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Process Modeling for New Media Artworks

Abstract Practices in new media art pose very interesting challenges to the multimedia research community in terms of software tools development, usage of media technologies or documentation and conservation of new meda artworks. In this paper, we present the different stages in the life cycle of new media artworks and we illustrate the use of the canonical processes of media production in this context. This work is a first step towards a process modeling framework for the description and documentation of new media artworks.

1 Introduction

In their recent book "New Media Art" [11], Mark Tribe and Reena Jana describe New Media Art in terms of "projects that make use of emerging media technologies and are concerned with the cultural, political, and aesthetic possibilities of these tools". This art movement is very active and is also evolving very rapidly. Video art for example, has expanded significantly since early explorations with the transmission and reproduction of electronic moving image and sound. Contemporary video practices today take on a multiplicity of forms [2,8]. These include high definition, large screen pieces, multi-screen, multi-channel programs, interactive and adaptive installations, and web based streaming video works.

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Practices in new media art thus pose very interesting challenges to the multimedia research community. First, new media artists are very demanding users and they push pressure for integrated, flexible and easy-to-use software tools supporting the concepts they push and experiment in their artworks and installations. Second, they face and circumvent the complexity and difficulties of multimedia art creation and their practices can provide a better understanding of the usage of multimedia technologies. Third, preservation, documentation and re-displays of new media artworks are important problems curators, gallerists and collectors imperatively have to solve. Approaches based on knowledge management and process modeling should be very helpful to address the second and third issues.

In this paper, we present the different stages in the life cycle of new media artworks and we identify the corresponding processes. We illustrate the use of the canonical processes of media production [3] in the context of new media artwork design and production, more specifically for adaptive video artworks. The rest of the paper is organised as follows. Section 2 describes our research context and approach. In Section 3 we present the life cycle of new media artworks and we model the different stages using the canonical processes. Section 4 concludes and presents future work.

2 Our approach

2.1 Research context

This work has been initiated in the framework of the research group: "New Forms of Narrative and Audio/Video Practice", being part of Hexagram, the Institute for Research/Creation in Media Arts and Technologies founded by Concordia University and Université du Québec à Montréal [4]. The artists and scientists of this group explore the relationships between video and the new technologies of producing and disseminating moving images and sounds. They research and develop new content and narrative forms of image and sound that exploit the

possibilities offered by new technologies of reproduction, treatment and dissemination of video and sound.

In this context, we have conducted a collaborative research project which aimed at exploring the approaches, processes and software tools required to facilitate the design, creation and experimentation of adaptive new media artworks. Adaptive and interactive artworks are artworks that can modify their behaviour in response to changes in the state of the environment or the spectator. In this project we have proposed an adaptation framework that combines semantic and physical adaptation and which is supported by an adaptation engine. The adaptation framework has been validated through the implementation of a prototype of the adaptation engine. This prototype integrates the management of various types of metadata and allows a representation of adaptation scenarios in terms of the involved media objects, the events triggering the adaptation and the actions to be performed [9,10]. The adaptive new media artwork "The Man of the Crowd" by Paul Landon served as a case study for this research project.

2.2 Our case study: The Man of the Crowd

The Man of the Crowd is an adaptive new media artwork produced and exhibited in 2003 and 2004 by Paul Landon, media artist and researcher in the School of Visual and Media Arts at UQAM [7]. This artwork served as the case study in the collaborative research project we conducted.

Landon explores the states of distraction and fascination the urban spectacle can inflict on the individual. "The Man of the Crowd" is an attempt at analysing and reconstructing the movements of a crowd. As the spectator enters a corridor, she sees four white screens. As she moves down the corridor, images appear on the screens. She sees the head and shoulders of a man walking past and she hears his footsteps. The same man appears on all the monitors at different intervals. The frequency of the man passing on the screens is increased as the movement of the spectators in the corridor increases.

This installation (see Figure 1) consists in four video monitors, the selection and diffusion of video sequences are adapted to the spectators' movements captured using a web camera. This installation has been produced as an application developed using the PureData graphical programming environment. The Pure Data application reads the spectators movements by way of the web camera and delivers compressed video and sound based on their position and movements.

