projections to 1995

assume that the videodisc player market will in general increase by 43% annually, boosted by demand in the US and Japan (Copeland 1992:56). There are currently an estimated 25,000–30,000 laserdisc players in the United Kingdom.

49.1.4 Laserdisc structure

The total capacity of a 12 inch, constant angular velocity (CAV) laserdisc is 111,000 frames (55,500 on each side). This is the equivalent of 74 minutes of full motion video in PAL at 25 frames per second and just under 62 minutes of NTSC video at 30 frames per second. If the information were digital it would equate to 2 gigabytes per side. The disc's two digital audio channels can be used in conjunction to provide stereo sound, or separately, perhaps to produce a sound track in two languages.

49.1.4.1 Videologic DVA-4000

The Videologic DVA-4000 is used to combine a laserdisc player and a computer to create a fully interactive application. The DVA-4000 is a full motion digital video adapter which takes in VGA graphics and analogue video and puts out digital videographics. This digital image can be squashed, mixed, moved, overlaid but not enlarged beyond a full screen. The two switchable video input sources can be from NTSC, PAL, composite video, RGB, or S-VHS.

There is full software control of picture content, hue, saturation, contrast and brightness. The opacity, translucency and transparency of colours can also be manipulated and all are available simultaneously allowing pictures from the laserdisc to be combined with databases and a graphic front end provided by the computer.

The DVA-4000 is designed to work with future storage technologies such as CD-I and DVI.

49.2 INTERACTIVE PROJECT

49.2.1 Basic design

The World of the Vikings not only tries to avoid stereotypical notions about the Vikings but also attempts to move away from the conventional computer interfaces provided for public use. These usually take the form of flashy graphics hiding minimal content or lists of numbered choices selected via customised numeric key-pads. Frequently the information in the system is too closely derived from the academic catalogues and becomes clogged by academic style.

Menus are an essential feature of any interactive system but they must offer genuine interac-

tive opportunities and not just reveal a cumbersome or inadequate hierarchy of data. A touch sensitive screen allows visitors to interact directly with menus built into the actual pictures rather than relying on key-pads.

Animations and graphics are used at key points to add motion and excitement to menus making the images become the inspiration for decision. Written text still remains a useful means of communication but it no longer plays a crucial or primary role, an important consideration for any international or educational project.

The World of the Vikings takes as its starting point the Coppergate interactive video project (Maytom & Torevell 1990) currently in use at the Archaeological Resource Centre (ARC) in York.

49.2.2 Disc geography

The computer dispenses with any need for the pictures and video to be arranged in a coherent order on the laserdisc. So long as a list of laserdisc frame numbers are recorded, perhaps in a printed index, any given image can easily be selected. Complex sequences of frame numbers can be stored in databases or hard-coded into computer programmes to display a succession of images in a comprehensible order. Image location on the laserdisc is unimportant.

To the user lacking any advanced computing facilities, such as the educational or home user, this incoherent disc structure will present many problems. Any attempt to step through the images one at a time, using only a laserdisc player, will result in a completely unrelated jumble of pictures showing unknown objects and sites. Therefore if a major potential audience is to benefit properly, images must be placed on laserdisc so that when they are stepped through frame by frame they encounter a logical collection of material.

The integrity and usefulness of the laserdisc can be further enhanced by structuring groups of images into *chapters*; *The World of the Vikings* is divided into eleven thematic and sixteen regional chapters. Captions can be used in conjunction with the images. These can either be part of the image frame (perhaps on a card next to the object when photographed) or on a separate associated *caption frame*. The latter method is by far the easiest when using existing, uncaptioned photography or site shots. These caption frames are not necessarily ever referenced by the interactive software. *The World of the Vikings* caption frames contain, in both English and Danish, a frame number, a chapter reference, the object/site name and material, a short description and provenance.

49.2.3 Chapter structure

49.2.3.1 Thematic chapters

The thematic chapters are the most straightforward to construct, as information tends to fall most easily into thematic categories. The eleven major chapters are: *transport, religion, weapons and warfare, settlement, subsistence, crafts, art, people, leisure, trade and language and literature*. Within each chapter there may be many further sub-divisions, i.e. *transport* is divided into *land* and *water transport*; *land transport* is divided into *carts, horses, skates* etc.

