PRESENTATION AND NAVIGATION OF CONTEMPORARY ART IN 3D DIGITAL DOSSIERS

A case study

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Abstract: In this paper, we describe a case study of creating a digital dossier to present a collection of artworks of the Serbian-Dutch performance artist Marina Abramovic, together with the art related information for the preservation and re-installation of these artworks. For the presentation of information we choose a 3D environment which facilities the presentation of text, pictures and video as well as 3D models of artwork installations. For navigation we developed a concept graph that allows for choosing inter-related concepts, artwork-related information and media recordings of artworks in a unified intuitive fashion. The Abramovic dossier, developed as a collective student project, was based on a set of video recorded interviews with the artist. The outcome of these recordings can also be accessed by using the concept graph as a navigation paradigm.

1 INTRODUCTION

Digital archives for contemporary art that mimic a real-life museum in 3D space lack the ability for effective information retrieval when dealing with a large amount of highly inter-related information.

From the perspective of entertainment these virtual museums can certainly amuse but the concept of copying a real life museum in a virtual environment is not very original anymore.

To cope with highly inter-related information structures, in such a way that is supports effective information retrieval and relationship detection in 3D space, we created a special kind of digital archive, further called digital dossier, for which we developed a new interface paradigm.

The case study is a project of a multimedia course at the Vrije Universiteit Amsterdam. The project's aim was the creation of a digital dossier for the Netherlands Institute for Cultural Heritage in the domain of contemporary art. The digital dossier was realized by a team of nine students with different educational backgrounds and skills. The digital dossier presents itself as a digital archive in 3D space, containing information about the artworks of the performance artist Marina Abramovic by presenting media content and relational structures. The idea of the digital dossier originates from the traditional medical dossier, which contains patient's information of relevance for diagnosis and treatment. In this particular case, the digital dossier presents the artist Marina Abramovic's artworks, serving as an information source for the museum's curators to conserve and install the artworks.

Our digital dossier introduces some innovative features with respect to navigation and presentation in 3D environments.

For navigation, we designed a concept graph that links multimedia elements in a structured hierarchy. The hierarchal structure is dynamic i.e. the selected information determines the presented hierarchy and visualizes parent-child relationships between information nodes.

For the presentation of media content, we designed a content gadget consisting of three windows positioned in a way that allows to deal with multiple media simultaneously.

The structure of this paper is as follows: In section 3, we give an example of using the digital dossier and in section 4 we explain our approach and implementation. In section 5, we discuss extensions to the digital dossier with respect to data representation and content management and in section 6 we discuss initial user experiences. Finally, in section 7, we draw our conclusions.

2 BACKGROUND AND RELATED WORK

The digital dossier described in this case study was developed in close collaborations with the Netherlands Institute for Cultural Heritage (ICN). ICN is a leading, independent knowledge institute for the preservation and management of moveable cultural heritage. ICN is coordinator of International Network for the Conservation of Contemporary Art (INCCA).

The digital dossier for the artist Marina Abramovic had to satisfy the following requirements:

- It must serve as an information source for conservators and curators of contemporary art,
- It must present rich media recordings of all artworks, and,
- In addition, it must also provide background information for the general public (non-expert users).

A common environment used to present art related information in 3D space is the virtual museum. A virtual museum is a navigation orientated environment where navigation and presentation of content are overlapping [2]. While navigating for content, representation of the artworks are constantly visible. For quick navigation or searching in large information collections, this could lead to confusion and disorientation.

Many different visualizations have already been proposed to navigate hierarchical information structures [4]. These visualizations can be in 2D or 3D and are needed to interpret the intended hierarchy of a particular information collection. Such diagrams are aimed at reducing the cognitive load for the user.

A well-known example of a 3D information visualization is the 3D cone tree [3]. The 3D cone tree visualizes hierarchical structures and consists of cone objects. The motivation of using 3D over 2D cone trees is that 3D visualizations make optimal use of screen space and provides the opportunity to visualize larger hierarchical structures.