2.3 Objectives and approach

From this collaborative work around the new media artwork "The Man of the Crowd", we had the opportunity to study artistic practices and to understand the
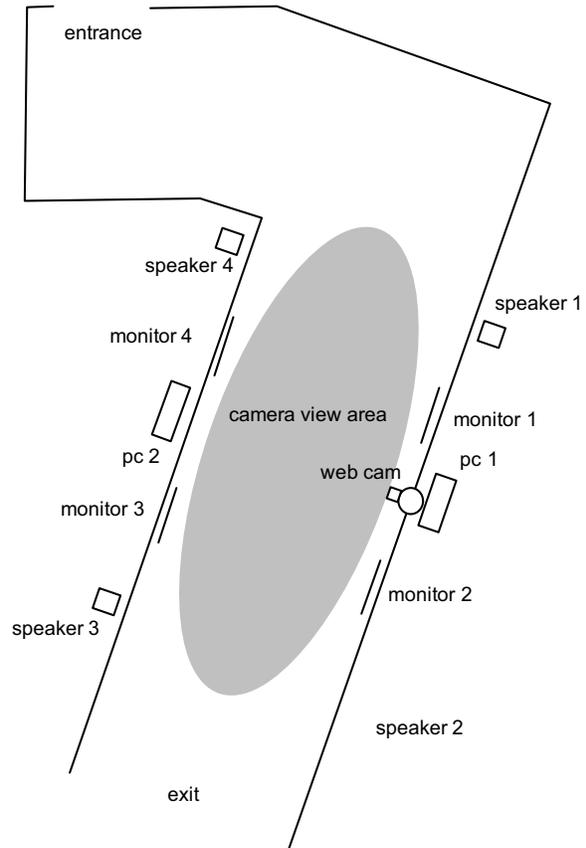

Fig. 1 The Man of the Crowd Installation.

design and production processes of new media artworks. That leaded us to describe the life cycle of a new media artwork and to detail it in terms of the canonical processes of media production defined during the Dagstuhl Workshop [5]. A preliminary version of this work was presented during the ACM Multimedia 2005 workshop: Multimedia for Human Communication - From Capture to Convey [6].

While "The Man of the Crowd" was the case study of our initial research project, we also worked to enhance our approach and to extend it to support the needs of other artists involved in the research group. More specifically we worked with Chantal duPont and Mario Côté, whose practises consider online and audio artworks. Once again, we perceived the interest of using the canonical processes of media production to understand, describe and document new media artworks. We also used these canonical processes to identify common processes and stages in the life cycle of several new media artworks. Our objectives are to propose a process modeling framework for the description and documentation of new media artworks and to validate this framework through a multi-case study. Such a process modeling framework will be helpful to artists, curators, gallerists and students to better understand existing new media artworks and to allow documentation and preservation of these art pieces.

3 Processes for New Media Artworks

In this section we illustrate the use of the canonical processes to model the life cycle for new media artworks design and production, focusing on adaptive video artworks. We first present the four stages of the life cycle and then we detail each stage and give the corresponding UML class diagram.

3.1 Life Cycle

The life cycle of new media artworks is divided into four stages: Artwork design, Media acquisition and production, Artwork production and Artwork exhibition. These four stages are defined as complex media production processes. Figure 2 presents the life cycle for new media artworks.
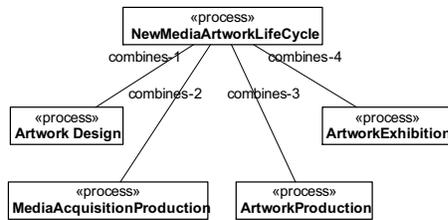
Fig. 2 The life cycle of new media artworks.

3.2 Artwork Design

For the artist, this first stage in the life cycle consists in gathering, studying and clarifying the ideas he has concerning the construction and production of a new piece of new media artwork. During this stage, the artist defines the two fundamental aspects of the artwork: the message and the content. He clarifies and expresses the artistic message he wishes to convey to the spectators. He also makes decisions relative to the different elements he will use to build the artwork (media artefacts such as audio and video as well as the narrative structure). Decisions also concern the materials and the technologies to be used.

In "The Man of the Crowd" the intended message of the artwork can be expressed as follows: "The adaptive artwork intends to reconstruct the movement of the crowd through the display of video clips that is simply adapted to the spectators' movements. This artwork should produce a passive, almost unconscious interactivity with the spectator". Concerning the content and structure of the artwork, different decisions are taken and described. Some decisions concern the architecture and the equipment used for the installation: a corridor,

four monitors, a web cam and computers. Other decisions specify that two different media captures are required: pre-recorded video sequences, to represent the movement of the crowd, and real-time video sequences to capture the spectators' movements. Other decisions also concern where to place the camera for monitoring the spectators and what type of crowd movement should be considered.

