Capturing Unstable Media
Summary of research

March 2003
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> *Die dingliche Umwelt ist uninteressant geworden, das Interesse hat sich auf die Dokumente verschoben.*
>
> Vilém Flusser, 1989[1]

> *Alle Kunstformen werden durch die Digitalisierung zu exakten wissenschaftlichen Disziplinen und können von der Wissenschaft nicht mehr unterscheiden werden.*
>
> Vilém Flusser, 1991[2]

1. Introduction

Media and technology play an increasingly important role in contemporary society. Communications, production, trade, urbanism, medicine are all being changed by technological developments that are also transforming the arts. Art that makes use of electronic, especially digital or 'unstable' media, explores the meaning, the specificity and the boundaries of these media.

V2_ is a center for art, culture and technology in Rotterdam that engages itself with these electronic arts (or, synonymously, unstable media arts). For the last twenty years, V2_ has shown electronic art installations, applications, performances and related debates and research within the framework of festivals, exhibitions and other programs. V2_Lab is a workplace for artists, scientists and technicians emphasizing exchange and meeting between the various disciplines that are involved in the realization of unstable media productions.

So far, few attempts have been made to document and preserve this field of unstable media art (or electronic art), partly due to the complex, heterogeneous nature of these activities, partly because the field is still in its infancy. In order to stimulate the debate and to help safeguard its own history, V2_ has conducted research on the documentation aspects of the preservation of electronic art activities – or Capturing Unstable Media -, an approach between archiving and preservation. The research took place in 2003; it involved a broad inventory of related, relevant archiving and preservation initiatives (summarized below in the section on research context) and the formulation of recommendations in the areas of documentation strategies, formal modeling, metadata and archival interoperability (summarized in the section of research results).

[1] Vilém Flusser, *Auf dem Weg zum Unding*. Vilém Flusser *Medienkultur*, p. 189. Fischer Verlag, 1999.
[2] Vilém Flusser, *Digitaler Schein*. In: Vilém Flusser *Medienkultur*, p. 214. Fischer Verlag, 1999.

2. Research context

In order to define the broader context for the research in *Capturing Unstable Media*, an inventory was made of the current "state of the art" in documentation and preservation of electronic art, focusing on the field and practice of electronic art and its institutions, on existing methodologies to describe and document these practices and on preservation issues. Recently, researchers like Stephen Wilson[3] and Michael Naimark[4] have written broad and systematic inventories of practices, institutions and research laboratories in the field of electronic art. For *Capturing Unstable Media* a selection was made of organizations maintaining an archive database which is accessible online, based on disciplinary and geographic diversity and diversity in content focus. Five archive projects were analyzed and compared (Rhizome.org[5], Daniel Langlois Foundation – Centre for Research and Documentation[6], Netzspannung.org[7], Database of Virtual Art[8], and the Walker Art Center's Collections and Resources and New Media Initiatives[9]) together with their related preservation initiatives: Rhizome's preservation strategy for its Artbase[10], Archiving the Avant Garde[11], Conceptual and Intermedia Arts Online[12], and the Variable Media Initiative[13].

Rhizome.org, an online platform for the new media community, offers a mailing list discussion (*Textbase*) and a web-based archive and open repository of internet-based artworks (*Artbase*). Building on the Artbase, their existing system for submission, storage and display of Internet-based artworks and accompanying metadata, Rhizome explores new grounds and methodologies in preserving new media art. A key part of this system, the Artbase Artist Questionnaire, gathers information necessary for guiding future preservation measures, in analogy with the Variable Media Initiative. Artists can choose between having their work documented ("linking") or preserved ("cloning").

The Daniel Langlois Foundation is an international funding body for art, science and technology, which maintains a research center with online data collections of

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[3] Wilson, Stephen. Information Arts: Intersections of Art, Science and Technology. Cambridge, Mass.: MIT Press, 2002.

[4] Naimark, Michael. *Truth, Beauty, Freedom and Money: Technology-Based Art and the Dynamics of Sustainability.* May 2003. 31 December 2003 <http://www.artslab.net/>.

[5] *Rhizome Artbase.* December 2003. Rhizome. 31 December 2003 <http://rhizome.org/fresh/art/>.
Rhizome Text. December 2003. Rhizome. 31 December 2003 <http://rhizome.org/fresh/text/>.

[6] *Daniel Langlois Foundation –Centre for Research and Documentation.* December 2003. Daniel Langlois Foundation for Art, Science and Technology. 31 December 2003 <http://www.fondation-langlois.org/e/CRD/>.

[7] *Netzspannung.* December 2003. MARS Exploratory Media Lab, Fraunhofer Institute for Media Communication. 31 December 2003 <http://www.netzspannung.org/>.

[8] Grau, Oliver. *Database of Virtual Art.* December 2003. Kunsthistorisches Seminar Humboldt Universität Berlin. 31 December 2003 <http://www.arthist.hu-berlin.de/arthistd/mitarbli/og/database.htm>.
Grau, Oliver. *Database of Virtual Art.* January 2003. Kunsthistorisches Seminar Humboldt Universität Berlin. 31 January 2003 <http://virtualart.hu-berlin.de/>.

