TECHNOLOGICAL ARTS PRESERVATION

Edited by
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Osman Serhat Karaman
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CONTENTS

PREFACE

It is with an increasing tendency that works of art produced with the help of technology (such as video, sound, image, code, virtual reality, augmented reality, kinetic, digital and physical hybridities), or that require technology to work (such as hardware or software) are being included into various art collections. How these artworks would be carried into the future considering the rapidly advancing technology becomes a conundrum for all cultural institutions responsible for conserving cultural heritage. As a response to these needs, The Technological Arts Preservation Project has come into existence with the cooperation of Sakıp Sabancı Museum and Sabancı University. The project was initiated on May 23, 2019 when Osman Serhat Karaman, Sakıp Sabancı Museum digitalSSM Archive and Research Space Manager, invited Selçuk Artut, faculty member of Sabancı University Visual Arts and Visual Communication Design Program to give a speech on the issue.

The Technological Arts Preservation Project aims at cooperation and information-sharing between professionals from various disciplines and areas of expertise. Scholars, media theorists, researchers, digital art conservators, curators and artists, software engineers, and computer scientists from significant institutions such as INA (Institut national de l'audiovisuel), Rhizome, Tate Modern, ZKM have contributed to the research project that gained international status. Within the scope of the project between November 15, 2019 and November 20, 2020, nine conferences and a workshop have been conducted on the preservation of software-based art, preservation of virtual reality, media archaeology, net art and web archiving. Our aim in organizing these conferences and workshops was to contribute to the international research in carrying both digital art and digital culture into the future, to discuss the results of new research, and to develop new and interdisciplinary modes of cooperation. We have reached a total number of 2000 participants through these events we have organized within the scope of the project, continuing our efforts online due to the pandemic, beginning from May 2020.

Presently, technological arts preservation is a common issue. Many problems such as erased digital photos, unrepairable, broken backup units, or records that would fall into oblivion due to discontinued media players now constitute a significant part of our daily lives. However, in terms of artworks, it is of vital importance that the matter should be handled with an interdisciplinary point of view within the context of preservation of cultural values. The book you have in front of you was prepared with great care and in awareness of the aforementioned responsibilities. Bringing together esteemed scholars, leading figures in arts and culture, artists as well as scientists, all expert names in their respective fields, this study includes comprehensive texts approaching the issue from different points of view. Consisting of three sections, the first part of the publication includes in-depth essays, the second part brings together content created based on the events we have conducted, and lastly, the third part chronicles answers of the artists to a questionnaire on the preservation of their work. We hope that this book will constitute a well-rounded source for those who have a sensibility for the very cultural values that make us human and how they may be carried into the future; we sincerely hope it will light the way for similar studies in the future.

ARTICLES

CONSERVATION OF TECHNOLOGICAL ARTWORKS

Selçuk Artut

There are various concerns and questions in terms of relaying technological artworks to the future in today's art as with all other constituents that involve technology. This issue concerns many components of the art ecosystem, including artists, art institutions, and art collectors. When faced with constantly developing technologies, a comprehensive and interdisciplinary study should be undertaken to determine principles valid for the consistent conservation of contemporary artworks produced with these means. In this article, sections from the studies and views on the conservation of technological artworks of different communities will be presented.

In conserving artworks in familiar forms such as painting and sculpture, methods of cleaning, fixing, and undoing damage are used to maintain and restore the works to their initial forms, while in restoring technological art, the hardware and software that belongs of the work need to be updated while audio and visual materials that constitute the work need to comply with new systems. The problem of the loss of function in the technological components that compose the technological artworks, which amounts to the disappearance of such works in the future, necessitates comprehensive research on the issue of current conservation criteria that include durability and uniqueness.

The conservation of artworks is certainly an issue on which extensive work has already been done. When we consider the definition of conservation within the purview of cultural heritage as part of museology, The Committee of ICOM-CC, the most comprehensive organization with over 2600 members of different fields within museology and conservation worldwide, defines conservation as below:

> Conservation - all measures and actions aimed at safeguarding tangible cultural heritage while ensuring its accessibility to present and future generations. Conservation embraces preventive conservation, remedial conservation, and restoration. All measures and actions should respect the significance and the physical properties of the cultural heritage item.

Experts dealing with the conservation of traditional artworks perceive the work as a physical object for their purposes and they apply recognized methods to conserve the same physical properties. Based on the definition presented above, while all experts for conservation pursue the same goal in the larger sense, the subject of the Conservation of Technological Artworks, which we come across today, develops in different directions than what is familiar, due to the distance of the works in this field from traditional works of art. According to Marchese, F.T. (2013), any conservation strategy for digital artworks should deal with the issues associated with the continuous maintenance; the short-lived qualities of such works, the discontinuity of the technological components on which they are based, the inevitability of evolving sizes and diversities in a museum collection require sustained efforts of conservation.

A clear definition of technological works is challenging as the subject needs to be tackled on the overlapping axes of art, science, and technology. These types of works can be considered in hybrid classifications that are also permeable, including digital art, media art, electronic art, online network art. For example, the primary defining quality of digital art is that these types of works often exist in a purely artificial digital environment, while today, most works include such elements as well as components that are functional and tangible. The hybridization of technological art within its subcategories gains rapid acceleration as digital environments are accepted as part of contemporary art. The most impactful element of the aforementioned digital environments is the use of information technologies since the middle of the 20th century in all areas of life. Artists who include technology as a creative factor in their works have begun to produce works of hybridity to varying degrees both in terms of aesthetic and conceptual content.

Figure 1: An example of hybrid productions: Candaş Şişman - Refraction *(2019)*

Artists who are inspired by the range of opportunities afforded by the rapidly developing technology are keeping up with this progress on the one hand while on the other, they witness the very quick disappearance of the technological possibilities that they have access to. Technological loss presents a grave danger to technological art. Technological developments and the standards that are consequently emerging as to be able to apply these developments change by the day. For example, tube televisions which were used as a mass media communication tool in the 1950s were replaced by liquid crystal displays at the beginning of the 2000s. Millions of old-style tube televisions became junk and users preferred newer technologies in their televisions. However, this situation should not be considered as a transition from one imaging system to another. The ratio of the screen, which was 4:3 was transformed into 16:9, and accordingly, the measurements of broadcasting had to be changed as well. The industry is not equipped to reproduce the old unless there is financial gain and is also not preoccupied with the repair or by taking precautions to prevent malfunction. As a result, old-style televisions inevitably became functionless. When we consider the works of Nam June Paik, who used tube televisions with the 4:3 image as an aesthetic component, it becomes clear that the transfer of these works into the future will be problematized by the rapid loss of the technological material that is used as components of the work. Tate Modern, the collection of which hosts works by Paik, have purchased spare parts to be able to control the renewal process that will be necessitated by the possible loss of the technological components in the future. This approach presents the view that as an artistic installation, all the technological objects that constitute the work are integral and that the representation of the work can be executed by

staying true to the original form.

Figure 2: Nam June Paik - TV Buddha (1974)

In his text “Artificial Life and Natural Death” written on the occasion of the exhibition at the Guggenheim Museum in New York in 2004, *Seeing Double: Emulation in Theory and Practice*, Ippolito (2013) makes remarks about their discussions with the co-curator of the exhibition Caitlin Jones; John Hanhardt, who had been studying Paik for a long time, and Jon Huffman, who assisted Paik, on subjects of migration and emulation; they concluded that the only strategy to retain the fundamental dynamics of the work TV Crown is to store the work, which includes tube televisions and other electronic components.

In her text “The management of display equipment in time-based media installations. Studies in Conservation”, Laurenson (2004) underlines that the functional importance of the equipment needs to be questioned while also taking into consideration the aesthetic, historic, and conceptual aspects.

However, considering the issue within the framework of technical possibilities disappearing does not suffice in thinking about the migrating technological artworks to the future. For example, in her text “Presenting, Mediating and Collecting Media Art at HeK, House of Electronic Arts Basel”, Sabine Himmelsbach (Serexhe, 2013) talks about some of the issues that arose when the work Electrical Walks in Basel by Christina Kubisch was acquired by the collection; the work was exhibited in “Sensing Place. Mediatizing the Urban Landscape”, held between 31 August-11 November 2012 at the aforementioned space.

