The Robert De Niro *Cape Fear* Costumes and Props Collection

A Case Study on Digital Libraries and Apple's QuickTime Virtual Reality

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With the advent of the Internet, libraries, museums, and archives started to place their collections online. However, due to budget and technological constraints, many of these new digital libraries use two-dimensional (2D) still images to represent the three-dimensional (3D) items in their exhibits. Virtual Reality (VR) software, such as Apple's QuickTime VR (QTVR), creates 3D interactive movies of real-life landscapes and 3D objects. Currently, there are very few digital libraries that have included VR representations into their collections. By gaining an understanding of the benefits of QuickTime VR and of the technology that is used to put together the QTVR movies, as well as exploring its utilization in current Digital Libraries, it is possible to see how this technology could be employed in future Digital Libraries. In order to test this theory, I created the Robert De Niro *Cape Fear* Costumes and Props Collection using QTVR to make 3D representations of the costumes and props from the movie *Cape Fear*. In doing so I gained experience in using software to create QuickTime VR movies and knowledge about how QTVR can be used in future collections.

What is QuickTime VR and how does it work?

The Wikipedia article on virtual reality states, "Virtual Reality (VR) is a technology which allows a user to interact with a computer-simulated environment, be it a real or imagined one." There are a number of VR programs that fulfill those requirements, such as Virtual Reality Modeling Language (VRML), eXtreme Virtual Reality (XVR), and QuickTime VR (QTVR). However, QuickTime VR is different from the other VR software in that, instead of rendering computer-simulated environments which can tax the end user's computer's resources, it uses a series of pre-created images, which have been

stitched together in a movie (Chen 29). Images can come from a variety of sources, such as traditional or digital photographs of real world objects, microscope slides, film, or even still images rendered by a computer program, depending on the focus of the QTVR movie (Trelease et al. 65). These images are then combined to create a non-linear movie. Non-linear movies are movies in which, instead of having a pre-determined timeline as a regular movie does, the user can choose how the sequences in the movie are viewed (Kitchens 6-7). This creates an interactive online environment where the user has control over the manipulation of a space or an object in space. Another advantage of QuickTime VR is that it does not require special software extensions or plug-ins to play. Starting with Version 2.1, released in 1998, it was fully integrated into the regular QuickTime software, which is playable through almost all computer platforms and standard Web browsers (Trelease et al. 66; Kitchens xv).

There are two types of QuickTime VR movies, the panoramic movie and the object movie. A panoramic movie is a spatially oriented movie where the camera stays in one location and rotates around in a circle (Trelease et al. 65). Panoramas are often used to show off both real locations, such as real estate locations and historical site tours, and virtual locations, such as a place in a video game (Kitchens 8-9). To create still images for a panorama of a real-life location, the camera is placed in the center of what is to be shown, called the *nodal point* (Kitchens 19). The camera then takes a picture, rotates at a predefined interval (usually 10°), and then takes another picture (Trelease et al. 67). At each point, the camera can also be tilted up or down and another picture can be taken; this will simulate looking up or down when the movie is put together (Kitchens 21).

An object movie is a movie that allows the user to examine an object from different sides and/or angles. Object movies are used to show models of both real and simulated items, such as pottery, human skulls, and computer animated characters (Dusinberre et al.; Trelease et al. 68; Kitchens 8). There are two different ways that the photographs of a real-life item for an object movie can be taken. The first involves keeping the camera in the same location while placing the object on a rotating base in front of a neutral background. The object is photographed and then carefully rotated (again usually 10°) and photographed again. In this case, the camera can also be placed on a circular arm that permits it to move up and down, which will simulate the tilting of an object in the movie. (Kitchens 92-95). Kitchens recommends taking all images at the same vertical angle while rotating the object on the horizontal access, then raising or lowering the camera and doing it over again (93). The other option when creating an object movie is to place the object in the center, surrounded by a neutral background, and rotate the camera around it at a specific distance, taking pictures the predefined intervals (Chen 35). While this might be an ideal way of dealing with fragile materials, I believe that as long as the rotation is done slowly and carefully, it is probably easier and less costly to do it the first way. The exception to this would be if the object were not something that could be brought into a room to be photographed, such as a building.