During the Artwork Design stage, we use two canonical processes: Premeditate and ConstructMessage. We specialised these processes into ArtworkPremeditate and ArtworkConstructMessage since we make a clear distinction between ArtworkIdeas and ArtworkDecisions. ArtworkIdeas are the input of both processes while ArtworkDecisions are the output of the ArtworkPremeditate process. ArtworkDecisions can be seen as a premeditate artefact. For both processes, the process actor is the ArtworkArtist.

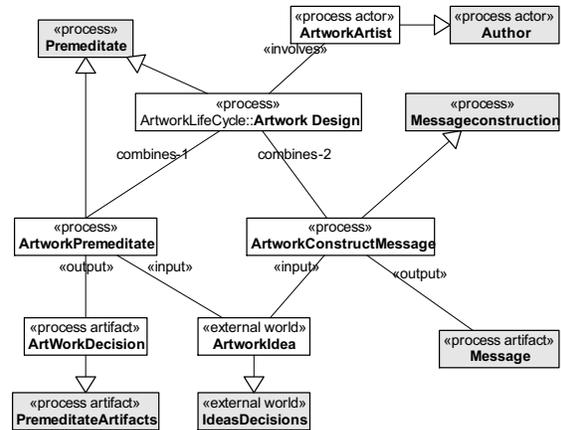The artwork design stage is presented in Figure 3.

Fig. 3 Artwork design.

3.3 Media Acquisition and Production

The second stage of the life cycle consists in the production, annotation and storage of the media artefacts that constitute or are part of the media artwork. These media artefacts can be simple such as an image or a sound sequence, or complex and built through the combination or transformation of other existing artefacts. Semantics is also added to these media artefacts with the help of metadata generated during capture or transformation as well as metadata generated during the annotation phase. The media artefacts and the corresponding semantics are then stored in an archive.

In "The Man of the Crowd", the media artefacts produced during this phase are the video sequences that will be displayed in the installation. The elementary video sequences consist of the head and shoulders of a man

walking past and his footsteps were recorded. In order to represent different crowd movements, complex video sequences were generated through the superposition of several elementary video sequences.

The created sequences are annotated to specify the crowd movement they are representing, namely: heavy, light or no movement, as well as the depth of the man in the video, namely: back, medium and front. These annotations are used to classify the video sequences according to the type of movement and the depth. The annotation will later be used to choose a video sequence during interaction with the installation. The video sequences and their corresponding annotations are then stored.

During this stage, we use three canonical processes: MediaAssetCreation, Annotate and Package. These three processes are combined in sequence. We also use three specialised processes for MediaAssetCreation: Capturing, Transforming and Generation. We specialised all these processes into: VideoAssetCreation, VideoAnnotate, VideoPackage, VideoCapture, VideoTransform and VideoGenerate. The media acquisition and production stage is presented in Figure 4.
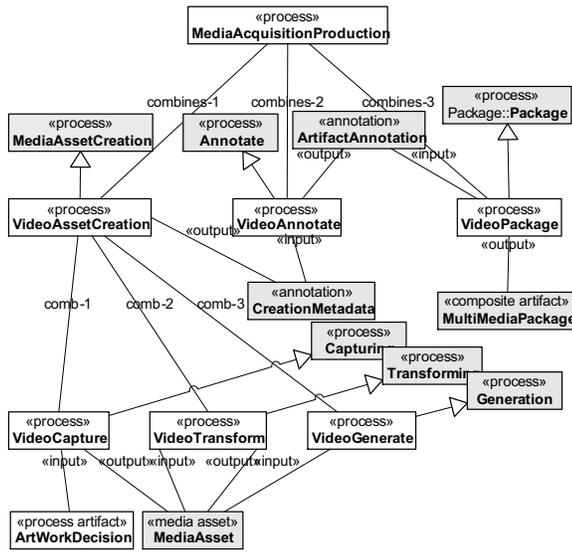

Fig. 4 Media acquisition and production.

The four processes VideoAssetCreation, VideoCapture, VideoTransform and VideoGenerate are used for the production of media artefacts, the video sequences. These artefacts can be captured but they can also be generated after a transformation process. We use the Annotation and Package processes as defined.