The exhibition visitor embarks on a journey to explore the electromagnetic fields of the city of Basel on a route, on which different sound points are marked, together with headphones with integrated induction coils and reacting to electromagnetic fields specially developed by Kubisch. The spectrum, timbre, and levels of the sounds differ from place to place. Light systems, cash machines, antennas, computers, and many other things make up the music of an extraordinary being. Most of the sounds heard through the headphones can produce surprisingly musical content, and for those who experience it, this piece creates a different perception of a world that they are familiar with.

During the process of acquiring the work for the collection, the House of Electronic Arts Basel provided resources so that a sufficient number of these custom headphones could be acquired for a future experience of this work. However, beyond the protection of headphones against wear and deterioration within the scope of technical possibilities, there are external factors beyond control that need to be taken into account.

It is possible that differences will emerge in the electromagnetic fields of the city and for the city streets to change formally, which would shift the structure of the map. The environment that the technological works are in is constantly changing and this situation presents risks for the future of the works. Of course, art is also changing, but this situation presents itself more starkly within the framework of technological art. Technological art has a structure that often requires an application and a potential construction that is directed towards happening. These characteristics entail that technological artworks are dissimilar to traditional artworks, which are self-sufficient and which include everything they need to be presented. In particular, digital artworks require the technological environment to exist and these measurements need to be developed about the unique characteristics, conceptual content, and aesthetics of the work. Artworks have an essence that is a lot more comprehensive than the physical objects that constitute them.

In his article “Digital Preservation and Curation: The Danger of Overlooking Software”, Hong (2011) articulates his opinions on the conservation of computer software for the future and delineates seven systematic approaches.

1. Technical preservation (technology-centric) - the preservation of the hardware and software together in their initial form

2. Emulation (data-centric) - imitating the hardware and the software in their initial form in a different hardware and/or software environment

3. Migration (functionality-centric) - constantly updating the software without impacting its function

4. Cultivation for all (process-centric) - keeping the software live by making it available on more open-source development platforms

5. Hibernation (knowledge-centric) - preserving the information on how the software can be regained at a further date

6. Depreciation - self-consciously not making an effort to revive the software nor to recreate it and let it disappear

7. Procrastination - to just let the software disappear

In the technical preservation approach, the hardware and software components are preserved in an organized and self-conscious manner. Spare parts are provided when necessary and the work is thus preserved and sustained. However, one of the main challenges of this approach is the difficulty of replacing aging technology. The preservation of the software and its loss of function outside of environments in which it is functional limits technical preservation. However, it is quite difficult to preserve the concord between the software and the hardware in the long-term.

The method of emulation involves emulation software that mimics an older software and hardware system. Thus, the software retains its functionality in new environments. However, imitation software is not easy to keep and it is also necessary to develop this software anew when required. It is then quite possible that similar issues arise about the conservation of the emulation software.

Cultivation approach to conservation presents the source codes to be developed further by

programmers from the outside through an open-source sharing scheme, helping further the code with their contributions. Making the code available to developers helps prevent the code from being limited to the development of one specific person. However, to create such an environment, a community of people who are interested in the subject needs to be composed and such an enterprise requires time and effort. Furthermore, the necessary open-source environment needs to be established which requires time and effort. Moreover, the preferred open-source environment needs to be defined correctly. The aforementioned community needs to take ownership of the subject and constantly endeavor to sustain the software.

In the hibernation approach, the use of the software has neared its end. Documentation of the software, recording the primary characteristics of the software, and fundamental information about the software that could respond to the possible interest and need about the software in the future, including methods to form an artificial code are retained. In this method, an in-depth documentation process needs to be undertaken.

The approach of letting the software be depleted means that the necessary resources to preserve the software are not available and that in contrast to the putting to sleep approach, there is no documentation effort.

In the procrastination approach, there is no effort in conserving the software. Naturally, the software is left to disappear when left on its own.
In Hong's above-mentioned analysis for the conservation of software, there are important points that can be valid for the process of conserving technological art. Software is frequently used in technological artworks, but the preservation of software is just one of the things that need to be done to protect the technological artwork. For example, in his article, “Bridging the Gap in Digital Art Preservation: Interdisciplinary Reflections on Authenticity, Longevity and Potential Collaborations” (2012), Perla raises the point that digital art has the characteristic of being performed together with the viewer. Similarly, technological artworks perform a series of behaviors within their own entities as prescribed by the artist, performing their purpose in front of the viewers. This situation shows us that many technological works might have components that are based on the work’s performance and the viewer’s experience. This situation creates difficulties in making decisions about the preservation of the work that is consistent and unchanging. Because in performance art, interactive art, installation, which by definition include performative content, change is in the nature of the work. When conservation is perceived as the opposite of change, there can be a conceptual contradiction; what needs to be conserved is the existence of the works as a whole of these shifting elements. For example, Felix Gonzales Torres’s 1991 Untitled (Public Opinion) is a sculptural work that appears in different forms in different environments. This work consists of small pieces of candy in wrapping paper; Torres formed many different versions of the work, based on the body weight of his partner who was battling a fatal illness at the time. Viewers could take a piece of candy while visiting this work and as a consequence, the work would disappear over time. The conservation of this kind of work requires a preservation method that takes into consideration the conceptual framework that is specific to the work.

Taking into consideration all these observations, it is possible to postulate that technological

Figure 3: Felix Gonzales Torres - Untitled (Public Opinion), 1994

artworks comprise of many components that are both technological and not technological. When conserving technological artworks, it is necessary to talk about the meaning of the work, the conceptual content, formal qualities, possible experiential states, the technological components used, and the relationship formed with the environment as well as social and cultural influences. In delineating methods of conserving technological works, instructions for restoring the works in the future and the relevant general guidelines are hard to define. Today, we have numerous technical possibilities to reproduce that which is unique. This is even more obvious for technological artworks and in particular for digital artworks. A photographic work that is kept in the digital environment is easily transferred to another space as an easily stored file in the electronic environment and it can be reproduced exactly using digital means. However, the most important aspect of the process is to be clear about the intention of the artist. If the work was produced with the goal of being unique, then the work is not intended to be a digital file. In this case, the work needs to be perceived with the aura that the artist presents. When considered within this framework, for example, reprinting a photograph that has frayed could be perceived as an intervention into the unique state of the work and consequently, legal discussions about the intellectual property could be warranted. When parts of a work are reproduced in trying to conserve a work, the risk of infringing on the reserved rights of the work might come into play. Although the factors in question that change in the work in an effort to conserve might produce the same functional results, it is possible to have unintended consequences in the content of the work. Considering the scope of the responsibilities of the custodian, the criteria to be set by the artist who produced the work are extremely important in determining the elements of how the preservation should be executed.

It has also been established that some works of art can be produced without any specific intention at any level. According to Kim (2020), it is very difficult to interpret many works of contemporary art only on the basis of “artistic intention”. For example, in the production of some works of art, artists throw their own contributions aside and invite others to the creation and setup processes. When the artist attributes their intention to distinct physical forms only through the characteristics of the work, the process of extinction coincides with the disappearance of matter. When considered within this framework, the Conservation of Technological Art requires us to examine the physical and not physical components of the work as well as the intellectual integrity of the work, as well as the conceptual framework and experiential processes.

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PROSPECTIVE ARCHAEOLOGY
Siegfried Zielinski

Undoubtedly, Turkey is one of the countries with an extraordinary deep time culture. From the ancient sites of Anatolia or the Byzantine and Ottoman Empires up until modern times, a diverse and heterogeneous material culture has been generated, which is also of great importance for the more recent and shorter history of techno-based art. This culture includes parts of the avant-garde of automaton construction, outstanding contributions to the technology of clockworks, astronomical observation instruments and musical artefacts. The Istanbul Museum of the History of Science and Technology in Islam tell some of these stories, underscoring how important their protagonists, namely the artefacts and technical systems, are for the cultural present and possible futures.

