

Celtic Art & Cultures



Images



Maps &
Timelines



Design



Topics



Vocabulary



Site Info

A Web site and CD-ROM



**USING NEW TECHNOLOGY TO TEACH ART HISTORY:
THE CELTIC ART AND CULTURES PROJECT**

by

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This paper describes the development of the Celtic Art and Cultures Web site and CD-ROM.

The Celtic Art and Cultures Web site is an organized collection of multimedia materials used as the basis for a university course in Celtic art and cultures. The Celtic Art and Cultures CD-ROM contains an identical version of the Web site and enables students to access the course materials without requiring an Internet connection.

The categories of the Celtic Art and Cultures Web site include Images, Maps and Timelines, Design, Topics, Vocabulary, and Site Information. The materials in these categories include over 1000 still images, QuickTimeVR panoramas and object movies, animations, audio clips, and interactive quizzes. This paper describes how these materials were selected and developed, how the Web site was designed and organized, and how the CD-ROM was made.

Headings:

Computer-assisted-instruction

World-Wide-Web-Teaching

Information-systems-Special-subjects-Exploration

Celtic

Special-collections-Exhibits-and-displays

In the Fall semester of 1998, Dr. Dorothy Verkerk taught an Art History course entitled “Celtic Art and Cultures” to 27 students at the University of North Carolina at Chapel Hill (UNC). Dr. Verkerk had previously taught this course as a traditional lecture course; in 1998, however, the course was centered around a Web site and CD-ROM containing a wide range of multimedia materials. I created the Web site, CD-ROM, and multimedia materials as my Master’s project. This paper describes the work I did to complete the Celtic Art and Cultures project, including the selection and development of appropriate multimedia materials, preparing the materials for the Web, designing the Web site and CD-ROM, and supporting the materials as the course began.

How the Project Began

In the Fall of 1997, I approached Dr. Verkerk, an Assistant Professor of Art History at UNC, with an idea to create multimedia materials she could use to help illustrate the concepts she taught in her Celtic Art and Cultures course. Dr. Verkerk and I wrote and submitted a proposal to the Office of the Chancellor at UNC to do this work under one of the Chancellor’s Instructional Technology grants. We were subsequently awarded a 1998 Instructional Technology grant¹ and were provided the funds to buy multimedia software and to pay an assistant to scan slides and perform other supporting activities².

We began the project in early 1998. As we thought about the ways in which we could use multimedia to teach the concepts of the course, we realized that in many ways Celtic art and design, with its geometric, abstract, and rhythmical vocabulary, seemed to

be an ideal topic to which to apply technology. At the same time, we felt that Web technologies have developed to the point where it would be both feasible and useful to develop course materials as Web-based multimedia and to use the Web as a means for enhanced student communication and collaboration. We thus expanded our original idea and decided to develop the multimedia materials in such a way as to make the course centered around them, rather than simply using them as adjunct materials. After developing the materials in the first half of the year, the Celtic Art and Cultures course is currently being taught to 27 students at UNC using a Web site³ and CD-ROM as the basis of the course.

This paper describes the work required to complete this project. It is organized in the following sections, corresponding to the major phases of the project:

- ◆ Selecting and preparing the multimedia materials
- ◆ Designing the Web site and CD-ROM
- ◆ Supporting the Web site and CD-ROM
- ◆ Conclusion

Selecting and Preparing the Multimedia Materials

We began the project by discussing the types of multimedia materials it would be useful to create, and how we could create them. In some cases, we were able to easily adapt existing materials for our purposes; in other cases we referred to a variety of sources and synthesized the material to create original materials. The process of selecting and creating materials took place primarily in the first half of the year, but we continued to develop new ideas throughout the project and thus found ourselves developing and adapting source material up to the last minute.

Although the organization of the Web site and CD-ROM wasn't finalized until late in the project (described in "Designing the Web site and CD-ROM"), in this section the process of selecting and developing appropriate materials is described according to the major categories of the final Web site:

- Images
- Maps and Timelines
- Design
- Topics
- Vocabulary
- Site Information

Images

The central component of the Celtic Art and Cultures Web site is the image database.

Many aspects of Celtic art, design, and history are illustrated through photographs of art

objects, burial objects, structural ruins, excavations, and intact structures. The study and discussion of these photographs is arguably more important to the Celtic art and cultures student than even the most authoritative text. In teaching the previous lecture-based versions of this course, Dr. Verkerk illustrated her lectures by projecting slides from the Art department's collection of more than 1000 Celtic-related images. We felt that giving students easy and direct access to the complete collection of these images would be a critical component of the technology-centered course.