49.2.3.2 Regional chapters

The regional chapters are much more likely to be disrupted by the unavailability of material. If access is denied to significant collections of objects the project can no longer claim to present a balanced regional view. Important objects may reside un-photographed in geographically isolated museums lacking the finances to produce large quantities of photographs. Nor may the collection in a major museum necessarily be representative of the region as a whole and other museums, perhaps in other countries, must be approached to complete the picture.

The sixteen major regional chapters are: *The Low Countries and Holland, Russia, East Baltic, Poland, Germany, Denmark, Sweden, Norway, France, England, Ireland, Scotland, Faroes, Iceland, Greenland and Newfoundland*. These regions are primarily defined by the presence of Viking age material. Images of typical landscapes and modern structures with Viking age associations have been included, e.g. monuments to battles or Christian churches built on pagan Viking burial sites.

49.2.3.3 Temporal chapters

There will be no actual temporal chapters stored on the laserdisc. Information will only be accessed temporally by the interactive display software. The computer will select material from the other laserdisc chapters and construct from it the temporal storylines. They are simply not distinct enough to warrant separate treatment on the laserdisc itself.

49.2.3.4 Storylines

The computer can access pictures from the 27 disc chapters to produce storylines. These storylines need not confine themselves to a single topic but can draw references and supporting evidence from across the laserdisc. The temporal storylines, for example, will be constructed entirely using this method.

A storyline can extend far beyond the scope of the individual chapters and turn the linear pic-

ture sequences into a vast three-dimensional maze. Comparisons can be made with other regions, e.g. whilst exploring *land transport*, digressions into topics such as *wood-working* or *horse bridle manufacture* are possible. The contents of a grave can be considered as a discrete group of related material, but each object can in turn belong to other storylines such as *weapons and warfare* or *subsistence*. It is this maze which the user negotiates, never quite knowing where an enquiry will lead.

49.2.4 Photography

Photographs have been collected from across the world. Local photographic styles are often extremely diverse; the colour of backgrounds, the inclusion of scales, artistic presentation etc.. They can be visually distracting and make the combining of images on the screen awkward. An ideal solution is to retake all photography using a single project style, tailoring them to the project.

35 mm slides have proportions that differ from those of a computer screen and they do not fit comfortably within the screen boundaries. Portrait format photographs only increase these problems, and ideally these pictures are retaken in landscape format. The photographic style needs to satisfy the discerning researcher and at the same time meet with public approval.

Interactive video also demands a more three-dimensional approach to photography. Excavations and ancient monuments need to be photographed in the context of the landscape in which they stand, perhaps by including views looking out from the site. In the same way instead of just one picture of an object a whole series of pictures can be taken, perhaps showing the back, front and sides. The computer can then structure these images into a *surrogate walk*, although this is a term most often applied to sites around which you would literally walk, i.e. a stone circle.

49.2.4.1 Photographs as menus

Using software, a photograph displayed on the touch-screen can be turned into a series of doors that lead to successive pictures. Sensitising areas of the screen in this way avoids the need to use list structured menus. Photographic details of objects can be made accessible in exactly the same way. A photographer needs to be aware of the potential of the new interactive technologies and take a fresh approach when photographing objects and sites.

49.2.5 Video

New video has been used primarily to illustrate the craft and technology chapters. Constraints of

time and budget did not allow us devise complete, costumed reconstructions so the sequences simply show Viking age methods being employed by modern-day craftsmen and women. The majority of the video was taken in Britain and Denmark.

Although physically grouped together on the laserdisc, the video sequences are included in the interactive storylines inbetween the still pictures. Users could find the option they have chosen displays a moving video as a still picture. In some instances video sequences have been deliberately punctuated with still images to separate the different aspects of a manufacturing process.

A control panel, generated by computer along the bottom of the screen, controls all the video sequences. This panel contains instantly recognisable video player commands such as *pause* and *fast forward*. A complex or obscure control mechanism, requiring a learning period, would only distract the user from the relatively short sequences.

49.2.6 Sound

The two digital audio tracks can be used to provide stereo sound for video sequences. They must be recorded in conjunction with the video frames since separate regions of the laserdisc cannot be played concurrently. This does not prevent the independent use of the audio tracks to provide commentaries or sound effects for animated menus. The two audio tracks are software selectable and will function independently of each other, e.g. a different language can be recorded on each track.

To make full use of all available disc space, sound can also be recorded on the audio tracks alongside a series of still images. The video picture must be switched off whilst the audio tracks are playing to avoid a rapid and discomfiting display of consecutive images. The DVA-4000's digital frame store can be used to hold a static image, thus avoiding a blank screen, whilst the sound is playing.