[9] *Walker Art Center Collections and Resources.* December 2003. Walker Art Center. 31 December 2001 <http://collections.walkerart.org/>.
Walker Art Center New Media Initiatives. December 2003. Walker Art Center. 31 December 2001 <http://www.walkerart.org/nmi/>.

[10] Rinehart, Richard. *Preserving the Rhizome Artbase.* September 2002. Rhizome. 31 December 2003 <http://www.rhizome.org/Artbase/report.htm>.

[11] *Archiving the Avant Garde.* December 2003. Berkeley Art Museum & Pacific Film Archive. 31 December 2003 <http://www.bampfa.berkeley.edu/about_bampfa/avant_garde.html>.

[12] *CIAO – Conceptual and Intermedia Arts Online.* University of California, Berkeley Art Museum & Pacific Film Archive. 31 December 2003 <http://www.bampfa.berkeley.edu/ciao/>.

[13] *Variable Media Initiative.* December 2003. Variable Media Network. 31 December 2003 <http://www.variablemedia.net/>.

documentation on media art. This Centre for Research and Documentation supports the Variable Media Initiative, a network of cultural heritage organizations dedicated to inventing and sharing approaches to preserving art in new media. This affiliation proposes an unconventional new preservation strategy, the Variable Media Paradigm, that has emerged from the Guggenheim's efforts to preserve its collection of conceptual, minimalist and video art The aim of the affiliation is to help build a network of organizations that will develop the tools, methods and standards needed to implement this strategy.

Netzspannung.org is an Internet-based platform for media art, science and technology initiated by Media Arts Research Studies (MARS), a German interdisciplinary research group focusing on human presence in and experience of new technologies. Its umbrella organization, the Fraunhofer Institute, participates in the Database of Virtual Art, a research project initiated by the Humboldt University Berlin to provide for the appropriate documentation of virtual art, as a prerequisite for preservation and collection.

The Walker Art Center, a 20th Century modern art museum in Minneapolis (USA), focusing on visual, performing and media arts, has been involved in several experimental on-line projects concerning presenting and preserving digital arts (*New Media Initiative*, *Telematic Arts*). It takes part in Archiving the Avant Garde, a collaborative project of North American art institutions to develop, document and disseminate strategies and standards for describing and preserving non-traditional, intermedia and variable media art forms, such as performance, installation, conceptual and digital art. This joint builds on existing relationships and the previous work of its founding partners in this area, like the Variable Media Initiative and the Conceptual and Intermedia Arts Online (CIAO) Consortium.

This overview demonstrates that archiving and preservation initiatives are highly dependent on the practices of the involved institutions. For V2_ and many other institutions in electronic art, projects often consist of longer research processes; outcomes are the result of a collaborative team effort between artists, scientists, engineers and designers. Together, such teams realize artistic and cultural expressions within the larger context of research themes, public performances, festivals or exhibitions, referred to as aRt&D, or artistic research and development[14]. Capturing such projects, research practices, or components of them, calls for a different methodology than the documentation of more simple and static objects (like sculptures) for which standard description models already exist. Questions arise around defining which elements should be documented, described or preserved (in short: captured).

V2_'s archive of unstable media art[15] is an example of a pioneering project in this area; it served as a starting point for the *Capturing Unstable Media* project. The archive has grown organically out of V2_'s diverse activities. As a result the archive reflects a broad set of creative projects and practices employing or responding to new, electronic, technologies and taking different forms. They are therefore described in the archive in various ways, by various media: an interactive installation is documented with different

[14] Nigten, Anne. *Human factors in artistic research and development in multi- and interdisciplinary collaborations.* 2002. V2_Lab. 31 December 2003 <http://lab.v2.nl/home/_docs/nigten_2002_humanfactors.pdf>.
[15] *V2_Archive portal.* 2003. V2_Organisation. 31 December 2003 <http://archive.v2.nl/>

images, flyers, textual descriptions, video and audio clips or even preparatory technical drawings and manuscripts.

Unlike Rhizome's Artbase, V2_'s archive only documents the works or projects, but does not collect them. V2_ focuses on the field of electronic art and its relation to society, which comes closest to the field of investigation of the Daniel Langlois Foundation. Similar to the latter and Netzspannung.org, V2_ supports research and art projects and makes this information public through publications, presentations and on-line activities. V2_ 's electronic art projects are often developed and presented within a larger context. Artworks may be shown during and adapted to specific programs in a certain thematic framework and are part of longer-term developments for artists and institutions. In fact, the presentation of each work can be seen as part of a broader context and story, as proposed by the Database of Virtual Art. For this very reason, V2_'s archive is not built as a traditional, record- and object-based documentation archive. Instead, it is a cloud of objects and relations, describing works and actors, events and activities (the organization's history), keywords and themes, as a broad context for the art projects, similar to the C*ollections and Resources* of the Walker Art Center.