Converting the slides to digital media was a relatively straightforward, if time-consuming, task. Our assistant scanned the slides over a period of a few months, saving the digital files as high-quality JPEGs and transferring them to UNC's ISIS Web server, where the course Web site is located. The original slides were already uniquely numbered; an existing database used these numbers to maintain information about each slide in the collection. For convenience, our assistant used these numbers as file names when saving the digitized images.

Image Database

The Art department's slide librarian maintains a database of all the slides in the Art department's collection. Although it wasn't possible to use this database as is (it had significant data integrity problems), it was very helpful as a basis for preparing the image database for our Web site. Working with the slide librarian enabled us to export the database records that were associated with the Celtic slides to a tab-delimited ASCII file. A database was then created in Microsoft Access with corresponding fields and the database records imported into the database. Although we now had a database that

roughly corresponded to the scanned slides, there were a number of database problems that had to be worked out before the database information would be usable for the completed Web site. These problems included numerous typographical errors in the data, inconsistencies in the way the data was entered, and the lack of consistent terminology. Because of these problems we couldn't do reliable queries on the data (all records of images of high crosses couldn't be easily found, for example, because these records were variously labeled "cross, highcross, cross's, crosses, high cross"), and we couldn't use data containing typographical errors on pages that would be displayed on the Web site.

A limited set of consistent terms for the most important data fields (period, material, object, country) was methodically generated and the data in the database was edited to correspond to these terms and to remove errors and inconsistencies. Considerable time was also spent removing records from the database for slides that for one reason or another would not be included in the final collection of images, and completely new database entries for about 200 slides of photographs we took ourselves in Ireland were added. With the slides scanned and the database completed, we still needed a way to display a given image with its associated database information on a Web page, and a way for the student to select a particular image to view. Furthermore, because we had limited control over the ISIS server on which the final Web site would reside, and because we also wanted the entire Web site to be fully functional from a CD-ROM without requiring Internet access (the reasons for this are described in "Creating the CD-ROM"), our solution couldn't depend on server-based functions.

Image Web Pages

A prototype Web page was developed which contained an image and associated descriptive text, suitable background, text, and link colors, and was organized in such a way that the layout and legibility would be maintained for browser windows of various sizes. After the design of the prototype Web page was settled, however, it was necessary to find a way to create a separate Web page for each of the 1000 images in the database without having to enter information manually. To automate this task, a script in the awk programming language was written. This script looped through a series of statements that built the HTML required for the page, inserting the required information for a given image using a tab-delimited ASCII version of the database as the input file. When a page was completed, the script saved the file, using the image number as the filename and .html as the filetype, and repeated the process for each subsequent image record in the database until it reached the end of the input file. This script enabled us to easily rebuild all 1000 image Web pages several times as we discovered errors or made modifications to the page layout.

With Web pages for all the images created, a mechanism was needed to enable students to select the image they wanted to display. Again, because we wanted the Web site to be functional without server capabilities, it was decided to create a search page that enabled the student to choose from a wide selection of pre-defined queries and display the results using thumbnails of the images that matched that query. While creating the basic search page itself was not difficult, creating the thumbnail images and the actual query results took more time.

Image Thumbnails

By experimenting with different sized images, an optimum width for the thumbnail images of 65 pixels was chosen (large enough that the content of the image could be recognized, but small enough that many thumbnails could be displayed on a single page). After copying all 1000 images from the UNIX-based Web server to a temporary directory on a PC, the Actions function of Adobe Photoshop was used to write a semi-automatic process that opened a JPEG image, changed the image mode to indexed color, scaled the image to 65 pixels in width, and exported the image in GIF format using the same filename. This actions procedure was run in batches of approximately 50 images (memory constraints prevented larger batches) until thumbnail versions of all the images in the database were created. By specifying a constant width, all the thumbnail images line up neatly on the search results page, but by permitting the height of the GIF to be scaled proportionally to the width, accurate proportions of the image in the thumbnail were preserved.