No matter what type of QuickTime VR movie is being created, the most important thing to remember when taking the pictures is that there needs to be an overlap between adjacent pictures so that the images can be stitched together later without any gaps in information; Chen recommends that this overlap be about 50% (34). The reason

for this is that the next step involves using an authoring program to stitch the images together. To set up the movie, the images are "arranged in a grid – the horizontal rows correspond to panning the camera and vertical columns correspond to tilting the camera (Kitchens 23)." (See Figure 1 for an example of this type of layout.) If panning is the only movement desired, then all that will be created is the horizontal row. Once the images are in place, the authoring program takes the grid and stitches the images together, using correlation-based algorithms, and then it compresses the frames to make a QuickTime VR movie, or *node* (Chen 34; Trelease et al. 67).
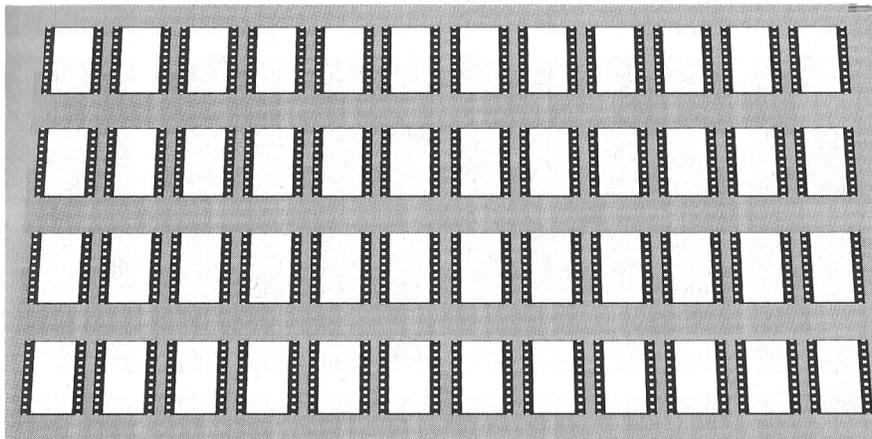
Figure 1 (Kitchens 23)

Beyond simple panning and tilting, QuickTime VR has a number of optional features that can be added to a node, such as zooming, hot spots, and hot spot linking. Zooming is when the user zooms in on part of the still image that is currently displayed in the QTVR application. If zooming is desired, then the quality of the original still images needs to be high otherwise pixilation can occur. "Hot spots" are predefined places within the movie that allow for increased user interactivity (Chen 32). When clicked on, a hot spot can do one of several things; it can show a special close up image of part of the node, link to another node, link to a URL, or have text pop-up on the

screen (Trelease et al. 68). Linking a node to other nodes through hot spots creates a *scene*. In combination with hot spots and linking, a scene allows a user to "walk" through an environment, examining new locations and objects along the way. (Kitchens 18). However, in the study "Activity Breakdowns in QuickTime Virtual Reality Environments," Norris and Wong found that users often had trouble locating hot spots within the QuickTime VR movies (70). They recommended that the locations of hot spots be thought out during the creation of the QTVR movie and that they should be in places where users would naturally expect them to be (Norris and Wong 71).

Examples of QuickTime VR in Digital Libraries

There are relatively few Digital Libraries on the Internet that use QuickTime VR or any sort of virtual reality interface. Those that do use them usually include them as a special part of a larger collection. QuickTime VR is currently being used in Digital Libraries for medical education, to explore ancient art and artifacts, and to display historical costumes and clothing.

Trelease et al. have developed several Digital Libraries for the purpose of medical education, specifically for the "Visualization of Anatomical Structures (64)." Three of the authors of their paper have Digital Libraries online which use QuickTime VR in order to show an aspect, or aspects, of anatomical structures. Trelease's Web site, the *VR Anatomy Collection*, has a collection of QTVR movies from real images of CT scans and MRIs as well as from computer generated images of parts of the body, such as hands and pelvises. Many of these movies also include labeling, which appear at specific points during the movie. The movie that I was the most impressed by is of a

knee joint (see Figure 2); not only can the joint be rotated, but the user can also move

the top bone up and down to see how it works. (Trelease et al. 66, 71). Dørup used

Figure 2 (Trelease)

QuickTime VR to make movies of shots from electronic microscopes. These

microscopes require a great deal of training to use, but by making QTVR movies of

images from them, students are able to view the slides; by including hot spots that zoom

to another slide or display a label, it helps students to identify what they are looking at.