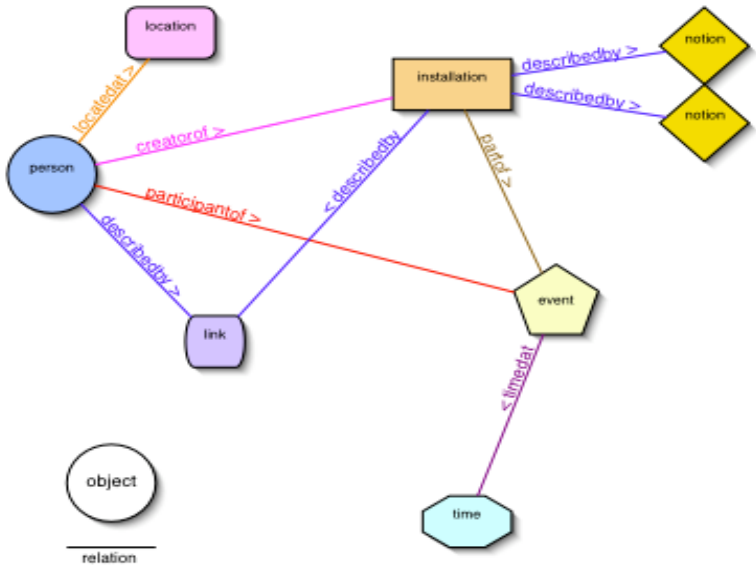

Figure 1. Schematic visualization of the basic principles of V2_Archive's object-relation metadata structure

Until 2003, V2_Archive has developed an object-relation data model, in which relatively small objects can be combined through relations in a flexible way (See figure 1)[16]. V2_'s detailed terminology resources (most notably its keyword thesaurus, related to Getty's Art and Architecture Thesaurus) are unique for the field of unstable media art, although the subject index of the Daniel Langlois Foundation's CR+D Database is closely related in scope[17].

[16] More information about the content of V2_Archive and about earlier developments can be found in Fauconnier, Sandra, Anne Nigten and Boudewijn Ridder: *V2_Archive: Archive of living actualities.* 2001. V2_. 31 December 2003 <http://lab.v2.nl/home/_docs/v2_archive.pdf>.

[17] An analysis of both terminology resources is included in *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>.

A public interface for this archive was implemented as one of the deliverables of *Capturing Unstable Media*. Furthermore, during this period V2_ has converted its archive to an entirely XML-based data management model, independent from database applications[18]. This XML framework facilitates easy data transformations, which can be applied, among others, as a basis for interoperability with other archival systems (see further).

3. Research results

Capturing Unstable Media presents a complimentary approach to the widespread material- and object-focused, rather static approach in preservation of contemporary art. For unstable media art, it is difficult to define the notion of 'original state' of an art object. Documenting the context of electronic art activities is important, as well as a perspective of process over product. Unstable media art activities often take place in dynamic, networked environments and are the result of an artistic research and development process. Such aRt&D processes can have very diverse outcomes, ranging from tools and installations to presentations and symposia. Each of those needs to be valued in the context in which they are produced, and, if necessary, needs to be captured.

In short, the following characteristics of electronic art need to be taken into account when trying to capture unstable media: (1) electronic art activities are process-based; (2) context is very important; (3) the activities are heterogeneous in materials and practices; (4) projects are usually created through interdisciplinary or multidisciplinary collaboration; (5) user interaction is an essential activity in the dissemination phase of many projects; (6) it is important to speak about electronic art activities, and not just artworks; (7) preserving and reconstructing objects becomes less relevant than in contemporary art preservation.

A. Analysis of case studies

In order to distinguish the essential aspects of electronic art activities, and to define aspects that need special attention in this research, various projects from V2_'s archive were investigated[19], including two major case studies co-developed at V2_Lab: *whisper*[20] by Thecla Schiphorst and Susan Kozel, a project related to wearable technologies, performance and the body; and *DataCloud 2.0*[21] and previous and later DataClouds, projects that involve web-based 2D or 3D visualizations of complex information structures.

First, essential components of activities and their terminologies were defined for all projects. As many concepts as possible were defined, focusing not so much on the

[18] *Capturing Unstable Media: Deliverable 2.2 – Publishing and disclosure systems.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/2_2_publishing.pdf>.
[19] For an overview of all projects, see *Capturing Unstable Media: Deliverable 1.4 – Content research.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_4_content.pdf>.
[20] *whisper*. 2003. V2_Archive. 28 February 2004 <http://framework.v2.nl/archive/archive/node/work/default.py/nodenr-135466>
[21] *DataCloud 2.0.* 2003. V2_Archive. 28 February 2004 <http://framework.v2.nl/archive/archive/node/work/default.py/nodenr-133579>

reconstruction and display of a finalized artwork, but rather on several manifestations in a process, all possible components of these manifestations and the interplay of these components. Next, the available documentation for each case was studied, from the broadest perspective (including their social environment, development stages and research context) to the lowest meaningful level of detail (such as technical environment and network specifications). For *whisper* and *DataCloud 2.0*, the whole range of data and documentation, generated as a by-product of the research process, stored on project sites and in multi-user file versioning systems (CVS), was analyzed in depth[22]. For this research summary, we focus on an overview of the *whisper* project.