Search Queries

Predefined search pages for each of the ways a student might want to search for particular images—period, object, material, country, and image number—were created. For each of these categories, a database query was performed in Access to generate a list of images (and associated descriptions) for each unique value. For example, the Period category contained 10 different values, ranging from Bronze Age Europe to Romano-Celtic. Performing queries for each value of each category resulted in a total of 60 unique queries. The results of each query were exported to a text file, which was then used as

input to an awk script. This script combined the exported query data with HTML tags to build a Web page that displays a thumbnail image and corresponding image number for each image that matched that query, arranged in a 7-column table that fits comfortably in an average-width Web browser. Each thumbnail on the query results pages is hyperlinked to the Image page for that image.

To provide the student a way to select from the available queries, an image search page listing the search categories was created. Each category contains a drop-down menu list with the available query results pages for that category. Also, because the students of the Celtic Art and Cultures course were expected to frequently know exactly which image they want to display (the number of an image is displayed along with the image whenever it is used on the Web site, and the students will refer to these image numbers in online discussions), a selection menu that enables the student to select and display a specific image by number, bypassing the thumbnail images, was added.

Preparing the database, thumbnail images, and creating the associated image and query results pages were challenging and often tedious tasks, but the results were worth the effort. The Image Search and query results pages provide students with an easy and relatively quick way to browse and view more than 1000 images and associated database information, including a description of the object in the image, what material the object is made from, where it was found, what historical period it dates from, and what collection it resides in today.

Maps and Timelines

The Celtic Art and Cultures Web site contains eight maps and a timeline. Of the eight maps, three are simply scanned directly from books, while our assistant created the remaining five. The maps included as scans were ones that provided important information and were originally designed in a format clean enough to remain reasonably legible online. The source of each of these maps was cited on the final Web site.

Maps

A topic such as Celtic culture, which spans both a large period of time and a broad geographical area, seems ideal for creating a wide variety of useful maps, and the potential to use animation to make maps more useful and interesting certainly exists. We spent a significant amount of time in UNC's Wilson Library Map room and at Davis library looking through books of maps and Celtic history trying to find source material upon which we could base animated maps. Unfortunately, this task is more difficult than it at first appears, both because of the display limitations of the Web and computer monitors, and because of the amount of effort required to create legible maps on computers.

Most of the source maps we found, while legible in print, were cluttered with too much data and text to be readable on a computer screen. Maps frequently contain text set in small type that is illegible on standard computer monitors. While it is possible to use larger type for this text, that limits the amount of space available for other text and data on the map.

In cases where we could imagine creating a map with a limited amount of text and data, the problem became how to accurately reproduce the map online. We had some access to clip-art maps, which provided us with broad continent and country outlines, but to accurately place the text and data for a map within these outlines is difficult to do without spending a significant amount of time on each map. We felt that maps were important to the Celtic Art and Cultures Web site, though, so we scanned a number of maps, and our assistant recreated several of the simpler ones.

Timelines

The timeline was also more difficult to create than it at first appeared it would be. The time period covered by the Celtic Art and Cultures course is fairly broad (800 BC to 1000 AD) and we felt that a timeline that summarized the major periods and events of Celtic history would be very useful to students. Books on Celtic history provided several examples of timelines, which we synthesized to create a paper prototype. The difficulty of this task was to decide what events to limit ourselves to, since we would again be faced with the problem of not being able to display as much text in a given space online as is possible in print. The timeline events used in the end were determined primarily by available space given the format of the final version of the timeline.

The finished timeline was a result of much trial and error. After the events to include in the timeline were selected, an HTML table was created and an attempt was made to fit the events into the table, using line breaks, lists, and nested lists to try to force events to line up along the timeline in a consistent way. Standard HTML, however, does not provide effective methods for positioning text exactly where you want it. The text

produced by this attempt looked ragged, the events were only roughly positioned along the timeline, and the results were not satisfactory.

The next attempt involved using the absolute positioning feature of dynamic HTML. Although using dynamic HTML currently has the drawback of requiring version 4 browsers, and sometimes produces inconsistent results between Netscape and Internet Explorer, in the case of the Celtic timeline these disadvantages were not especially important, while the advantages of using dynamic HTML for the timeline were significant. Being able to position text to the exact pixel enabled the events to be placed in accurate relation to other events, so that, for example, an event that occurred in 565 AD was just a bit closer to the 600 marker than it was to the 500 marker. We intended to recommend version 4 browsers for other reasons, and the differences between Netscape and Internet Explorer for the finished timeline were negligible.

To complete the timeline a graphical legend listing the years and major eras was created in Photoshop and related image thumbnails were inserted to add visual interest. The completed Web-based timeline is both pleasant to look at and accurate in its representation, yet it is much smaller in file size than if it were done entirely as a graphic.