(Trelease et al. 71-73). Nieder's site, the *QTVR Anatomical Resource*, contains object

movies of "skeletal material, arterial casts, as well as wet specimens of the head,

extremities and internal organs (Trelease et al. 73)." These movies allow students to

study the different layers of the human anatomy without having to be in a classroom or

lab. A really nice feature of this site is that each QTVR movie comes in several different

sizes, which allows the user to pick the one that best fits his or her monitor and bandwidth. (Nieder; Trelease et al. 73-75).

There are a number of Web sites that use QuickTime VR to show ancient sites and artifacts. In his article, Milbank states that the *Perseus Digital Library* includes QTVR movies of ancient sites and of specific buildings within these sites. To create one of the movies, digitally rendered images of the Treasury of the Athenians at Delphi were used. Milbank describes how the movie would not only rotate and tilt, but could also be linked to close ups of the freezes along the border of the building and to a map of the site. (Milbank 5-7). However, when looking at the Perseus Web site, all that was there was the movie of the Treasury and a reference map that showed the direction the camera was pointing in. I could only find two more QTVR movies on Perseus, panoramas of an Egyptian Tomb and of the Roman Forum. (Crane). While it seems as though there were a lot of ideas about how to use QuickTime VR within the Perseus Project, most of them were not implemented.

In contrast with Perseus, *Wining, Dining, and Dying in Ancient Greece*, produced by a class in the Classics Department of the University of Colorado, is an excellent example of the way that QuickTime VR can be used within a Digital Library. There are 25 separate QTVR movies of the pottery and statues from the collection (see Figure 3 for an example). The picture quality of the base images is high enough that the details on the artifacts are very clear and, when zooming, there is not much pixilation. Also, hot spots are used to link to a page with close-up still images of the artifact. Furthermore,

Figure 3 (Dusinberre et al.)

there are two sizes of each movie, in case users have different screen sizes.

(Dusinberre et al.). I really enjoyed browsing this collection and I believe that it is a very

good illustration of how QuickTime VR can be used to enhance museum exhibits online.

Another example of a well done collection of artifacts is the *Saving Southwest*

Traditions: The Pottery Project: 2,000 years – 20,000 Vessels on the Arizona State

Museum Web site. This collection contains a large number of QTVR movies of Native

American pottery. There are at least three viewing angles for almost every movie: a side

view, a top view, and a tilted between side and top view. This collection demonstrates

how well tilting can be used in a QTVR movie to show different angles of an object. This

site also contains an "Online Tour Help" page which explains to the user how download and install QuickTime so that the user may properly view the QTVR movies. Moveover, this help section includes navigation instructions for interacting with QTVR. (Arizona State Museum).

The *Drexel Historic Costume Collection* is a collection of costumes and clothing from Drexel University and is unique among costume collections online because of its 3D representations (Martin 35). When creating the Digital Library, surveys and interviews were done with a variety of potential users, such as fashion scholars, design professionals, and students. They found that, "what all the users wanted most from this site were high quality images, multiple views and details of the objects in the collection,…(Martin, Lin, and Lunin 281)." They discovered that QuickTime VR was be the best way fulfill these needs because of its ability to give multiple views through 3D rotations and provide close-ups through zooming and hot spot linking (Martin, Lin, and Lunin 284). The Web site has an easy to use search feature with images of the costumes as well as having a panorama in the Digital Gallery, where a user can click on a costume in the image and a window with the QuickTime VR movie and associated metadata pops up (see Figure 4). The hot spots are easy to identify by the blue shading and clicking on one links to a high quality images of the costume's details (see Figure 5). (Martin, Lin, and Veksler). The amount of detail of the costumes that the QTVR movies show is both extensive and impressive, as is the variety of costumes that they have in the collection. My only wish that there was zooming and tilting available, but I found the detailed images in the hot spot close-ups to be an acceptable substitute.

Figure 4   Figure 5

(Martin, Lin, and Veksler)

Creating the Robert De Niro *Cape Fear* Costumes and Props Collection

In order to gain real world experience with QuickTime VR, I created the Robert De Niro *Cape Fear* Costumes and Props Collection. This collection contains QTVR movies of four costumes and one prop from the movie *Cape Fear*, which are part of a larger collection of Robert De Niro materials housed at the Harry Ransom Center in Austin, TX.