whisper is a research trajectory on "wearable architectures", dealing with small wearable devices and intelligent garments that are linked to a network. These computing devices gather physical data and signals generated by the body, and respond to these. During the DEAF03 festival[23] organized by V2_, *whisper* took place as a performance in an installation space. Participants entered the space wearing data suits and could interact with each other and with the devices, networked to a central database server. The server translates these behaviors in an aesthetic, shared audiovisual experience. The whole initial concept of the project was written down in a project proposal[24].

whisper consists of a number of intertwined research and test activities, some of which took place at the V2_Lab, producing data and resulting in several manifestations, like presentations and performances. During the first artist-in-residence period at the V2_Lab (June-July 2002), the research focused mainly on hardware and system development and design issues. The project was also presented at *Anarchives, Connection-machines*[25], a conference organized by V2_. The second residency (January-February 2003) emphasized the practical implementation of the participatory public installation and on wireless communication between the different modules of the *whisper* system. Next, *whisper* was performed in a public installation at the DEAF03 exhibition and at the E-Culture Fair.

B. Projects, occurrences and components

Electronic art projects, like *whisper*, consist of several research phases and manifestations (*occurrences*), each of which is documented by different types and genres of documentation. On a more detailed level, these occurred activities and products can be subdivided into smaller functional components, such as installation objects, network setups, software and hardware components in a specific configuration. In the case of *whisper*, several components were researched and developed at different co-production phases at the V2_Lab and were covered by different types and genres of documentation. See figure 2 for an overview of occurrences and components of *whisper*.

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[22] See Deliverable 1.4, Appendix 1 for references to documentation pieces of the *whisper* project.
[23] *DEAF03.* February-March 2003. V2_. 31 December 2003 <http://deaf.v2.nl/03/>
[24] All pieces of documentation discussed here are listed and referred from *Capturing Unstable Media: Deliverable 1.4 – Content research.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_4_content.pdf>, Appendix 1.
[25] *Anarchives; Connection-machines*. 2003. V2_Archive. 31 December 2003 <http://framework.v2.nl/archive/archive/node/event/default.py/nodenr-135524>

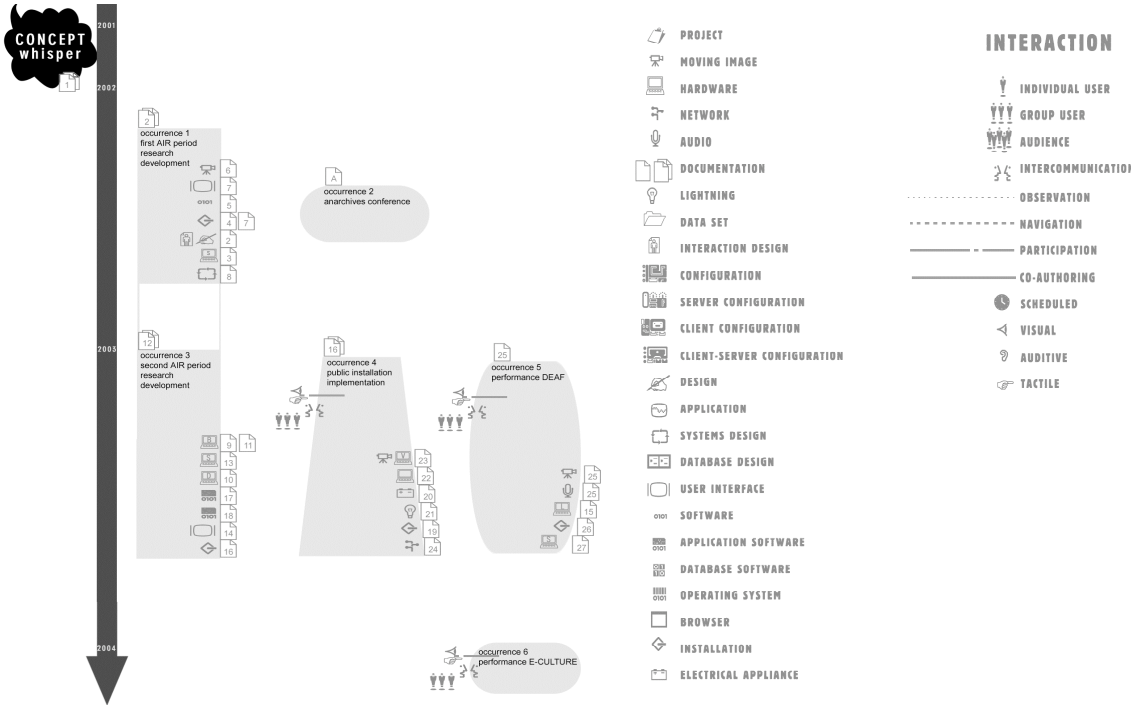


Figure 2. Capturing scheme of whisper

The *whisper* team members focused on different components during their first residency. Some designed the aesthetics of the input and output sensors, documented by photographs and sketches, while others focused on the technical design of these devices and their wireless Bluetooth communication, as outlined in a wiring diagram. A mathematician developed special application software, the so-called particle system, which generated the visual output projected on the floor of the space where the performances took place. The source code for this software is stored on an internal CVS server at V2_.