In addition, a new artistic field has been developing for about half a century, in which Turkish museums and collectors are increasingly involved and engaged. In short, it is called *media art*. This *mixtum compositum* refers to an artistic practice that is essentially realized with and through technical media. In the last 30 years or so, this field has no longer been centered on chemical and opto-mechanical systems such as photography and cinematography, but on analogue and digital electronic equipment, algorithmic artefacts such as computers and networked telematic systems.

The hardware and software of the *Laterna magica*, which I have kept available in my own media archive for the past half a century, can still be demonstrated anywhere today—150 years after the projection device and the images had been produced. I do not even need electricity to activate it, but just some petroleum to set light to it. In theory, the same principle applies to a hundred-year-old film in 16mm or 35mm format. Their electric soul from the 20th century produces more regular movements of the projector and more brilliant visual conditions on the screen, but this is not an absolute prerequisite for the performance of an opto-mechanical film.

With the electrification and furthermore, the electronization of artistic processes, completely new challenges arose; these challenges are not faced only by artists. Collectors and the institutions that present works of art with and through technical media were also confronted with completely new tasks. This is because the speed with which these electronics and, more recently, digital systems develop, have been and is still incredibly fast. Within a short period of time, operating and playback systems become media dinosaurs, recording media can no longer find any hardware to play them, control systems and their software are as

cumbersome to reconstruct as complex and precise mechanical apparatuses from the early days of clockwork construction.

All this is so simple and so complex at the same time. Museums, galleries and other art institutions are now showing and will in the future show what has been produced in the past present. Without a growing creative relationship to the challenges of technically based or technically manufactured arts, a significant part of this artistic wealth is doomed to disappear.

Artists can respond to such challenges in a pragmatic and ironic manner, as, for example, Friedrich Böll did in 2018 with his work group titled *Dead Pixels*. Cell phones that no longer function are exhibited as what they are following their technical exodus: narrow containers with glooming surfaces, where we can now only imagine what they used to mean for the world until recently. As (media) archaeologists, we can be taken with the aesthetic appearance of the dead devices, but at the same time the gesture leaves us unsatisfied. We want to see and hear the technology alive, in all the possibilities it was once programmed and used with.

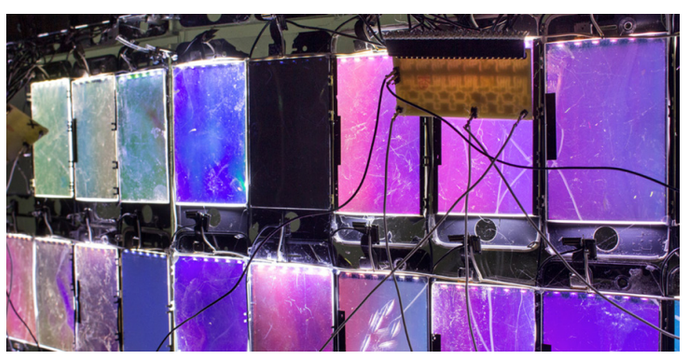

Figure 1:

Dead Pixels, *Friedrich Böll, (2018)*

Restorers –especially those who deal with more or less complex technical artefacts and systems– are dependent on the cooperation of the preserving and exhibiting institutions, but above all, of the artists themselves. The more carefully they document their works and the modes in which they are to be performed or shown, the greater the likelihood is that they will be able to function and develop as a phenomenon of cultural heritage in the future. Three very different examples may suffice to illustrate this connection.

Massimiliano Lisa, Mario Taddei, and Edoardo Zanon are the founders of the group L3 (Leonardo3), an innovative media company and research center in Milano/Italy. Their mission, which they follow with great passion, focuses on the study and the mediatization of cultural artifacts from deep time techno-culture through innovative methods and technologies. They are renowned for their popular work on Leonardo da Vinci's spectacular technical models from early modern times. Lesser known is their extraordinary project on the *Kitāb al-asrār fī natā'ij al-afkār (The Book of Secrets in the Results of Ideas)* by *Ibn Khalaf al-Murādī*. *The Book of Secrets in the Results of Ideas* had been copied in 1266 from an original text, the current location of which is unknown. It was written by *al-Murādī* earlier in the 11th century a few decades before al-Jazari's well known and outstanding work on mechanical automata from 1206.

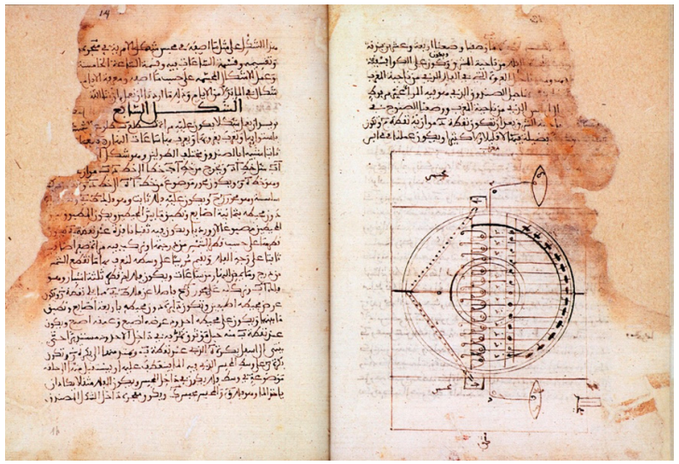

Figure 2:

Book of Secrets in the Results of Ideas, *Fragment from Al-Muradi, Cordoba 11th cent., manuscript from 1266*

The only copy of Al-Muradi's manuscript is preserved and accessible in the Biblioteca Medicea Laurenziana of Florence, where I had the opportunity to study it. It is one of the very early testimonies of highly precise text and image work on mechanics, which can nowadays serve a manual for gifted engineers. Through a lengthy working process, which was financially supported by the Emir of Qatar, the L3 group restored the considerably damaged manuscript from 1266, rendered it completely readable again, and began to build the impressive models that had been described by al-Muradi. From a media-archaeological perspective, many of the mechanical devices that al-Muradi had described derive from the Byzantine tradition and from Heron of Alexandria, while others developed further by the author and optimized—for instance, some sophisticated clockwork-mechanisms.[1]

1
L3 has published extensively on this project. A concise presentation of their work on al-Muradi is available in Zielinski and Weibel. (2015)

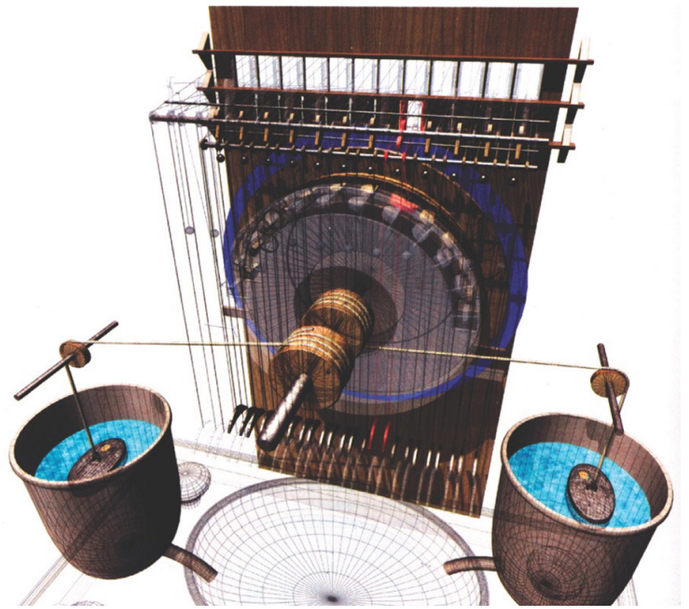

Figure 3:

Re-construction of the illustrated model in Figure 2 by the L3 group: An automaton for showing the passing of time (L3, Milano)

An interesting example from our project on the Catalan philosopher Ramon Llull (1232-1316) and his thinking machines has become Philipp Tögel's re-Interpretation of Llull's *Ars Generalis Ultima* as a transformation of Llull's combinatory paper machine into computer software. This subproject was concerned with recognizing the algorithm of the paper machines, describing it precisely, and implementing it as computer code in such a way that the paper machines can be played as graphic representatives on conventional computers. We were able to draw on an experiment carried out almost 40 years ago by the Berlin writer and computer scientist Werner Künzel. The updated version of Künzel's software by Tögel in 2017-2018 attempted to connect the visual imagery of Llull's figures and charts with the possibilities offered by the expanded interfaces of the *Ars Generalis Ultima*. The new software

seeks to approximate the Llullian algorithm more closely in utilization and graphic depiction. The simultaneously impressive and iconic graphic design language, which Llull himself invented, was to be taken up in the implementation for the contemporary computer screen.