When coming up with ideas for this project, Steve Wilson at the Harry Ransom Center (HRC) was approached to see if there were any costumes that they would allow

me to digitize and create QuickTime VR movies of. Fortunately, the HRC had recently

acquired a large collection of materials from the actor Robert De Niro and creating

QuickTime VR movies of the costumes in the collection had already been proposed.

Together, Steve Wilson and I looked through the costumes and props that were easily

available. It quickly became apparent that there were plenty of items from *Cape Fear*,

both in terms of numbers of costumes and variety of props.

The first step in creating the collection was for me to watch *Cape Fear* in order to

see which costume pieces were worn in which scenes as well as what props would be

interesting to use. I already knew that I wanted to use the outfit from the fight sequence

because the HRC had a number of different versions of the costume from different

stages in the fight. The other two costumes that stood out were the Palm Tree shirt, due

to its loud design, and the outfit worn during the seduction scene, due to the way it is

enacted. As for props, the only one that seemed to me to be a worthwhile subject for a

QuickTime VR movie was the lighter used near the beginning of the film. While the HRC

did have a number of props used for fight sequences, such as fake rocks and pipes,

their ability to be lifelike in appearance while having no real weight to them was what

made them stand out for me.. I felt that they would only be good to use in this project if

we could cut one in half to see its construction, but other than that, a spinning rock just

didn't seem that exciting.

The photo shoot for this project was held on June 26, 2007 with Eric Beggs as

the photographer. It took place in the photography studio of the Harry Ransom Center,

which was set up with a black velvet backdrop and special lighting (see Figure 6). A few

days prior, a male mannequin was borrowed from the UT Drama Department's Costume shop; he was already set up with the bloody fight costume before the shoot began.

Figure 6

Before we could start taking pictures, the turntable that the objects were to be placed on had to be prepared. It had already been notched every 10° and then covered in black velvet. Unfortunately, when one of the HRC interns started marking the turntable by feeling for the notches, it was quickly discovered that folds in the velvet made it difficult to find the cuts. As a blueprint, I had created an image of 18 rotated lines each one rotated 10° from the one before it, using Adobe Illustrator (see Figure 7). The image was downloaded and printed it out on extra large paper. It was then pinned down to the middle of the turntable and, using it as a guideline, 36 pieces of silver tape were placed on the side of the turntable. A piece of tape was also placed on the side of the turntable to be a marker.
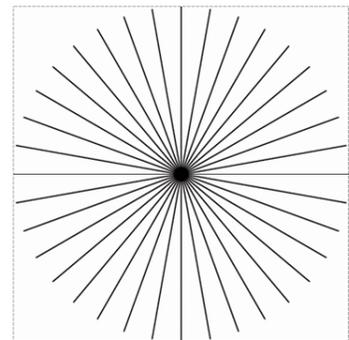
Figure 7

After the turntable was set up, the mannequin was placed on it and checked to make sure that it was centered. The turntable was rotated so that the front of the costume was centered to the camera and then adjusted slightly so that a mark on the turntable matched the marker line. A piece of tape was placed across this mark so the person spinning the turntable would know when a full rotation had happened.

Each costume and prop had 36 pictures taken of it, one at each of the 10° markers, which would become the base pictures for the single row object oriented QuickTime VR nodes. Pictures were taken with a Nikon D2X, 12.4 Megapixel SLR digital camera and stored as 300 DPI TIFFs at 4,288px by 2,848px to ensure high levels of detail. Unfortunately, this caused a slow down in the photo shoot process as we would be able to take approximately half of the pictures for one costume or prop and then would have to pause to wait for the camera to write the pictures to the memory card.

It took approximately 4.5 hours to do the photo shoot of four costumes and one prop. However, a large portion of that time was taken up with changing the mannequin, making sure that the outfit was set up in the exact same way it was in the movie, and centering the mannequin or prop on the turntable. These hold-ups were some of the same kinds that would be experienced in almost any photo shoot of this type, demonstrating that taking 36 pictures does not take much more time than a photo shoot where only one or two still images will be used in the final product.

The next step was to choose the QuickTime VR authoring software to use for this project. Demo versions of different QTVR software, found through the International VR

Photography Association (IVRPA) Web site, were downloaded and tested for compatibility and ease of use. I chose the VR Worx 2.6 because it was MAC/PC compatible; furthermore I found it to be the most intuitive and easy to use.