Between both residency periods, several activities took place outside V2_, including workshops on experience modeling. These were not part of V2_'s collaboration and are therefore not covered in this research project – although the research findings of *Capturing Unstable Media* include recommendations on interoperability between complementary archives (see below).

During the second artist in residence period, a team of software and hardware designers worked on the communication between hardware and software components, like the storage device of the system ("data collector" in Figure 3) and the different servers ("Main Brain" server, pool visuals servers and sound server). They focused on a serial protocol (the 1-Wire protocol) that enables communications between the data collector server and the JavaStamp microcontroller to which the sensors have been connected. The results of this research trajectory are summarized in a technical research report.

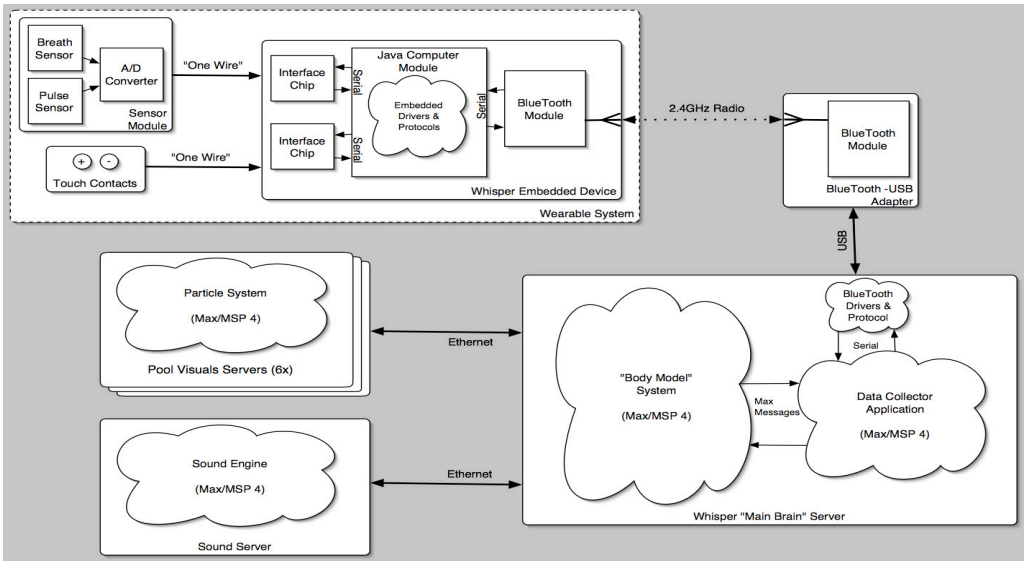


Figure 3. Deployment diagram with a schematic overview of the different modules of the whisper systems design and its dependencies.

For capturing on a detailed level, it is important to be able to describe how an occurrence (in the case of *whisper:* its public installation) has functioned. How did the different components work together? As demonstrated in Figure 3, the breath and pulse sensors (input devices) for the participatory installation are integrated with other components, like the garments participants wear (installation objects) and are part of the wearable configuration. This configuration (called "wearable system" in the above diagram) comprises a central processing unit, CPU, (JavaStamp microprocessor), an input/output device (Bluetooth module), and an output device (LEDs sewed on the garments). So, one could identify systems design and configuration as special technical components of electronic art projects.

For the actual implementation of the installation and for the public performance during DEAF03, the physical properties of the installation space were mapped in a plan and in sketches. The required wireless network was set up, together with the sensors, documented by installation instructions. Finally, lighting, visuals and audio were implemented, also documented in installation instructions. Photographs and a digital video report served as documentation for the resulting public performance during DEAF03 and the corresponding interaction between participants.

C. Problematic aspects of unstable media

A series of problematic aspects for the capturing of unstable media projects were encountered. User interaction is an important characteristic of many projects, but is difficult to describe and capture in a generic and objective manner. Furthermore, an attempt has been made to describe the very diverse modes of distributed authorship of a project and to describe, in a basic way, the dependencies of a work on hardware and software components. In *Capturing Unstable Media*, a series of proposals were formulated for dealing with these problematic aspects; proposed solutions include documentation strategies and an elaborated conceptual model, featuring metadata sets for some of these problematic aspects. These proposals will be described below.

D. Documentation strategies and recommendations

For *Capturing Unstable Media*, institutions need to decide on the level of detail in documenting a project (how extensive should the documentation be?) and on the point of interest in a specific project (which stages, versions or components need to be documented?). During the research it also became clear that there is much confusion on types and genres of documentation. There is a lack of standard terminology and a need for agreement on definitions.

