



Centrum voor Wiskunde en Informatica

REPORTRAPPORT

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Subjects

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Information Systems (INS)

INS-R0022 November 30, 2000

Report INS-R0022
ISSN 1386-3681

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CWI is the National Research Institute for Mathematics and Computer Science. CWI is part of the Stichting Mathematisch Centrum (SMC), the Dutch foundation for promotion of mathematics and computer science and their applications.

SMC is sponsored by the Netherlands Organization for Scientific Research (NWO). CWI is a member of ERCIM, the European Research Consortium for Informatics and Mathematics.

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Virtual Context — Relating Media Objects to their Real World Subjects

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ABSTRACT

Virtual Reality (VR) is sometimes used to give the user an immersive, three-dimensional sense of a real-world setting. VR is also sometimes used for information visualization, taking advantage of the perceptual characteristics of VR to convey information. This paper presents the *Dam Square Virtual Context*, a Web-based VR that is a combination of both these uses. This VR presents mock-ups of both Dam Square in the city of Amsterdam and the city's largest museum, the Rijksmuseum. This VR conveys abstract information that includes the relationships between objects in the museum, such as paintings of Amsterdam cityscapes, and the corresponding objects in Dam Square itself, such as the buildings and neighborhoods shown in these paintings. It is thus a multimedia combining VR wireframes and bitmaps with still images and interface scripts. The principle behind this is that the user learns how to walk through the museum to view objects that together convey a unified view about Amsterdam, which the user can then later walk through.

1998 ACM Computing Classification System: H.5.4, H.5.1, I.4, J.5

Keywords and Phrases: Virtual Reality, museum objects, hypermedia

Note: The research performed at the CWI was funded in part by the Multimedia Information Analysis (MIA) project and by the ToKeN2000 project.

1. INTRODUCTION

Cultural heritage and museum applications often use VR as “mock-ups” that recreate currently or previously existing real settings and objects. These are based on measurements of the real setting and its contents. Often photographic images are used as well. The intent here is to recreate the real setting as accurately as possible. The primary advantage of such VRs is that they can widely distribute an immersive perception of a real world environment without requiring the user to travel there. Of course, they are much inferior to the sensory experience of actually being there, and provide no additional information to actually being there.

Alternatively, rather than recreate real world three-dimensional immersion, a sense of three-dimensional immersion that is not based on reality is sometimes used to communicate more abstract information to the user. For example, VR can be used to communicate the shape of molecules, or to provide scientifically visualize the shape and form of storm systems. These applications use sensory perception that can only be conveyed electronically by virtual reality. The most commonly-used of these senses is that of physical placement in a three-dimensional environment.

This paper presents the *Dam Square Virtual Context*, a use of VR features to enhance reality-based information with abstract information about the real world objects represented in multiple settings. The subject of the VR presentation is Dam Square in Amsterdam. The primary component is a VR recreation of the Dam as it physically exists. Old paintings of the Dam as it previously existed are also used. Images of these paintings are superimposed on the Dam Square VR to give the user information also includes how Amsterdam has changed over time, and how various paintings in the museum, when seen together, record and communicate these changes. The VR may be used stand-alone, or made accessible across the Web as part of a multi-user virtual environment.

2. The Subject and Context: Dam Square, Amsterdam

Dam Square was chosen for this application because it involves information that is both immersively three-dimensional and abstract. The three-dimensional and immersive information comes, of course, from the physical composition of the square itself: the measurements and forms of its buildings, where they are placed and their visual appearance. The abstract information comes from 700 years of recorded history about the square. This historic data includes dates of events in its architectural history, old maps and images of buildings on the Dam that no longer exist.

Figure 1 shows the “real world” Dam Square as it currently exists. Figure 2 shows the VRML world of the Dam used in the Dam Square Virtual Context. It was adapted from the 3De Dam VRML world, a recreation of the three-dimensional physical setting of Dam Square [1]. It enables three-dimensional “walk-through” and “fly-through” navigation of the Dam Square world with VRML browsers. It gives the user a three-dimensional sense of the form of Dam Square, and the form, position and appearance of buildings currently within it. With three-dimensional goggles, it also gives the user a sense of the size of Dam Square and its buildings. However, the original 3De Dam VRML does not provide and information that would not be effectively available from standing in Dam Square itself.