Upon receiving DVDs of the photo shoot, the pictures were rotated, edited to remove the edges of the backdrop, and renamed [item]00-35, based on their degree of rotation, using batch processing in Adobe Photoshop CS. I started to import the edited base images into the VR Worx to create preliminary QuickTime VR movies. However, it quickly became apparent that the files were so large that the program had trouble working with them, even though it would resize the final movie. It was also noted that the VR Worx compressed the movies in such a way that an image quickly became pixilated when zooming in. In order to ease the process in working with the program, two smaller versions of each set of pictures were created, one at 531px by 800px and the other at 356px by 536px. The thought behind this was that by creating two different sizes, users would be able to pick the version that was most compatible with their monitors and internet connection speed, following the example of *the QTVR Anatomical Resource* site, mentioned earlier. Ten object nodes (one of each size of each of the costumes and props) were created from these sets. Eight scene movies were then created using the nodes of the costumes and still detail photos, taken from the large base photo files, as hot spots. I decided that it was unnecessary to create hot spots for the lighter since the base images were already so detailed. Since high quality TIFFs were used in this project, the movies ended up being about 60MB for the larger versions and about 28MB for the smaller ones.

When creating the scene movies, consistent hot spot linking language was developed for display on the Information Bar of the QTVR controller. Also, the placement of the hot spots were noted when making the larger version of the movie, so that the hot spots could be created in the same place and at the same angles on the smaller versions.

A Web site to house the collection of QTVR movies was created, placed online, and password protected due to copyright. A landing page was created for each costume and prop, which contained a screen shot of it being worn or used by Robert De Niro in *Cape Fear*, a description of the scene, and links to the large and small versions of the QTVR movie (see Figure 8). Each movie file was embedded on a separate page with

Figure 8

the following code,

```
<embed src="movies/seduction_sm_scn.mov" width="356" height="552"
controller="true" pluginspage="http://www.apple.com/quicktime" />,
```

which would always display the controller at the bottom of the movie and also would

direct users who do not have a QuickTime plug-in to the Web site from which it could be

downloaded.

Metadata about the physical objects was also included on the QTVR movie

pages. Following the *Drexel Historic Costume Collection* model for clothing metadata,

each part of the costume or prop was described using the full extent of the available

information. Metadata used included color, material, maker (if known), and size (if

known), as well as any notes about the part of the item being described. The basic

locations and descriptions of the hot spots were also included to help users find them,

influenced by the findings of Norris and Wong, as discussed earlier.

Finally a set of pages "About this Collection" was created. These included

information about using the collection and a simplified version of the creation process

discussed above. I also included a page on how to use QuickTime VR, for the novice

user, in a similar fashion as the Arizona State Museum.

Conclusion

Overall I felt that this whole process was an invaluable experience and I am

grateful to have had this opportunity. I found out with a little practice, the process of

creating QTVR movies was fairly simple, even the scene type with multiple nodes and

hot spot links. Also, once we got the kinks of the turntable worked out, the photo shoot

went almost as quickly as I imagine a normal photo shoot would. The ability to batch

process photos saved time when it came to editing them. While the size of the final Web site was around 500MB, since the cost of storage is so inexpensive, it was not a problem to host it on my personal Web site. Since the rate of transfer over the Internet is getting faster every day, these large files, on a broadband line, only take several minutes to fully load. It is fairly simple to make multiple versions of a movie in different sizes to further allow for variations in end-user needs.

For the future I would like to find out if compressing the moves into JPGs would help to lower the size of the files. Unfortunately, I did not have the time to do try it for this project. Also, I was disappointed with the way that the VR Worx compressed the movies so that pixilation occurred so quickly when zooming in. I would like to find a program that leaves high level of detail in the images so that when a user zooms in, it takes a while before becoming pixilated. This would allow the user to be able to see a close-up of the detail more clearly without always having to use hot spots.

Based on my experiences while working on this project, I conclude that it would not be that difficult for libraries, museums, and archives with three-dimensional real world materials to create QuickTime VR movies to help give their users a better sense of the physical objects when viewing their online collections. I believe that the amount of time and resources needed for such projects is not that much greater than what is currently required to create digital libraries with still images, and there will be even less of a difference in the near future, since the cost of storage continues to fall and the size of storage continues to increase. I hope that the Robert De Niro *Cape Fear* Costumes and Props Collection will help inspire libraries, museums, and archives to represent the 3D objects in their collections with QuickTime VR or other virtual reality programs.