With respect to usability, we observe that the cone tree presents all information at once. In case of a large amount of highly inter-related information structures this could lead to an information overflow.

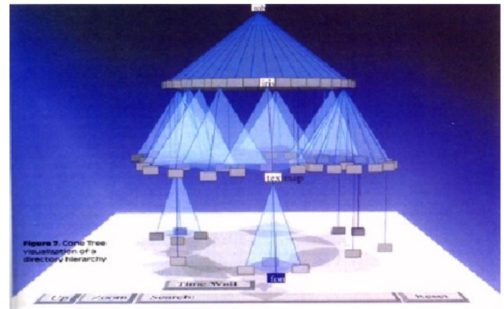

Figure 1. Cone tree visualizing hierarchy

3 A SCENARIO OF USING THE DIGITAL DOSSIER

In this section we will give an example of using the digital dossier illustrating how to find information related to the artwork ‘China Ring’.

The dossier opens with a short introduction which will quickly be replaced by the main concept graph. (see figure 2).

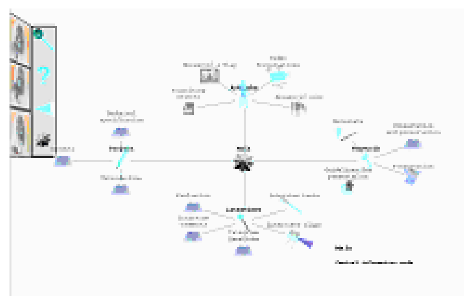

Figure 2: Overview concept graph

In the center of the concept graph, there is a shining star as a start object. Click on it, then the star structure spreads and children objects appear surrounding the center star object (see figure 3, right).

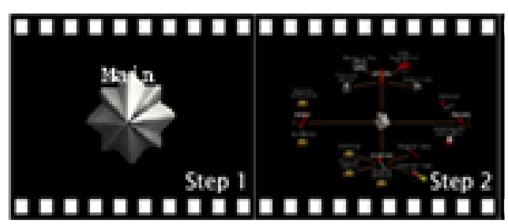

Figure 3: initialization hierarchic information structures

Clicking on the information node ‘Artworks’ and then on ‘China Ring’ will bring the node for ‘China

Ring' into focus. Alternatively, using the keyword search function, the artwork 'China Ring' can be easily found without concept graph navigation.

The tree depicted in figure 4 shows 'China Ring' as the center node, surrounded by all its children nodes, which present information in text, picture and video format.

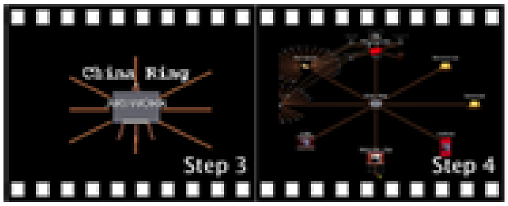

Figure 4: the artwork 'China Ring'

When clicking on the current center node 'China Ring', the content presentation environment appears. It functions as a content gadget with three windows to present different types of information which are grouped into categories (text, pictures and video) listed below the windows. The information items can be dragged-and-dropped to any window for display. As we can see from figure 5, step 5, the picture of 'China Ring' is presented in the left window, video in the middle window and text description in the right window. If desired, the user can focus on any window by using a zoom function, (figure 4, right).

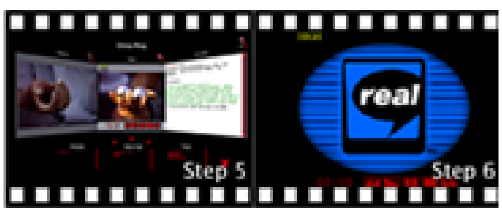

Figure 5: presentation of 2D media content

When the presentation of media content is finished, clicking on the close button will result in going back to the concept graph. Alternatively, the 'home' function of the tool bar, may be used to return directly to where we started, the original shining star.