Spoken sequences have been used in the *language and literature* chapter to provide reconstructed examples of Old Norse and to highlight the importance of the Viking tradition of storytelling. Two short sequences taken from sagas are told in both English and Danish.

49.3 SOFTWARE

49.3.1 Computer graphics

Autodesk *Animator*, *Animator Professional* and *3D Studio* were used for both the static art work and the animated menu sequences. During the course

of the project, *Animator* was superseded by the upgraded package *Animator Professional*. *Animator* had previously only been able to achieve a screen resolution of 300×200. *Animator Professional*, depending on hardware and available memory, will operate up to a maximum resolution of 10,000×10,000. Time and budget constraints did not allow the animations already produced to be recreated using a higher resolution, although some of the later artwork does make full use of a 640×480 resolution.

49.3.1.1 Modelling in 3D

3D Studio is an extensive 3D modelling package. It will run on a standard 386 computer, providing it has at least 4 MB of memory and a 80387 co-processor. To gain full benefit from the package a 486 is desirable. All project 3D graphics were constructed using an Opus 386.

2D Shapes are either created within *3D Studio* or are imported as .DXF files from a CAD package such as *AutoCAD*. They are then *lofted* into 3D objects. These objects are then edited and combined with other objects to construct the 3D model. Objects within the model can then be assigned materials and surfaces. The package has an extensive library of materials, any of which can be edited to produce new and exotic combinations. It may be pertinent, for instance, to make wooden buildings transparent by changing the opacity of the wall materials to reveal interiors. Real surfaces, such as wicker and wood, can be imported into 3D Studio using a video camera and then used to render the model. The model of Viking houses at Hedeby, for instance, has used surfaces, such as wicker and plaster, taken from the reconstructed buildings at the Jorvik Viking Centre, York. The jetty at Dorestad, showing its sequential extension as the river Rhine silted up, has been given surfaces taken from planks of wood. Animated map sequences have also been produced using a large 3D model of part of the Northern hemisphere.

Once a model is complete, cameras and lights are added and a *flight-path* defined. In the case of the map sequences, a *flight-path* was defined for each of the nineteen separate regions. The same model, with an altered *flight-path*, was used to create the animation illustrating Othere's journey by boat from Norway to Denmark.

The initial rendering of each frame of an animation may take several hours but once complete, they are stored on hard-disc and may then be played in real time.

Large 3D models or prolonged animated sequences can take a considerable time to render (a

640×480 rendering of one frame of the Hedeby model took 4 hours 30 minutes on a 386). The Hedeby and Dorestad models could easily be added to the geographical model at the correct location and scale, but the time required to process all the objects begins to be an unrealistic task.

All of the animated model sequences were deliberately treated in a fairly schematic fashion and kept short. Once fully rendered, the animated sequences were edited within *Animator*, automatically restricting them to a 300×200 resolution. This gives them a slightly misty quality and actually has the advantage of avoiding razor-sharp wicker and the equatorial sun that so often seems to burn down on 3D computer reconstruction's.

49.3.1.2 The animated menus

Computer generated animation's and title sequences are now commonplace on our televisions and have given rise to a very discerning public audience. The project makes use of simple animation techniques at key points in an attempt to match these expectations. High level menus, having the greatest public exposure, have been primarily targeted for animation.

The opening main menu shows a runestone standing in a notional Scandinavian landscape. It holds on its surface three icons representing the three main project access routes: by theme, by region and by time. Runestones were traditionally vehicles for information and its use in this context is considered highly appropriate.

Choosing the thematic route from the main menu causes the runestone to dissolve into an elaborate wooden background, derived from the church at Urnes. The wooden structure grows from the bottom of the screen and loosely represents *Yggdrassil*, the *World Ash*. Upon this background appear icons representing the eleven thematic chapters. The same icons are used throughout the system as a means of chapter identification and user orientation.

A choice of regional route dissolves the main menu into a representation of the globe surrounded by a stone carving of *Jormungandr*, the serpent child of the God Loki who was thrown into the sea, encircled the earth and clasped its own tail in its jaws. The stone flies apart, the World is freed and fills the screen. This map now becomes the menu for the selection of individual regional storylines. Present day country boundaries have been avoided for several reasons: they are not relevant to the Viking age; some of the regional chapters do not consist of an individual country but groups of countries; most importantly, they kept changing as we constructed the maps.

Buttons will be added at run time as a regional focus with which to highlight the available choices.