Bibliography

Apple Computer, Inc. "QuickTime VR." *Apple*. 6 May 2007 <http://www.apple.com/
	quicktime/technologies/qtvr/>.

Arizona State Museum. The Pottery Project: 2,000 Years - 20,000 Vessels. U of
	Arizona. 23 Aug. 2007 <http://www.statemuseum.arizona.edu/exhibits/pproj/
	index.asp>.

Chen, Shenchang Eric. "QuickTime VR: An Image-based Approach to Virtual
	Environment Navigation." *International Conf. on Computer Graphics and
	Interactive Techniques*. Proceedings of the 22nd Annual Conf. on Computer
	Graphics and Interactive Techniques. Ed. S. G. Mair and R. Cook. New York:
	ACM, 1995. 29 - 38. *The ACM Portal*. 4 May 2007 <http://doi.acm.org/
	10.1145/218380.218395>.

Crane, Gregory. *Perseus Digital Library*. Vers. 4.0. 27 May 2005. Tufts U. 4 May 2007
	<http://www.perseus.tufts.edu/>.

Dusinberre, Elspeth, et al. *Wining, Dining, and Dying in Ancient Greece*. Spring 2005. U
	of Colorado at Bolder. 4 May 2007 <http://www.colorado.edu/Classics/
	exhibits/GreekVases/exhibit.htm>.

Kitchens, Susan A. *The QuickTime VR Book*. Ed. Jeanne Woodward. Berkeley, CA:
	Peachpit, 1998.

Martin, Kathi. "The Role of Standards in Creating Community." *International World Wide
	Web Conf.* Proceedings of the 13th International World Wide Web Conf. on
	Alternate Track Papers & Posters. New York: ACM, 2004. 35 - 40. *The AMC
	Portal*. 4 May 2007 <http://doi.acm.org/10.1145/1013367.1013374>.

Martin, Kathi, Xia Lin, and Lois Lunin. "User Centric Design and Implementation of a
	Digital Historic Costume Collection." *Proceedings of the American Society for
	Information Science and Technology* 40.1 (2003): 280 - 290. Wiley InterScience.
	U Texas at Austin. 4 May 2007 <http://dx.doi.org/10.1002/meet.1450400135>.

Martin, Kathi, Xia Lin, and Bella Veksler. *The Drexel Digital Museum Project: Historic
	Costume Collection*. 29 Aug. 2003. Drexel U. 4 May 2007
	<http://project.cis.drexel.edu/costumes/home.html>.

Milbank, Thomas L. "Spacing Out: Web 3D and the Reconstruction of Archaeological
	Sites." *Ancient Studies -- New Technology* (Dec. 2000). *Perseus Digital Library*.
	Ed. Gregory Crane. Vers. 4.0. Feb. 2003. Tufts U. 4 May 2007
	<http://www.perseus.tufts.edu/Articles/20001208_Milbank_ASNT.pdf>.

Nieder, Gary L. QTVR Anatomical Resource. 28 Dec. 2001. Wright State U. 7 May 2007
<http://www.anatomy.wright.edu/QTVR/index.html>.

Norris, Brian E, and B.L. William Wong. "Activity Breakdowns in QuickTime Virtual
Reality Environments." *AUIC*. User Interface Conf., 2000. AUIC 2000. First
Australasian. Washington, DC: IEEE Computer Society, 2000. 67-72. *IEEE
Xplore*. Vers. 2.3. 4 May 2007 <http://doi.ieeecomputersociety.org/10.1109/
AUIC.2000.822068>.

The International VR Photography Association. "VR Links." IVRPA. Ed. Landis Bennett.
31 July 2007. 28 June 2007 <http://ivrpa.org/vr/links>.

Trelease, Robert B. *VR Anatomy Collection*. UCLA. 7 May 2007
<http://compubio.medsch.ucla.edu/VRanatomy/index.html>.

Trelease, Robert B., et al. "Going Virtual with QuickTime VR: New methods and
standardized tools for interactive dynamic visualization of anatomical structures."
Anatomical Record 261.2 (Apr. 2000): 64-77. Wiley InterScience. U of Texas at
Austin. 3 Apr. 2007 <http://dx.doi.org/10.1002/(SICI)1097-0185(20000415)261:
2<64::AID-AR6>3.0.CO;2-O>.

"Virtual Reality." *Wikipedia*. 5 May 2007 <http://en.wikipedia.org/wiki/Virtual_reality>.