3.4 Artwork Production

This stage consists in building the artwork through the combination of the different media artefacts that were produced and archived in the previous stage. From the ideas he has, from the message he wishes to convey to the spectator and from the decisions he took during the design stage, the artist specifies and puts into practice the narrative structure he defined for the new media artwork in production. The narrative structure can take different forms and can be supported by different technologies and mechanisms. From the narrative structure and the media artefacts, the artwork is produced. The result of the production can take multiple forms such as of a computer program, a multimedia document or a web application.

In "The Man of the Crowd", the combination of the video sequences is done through the definition of an adaptation scenario which represents the narrative structure. The adaptation scenario is built from adaptation rules describing how the display of video sequences is triggered [10]. Adaptation rules can be seen as Event-Condition-Action (ECA) rules, specifying which, how and where the video sequences will be displayed. The events represent the movement of the spectator in the installation and are captured by the webcam and analysed. The ArtworkProduce process constitutes the development of the code of the application. The result of this step is a computer application developed using the PureData graphical programming environment. This application will run during the exhibition of the artwork.

During this stage, we use two canonical processes: Organise and Publish that are executed in sequence and that constitute two steps in the production stage. We specialised these two processes into ArtworkOrganise and ArtworkProduce. The artwork production stage is presented in Figure 5.
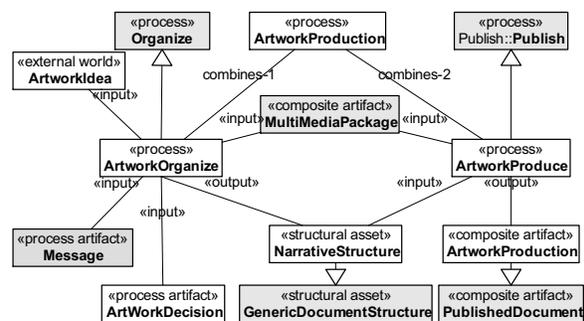

Fig. 5 Artwork production.

The inputs of the process ArtworkOrganise are: ArtworkMessage, ArtworkIdea, ArtworkDecision and the media artefacts and their annotations MultiMediaPackage. The actor for this process can be the artist but he will generally have the help of technicians or computer programmers. The output of the process ArtworkOrganise is the ArtworkNarrativeStructure.

The inputs of the process ArtworkProduce are MultiMediaPackage and ArtworkNarrativeStructure. The output of this process is the ProducedArtwork.

3.5 Artwork Exhibition

During this stage the new media artwork is experienced by the spectators. The artwork can be conveyed to the spectators by different means: an installation in a given place, a web application launched on an internet site or an interactive DVD distributed to interested persons. In our context, we focus on interactive videoartworks where the interaction with the spectators influences the behaviour of the artwork. The interaction can be conscious and constituted of actions carried out by the spectator, or unconscious, for example with the use or sensors. During the exhibition, the different components of the artwork: the media artefacts and the narrative structure are used to convey the artistic message to the spectators. The media artefacts are then delivered to the spectators.

As described previously, the installation "The Man of the Crowd" consists in four monitors on the walls of a corridor and a web cam to capture the spectators' movements. The video sequence captured by the web camera is analysed (annotation process) to identify the spectator's movement in terms of the annotation characteristics — heavy, light or no movement.

The combination of the video sequences presented to the spectator is controlled by the adaptation scenario. Appropriate video sequences are selected from the archive of sequences based on the movements of the spectators in the installation. The specification of the query depends on the annotation characteristics decided upon in the message construction phase and on the real-time interactions of the spectators in the installation. The selected video sequences are distributed, in this case displayed, to the spectator.

During this stage, we use four canonical processes: Capturing, Annotate, Query and Distribute. They are executed in sequence and they constitute four different steps in the exhibition stage. We specialised these four processes into MovementCapture, MovementAnnotate, VideoQuery and VideoDisplay. The artwork exhibition stage is presented in Figure 6.

MovementCapture is concerned with the capture of the spectators' interaction with the artwork. This process has no inputs. The output is a MediaAsset which is the constituent of the interaction and in the case of "The Man of the Crowd", this is a video sequence.

MovementAnnotate consists in analysing the video sequence captured by the webcam in order to give it semantics. This process has MediaAsset as input and MovementAnnotation as an output.

VideoQuery consists in selecting video sequences from the archive in order to display them to the spectators. The inputs of this process are: MultiMediaPackage, ArtworkNarrativeStructure, MovementAnnotation and ProducedArtwork. The output is MultiMediaPackage.