Design

Much of Celtic art and design incorporates patterns that appear to be very intricate and complex. These patterns, however, are the result of the use of repeating geometrical patterns; often once the underlying geometry is visualized the pattern is easily understood. We attempted to make understanding Celtic design easier for students by using animation to reveal the basic patterns of several examples. The Design category of

the Celtic Art and Cultures Web site includes six such examples, using Macromedia Flash and JavaScript to provide the animation.

Flash Animations

Flash uses a timeline framework for creating animation and, once a beginning level of competency is attained, it is relatively easy to use to produce high-quality animations. We used Flash to create two animations of Celtic design. One is a very simple animation of two primary types of swirl patterns used in Celtic design. At the top of the Swirl Patterns in Celtic Design page we display a photograph showing beads that were painted with swirl patterns. Below the photograph are two hand-drawn swirl patterns; in one the swirl is started from the outside and moves in, in the other the swirl is started from the inside and moves out. Buttons below each type of swirl give the student the option to either step through progressive stages as the complete swirl is drawn, or to display the entire swirl being drawn in a continuous motion. By showing how the swirls are created, the animation helps the student understand the difference between the two types in a way that is not as easily done by viewing static images of the completed design.

The other Flash animation shows how an intricate design is created. We first show the completed design, which is a rather complex-looking phalera. When the student clicks a button to start the animation, the finished design fades away and successive button clicks reveal the basic geometrical patterns that were used to create the final pattern. Explanatory text is displayed next to the various stages of the pattern to describe the significance of each geometrical pattern. Again, the animation enable the student to see how a complex pattern is actually made up of simple geometric shapes.

JavaScript Animations

The remaining examples of Celtic design were created in JavaScript. Each of these examples is based on an image of Celtic art and uses the JavaScript image swap function to display an altered version of the image to illustrate a concept in Celtic art and design. For example, to illustrate the concepts of shape-shifting (where an image can alternately resemble a human or an animal), and triplism (groupings based on the number three), an image of the Aston mirror was selected. Photoshop was then used to selectively highlight portions of the mirror to create several altered versions of the mirror. One version brings the shapes of birds in primary focus, another the shape of a face, and two others the groupings of shapes in threes. When arranged on the Web page with rollover buttons for triggering the image swap function, these altered versions of the Aston mirror produce animations that simply but effectively illustrate the design principles discussed in the accompanying text.

Topics

The completed Celtic Art and Cultures Web site includes three topic explorations: Hallstatt Elite Burials, Irish Monasteries, and Celtic High Crosses. These topic explorations are intended both as a source of in-depth information about the given topic and as models for the projects students in the course are asked to create. Each topic incorporated more than one type of media and posed its own challenges to create.

Hallstatt Elite Burials

The Hallstatt Elite Burials topic is a series of Web pages that describe, with many illustrative images, the type of burials given to royalty in the Hallstatt period. We combined the images and descriptive text to lead the student from an aerial view of an actual burial mound, into the burial chamber, to detailed views of the objects that were left in the burial chamber to accompany the deceased. We also recorded Dr. Verkerk narrating a description of these pages, much as she would if she was lecturing and using the images as illustrative aids. We compressed and encoded the audio files in the RealMedia format and provided links on each page so that the student can hear Dr. Verkerk's narration of the topic as they proceed from page to page.

Irish Monasteries and Celtic High Crosses

The Irish Monasteries and Celtic High Crosses topics each consist of several pages of text and images about the topic. Each of these topics also incorporates QuickTimeVR (QTVR) images, which enable the student to move the object in the photograph with the mouse to examine all sides. The process of creating the QuickTimeVR images began early in the year when we went on a research trip to Ireland. Several Celtic high crosses, a monastery building, and the grounds of another monastery, each in a different part of Ireland, were photographed. Each of these situations required that photographs of the object be carefully taken at regularly-spaced intervals from all sides of the object. Each object required from 16 to 20 images and took an hour or more to photograph.

After developing the film, all the photographs were scanned. Because of less than ideal lighting conditions in Ireland, a significant amount of time was required to correct

the scanned images using Photoshop, a difficult process because each image for a given object had to be similar in brightness and size if the completed QTVR image was to look smooth and consistent. After correcting the images, the Apple QTVR Authoring Studio was used to stitch the images together and create the finished QTVR image.