4 APPROACH AND IMPLEMENTATION

In this section we will indicate what technology we used, and we will describe the realization of the concept graph in somewhat more detail. We will then discuss the way media content is presented and how 3D models of artworks may be incorporated.

4.1 Technology

The digital dossier was created with Virtual Reality Modeling Language (VRML). It allows creating virtual worlds connected via the Internet and hyperlinked with the World Wide Web to expose the digital dossier to a broader audience.

4.2 Concept graph for navigation

As a user interface for navigating the digital dossier, we created a concept graph that represents hierarchical information structures. The concept graph allows the user to detect relations and search for information. Unlike the 3D cone tree, where the complete hierarchical structure is presented, only a subset of the hierarchy is shown - three levels deep.

The concept graph is implemented as a star-structured-hierarchy diagram representing related information objects. (See the appendix for more implementation details.) By star-structured we mean that relations between information objects are visualized by lines, getting a structure consisting of parent-child relationships, showing a centered information object surrounded by related information objects.

The actual structure, originated by the parent-child relationships, is dynamically generated when selecting an information object. The selected object will be translated to the center of the screen, involving movement in the X and Y direction. It then becomes a parent node showing its children around it. The structure presented is dynamic and actually determined by the user's choice. To compensate for the lack of an instant overview, where all information is shown at once, the user can, as already indicated in the previous section, also use keyword search instead of navigation.

In summary, there are two ways of finding information in the digital dossier:

1. Concept graph navigation - Through selecting an information object it becomes the center node showing its relations to other nodes.

2. Keyword search - The search facility enables the user to locate information based on textual input.

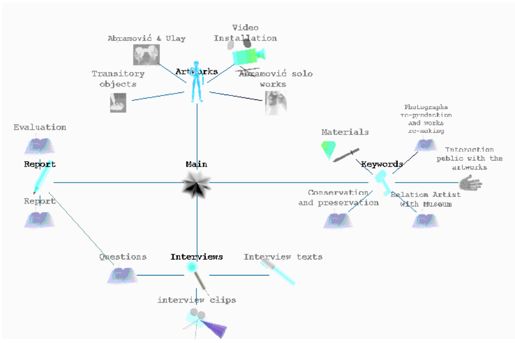

Figure 6. Concept graph visualizing hierarchy

Information objects shown in the concept graph are represented by 3D icons. These 3D icons visualize a certain type of information. The icons tell the user what information s/he can expect when clicking on it. We distinguish between two information types:

- Conceptual information type – 3D models that represents categories.
- Content information type – 3D models that represents certain types of content.

The content information type itself consists of different media types. These are:

- Text content type – 3D models that represents textual content.
- Picture content type – 3D models that represents static visual content.
- Video content type – 3D models that represents audiovisual information.

4.3 Presentation of media content

Presentation of media content is supported by different visualization facilities. Presentation is an essential part of the digital dossier but is separated from navigation. The presentation facilities are deployed when media content is selected for view. The digital dossier contains different presentation facilities for 2D and 3D content.

For 2D media content a visualization facility is needed that is able to present video, images or textual information. This facility is implemented as a content gadget with three windows. In each of the three windows the user can view 2D media content. These windows are positioned in such a way that the user can inspect the information simultaneously (see figure 7). In our experience, three images can be presented at the same time without much visual distortion

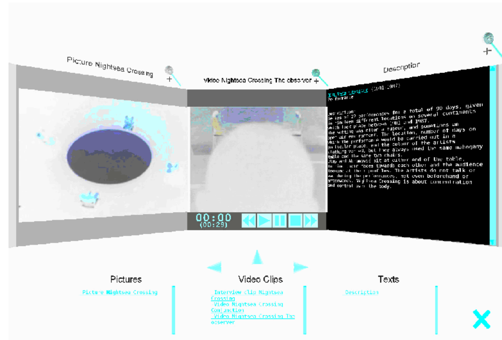

Figure 7. Presentation gadget with 3 panes visualizing content

Below the three windows a list of all content related to the selected information object is displayed. The content is categorized lists for each content type.