Llull’s art of combination basically consists of three elements: A vocabulary of “absolute principles,” represented by the letters B to K. These function as a comprehensive collection of ideas that is assumed to be possessed by all humankind. In addition to this, there is the logic that connects the principles and their levels of meaning. Through this permutative grammar, the principles can be combined to form statements and questions. Then, a last step completes the combinatorics: the combinations of letters generated by the rules are read and interpreted as questions or statements by the user. The four figures that make up Llullian combinatorics show the repertoire of terms and the rules of combination to which they refer, but only in part. It is the user who has to form statements and questions from the chains of letters.

In order to achieve his ambitious goal, Tögel had to not only study the existing software, but also to delve deeply into Llull's extensive and complex manuscript work which oscillates through theology, philosophy, ethics and aesthetics.

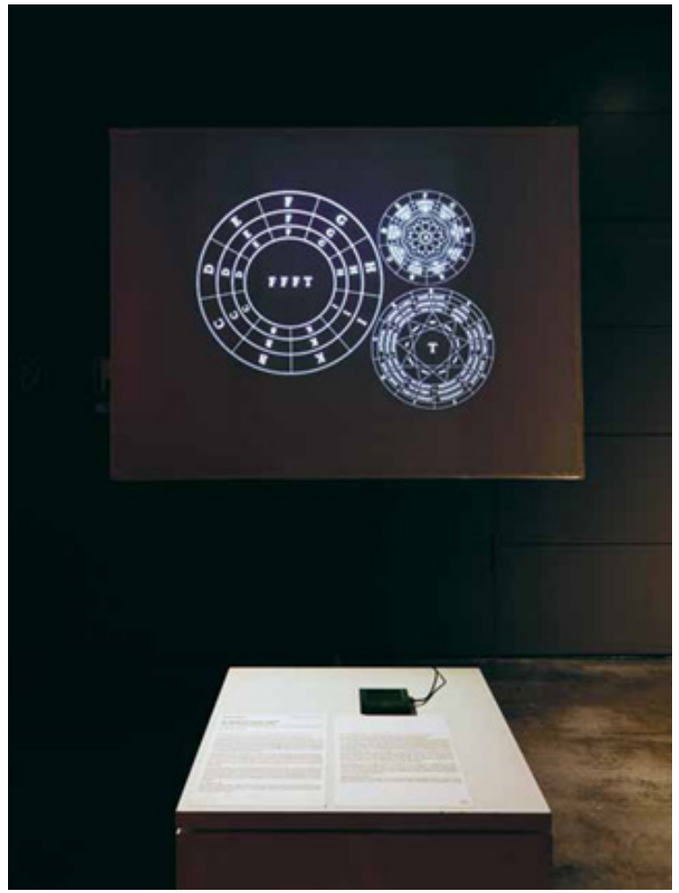

Figure 4:

Llull's paper machines

Philipp Tögel's graphic-abstract representation of Llull's paper machines from 2018. The rotating data disks are activated and recorded via the touch pad in the foreground.

The essence and structure of the ars magna, the great art of combination from 1306, opened up for the contemporary young artist and computer scientist, quite like a manual, to work out Llull's ideas towards a formalized logic.[2]

2
The project is documented very well in Vega et al (2019)

In 1963, the American artist-engineer and programmer Kenneth C. Knowlton, who at the time was working in the Bell Laboratories in Murray Hill, New York State, published the first working method of generating cinematic animations using a computer. The programmed film language BEFLIX (Bell Flicks) had been developed within the framework of MACRØ FAP, a machine-oriented assembly language. Knowlton had the program perforated on an IBM 7094, which at the time was still taking on room-filling dimensions. In order to store the image information produced in the computer, Knowlton used a microfilm recorder in the variant of a Stromberg-Carlson 4020, and the strips of this master film could then be copied onto 16mm film for projection. The inscription of the microfilm was controlled by a subprogram called >Camera<, which was written on a magnetic tape. The inscription can be likened to a typewriter print.

Figure 5:

Film box: Kenneth C. Knowlton (Photo by: Mono Krom)

We know all the details of the method and its application, the hardware, as well as the software of this early project on computer animation, thanks to an extremely fortunate circumstance for media archaeologists. Knowlton has not only left detailed and accurate text documents, but he has also produced a film, for which he used exactly the means he has described. *A Computer Technique for the Production of Animated Movies* (1963) is a computer-generated microfilm that was transferred to 16mm film in a small edition for research purposes. It was about 45 years ago that I found one of the rare copies of the 17-minute black-and-white film in a garbage container at the Technical University of Berlin by chance, ready to be thrown away and destroyed forever. Intuitively following Michael Thompson's idea from his *Rubbish Theory: The Creation and Destruction of Value* (1979), I saved the object in the tin box and put it back into the chain of valuable media artefacts.

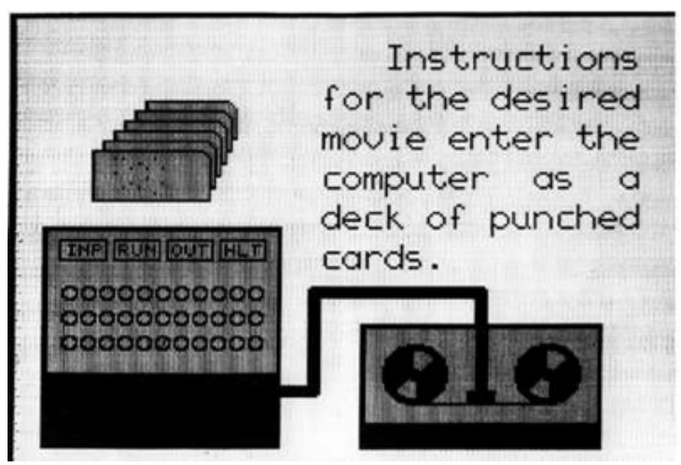

Figure 6:

Kenneth C. Knowlton 1963-64, Bell Labs: Program-language BEFLIX, Macro FAP for IBM 7094

In the following section, I would like to focus on a new field of research and teaching that I invented a few years ago, which came about as a consequence of my projects in media archaeology. I am convinced that this field can enrich collecting, archiving and exhibiting practices as well as academic institutions to the extent that they deal with techno-based art processes; I call it *prospective archaeology*. It represents a constructive and tactical intervention into the exciting interrelations between past, present and future. I am also convinced that it can generate exciting new professional activities that are invested in transversal knowledge structures and cross-disciplinary cooperation. But before I do so, I would like to start by establishing a short theoretical framework (II.), then present a minimal case study (III.) and finally (IV.) to formulate a minimal *vade-mecum* that can be understood as a general manual for projects in this field.

II. Origin Future

The possibility of being able to think, dream, draft and configure through past presents into those of the future opens up a very particular kind of experimental space. *Prospective archaeology* is just as much a space of doing as it is a space of thinking. *Prospective archaeology* is, in this manner, a poietic, as well as a cognitive-speculative praxis. If I am dedicating my contribution to a concise account of the concept, I have two motives for doing so.