An important aspect of Capturing Unstable Media is the act of collecting documentation that is most appropriate to the entities of the object of research that need to be captured. Institutions need to make a selection in the documentation, depending on the relative importance of the object or activity and to the level of detail in which it will be described; furthermore, documentation can be selected on the basis of its quality, variety and standardized readability[26].

A few general guidelines, resulting from the research on the case studies for *Capturing Unstable Media*, can already be formulated[27]. Some categories of documentation will not be relevant for certain types of institutions; for example, organizations without a media lab or workshop will not have access to, or generate, documentation related to research processes – which does not mean that this type of documentation is not important.

aRt&D process

Electronic art projects are often researched and developed through interdisciplinary or multidisciplinary collaboration[28] and generate documentation on concept, research objectives, design issues, the flow of technical experimentation and innovation, the technologies used and the results of the research process. This category of documentation also includes information on the operation, interrelationships and interdependencies of the components of a system, as well as its software, hardware and network configurations. Most often this documentation will be textual or visual in nature and include genres such as source code of applications, research reports and schemes and diagrams of interdependent components. Depending on the perspective and goals of the institution that is involved in this process, the selected documentation will rather emphasize finalized, implemented versions of the documented object, or may, on the contrary, emphasize the evolution of the research process itself.

Implementation

Electronic art projects are implemented once or several times in a physical (installation), digital (application) or mixed environment. Documentation for implementation will include practical information and instructions on the technical and/or physical environment in which the electronic art manifests itself, as well as user-oriented instructions. This category of documentation is mainly textual or visual, and

[26] Chapter 5 of *Capturing Unstable Media: Deliverable 1.2 – Capturing strategies.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_2_capturing.pdf> includes recommendations for building a digital media archive.
[27] *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>.
[28] Nigten, Anne. *Human factors in artistic research and development in multi- and interdisciplinary collaborations.* 2002. V2_Lab. 31 December 2003 <http://lab.v2.nl/home/_docs/nigten_2002_humanfactors.pdf>.

may include genres of a directive nature, such as installation instructions, technical riders, schemes plans and documentation on ambient sound or lighting conditions.

User interaction

In this research project, a formal, restricted metadata model for describing user interaction was designed, including parameters on number of users, temporal and place dimensions, sensory mode (visual, auditive, tactile etc.) and on the level of intensity of the interaction (examples are navigation, participatory interaction, intercommunication between users)[29]. However, the specific, subjective characteristics and quality of a user's interaction with an electronic art piece cannot be captured by metadata alone; specific documentation of a user's experience is needed here. Available documentation may be textual or visual use case scenarios. However, for a good understanding of user interaction, additional documentation often needs to be actively created, such as audiovisual reports or registrations of someone interacting with a piece. Interviews with users may also prove very useful; in general, recordings and registrations of user testing activities are rare, but interesting documentation materials.

Interdisciplinary collaboration, distributed authorship

Individual contributors' involvement in a project can be outlined in a formal model; the Capturing Unstable Media Conceptual Model offers a proposal for dealing with this issue (see further). However, it is also important to gather additional documentation on contributors and their specific roles or functions in the project as related to the specific aspects of each activity. This includes documentation on copyright and biographical information about artists, main contributors and technical staff, mostly of textual nature.

The documentation that is obtained along these guidelines needs to be appropriately mapped to the relevant entities as defined in the Capturing Unstable Media Conceptual Model (see further). Digitalized or digitally-born materials need to be stored according to well-defined procedures, respecting the basic principles of maintenance of a digital media archive[30].

E. Capturing Unstable Media Conceptual Model

Apart from gathering documentation about a researched object, describing the object and its documentation in an appropriate formal model is an important step in the process of capturing. A formal model, such as an archival metadata structure, makes large numbers of research objects accessible and makes it possible to compare and study them on an equal level. Each organization will inevitably develop its own modeling system according to its own activities and goals; the Capturing Unstable Media Conceptual Model (CMCM) was designed as a source of inspiration for providing clear concepts and terminologies that can be used in such an individualized model.

The CMCM describes electronic art activities in a generic way, by using a structure of typical concepts. The concepts were derived from the study of projects from

[29] *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>: see Chapter 6.
[30] Chapter 5 of *Capturing Unstable Media: Deliverable 1.2 – Capturing strategies.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_2_capturing.pdf> includes recommendations for building a digital media archive.

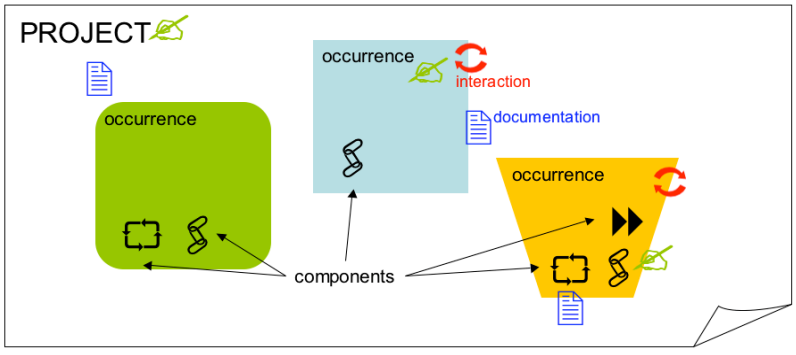
V2_Archive and the analysis of the case studies (see above). The idea was to create an abstract reference model for outlining the different (levels of) concepts through which activities in the field of electronic media art can be captured. Such activities may be as varied as long-term international research projects and specific, short-lived artworks, R&D activities and pieces of hardware, workshops and user interfaces.