The user can control on which of the three windows content is displayed. By using drag-and-drop the user can view content on a window of choice. This functionality gives the user some freedom for customization instead of being bounded to a fixed display.

If necessary, the user can focus on a particular window with a zoom option, to avoid distraction from the other windows.

4.4 Incorporating 3D models of artwork installations

Since we adopted 3D technology, we could easily accommodate a 3D model for one of the installation art works by Marina Abramovic.

We implemented a plain exhibition room, providing a 3D perspective of the installation 'Terra degli dea madre' that allows the user to manipulate the position of the objects by a click-and-drag function.

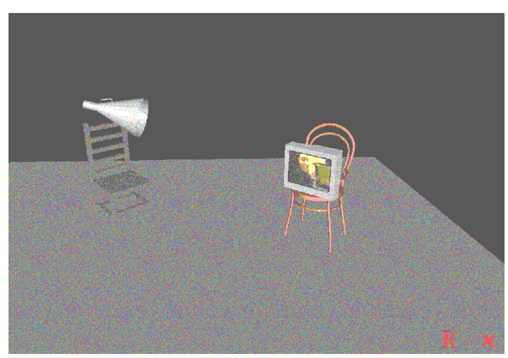

Figure 8. 'Terra degli dea madre' in 3D

The 3D environment demonstrates the interactive exploration of the installation of an artwork. By manipulating position and/or angle of objects, museum curators can get insight into how the artwork could be exhibited.

5 DATA REPRESENTATION ISSUES

To preserve the information stored in the digital dossier for future use, we must consider the data representation i.e. how the information is stored and structured. To use the information presented by the digital dossier, taking into account future developments in 3D technology or other application contexts, it has to be independent of formatting information. This means that the same information instance can be used for other presentations in a relatively easy way. In case of the digital dossier the presented information has to be VRML independent.

As an extension to the digital dossier we created a web-based content-management tool that generates XML (eXtendible Markup Language) structured data output from textual information input. XML is independent of formatting information and therefore suited for multiple presentation forms.

The tool has initially been created for non-expert VRML users that want to create a 3D digital dossier in a relatively quick and easy way, without programming or adjusting existing code.

By using style sheets, the generated XML output can be presented in various ways by giving it formatting information. In case of the 3D digital dossier a style sheet conversion is needed from XML to VRML format.

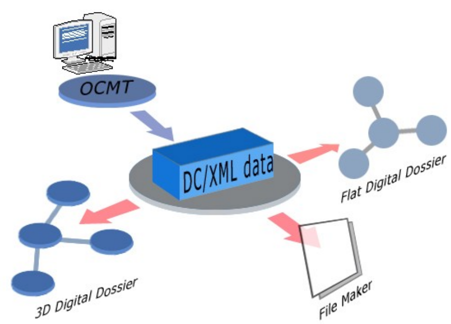

Figure 9. OCMT generates XML output for various presentations

6 USABILITY EVALUATION

As a first review of the digital dossier we conducted a cooperative evaluation [1] with potential end-users. The cooperative evaluation is a variation of a think-aloud evaluation and has the following advantages:

- It's easy to conduct, and involves no extra costs.
- It delivers test results in a relatively short time.
- It encourages the user to criticize the application and the style of interaction.

The actual evaluation sessions of the digital dossier were recorded on video.

6.1 Evaluation

The evaluation was designed to assess domain related tasks where the user uses all functionality related available for navigation and presentation. It focused on the following aspects of the digital dossier:

- Navigational actions
- Interpretation of navigational results
- Interpretation and detection of relations between information
- Presentation of content
- Functionality of presentation gadget

In general, we were interested in explorative tasks, where the evaluator has a passive role.

6.2 Evaluation results

The test results give a first indication of the usability of the digital dossier:

Positive results:

- The concept graph makes it easy to detect relations between information
- Using a concept graph for navigation appeared to be intuitive for all users
- The close relation between the concept graph and presented media reduces dis-orientation.