First: Future realities, including the arts of presents still to come, obviously do not emerge from nothing. They are always generated from past presents and those sedimentations which we refer to as historical complexity. Since we cannot know the future, the equivalence formulated by Martin Heidegger—that it remains identical with the past—makes no sense. Heidegger's equivalence *Herkunft = Zukunft* (origin, or derivation = future) subjects the past to the primacy of time still to come. It excludes, in a nutshell, both modes of the experience of time.

To subject the past to the demands of the future is not, as might be assumed at first glance, a gesture of ecological coupling, but one of depletion. This has become abundantly clear in the exploitation of the planet's energy resources that we have been witnessing for at least the past 150 years. In the cultural sphere, history itself has since become the limitless resource to be exploited. *Prospective archaeology*, however, abolishes the simple equation, pluralises these cumbersome ontological notions, thus deconstructing while at the same time allowing an open reciprocal play in the relationship between these two temporal orientations: origins futures.

Second: Over the last three decades, several artists have taken up the challenge of intervening into the possible future historiography of their work by themselves. Two outstanding examples are the makers and philosophers of cinema Jean-Luc Godard and Werner Nekes. With his magnificent and completely unique *Histoire(s) du cinéma*, which was created in the decade between 1989 and 1999, Godard not only presented his interpretation of first-century cinema history with the very own means of representation of film, but also reflected on his own work within this frame of reference. In 1985 and 1996, Nekes produced six parts of a fantastic

series he called *Media Magica*. In this film series, he presents the largest and most qualified private collection of technical artifacts for image production, primarily for cinema, and at the same time organizes deep insights into his life's work as a filmmaker, collector and image researcher.

Figure 7:

Still from Jean-Luc Godard's Histoire(s) du cinema (Part 2)

Figure 8:

Histoire(s) du cinema

Originally Godard planned the project as a history of both mass media of the 19th/20th century, cinema and television.

Figure 9: WUNDERKAMMER

Werner Nekes in his WUNDERKAMMER in Mühlheim, where he also produced Media Magica *(Photo by: Mono Krom)*

Figure 10: The lab inside Nekes' WUNDERKAMMER

(Photo by: Mono Krom)

And just one example from contemporary media arts: above all, the recent work of Japanese artist Masaki Fujihata obeys a narrative logic according to which history is not simply to be drawn from as a resource for the fabrication of new works. Rather, the artist creates encounters between his early works and the image and communications technologies of the now. In this way, the older works are reinterpreted. In his superb an-archival interactive reading work, this gesture achieves a quality that no other artist has yet obtained.[3] That which had been suspended in the medial memory, once re-actualised by means of contemporary image-machines, passes over into an alluring tension with history.

In a most recent project Fujihata rediscovers GPS, the telematic observation and localisation technology, with which he had already been working decades earlier in his ‘field studies’ (1992 ff.), linking it with the possibilities offered by today’s image and network technologies. *Being Parallel* (2019) is a machine designed to actualise the by-gone everyday experience as an image experience in the now. The appeal of the work consists in the way that the everyday moments researched and re-staged by the artist are linked, as sensations, with the auratic here and now. Past and present are together transformed into a *potential space* of the future. On the two-dimensional screen of the mobile smartphone, parallel worlds that coexist and overlap in visual perception as well as

3
(Duguet, 2016)

time come into being. We are dealing here, in miniature, with quantum reality.

Prospective archaeology is a counter-program which the most influential Christian teacher and philosopher Augustine of Hippo (354-430) paradigmatically explicated as his own program for research into time. Time, according to Augustine, comes from the future which does not exist into the present that does not last, then flows into the past which has ceased to be. By contrast, *prospective archaeology* sees itself as a pleasurable activity in the here and now.

The seemingly paradoxical abstract *mixtum compositum* that is prospective archaeology consists, in essence, of a practice that operates in accordance with two opposing arrows of time. One of these arrows is oriented vertically into the deep time of cultures that still remains to be explored and that, for me, is forever remade by virtue of interdependencies in the relationships among the arts, sciences and technologies. The other arrow points from the now into an enduringly and unremittingly opaque future. Where the utopian potential of media-archaeological activity and its associated artistic practices resides is in the possibility of bringing these two arrows of time into relation with one another, so that the passengers inside this particular time machine aren’t torn apart in the process. To continue seeking and finding in the old only the locus of multiplicities and particularities which are no longer accessible because they are no longer existing is boring; this inevitably leads to profound melancholy. But to learn and intellectually profit from the heterogeneity and wealth of relations in past constellations, for the sake of

future presents, is an alluring challenge. Only in this way can our experimental time machine become *a generator of surprises*.[4]

The realm of thought and action that I would like to help open through a prospective archaeology has something specifically Foucauldian about it. Michel Foucault's concept of archaeology always unfolds in a Janus-faced manner in his concrete studies. On the one hand, it was always bound up with the archival relic, *the datum*, the precise classificatory system of a given past present. On the other hand, it aspired its way out of the archive—into another possible time, into a potential alternative condition. This latter quality is the tactical element within Foucault's later concept of genealogy that had been at odds with the earlier strategic element in archaeology. It also represents the combative element in Foucauldian thought and action, the anarchic, the transgressive. It desired to be wholly out of line.

III. Two Case Studies

I will now outline two brief case studies to illustrate how *prospective archaeology* can function as an expanded hermeneutic and poietic practice. For this, I have consciously chosen two very different techno-sensations:

a) an object removed from both Europe and East Asia, or rather an object that lies, so to speak, somewhere between the Occident and the Orient—in 9th century Baghdad;

b) a techno-symphonic event, a large musical performance from the beginning of the 20th century that happened 1922-23 in the newly established Soviet Union, in two cities in Asia and Europe.

1) In 2015, I reconstructed (or possibly built for the first time) alongside a team from the Berlin University of the Arts a nearly 1,200 year-old automaton.[5] This universal musical automaton had been designed by three young men who have gone down in the history of mathematics and machine construction as *Banū Mūsā*.[6] Muhammed, Ahmed and Alhasan were the sons of *Mūsa Ibn Shakîr*, a man who had acquired his wealth as the leader of a gang of desert bandits. Because of his friendship with the caliph of Baghdad, *al-Ma'mūn*, *Mūsa Ibn Shakîr*'s sons were permitted to study at the "House of Wisdom'', a very early institution comparable to today's universities. The three brothers' academic work consisted, above all, of organisation, execution, review and exposition of translations. The research fields that peaked their curiosity were widespread—ranging from mathematics to geometry, mechanics to pneumatics, music to astronomy— or cross-

4
This is a concept developed by the biochemist Mahlon Hoagland. It lies at the root of the understanding of artistic practice as incessant experimentation.

5
The team consisted of a mechatronics engineer and programmer, Liang Zhipeng from China; a Russian programmer and engineer, Petja Ivanova; archaeological draughtsperson and animator Olivia von Pilgrim and designer Stephanie Rau, both from Germany; and Austrian professor of generative aesthetics in Berlin, Alberto de Campo.

6
The Museum of Science and Technology in Tehran quite recently made an illustrated book of some of the brothers' work, based mainly on a reconstruction of their manuscript *Book of Ingenious Devices*, written circa 830 in Baghdad (Tehran, no date).

disciplinary, as we would say today. Books V through VII of Apollonius of Perga's 3rd century mathematical-geometrical magnum opus on conics, written in Alexandria in Greek in the original, would never have made it to Europe if it had not been for the *Banū Mūsā* translation.

The Greek text has been irrevocably lost.[7] The same is true of a considerable portion of Heron of Alexandria's mechanics, without which automata would have been unthinkable for the Arab-Islamic world, as well as for early modern Europe.

Figure 11:

Recorder (left) player (right), Banu Musa's universal musical automaton, Baghdad ca. 850, re-built in 2015.

Mikro-archaeological (re)construction team at Berlin University of the Arts:

Programming/ Mechatronics:
Liang Zhipeng
Petja Ivanova
Animation:
Olivia von Pilgrim
Production:
Stefanie Rau

7
See Gerald (1990). This text machine, too, opens with an invocation to Allah, which is typical for manuscripts by Muslim thinkers: "In the name of God, the merciful, the forgiving. I have no success, except through God" (foreword to the Banū Mūsā, v. II, 620).