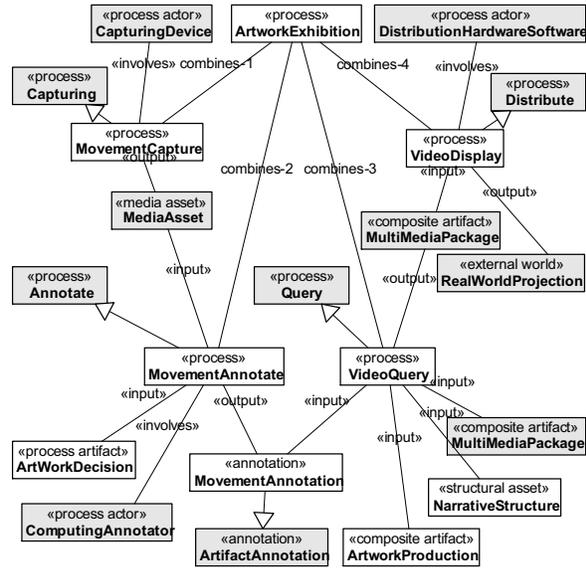ArtworkDisplay corresponds to the diffusion of the artwork to the spectators. The input of this process is

Fig. 6 Artwork exhibition.

MultiMediaPackage, and the output is RealWorldProjection.

3.6 Synthesis

We have used the canonical processes of media production to model the different stages in the life cycle of new media artworks. The canonical processes as proposed answer our needs and we specialised some classes in order to be more specific for some inputs and outputs of the different canonical processes. Table 1 synthesizes the use of canonical media processes in the different stages of the life cycle for new media artworks.

Canonical process	Stages of the life cycle of new media artworks
Premeditate	*Artwork design:* establishment of the main concepts of the media artwork; identification of the media to be used, their role and their relationships. Decisions about the types of media artefacts and their semantic, decisions about the installation and infrastructure. Input: ideas of the artist; Output: description of the decisions.
Create media asset	*Media acquisition and production:* Production of the media artefacts Input: description of the decisions; Output: the media artefacts and the metadata. *Artwork exhibition:* Capture of the spectator's interaction with the artwork. Input: none Output: interaction artefacts.

Annotate	*Media Acquisition and production:* Annotation of the media artefacts to be delivered to the spectator. Input: the media artefacts. Output: the annotation. *Artwork exhibition:* Annotation of the interaction artefacts. Input: the interaction artefacts. Output: annotation about the spectator's interaction with the artwork.
Package	*Media Acquisition and production:* Storing the different media artefacts and their annotation. Input: media artefacts and their annotation. Output: the stored artefacts and annotations. *Artwork exhibition:* Storing the narrative structure Input: media artefacts and their annotations plus the narrative structure. Output: the produced artwork.
Query	*Artwork exhibition:* Search of media artefacts to be delivered to the spectator. Input: the media artefacts and their annotations, the narrative structure and the produced artwork. Output: the media artefacts to be displayed.
Construct message	*Artwork design:* Construction of the artistic message. Input: the ideas and artistic vision of the new media artist. Output: the artistic message.
Organise	*Artwork production:* Construction of the narrative structure. Input: the artistic message, the artist's ideas and decisions. Output: the narrative structure.
Publish	*Artwork production:* Construction of the artwork Input: the media artefacts and their annotations plus the narrative structure. Output: the produced artwork.
Distribute	*Artwork exhibition:* Display of the media artefacts. Input: the media artefacts to be displayed. Output: the spectator's experience.

4 Conclusion and Future Work

In this paper we have illustrated the use of the canonical processes for media production to model the life cycle of new media artworks. This process modeling was accomplished through the study of different new media artworks produced by artists involved in a research team from Hexagram and CIAM, two research organizations in new media art. A detailed explanation of the use of the canonical processes was given for the artwork "The Man of the Crowd" by Paul Landon.

This work is a first step towards a process modeling framework for the description and documentation of new media artworks. Our future work will consist in a multi-case study where we will study other artworks from artists of our research group. In particular, we will provide a detailed process modeling of the artwork "Visual Phonographies" currently under construction by Mario Côté. We also plan to use this modeling framework to support documentation and conservation strategies to be proposed in the context of the DOCAM research project (Documentation and Conservation of the Media Arts Heritage), leaded by the Daniel Langlois Foundation [1].

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