For each topic Web pages were created to bring together descriptive text, the still images, and the QTVR images. For one of the Celtic high crosses QTVR images, an image map was also created to enable the student to select the side of the cross they want to view. After selecting a side, a Web page is displayed showing both a detailed QTVR image of the side (which permits them to pan up and down the side of the cross), and an illustrated diagram of that side of the cross. The diagram (adapted from a book about the Celtic high crosses) labels the scenes depicted on the side of the cross being displayed in the QTVR image.

Vocabulary

The Vocabulary section of the Celtic Art and Cultures Web site consists of 60 vocabulary terms and six vocabulary quizzes. A search page is provided to enable the student to directly select a vocabulary term or quiz. In addition to creating a basic Web page for each term, JavaScript and audio clips were also used to complete the vocabulary pages.

Vocabulary Terms

Each of the 60 vocabulary terms is presented on a page with a definition, one or more images that illustrate the term, and links to related terms. Because many of the terms are Gaelic words with pronunciations likely to be unfamiliar to the students, we recorded the

pronunciation of each term (using several speakers for variety and one Irish speaker for authenticity of the Gaelic terms). We edited the audio files of each term and saved the files in Apple QuickTime .mov format. This format is playable on both Windows-based PCs and Macintosh computers, and QuickTime is installed on most computers. The linked vocabulary term pages enable the students to learn the vocabulary terms at their own pace, following their own path.

Vocabulary Quizzes

To help the students ensure that they have learned the vocabulary terms, we included six quizzes. Each quiz presents ten multiple-choice questions, with the potential answers all drawn from the definitions on the vocabulary term pages. Clicking a button at the end of each quiz displays a window that tells the student the correct answer for each question and the total number of questions they answered correctly in that quiz.

The quizzes were built using HTML form tags to present the questions and accept the student's answers, and JavaScript to process the answers and present the results. Because the Celtic Art and Cultures Web site is also provided to the students on a CD-ROM, all the processing required for the quizzes occurs on the client computer.

Site Information

A category called Site Information was added to the Celtic Art and Cultures Web site for several reasons. As we worked on this project during the year, we received several requests for information about what we were doing, both from the local newspapers and from others on campus working on related projects. A Web page, called Project

Information, was developed to provide a description of our goals for the project and links to our work-in-progress. The Project Information page thus served as a convenient pointer for those interested in the project before the final Web site was completed.

Although we tried to keep the software requirements for viewing the Celtic Art and Cultures Web site as simple as possible, our use of Flash, QuickTimeVR, RealMedia, and dynamic HTML meant that some people visiting the site would not have the level of software necessary to successfully view all the materials. To let people know about the required plug-ins and browser versions, and to provide links to the sites from which they could download the required software, a Viewing Requirements page was created and added to the Site Information category.

Finally, we wanted visitors to the Celtic Art and Cultures Web site to be able to contact us if they had questions or suggestions. Rather than disrupt the look of each page in the site with a link in the page footer, a Credits page with details about the people who created the Web site and how to get in touch with us was added to the Site Information category. As described in the “Conclusion” section, several people from various parts of the world have used this method to contact us.

Designing the Web Site and CD-ROM

The organization of the Celtic Art and Cultures Web site was under consideration during the entire development process, but because we were continually trying out new ideas and discarding ones that didn't work, it wasn't feasible to create the final version of the Web site until shortly before the beginning of the semester. And even after all the

materials were created, building the final Web site and making CD-ROM versions of the site were significant efforts in themselves.

Organization of the Web Site

The primary goal in organizing the completed materials was to distribute them into a small number of distinct categories. A small number of categories was desired because we didn't want the site to appear overwhelming to students who weren't comfortable working with computers, and distinct categories were important because we wanted students know instinctively which category to go to for a given bit of information. These design decisions resulted in six categories, one of which (Site Information) was intended more for first-time Web site visitors and would be used infrequently by the students themselves.

After considering several layout and navigation strategies, a horizontally-stacked, two-frame layout was selected. The top frame is the navigation frame. It is minimally sized, always visible, and contains links to the main page of each of the six categories. The lower frame takes up most of the space in the browser window and contains the content for the category page being displayed. This layout scheme minimizes the number of mouse clicks required to move from one category to another (the student is always one click away from the main page of any category), but the navigation frame itself requires minimal space and doesn't draw much attention from the main content area. The main page for each of the categories contains a method to directly access any of the content of that category with one more mouse click, either in a pull-down menu (as in the Images and Vocabulary categories) or from an index page.