The musical automaton that we reconstructed dates back to a *Banū Mūsā* manuscript from the mid-9th century. "The instrument that plays by itself *(Al-alat illati tuzammir binafsiha)*" (Farmer, 1931)[8] is what the brothers called the construction described therein, and they characterise it as a self-moving apparatus. The above-quoted title of the text refers, moreover, to the universal significance which they attributed to this technology. They apparently wished to understand the invention independently of the concrete performance of the playing of a flute *(sornā)*. Birds and flautists whose movements were powered by water and pneumatics are well known from ancient Chinese literature as well as ancient Greek and Alexandrian literatures. The most technically advanced solutions to the problem of motive power were attributed to Apollonius. He had already developed such a complex hydraulic-pneumatic mechanism that his anthropomorphic figure could play the flute uninterrupted as long as a constant stream of water was ensured. By virtue of a circular construction—whereby a second container of water was filled as the first was emptied and forced out air for the flautist—the automaton had a constant flow of energy in the literal sense of the word.[9]

8
In the exhibition catalogue for *Allah's Automata* (2015), our complete translation of the manual is printed, as well as an essay by George Salibas on the provenance of the only surviving form, as photonegative.

9
Cf. Wiedemann (1914)

The three Baghdadi princes built a complete musical automaton that could not only vary its rhythms but also be fed a selection of melodies. George Farmer cites the stated intention of *Banū Mūsā* in his English translation of parts of the handwritten manuscript: “We wish to explain how an instrument […] is made which plays by itself continuously in whatever melody […] we wish, sometimes in a slow rhythm […] and sometimes in a quick rhythm, and also that we may change from melody to melody when we so desire.” (Farmer, 1931).[10]

The beating heart and truly spectacular aspect of this automaton is the hydraulically powered rotating cam cylinder that functions as the material carrier for the program. Its surface was wrought with rings made of wood or metal that bore studs of different lengths. Depending on the intervals at which these wood or metal studs were arranged in their individual rings and on the distance separating each individual ring from the others, a mechanical gear transmission either opened or closed the valve of the *sornā* (ancient Persian flute) or that of an individual pipe of an organ, or it activated some other sound-producing element. The manner in which the studs were placed along the cylinder formulated the musical instruction, the instrument’s *program*.

10
The Arabic characters that Farmer keeps in parentheses have been left out. The above-mentioned citations are also taken from this book.

In principle, the hardware is identical with the rotating cam cylinders, as were used 500 years on in the late medieval European glockenspiel and, later still, in the mechanical organ of the European Renaissance and in the Enlightenment-era musical and typing automata. Our reconstruction team decided on a slightly different approach, however, which proved appropriate for the exhibition’s months-long duration. We did not create the program for the music to be played by applying studs to the roller or by raising its surface via some other means but by grinding various depressions into the cylinder. The mechanical-kinetic effect is the same.[11]

The impact that this work of reactivation had on those who took part has been enormous. Of course, we learned a lot about how, more than 1,000 years ago, physical matter could be controlled by means of automation. We learned that the idea of a universal machine and the concept of a formalised command organisation—i.e., the idea for algorithmic artifacts—do not derive from military theory and practice, nor are they historically endemic to the European 20th century. We also learned modesty and to view European modernity as an effect or consequence of other modern constellations located, so to speak, temporally upstream in cultural contexts that European modernity too quickly and persistently adjudicates as primitive, even barbaric.

11
The automaton was on display, among other places, at the 2018/19 exhibition *Kunst in Bewegung—100 Meisterwerke mit und durch Medien. Ein operativer Kanon*, curated by Peter Weibel and Siegfried Zielinski (ZKM Karlsruhe).

2) "Factory sirens were howling. Factory horns gave a concert. Music and songs were silent. Just people and flags and people again. The sounds of the *International* floated in the waves of the crowd." - "The instruments of this strange extraordinary orchestra are scattered: in the courtyard of Moges there is a crude construction on which 50 locomotive whistles and three sirens have been fixed. On the other side of the Moskva, opposite the Palace of Labour, the percussion instruments, which play the role of the drums, batteries of guns. Red Army troops are firing volleys of gunfire. The conductor... had to stand a little higher than usual, on the roof of a four-store building, so that he could be seen on both sides of the river... On your marks! The students of the conservatory, among them some children, hurry to the wire levers connected to the horns. Each horn represents a note. On the roof, the conductor gives the flag signals... The drums thunder heavily, rolling as a roaring echo through Zamoskworetschje (a district of Moscow, S.Z.) ... What followed could only be heard by those who were far away. The participants and those present in the performance space, on the other hand, were only concerned with how to plug their ears as tightly as possible so that their eardrums would not burst."[12]

12
The quotations are from the text "Communist Bells" by S. Rumyantsev from the journal *Soviet Music* (No. 11, 1984). The text is the most accurate representation of the musical event in question. I would like to thank Andrey Smirnov of the Moscow Theremin Center who made the source accessible to me, and Ludmila Voropai for her translation support.

The two quotations are taken from contemporary reviews of a concert event that was performed only twice: on November 7, 1923 at noon in the center of Moscow and exactly one year earlier in the Azerbaijani capital Baku. The event was the most powerful symphony of the urban world ever staged. Its composer was the Donkosak Arsenij Michajlovich Krasnokutskij (1886-1944), who also worked under the pseudonym Avraamov. He was a music theorist and acoustic researcher, built numerous new musical instruments (including the >string polychord<), invented his own universal tonal system of 48 tones, for which he also wrote the music himself, taught at the conservatories of Rostov and Moscow, and held temporary high political positions in the young Soviet Union, including in the university city of Kazan. He signed his manifestos and pamphlets with the three-letter word *Ars*.

Figure 12:

Russian composer Avraamov composing the Symphony of Sirens *in 1922 in Baku.*

(Photo taken from René Fülöp-Miller, The Mind and Face of Bolshevism, *1928)*

The two performances of the "Horn Symphony" (or “Symphony of Sirens”) in Moscow and Baku turned out to be very different in detail. In the Soviet capital, the production began at 12.30 pm with a gun salvo, which signaled the start to all participants and the inhabitants of the city. Afterwards, the fanfares sounded, their penetrating sound reminding of the signals of the mining ships. Accompanied by rifle and gun salvos, the "Internationale" then sounded, sung by a huge lay choir of the "Young Guard". Experienced machine-gunners not only imitated drum rolls, but also constructed complicated rhythmic figures ... Over the "Red Square" twenty airplanes, which were used at different places of the symphony, were drumming at the same time ... More precise is the information about the premiere in Baku, the city on the Black Sea, which, due to its great wealth of oil, had repeatedly aroused the desires of various European invaders throughout history, and whose periphery was transformed into a ghostly machine landscape by a dense belt of huge metal oil pumps. In "Bakin's Worker", Avraamov himself published precise instructions for the execution of the event, making the scenario somewhat more imaginable. The symphony then consisted of three parts, each of which was divided by 25 cannon shots. I am quoting the composer's description indirectly in order to provide additional explanations and clarifications on my part.

Part 1, "Alarm": The noon gun, which normally sounds at this time of day on the occasion of the revolutionary celebrations, is cancelled. After the first gun salvo, the foghorns of the ships in the harbour begin punctually at 12 o'clock. After the fifth cannon shot, the horns of the cargo handling areas are added, and after the tenth cannon shot, the second and third groups of industrial horns follow. After the 15th shot, the first group of industrial horns sets in, accompanied by the sirens of the fleet in the port. At the same time, the big brass band with the "Warsawanka" starts. After the 18th shot, the aircraft, among others, latch on with their deafening noise. After the 20th shot the horns of the railway depot and the whistles of the locomotives standing at the station sound. Conducted by the composer's flag signals, machine guns and the steam orchestra start at the same time. With the last five cannon shots, the first part swells to a climax, which ends with the 25th cannon. Pause. All-clear from the "Magistral", an organ composed of steam boilers, which took on the function of a lead instrument for the symphonic performance. With 17 different tones, the machinists could play the "Internationale" on it in a rudimentary manner.