3. The Objects and Context: Paintings of Dam Square in the Rijksmuseum of Amsterdam

This application uses images of paintings on display in the Rijksmuseum, Amsterdam. These images come from the Rijksmuseum Amsterdam Website [6]. Three of these images are shown in Figure 3. The circumstances under



Figure 1. The “Real” Dam Square



Figure 2. The Dam VRML World (adapted from [1])



Figure 3. Three Rijksmuseum Paintings of Dam Square

which people typically see these include standing before them in the museum or viewing them as images on a Web browser.

These paintings convey information about Dam Square, its layout and its history. They show how the square and the buildings within it appeared at various periods in the past. They also show the position of structures in Dam Square that no longer exist. These paintings as a group provide information that can be combined to provide a better understanding of the history of the square and its appearance than the paintings can individually.

Each painting has, of course, a position in the square from which it was painted. These viewpoints are part of the paintings' contexts. Paintings are not photographs and thus may not be accurate recreations of what the painter saw, either because of painter error or artistic license. However, these paintings are accurate enough to provide information about the placement of Dam Square structures. And they provide information that is not available elsewhere.

Since the paintings provide useful information in combination, it helps to be able to have a combined view of them. This is not typically possible in the museum itself because they are located in different rooms. The images of the paintings can be downloaded off the Web and viewed together, making comparison easier.

Comparing the paintings of Dam Square from the past with its current appearance also provides useful insights. It may be ideal to take the paintings from the museum and bring them to Dam Square for comparison, but this of course is impractical. Having a computer display of the multiple images for the user while he or she is in Dam Square itself is a more workable solution, but is still quite impractical. A more portable solution, though lacking "real world" visual quality and immersive depth, is to compare the images with a virtual recreation of the physical Dam Square. The images and the Dam Square VR could be shown side-by-side on the user's display. This paper's Dam Square Virtual Context is this multiple display, but with further integration: the images are integrated into the virtual reality display for a unified presentation.

4. The Virtual Context

Figure 4 shows the interface to the Dam Square Virtual Context. This interface is an integration of the display of the painting images with the presentation of the VR world. This integration provides a richer understanding of what the paintings say about the appearance, structure and history of Dam Square than the other non-integrated presentations would.

5. The Integration

This interface integrates the display of the painting images with the three-dimensional Dam Square recreation in two ways. First, the images and the VR view are visually unified. Second, navigation is provided to the positions in the VRML world that are equivalent to the viewpoint of each painting. This integration is implemented mostly as a console added to the user's interaction with the VR. This console is shown at the bottom of Figure 4.

The display of all the images on the VR console is one aspect of this visual integration. This thumbnail display shows all the paintings that provide information about Dam Square. It also provides access to more detailed displays of each painting image. Clicking on one painting thumbnail makes that the primary "active" painting in the VR. A larger resolution image of the currently active painting is shown on the VR display. This larger display of the active painting is semi-transparent. A dial on the console controls the level of this transparency. This larger display can also be turned on and off with a console button, enabling the user to focus either on the painting itself or on Dam Square, the painting's subject.

The user is free to navigate to any viewpoint in the VR with the usual navigation controls. Clicking on a painting thumbnail to make that painting active provides additional integrated navigational control. When a painting is made active, navigation automatically occurs to that painting's viewpoint. The user can select any painting at any time and be moved to that painting's perspective. From this position, the semi-transparent display of that painting enables comparison with the corresponding view from within the VR. After automatic navigation to the newly activated painting's viewpoint, the user can continue normal VR navigation.

5.1. The Expression of Information Enabled

This integration of virtual reality with image and position data provides a richer sense of the geographic placement of the buildings, and how each painting conveys that geographic placement. This is particularly helpful with buildings that no longer exist, since old paintings can be the only source of information about their position. Users can see more clearly in the VR where demolished buildings existed in relation to currently existing buildings. This integration also helps convey the artistic license some painters used. Some paintings effectively move the buildings within the Dam to provide the best angle for each individual building in a setting. This distinction is made particularly clear with the semi-transparent display of the painting over its virtual view.

Another interesting insight on geographic placement and artistic license conveyed is that of structures that were painted but never existed. The tower of the New Church is included in several Dam Square paintings. This tower was planned, but never actually built. Nonetheless, artists that painted the square during its planning were instructed to paint the tower as it was planned to appear, with the expectation that the tower's inclusion in the painting would eventually be accurate. With this integration of painting display and VR navigation, the user can get a sense of where the tower would have been.