The temporal choice once again dissolves the main menu, but this time into the three Norns, guardians of time, spinning the threads of life. They are given the appearance of having been embroidered on the screen.

Menus and choices are an essential element of any interactive system, but traditional menu lists can often become tedious and lead to the feeling of becoming trapped in a deep hierarchical structure. The inclusion of movement in the opening menu sequences and a departure from familiar list type structures gives a lively and urgent feel; the system has *made its move*, now you must *make yours*. The act of making decisions is in itself exciting and unpredictable. Hopefully this leads to greater enjoyment when using the system.

49.3.2 Interactive control software

The interactive software produced for *The World of the Vikings* project has been written in-house at the York Archaeological Trust. The Dbase compiler *CLIPPER* and associated graphics and function libraries have been used extensively.

49.3.2.1 Icons

The user gains control of the system via touchable pictorial icons or *ticons*. Where possible, these icons are inspired by Viking age art, although for certain functions, such as *help* and *change language*, the use of modern symbols is unavoidable, especially if they are to be easily comprehended. The icons are .PCX files created using *Animator Professional* and loaded at run time with a graphics library called *MEGAVDI*.

It is important not to clutter the screen with a host of icons all requiring some form of explanation. Users spend more time deciphering the front-end than they do learning about the Vikings. They can become confused and frustrated when there is no apparent logic to the processes happening on the screen. Control should be given with the minimum number of icons.

The icons can be split into four groups:

- a) *control icons* that move the user from picture to picture, execute *zooms* and *comparisons*, and invoke *link* screens. Control icons are only present on the screen if a valid choice exists.
- b) *orientation icons* that show the current chapter.
- c) *system icons* that provide *help*, change language and produce extended *facts*.
- d) *video icons* that provide *play*, *pause*, *rewind*, *fast forward* control. The video icons are produced using a graphics library called *GFORCE*.

49.3.2.2 Return to main menu

The opening menu acts as a focus from which all routes begin. It can be returned to at any time although by occasionally removing this option the user is encouraged to explore rather than return too quickly to familiar ground. If the system is left unattended for a set length of time it will automatically return to the main menu, possibly via an interruptible, introductory *attract mode* video sequence.

49.3.2.3 Return to previous menu

The user is returned to the point at which they last made a storyline menu decision, i.e. male or female dress, land or sea transport.

49.3.2.4 Retrace your steps

A *go back* or *retrace your steps* function is an important and rather subtle feature of any interactive application. The user must feel free to roam at will, retracing steps if necessary. A left-pointing arrow is used as a universal symbol meaning *undo what I have just done*. It needs to respond correctly to the different types of next picture selection that the user has at their disposal or its function will only confuse. This function keeps careful track of the user's path and faithfully backtracks if requested.

49.3.2.5 Next picture

The right-pointing arrow moves the user progressively through a storyline. It functions in two different ways, either moving the user to the next picture or invoking *link* menus that can make leaps into other related storylines.

49.3.2.6 Zooms

A picture cannot be magnified beyond a full screen, but if photographic enlargements have been included on the laserdisc they can be used as close-ups. The presence of a *zoom* icon indicates when such an option exists and areas of the picture *boxed* to show the available close-ups. All zoom choices are recorded by the software and may even be reversed with the *go back* arrow.

49.3.2.7 Picture menus

Pictures can be used as menus by extending the *zoom* principle. An excavation photograph showing a male burial and associated grave goods can be used as a menu to access pictures of each of the artefacts. Each picture can in turn be the starting point of a new storyline. This mechanism can only be used if the subject matter of the picture on the screen is sufficiently indicative of the available topics. Areas of the picture are highlighted, not boxed as in the *zoom*, for the user to choose.

A photograph of a Viking age house does not obviously convey anything about the leather and antler working activities that were known to have been carried out inside. In this case no areas of the picture can be indicated and there is no alternative but to list the available choices on the screen using text. However, changes of storyline or chapter are indicated with the orientation icons. Menu selections that jump across chapters and storylines are those most likely to confuse the user. When such a choice is made, the change of storyline is always clearly indicated. The *go back* icon is once again used to retreat back to the old storyline. If touched, it will never reverse the user back up the new storyline.

49.3.2.8 Comparisons

The *comparison* function allows up to five additional images to appear on the screen at the same time; any more than five and they become unsatisfactorily small. These pictures could, for instance, be similar objects from other regions, different items from the same location or the same set of images obtainable through the *zoom* function. Any of these smaller images, including the original, can be selected to fill the screen, perhaps complete with a *next* icon and another *zoom* or *comparison*.