Part 2, "Kampf" (Fight): Triple siren chord. The aeroplanes fly lower. From the harbour the machine sounds "Hurray". The "Internationale" quadruple chord. In the middle of its second verse, the united wind orchestra begins with the "Marseillaise". When the melody of the "Internationale" is repeated, the gathered masses on the central square take over the function of the choir and sing all three verses to the end... While the "Internationale" sounds, all the industrial horns of the surroundings, the depot at the station and the locomotives are silent.

Part 3, "Apotheosis of Victory": It begins with a solemn chord accompanied by the salvos of the machine guns and the ringing of the city bells for several minutes. The ceremonial march of the masses was accompanied two times more by the sounds of the "Internationale". The symphony ends with a chord of all the industrial horns of Baku and its districts. Energetic inspiration for the "Symphony of Sirens" was the poetry of Aleksei

Kapitanovich Gastev, journalist, writer, tram driver, teacher, metalworker, trade unionist from Suszdal, who spent most of the years between 1910 and 1920 of in prison, interned in penal camps, on the run or in exile. He belonged to the free radicals of the futuristic scene of St. Petersburg/Petrograd. Between 1913 and 1920, alongside his political activities, he developed a radical economy of time, driven entirely by the spirit of technology, which he generalized and called "machinic". In 1920 he published his last volume of poetry in Riga. It consisted of ten poems, which he titled "A Package of Orders". The formal-aesthetic key of these poetic ten commandments of early proletarian culture were verses composed of one-word lines and containing machine orders or instructions for action. Gastev then crossed the border from art into everyday life and established institutes, first in Moscow and later also in other cities of the young Soviet Union, for the systematic study of the work. In the vicinity of Meyerhold's bio-mechanical theatre and Eisenstein's bimechanics, he wanted to develop an economy of labour based on a bivalent code of the mechanical (*Hub* and *Schub*/stroke and thrust), which stood in extreme contrast to the country's ponderous agrarian mode of production: entirely determined by the rhythm of the machine, becoming one with it, following the ideal of a proletarian man-machine, a collection of living expert systems.

In 2017, the Philharmonic Orchestra in Brno, Czech Republic, in cooperation with the Bavarian Radio in Germany, gave a group of artists under the artistic directorship of Andreas Amman and FM Einheit the opportunity to re-perform the "Symphony of the Sirens". (I was allowed to act as Avraamov and recite the texts of Alexei Gastev, who I rediscovered for media art). Because there had been no recordings of the sounds of these extraordinary sound events, the re-enactment had to rely exclusively on the performance reports, and, of course, the passionate engagement of hundreds of people. (Rundfunk, 2019)[13]

Figure 13:

Philharmonic Orchestra

Brno 2017 – in the foreground the core band with FM Einheit (right) and Andreas Ammer (left)

13
The re-enactment is documented on:
https://www.br.de/fernsehen/ard-alpha/programmkalender/ausstrahlung-1464208.html, (Aug 20, 2020)

Figure 14: Zielinski in Brno

(Photo by: Mono Krom, 2017)

VI. Vade Mecum

For all those artists and artistic researchers who are actively working for an archaeology of the media that approximates a *matériologie* [14] of the technical and its unique characteristics– in what follows I will outline a short *vade mecum* for a *prospective archaeology*. I view this as a minimal handbook for a particular tactic of knowledge-generation that I would like to see enforced in university laboratories and art schools in the future. The individual steps or actions should not be thought of as taking place in strict chronological sequence. In experimental practice, they would intertwine and repeatedly overlap.

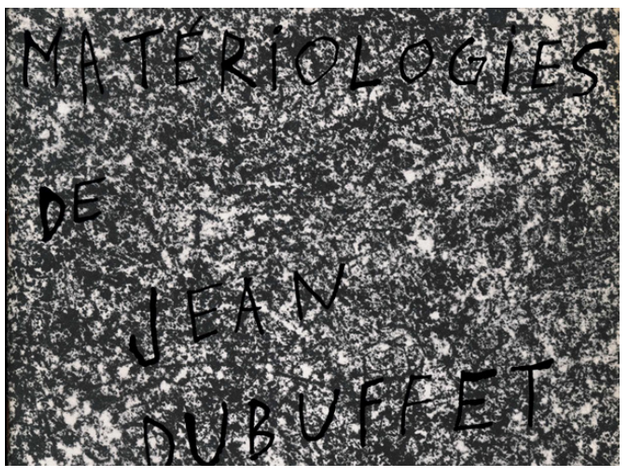

Figure 15:

Matériologies … the tidings of the correlations between heaven and earth, *Jean Dubuffet (catalogue 1961)*

14
I have borrowed this concept from Jean Dubuffet, who, between 1957 and 1961, used it to designate a phylum of pictorial objects that attempted to fathom the world between the earth and sky. Cf. e.g., Grohmann (1961. Bruno Latour informed me that the concept might originate with François Dagognet, a student of Georges Canguilhem.

Ia. Successful finding rather than fruitless searching

This is a Foucauldian gesture that corresponds with a particular research movement: to look into the accidental, the incidental, that which has been pushed aside, discarded as an irritant, which may be pursued only by detour, all that has vanished into the cul-de-sacs and labyrinths of engineering and the natural sciences, and to let these things impinge on existing knowledge. If, in the process, surprises are generated, this is an extraordinarily good sign and one should attempt to pursue them systematically. The study of secondary literature, in which curiosity and astonishment have been provoked by some object or event, is where the contours of the object of knowledge's desire begin gradually to emerge—including its historical contextualisation.

Ib. Systematic pursuit of source codes

Prospective archaeology does not rely on the speculations, interpretations and translations of others, insofar as precisely built and functioning artefacts and concrete technical systems are concerned. An adroit language game of the sort that would please a philologist may lend itself well to the artful crafting of metaphors but is not a sufficient basis for the reconstruction of technical objects. Thus the first question for a prospective archaeology is whether or not the inventor or designer of the artefact or concrete technical system in question has him- or herself composed any texts, descriptions, sketches or even manuals. Documents like these enjoy the privileged status of source code for later reconstructions. They are comparable to the readable basics of a computer program that, translated into machine language, control the program in its concrete application.

Ic. Translation / description

According to my understanding of source code, it originates first-hand, from the hand of the programmer or engineer, and is written in a language mastered by those who generated it. Transposed into our field of precise medial artefacts and concrete technical systems, this means that I must find the original-language variant of that first-hand description or manual. If the language proves insufficiently accessible to me, in a manner that I cannot understand it in descriptive and interpretive detail, then I must seek the collaboration of a qualified translator, ideally a researcher within the scientific and artistic field in question. I would prefer to work with someone who is well-versed in the historical period from which the object originates and who has fundamental technical knowledge. If earlier translations in my language or translations in other languages are in existence, these should be verified and compared against the original source. Gradually, in this way, a new master manual comes into being—in a language that is clearly comprehensible to those who wish to reconstruct the artefact or the ensemble of artefacts.

IIa. Expanded hermeneutics

Museums and conventional archives may be primarily interested in acquiring the most exact copies possible of objects that have been lost. Prospective archaeology, however, is a tactic for generating knowledge *through* the past *into* the potential space of the future. And that is why other epistemic things are at the centre of our concern. What were and are the most noteworthy use values of the object of our curiosity? What characteristics are of particular relevance for its reconstruction today? How do I conceptualise the object today, without using it in a historicising manner?

What materials would have been used to build it in its own time, and what materials might be used for its reconstruction, such that its performance might be optimised—for its own sake—without, at the same time, abrogating its origins? All these are the questions of an *expanded hermeneutics*, in which media studies urgently needs practice. In the 1960s and 1970s, as students of philology, poetics, theatre and linguistics, we were forcefully demanding that the concept of literature be expanded to include advanced technical media. This was meant to have enabled us to understand communications comprised of texts, images, sounds and various hardware and to interpret these within an open framework of action. Today, now that the technological aspects of communications have become dominant, extensive practice in an expanded hermeneutics is long overdue: not only at the interface of media-persons and media-machines that runs through the *interior* of the individual, but also at the interface between machines themselves.