Creating the CD-ROM

The Celtic Art and Cultures Web site contains over 1000 images, which generally range in size from 30KB to 150KB. The QuickTimeVR images are approximately 500KB each. Although these file sizes are small enough to load quickly when accessed from the high-bandwidth network on the UNC campus, we knew that many students would want to work with the Web site materials from home, where their network connection was likely to be much slower. To prevent the frustration likely to result from downloading the Web site materials from a modem, each of the students enrolled in the Celtic Art and Cultures course was given a CD-ROM version of the Celtic Art and Cultures Web site. Although the CD-ROM simply duplicates the Web site, it enables the students to work with the Web site materials from home without waiting for the materials to load over a slower network connection. Because no server-side functions are used on the site, the CD-ROM version of the Web site is just as functional as the live Web site and the response time is generally equal to or better than the campus network.

To make the CD-ROMs, all the Web site files were copied from the UNIX-based Web server to a PC with an attached CD-ROM recorder, with the directory structure of the site maintained on the PC. Using software provided with the CD-ROM recorder, a disk image of the entire Web site was written, resulting in a file approximately 150MB in size. The software was then used to write the disk image to a blank CD-ROM, which took about 10 minutes. In total, 50 CD-ROMs were created, 27 for the students enrolled in the course, and the remainder for Dr. Verkerk, several of Dr. Verkerk's colleagues, and the Art Library.

To complete the packaging of the CD-ROMs, labels for the CDs and both front and back covers for the CD-ROM jewel case were designed using Photoshop and Freehand. The labels and covers were printed using an ink-jet printer, the covers were cut to size, and all the pieces were assembled to produce the final CD-ROMs.

Supporting the Web Site and CD-ROM

Because most of the students enrolled in the Celtic Art and Culture course—and Dr. Verkerk—did not have strong computer backgrounds when the semester began, some technical support was provided until they were comfortable using the Web site materials. Instructions on how to use the Web site and CD-ROM and how to install the required software were presented in two separate information sessions early in the semester. These sessions provided an opportunity to answer specific questions and concerns the students had about installing and using the materials. A few more questions were answered by e-mail when two students had problems installing the QuickTime plug-in, but after the first month of the semester there were no more reports of problems.

Conclusion

Creating the Celtic Art and Cultures Web site and CD-ROM was a demanding and time-consuming project, but it was a worthwhile one. Although the course itself hasn't yet been completed, Dr. Verkerk has indicated that she is pleased with the way the students are using the Web site and that the multimedia materials have been useful in teaching the course. At the end of the semester we intend to ask the students to complete a

questionnaire that we hope will help us evaluate how effective the Web site was and what the students liked and disliked about it.

Although the Celtic Art and Cultures Web site is primarily intended for the students in the course, it is accessible to anyone on the World Wide Web (except for the images in the image database, which are password-protected for copyright reasons) and we have received positive comments about it from visitors outside of UNC. We have received complimentary e-mail from several art historians and Celticists, several local newspapers have written articles about the site⁴, and in October, 1998 it was selected by the Scout Report as a valuable Internet resource⁵.

In addition to providing a useful resource for students and others interested in Celtic art and cultures, I believe that this project also serves as an example of how multimedia will be used in the future. As multimedia authoring tools become easier to use and provide more functions, the quality of multimedia materials will improve. As technologies such as dynamic HTML and XML evolve, more options for displaying and interacting with these materials will be available. And as higher-bandwidth options become more widely available, accessing and working with these materials will become easier and more enjoyable for students. There are obstacles and downsides to all these developments, of course, but Web-based multimedia materials clearly have significant benefits for education and the use of such materials is sure to increase in the near future.

Notes

¹ Information about the UNC Chancellor's 1997-98 Instructional Technology grants is available at <http://bootcamp.oit.unc.edu/grants/>

² Karin Breiwitz performed many helpful tasks as our assistant. Richard Spinks and Paul Hagwood also made valuable contributions to the project.

³ Available at <http://www.unc.edu/courses/art111/celtic>

Due to copyright restrictions some images are password-protected. They can be viewed for educational purposes (username: art111 password: celts).

⁴ O'Kelly, K. "UNC Web site enables teaching of Celtic art." *The Chapel Hill News*, Sunday, July 19, 1998, p. B1.

⁵ The Scout Report. (1998).

<http://wwwscout.cs.wisc.edu/scout/report/archive/scout-981002.html> Vol. 5, Number 23, October 2, 1998.