If access is given to a new storyline the user is warned with an *orientation* icon and given the choice of returning to the old story or continuing along a new one. As with the *link* screens, the *go back* icon will return to the old storyline if touched.

When developing the system it is easy to become too conscious of the full extent of the labyrinth, the maze of choices it offers and the possible jumps across the chapters. The user accepts that the pictures are slowly unravelling a story and, if the storyline is properly constructed, never thinks «I wonder if I have missed something» or «I wonder how far apart in the database that jump was».

49.3.2.9 Screen captions

Although each image frame on the laserdisc is accompanied by a caption frame, the computer obtains the run-time screen captions from a database on the hard-disc. It contains observations and comments pertinent to the current storyline, perhaps pointing out less obvious details or supplying additional background information. These captions are restricted to a maximum of two lines, about 120 characters. They appear below the picture at the bottom of the screen on a semi-transparent band similar to television sub-titles. The content is not fixed and may be changed at any time by research staff or curators.

The caption can be used to ask observational questions relating to the picture and invite the user to respond by touching areas of the screen. These areas are not indicated, the user must find them. Answers, right or wrong, are always acknowledged. This form of rewarded interaction especially encourages younger people to pay greater attention to the images they are browsing through.

Larger amounts of text are displayed using the *fact* icon; this icon appears as an *arrow* icon following the caption. A *fact* screen displays a larger amount of textual information relating to the current picture.

At anytime the language of the on-screen text can be toggled between English and Danish by touching the *flag* icon. Any run-time computer generated text could also be translated into other languages.

49.3.2.10 Help facility

An exhibition system that requires a detailed help facility is almost certainly too complex. The project fails to meet its objective of providing an unattended interactive exhibit, usable by non-experts. The help icon only adds short descriptive captions in the current active language to the icons already present on the screen.

49.3.3 Storyline edit facility

Underlying the interactive public interface is a complex suite of editing commands that allows all the computer controlled links and text to be updated.

Although there is no public access to the editing facility, it can be made available to researchers with the minimum of training. It will permit them to link new sequences of pictures together to form new storylines. Knowledge of the material is far more important than an understanding of the computer system as is an insight into the powers of interactive media. It is an imaginative use of the system that makes the storylines effective. Even when on display in a museum gallery the system can be edited by a skilled curator to include new storylines, perhaps targeting them to specialist groups or different age groups.

49.3.4 The picture registration database

The primary function of the picture registration database (PRD) is to aid laserdisc chapter and interactive storyline construction. It holds information about every frame on the laserdisc. During the research process all requests for photographs are entered into the PRD. The PRD assigns every request with a unique picture number

(PICNUM). The PICNUM is used for reference and identification in all research, correspondence, notes and photocopies.

As photographs accumulate they are also stored in PICNUM order. Any photographs received that are not numbered or specifically asked for in the initial request, i.e. new unpublished material, are simply added to the PRD and assigned a PICNUM.

49.3.4.1 Complex searches

The PRD contains a powerful complex search facility based on the CIFR finds recording system used at the York Archaeological Trust. The data can be interrogated using combinations of fields and the resulting report used as a basis for chapter construction. During the research process, pictures are assigned to the different chapters and storylines in which they are considered to be relevant, e.g. a decorated leather knife scabbard could be relevant in the *leather working, art or domestic items* storyline.

Research can be structured thematically, regionally or in any other way considered appropriate. The PRD *complex search* can then be used to quickly generate lists of photographic requests for a single museum.

49.3.4.2 Copy

Single pictures required at more than one physical location on the laserdisc are given additional records in the PRD using the *copy* command. When the laserdisc is pressed the picture will be duplicated at all the relevant frame numbers.

49.3.5 Index volume and bar-codes

Accompanying the laserdisc will be an index volume. Produced in English and Danish, it will contain the frame numbers of all the pictures, graphics, animation's and video. Included in the index will be a series of bar-coded sheets. Compatible with the Pioneer range of laserdisc players, these bar-coded commands can be used independently of a computer to control the player. Bar-codes included throughout the index volume will allow any picture to be selected with the swipe of a bar-code reader. If bar-codes are structured into work sheets then a very high level of interactivity is possible. The advantage to schools of such a system is tremendous.

Remote infra-red bar-code readers can also be used to control players in museum galleries, although nothing approaching the level of interaction achievable with *The World of the Vikings* software would be possible.

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