Negative results:

- The meaning of 3D icons was not well understood,
- The users expressed the wish to customize the visual appearance of the concept graph and the icons used.

In general, we conclude that the concept graph supports both intuitive navigation and relationship detection. However improvement of the visual appearance of the digital dossier is definitely possible and desired.

7 CONCLUSION

We have argued that a concept graph implemented as a star-structured diagram, where the presentation of the structure is dynamic, as used in the digital dossier, may provide intuitive navigation when dealing with highly inter-related information structures in 3D space. Instead of presenting a complete view of the hierarchy, the concept graph shows only a subset of the information. Presentation of content is separated from navigation but the digital dossier indicates a strong relation between them.

So far, the results of the initial evaluation look very promising for using the concept graph as a navigation paradigm. Evaluation indicates that it is relatively easy to use and that it supports exploratory tasks rather well. As such, the digital dossier can be a solution for dealing with presenting highly inter-related information structures in 3D space. However, to get a more accurate view of the usability of the digital dossier, evaluations that are geared to obtain quantitative results need to be conducted. Also deploying the digital dossier in more real world applications may reveal new issues for its further development.

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- Technische Universiteit Delft: Jurgen Koster
- The Netherlands Institute for Cultural Heritage: Tatja Scholte, Ijsbrand Hummelen
- Montevideo: Bart Rutten, Gaby Wijers

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[3] Robertson, G., Mackinley, J. & Card, S., Cone trees: animated 3D visualizations of hierarchical information, Proceedings of the SIGCHI conference on Human factors in computing systems: Reaching through technology, 189 – 194, New Orleans, Louisiana, United States, March 1991.

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FOOTNOTES

1. http://www.few.vu.nl
2. http://www.uva.nl
3. http://www.montevideo.nl
4. http://www.icn.nl and www.incca.org
5. http://www.few.vu.nl/~dossier05

APPENDIX: CONCEPT GRAPH DRAWING

This appendix describes the way how information is displayed in the concept graph. The concept graph in the digital dossier visualizes the inter-related information items as nodes in a star-like diagram. As explained before, the concept graph allows the user to browse through a large amount of data while displaying a limited number of items at a time. The presented structure always consists of one centre node and surrounding nodes. The presented structure in figure A shows that the direct surrounding nodes of the center node called 'main' are themselves surrounded by nodes too.

The user can browse through the data by clicking on the visible nodes in the concept graph. The clicked node then becomes the new center node of the concept graph.

Both a search option and a history function (including a back button) are available.

Figure A: Structure concept graph

Drawing the graph

This section describes how the concept graph is drawn. When a new node has been chosen to become the center of the concept graph, we could say that the state of the graph changes. This is when the computation of the new positions of nodes in the concept graph starts. The positions of the nodes are computed as positions on a 2D plane. The process can be described in 5 steps:

Step 1: First the node that is selected is placed in the center of the space. We call this node the center node. The node represents the information the user is focusing on.

Step 2: Next, the available radius for the center node is set. In our application this value was kept constant for each state. The radius available must be larger than the space taken in by the center itself otherwise there is no room for drawing other nodes.

Step 3: In this step the radius that is available for each surrounding node of the center node is computed. The surrounding nodes of the center node will be called the child nodes. The children of the center node are the nodes with information related to the information of the center node.

The circle around the center node is divided into sectors. The number of sectors is equal to the amount of children of the center node. The space available for a child is the circle that fits inside a sector. However, the circle around the child may not intersect with the center node, this puts a minimum on the distance from the center to the child. If this is the case, the circle available for the child node is decreased to not intersect with the center node (i.e. the radius is derived from the minimum distance and the available space/radius of the center node).

Figure B shows how the radius of the area around the child can be derived. Figure C shows the minimum distance from the child to the center node.