Finally, this integration helps the user get an appreciation of how multiple paintings in a museum can together improve the perception of their subject. As the user clicks between the paintings and their virtual positions, he or she develops a better understanding of the paintings' shared context, and how each painting contributes individually to an understanding of it. Once the user uses this digital media integration to develop this understanding, it may enrich the user's view of the real paintings on display in the museum, and the user's wandering through the real Dam Square itself.

5.2. Implementation

This VR is encoded in VRML and makes up part of the RIF virtual environment [4], which is being developed at CWI using Blaxxun technology [3]. The interface was encoded as VRML scripts. Our selection of VRML as the virtual reality format is based on its wide-spread adoption and the availability of its tools. The Dam VRML world was taken from the De Digitale Stad Website [1]. Several changes were made to it, including updating it from

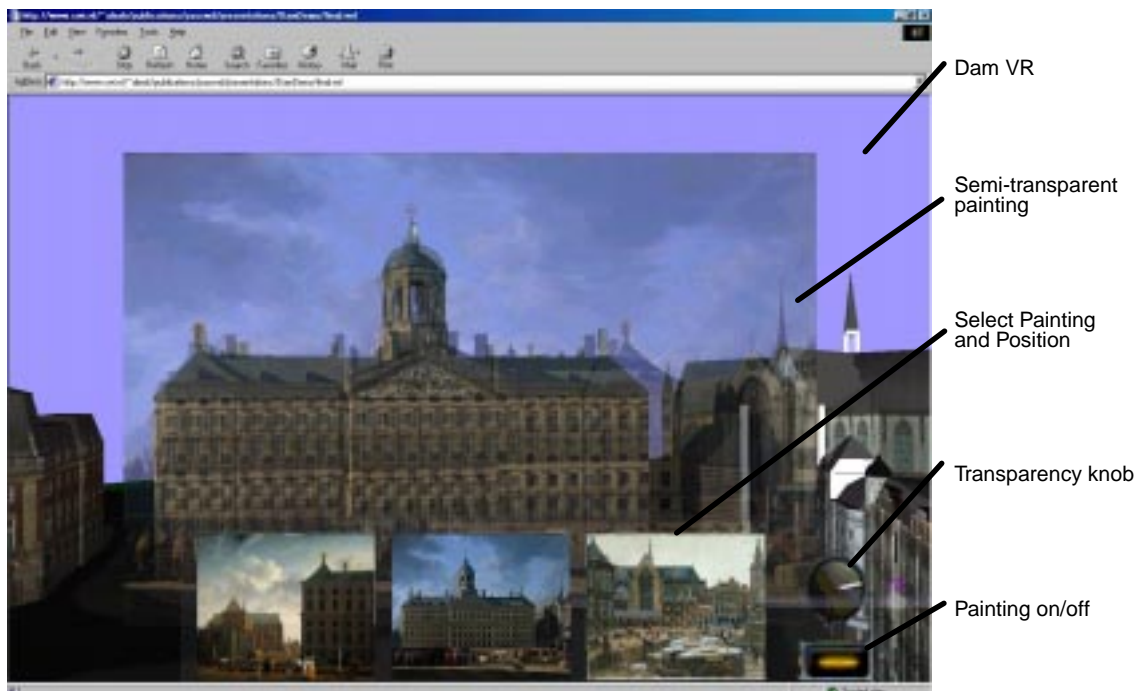


Figure 4. The Dam Square Virtual Context Interface

VRML 1.1 to 2.0, to improve the appearance of the navigability. The Dam Square Virtual Context VRML world is available off the Web [2].

6. Summary and Conclusion

Paintings in museums with subjects in common sometimes express information about their subject in combination in ways they can't individually. Some painting subjects have real world contexts that can be uniquely conveyed with virtual reality. The Dam Square Virtual Context integrates the display of multiple paintings of the Square with a three-dimensional recreation of it. This integration provides a further unique means to communicating an understanding and appreciation of the relation between object and subject.

7. Acknowledgements

The research for this paper was funded in part by the Multimedia Information Analysis (MIA) project [5] and by the ToKeN2000 project [7]. Images of Rijksmuseum paintings used in the figures of this paper were taken from the Rijksmuseum Website [6]. Rijksmuseum painting meta-data was made available by the ToKeN2000 project.

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