The CMCM is an ontology with a multi-hierarchical and object-oriented structure of interrelated concepts or classes (described below). The choice for an ontology, rather than another abstract information structure such as a topic map, was made because of the following considerations:

- The capturing model needs to be a standardized instrument that can be used by a wide variety of actors and institutions; a choice was made for opening the possibility of integration with Semantic Web technologies[31]. For ontologies, various markup standards exists, such as the older DAML + OIL or the newer OWL; these are open, W3C-supported markup standards.
- The capturing model needs to accommodate a fine meshwork of interrelations and dependencies between concepts or classes; for this purpose, an ontology is especially suitable.
- The model also needs to be an instrument for enabling archival interoperability between institutions (see further).

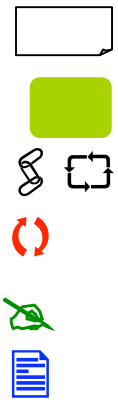
The ontology is not intended as the fundament of a database structure; it can exist independently from the varied metadata and database systems that are used at various electronic media art institutions throughout the world. Rather, the CMCM may function as an independent reference framework, useable as a basis for interoperability, where each institution can map its individual concepts in its database structure to the corresponding concepts in the model. Not every concept in the CMCM needs to be included in an individual institution's data model; the choice of concepts depends on the institution's profile. Some institutions might focus on the description of technical details within R&D projects or artists' works, while others may emphasize the description of larger contextualization of projects, activities and actors.

The CMCM offers a series of basic concepts that are of interest to the activities in the field of electronic media art, along with suggestions on how these concepts could interrelate with each other. An interactive overview of all concepts can be consulted in an HTML export of the CMCM ontology[32].



[31] *W3C Semantic Web.* 2003. World Wide Web Consortium. 31 December 2003 <http://www.w3.org/2001/sw/>.
[32] *Capturing Unstable Media: CMCM – HTML export.* 2004. V2_. 28 February 2004 <http http://archive.v2.nl/v2_archive/projects/capturing/cmcm/html/>.

Figure 4. Schematic overview of the main concept levels used in the CMCM[33]:



Projects are long-term activities that are subject to change (e.g. a research project which runs over the course of two years).
Occurrences can be activities or products with a distinct, short time span and an autonomous character.
These occurrences may contain or be related to **components**: small, non-autonomous entities, often of a technical nature, such as software or hardware.
Users interact with occurrences/components through various interaction models.
Projects, occurrences and components can each have their own **authors** or **makers**.
Each entity (project, occurrence, component) can be described through one or more **pieces of documentation**.

More in detail, subtypes of these concepts include[34]:

- Occurrences:
  - OccurredProduct
    - PublicInstallation, Application, Performance
  - OccurredActivity
    - Meeting, Presentation, Performance, R&DPeriod
- Components
  - ComponentPhysical
    - Installation, Publication, Hardware, Network
  - ComponentDigital
    - Software, Network
  - ComponentConceptual
    - Design
  - ComponentContent
    - DataCollection, Audio, MovingImage, StillImage...
  - ComponentTechnical
    - Configuration, SystemsDesign

Apart from this, the model focuses on several problematic aspects in the area of capturing unstable media and suggests metadata solutions: terminology for describing electronic art (through a special thesaurus[35]), genres and types of documentation[36], describing distributed authorship[37], hardware and software dependencies[38] and user interaction[39].

The CMCM includes an extended system for integrating and interrelating relevant documentation of each activity in the field. It also deals with the complex issue of

[33] For a concrete, instantiated example, refer to Figure 2. Capturing scheme of whisper.
[34] *Capturing Unstable Media: CMCM – HTML export.* 2004. V2_. 28 February 2004 <http http://archive.v2.nl/v2_archive/projects/capturing/cmcm/html/> and *Capturing Unstable Media: Glossary.* 2004. V2_. 28 February 2004 <http://www.v2.nl/Projects/capturing/glossary.html>
[35] *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>: see Chapter 2.
[36] *Capturing Unstable Media: CMCM – HTML export.* 2004. V2_. 28 February 2004 <http http://archive.v2.nl/v2_archive/projects/capturing/cmcm/html/>. A semi-hierarchical list of genres can be found in *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>, Appendix 4.
[37] *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>. Chapter 4.
[38] *Ibidem,* Chapter 5 and Appendix 5.
[39] *Ibidem,* Chapter 6.

interdisciplinary, distributed authorship in the field of unstable media art, by defining the roles of all involved actors as related to the specific aspects of each activities. This creates a horizontal and interdisciplinary meshwork of involvement, rather than a rigid list of credits with inherent hierarchy.