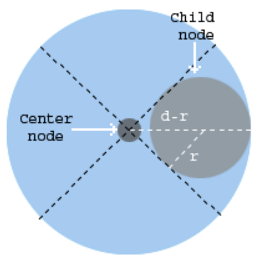

Figure B: The available space for a child node. In this example there is space for four child nodes.

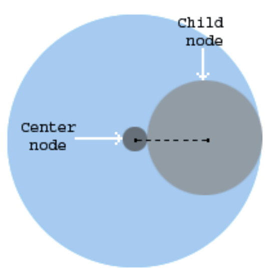

Figure C: The minimum distance between the center node and a child node.

Step 4: Now the actual radius that will be used by a child node can be computed as follows:

First for each node surrounding the child node (which can be regarded as grandchild nodes relative to the center node) we compute the distance it will be placed from the child node. We must make sure that the nodes do not intersect each other, so we arrange them around the child node, as depicted in figure D. The distance to the child node is equal for each node, where each surrounding node has the same sector size to be drawn in. The distance between a surrounding node and the child node is taken as small as possible such that the surrounding node just hits the borders of the sector. But in the case the center node and surrounding node would intersect, the center node and surrounding node are put next to each other, see figure D.

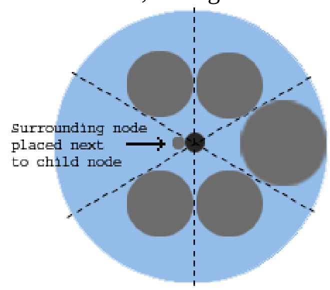

Figure D: Nodes surrounding the child node indicating the actual radius used.

The required radius of a child node is the radius of the circle with the same center as the child node in which all its surrounding nodes fit. However in case this radius exceeds the available space of the child node, the available radius is taken as the required radius. Also the child node and its surrounding nodes will be scaled down to fit inside its available radius.

Step 5: In this last step the position of all the nodes in the concept graph are computed. The child nodes are arranged around the center node like in step 4: The distance between the child node and the center node is minimized such that the required space of the child nodes fit in the sectors without hitting the center node. The positions of the child nodes can now easily be derived from the distance and the angle each sector is taking.

In case the available radius is smaller than the required radius, the child node will be drawn smaller and the distance of the surrounding nodes to the child node are scaled down to fit the available radius.

If the available radius for a child node is smaller than a predefined minimum, the children will not be drawn.

The positions of the surrounding nodes relative to their child node are computed in the same way as for the child nodes. In our application the concept graph could fill a rectangle space. The locations of the nodes are scaled/modified to make optimal use of the entire available screen space.

Resolving conflicts

Because of the (inter) relations of the data, sometimes multiple locations are possible for data items to be placed. (for example both as center node and as surrounding node of a child node). We have chosen to draw only one node for a data item: If a node is already present for an information item, the other possible locations will be left open. Since the center node will be drawn first, and subsequently the children nodes and its surrounding nodes, as a result, most open locations are around the child nodes.

The child node is always related to the center node because all relations are symmetric.

Therefore there is always one gap in the surrounding nodes of a child node. The locations of the surrounding nodes are rotated such that this gap is in the same direction as the center node from the child node.

To indicate relationships, lines are drawn between related nodes. If a node has a relation to a node that is among its children, a colored line is drawn. If the node is not among its children, because the node with the related information was already elsewhere, a visually less apparent line is drawn.

The surrounding nodes of the child nodes are drawn slightly transparent to make the center node and the child nodes visually more apparent

Animations

When the concept goes to a different state (because the focus has changed) the concept graph is animated to show the transition of the old state to the new. Nodes that represent information that is also needed in the new state, move to their new locations. Nodes that represent information that is no longer needed disappear from the screen with a fade out effect and new nodes that are needed appear with a fade in effect.

Future work

The algorithm described here draws nodes that are 2 relations away from the center node. Although it is possible to adapt the algorithm described here to support an arbitrary distance from the center node, for the digital dossier it was not necessary to draw more than 3 levels: it would have resulted in cluttering the screen with more items.