The research project also includes a proposal to describe hardware and software dependencies in a more generic way. It is often necessary to describe how a well-defined group of components work together. In the above description of *whisper*, the configuration and design of the different modules of its system were outlined (see Figure 3.). Both SystemsDesign and Configuration are entities in the CMCM that should be used for expressing meaningful clusters of technical components of an occurrence.

4. Towards archival interoperability

Capturing Unstable Media takes into account that the field of electronic media art is a large, international and distributed domain with many individual and institutional players, each with a different policy and approach towards research and development, presentation, archiving and preservation. It emphasizes the interdisciplinary, international, trans-institutional and process-based nature of the activities in the field of electronic media art, as a necessary addition to the object-focused approach that is still prevalent in the art and museum field.

The consequence of this approach is that data, information and knowledge about the specific activities in the field of electronic art is also not centralized at one point, but distributed internationally throughout the information systems and collections of many parties. The case studies in our research proved that necessary information related to various manifestations or occurrences of a project is often institutionally or geographically dispersed[40]. In most cases, in order to get a complete overview of an art project or a research trajectory, it would be necessary to consult the information systems of various institutions. The Capturing Unstable Media Conceptual Model was developed not only as a formalized stand-alone model – needed for capturing the activities in electronic art – but also as a tool for enabling this archival interoperability.

Taking into account the initiatives summarized in the introduction, it is possible to recommend possible points of departure for establishing interoperability between different archival systems[41]. Although every initiative and institution is using a different data model dependent on individual needs, it is possible to discover obvious shared concepts. A tentative list of shareable concepts is included below, indicating the extent to which the concept could serve as an entry point for allowing interoperability.

A general concept shared by most archival systems in the field of electronic art (and beyond) are **actors**; almost every data collection has a way to describe individual or group actors. Furthermore, several archival systems in this field contain a good amount

[40] Howard Besser is one author who describes the interrelation between preservation and interoperability. See Besser, Howard. "The Next Stage: Moving from Isolated Digital Collections to Interoperable Digital Libraries." *First Monday* 7.6 (June 2002). First Monday. 30 December 2003 <http://firstmonday.org/issues/issue7_6/besser/>.

[41] For example, the data model of the Variable Media Network, is designed to include information about exhibited artworks from a variety of institutional sources: *Variable Media Initiative.* December 2003. Variable Media Network. 31 December 2003 <http://www.variablemedia.net/>.

of shared instances of persons and groups – as an example, many artists and theorists in V2_'s archive database also appear in the data collections of the Daniel Langlois Foundation.

Similarly, most archival systems also maintain a list or thesaurus of relevant **keywords** and/or **themes**. The resemblance between V2_'s and the Daniel Langlois Foundations keyword lists was researched in depth[42]; mapping between keyword lists is also a good starting point for archival interoperability.

Most archival systems contain concepts for describing **projects**, **artworks** and/or **activities** in a more or less detailed way. For some data systems, like V2_'s, a good and detailed description model for events is very important, since these activities provide important context for other archival items. However, projects, artworks and events are, unlike actors and keywords, described in a much less standardized and uniform way across archival collections; therefore, seamless interoperability will be hard to obtain. Also, differences in approach between an object-focused perspective versus a process-based perspective may prove difficult. The CMCM was designed with this process-based perspective in mind, taking into account that the static objects described in some archival collections might be integrated in a larger interoperability framework where these works become part of a longer and more flexible process. For example, a work exhibited in a museum and described in a static way in a museum collection's documentation system might, in an interoperable environment, be shown in the context of its research themes, research trajectory and further exhibition history, provided by other data collections.

A wide diversity of methods is used by different data collections for describing **technical specifications**. In some archival collections, these specifications are described through documentation (often texts listing detailed technical requirements); other data collections describe technology through keywords[43]. The diversity of approaches here, and the lack of more formal description methods of technical metadata and the interrelations between technological components is a major hindrance in promoting archival interoperability in this area. With its proposal for a formal description of technical components, the CMCM is designed for promoting further necessary standardization.

As a general conclusion of Capturing Unstable Media, continued efforts in collaboration between institutions and their collections, archives and data sets will prove extremely important for safeguarding the rich history and variety of electronic art activities, incorporating continued work on archival interoperability, ontologies and alignment with Semantic Web developments. As a continuation of Capturing Unstable Media, V2_ wishes to pursue further research in this area.

[42] *Capturing Unstable Media: Deliverable 1.3 – Metadata.* 2004. V2_. 28 February 2004 <http://archive.v2.nl/v2_archive/projects/capturing/1_3_metadata.pdf>.
[43] An example here is the Netzspannung data collection. *Netzspannung.* December 2003. MARS Exploratory Media Lab, Fraunhofer Institute for Media Communication. 31 December 2003 <http://www.netzspannung.org/>.