IIb. Experience & concept formation

Among the many brilliant perceptions in biologist and historian of science Hans-Jörg Rheinberger's wonderful book about Gaston Bachelard and Albert Flocon, a reader will discover one crucial insight. Philosophical or scientific thinking, on the one hand, and sensuous experience, on the other, do not combine to form an irreconcilable contradiction, not even a bland antagonism. But when it comes to making, experience takes priority over abstraction. Prospective archaeology is at once a reflective and a poietic activity, a poietic thinking and doing. It belongs in the semantic vicinity of a *speculative reason*. And here I am enthusiastically aligning myself with Rheinberger's summarising thought, vis-à-vis Bachelard's poetology: He "sees as the decisive element in the work of the poet as in the work of the artist—and for that matter in that of the scientist as well—their openness to what lies ahead, their reaching outward, provoked by the material with which they are involved" (2016).

IIIa. Transdisciplinary dialogue

Depending on the idiosyncrasy and complexity of the artefact or concrete technical system to be built, one should assemble a team of experts with the requisite competencies for the various tasks that will need to be performed. Engineers, mechanics, carpenters, electricians/electrical engineers, programmers will work alongside artists and designers, media archaeologists and translators toward the realisation of these objects. Ideally, the team will be comprised of persons with hybrid qualifications—for instance, artists trained in programming or versed in some other technical skill—who at the same time have a serious interest in historical debates and conceptual work and who can, by way of ongoing dialogue, generatively contribute to bringing the reconstruction into being.

15
Cited in Rheinberger (2016)

IIIb. Precise philology

The individual prospective archaeological project does not end with the finished construction of the technical object. While working as an assistant to the mechanical engineer and literary and media scholar Friedrich Knilli at the Berlin Institute for Language in the Age of Technology in the early 1980s, I had already begun to understand the importance of having precise descriptions of technical artefacts and concrete systems, not merely for the sake of a particular coterie of contemporaries but also for the future use of complex technical things. Back then, we even founded our own working group for “technical documentation”, in the context of which we drafted and tested, as a kind of *prospective technology assessment*, among other things, descriptions of software for the Unix machines that Siemens had developed. Here, for the first time, I learned about the practices and demands of a *precise philology* and a *precise poetry*, as essential preconditions for working with a technologically expanded concept of literature. Writing has been for centuries and still remains the most reliable medium for archiving.

A Plea as a Conclusion

Technik—or, technique: understood in a material sense as a sensational artefact—emerges from a series of activities, in the course of which parts of nature are first disassembled according to a certain plan, in some circumstances down to the minutest of elements. Thus we arrive at a point where reality is only accessible nano-technologically or by means of electronic-dynamic processing, as with the latest hybrid machine *ex*telligences that operate in both digital and analogue modes.[16] These elements are then subsequently reassembled into an order that is not identical with the one in which they had been previously situated. In processes of transformation like these, the imperfection of natural things gets absorbed into the artificiality of the new order—which ranks among the most thrilling aspects in the conduct of experiments.

Since there can be no perfection in nature, there is none in technology either, and certainly not in the arts. All we find are attempts at approaching as nearly as possible the highest precision, the most perfect beauty. The “ubiquitous imperfection” [17] of artificially created things thus lead me, in conclusion, to define more precisely what the generators of surprise in a *prospective archaeology* would be aiming for methodologically in the future. I am pleading the case for the most exact possible philology, not of perfect but of precise and likewise beautiful things, contrived and developed for the sake of supporting, enabling and transforming dialogue with others and with the Other into a sensational and consistently spectacular, even scandalous occasion.

This plea includes the suggestion, that museums, galleries, academies should develop and offer special programs for archivists in

16
I am referring here to, among other things, the neuromorphic computing system BrainScaleS, developed by Karlheinz Meier and his research team at the Kirchhoff Institute for Physics at the University of Heidelberg.

17
Henry Petroski uses this concept, f.e. in: Petroski (1990) or (2003)

residence. For the arts, which are created with and through media, the connection between origins and futures is particularly close. The more traditionless they appear, the stronger their connection to history is. Many of the works that have been created since the second half of the 20th century threaten to fall into cultural oblivion, or will only be available in the future in the form of rudimentary documentation. The technical carriers on which they were created or on which they were kept are outdated and no longer exist in current versions. Often the records are damaged or –in the case of computer-controlled materials– corrupt. Programs were written with a cultural-technical gesture that is incomprehensible or can only be reconstructed with difficulty today… The resulting challenges for archives, museums and collections are enormous. The archivists of the present and the future need to be hybrid qualified research personalities. They should be as well versed in computer and information science as they are in the archaeology of the arts and media and critical archiveology.

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BEYOND THE HERE AND NOW: HOW TO BRING THE EPHEMERAL AND THE IMMATERIAL ARTWORKS TO THE FUTURE

Eda Sütunç &
Osman Serhat Karaman

The durability of network-driven internet artworks poses a serious problem; the primary reason behind this problem is the constant change to web-technologies.[1] This situation makes it more dangerous for artworks created with past technologies to remain legible, while transforming the structure of the new works produced on the web in parallel to the technological changes. This change in the structure of the works necessitates the development of conservation strategies that can relay artworks produced with past technologies to the future.

This change in web technologies has facilitated the production of artists and collectives including RYBN, Allison Parrish, Matthew Fernandez Plummer, Darius Kazemi, who produce internet artworks called artbots. These artworks are very different from the internet artworks of the 1990s in terms of their structure. This difference was articulated by artist Matthew Fernandez Plummer as: “The disparate communities of early internet art and artbots are notably influenced by the periods (and technological changes) that separate them; the former movement creatively explored HTML and standalone websites (amongst other things), and the contemporary movement is arguably more interested in social media platforms and APIs. Artbot practice is a sort of ‘internet art’ of Web 2.0”.(Plummer-Fernandez, 2019).

The challenges posed by the conservation of internet artworks are not only linked to the technological changes. The end of an artwork’s life could be due to the nature of the work. For example, “ADM8 is an amateur trading bot, designed to invest and speculate on the financial markets. Its decisions are taken with the help of an internal algorithmic intelligence system, and can be influenced by a wide range of external arbitrary parameters. THE PERFORMANCE STOPS WHEN THE ROBOT REACHES BANKRUPTCY”[2].

Thus, the notion of conservation cannot be limited to passing on the work into the future as is, updating it with new technologies or as a recreation. If a work needs to stop/end by its very nature, what could we retain about these works in the future?

1
Adobe’s statement that Flash Player would no longer be functional at the end of 2020 means that many internet artworks that use this feature will no longer be available. Adobe Flash Player End of Life https://www.adobe.com/tr/products/flashplayer/end-of-life.html#:~:text=As%20previously%20announced%20in%20July,(%E2%80%9CEOL%20Date%E2%80%9D

2
http://rybn.org/, http://www.rybn.org/ANTI/ADM8/

Figure 1:

ADM8 in ZKM – Panoramalab

Due to the shifting nature of technological developments and the consequent inconsistency, as well as the very nature of the works, internet artworks are ephemeral and immaterial, just like performance pieces. In this article, the structure of artbot internet artworks are analyzed from the perspective of the artists. The focus are the conservation problems that emerge from these works and the strategies that can be employed to deal with these problems. The goal of the article is to investigate what could be learned from the archiving of performance artworks in passing on artbot internet artworks to the future and the results will present an opinion on the archiving of artbot works.

Defining the Problem

In this section the Soundcloud bot works *Petita Tatata* and *Petita Dumdum Techa* by artists Matthew Plummer-Fernandez and Memo Akten will be explored and the problem that emerges with the conservation of these kinds of works will be delineated through these works. After describing the problem, internet artist Darius Kazemi's artbot work *Hip Hop Radio Archive Bot* will be analyzed as a case study.

Petita Tatata (2016)

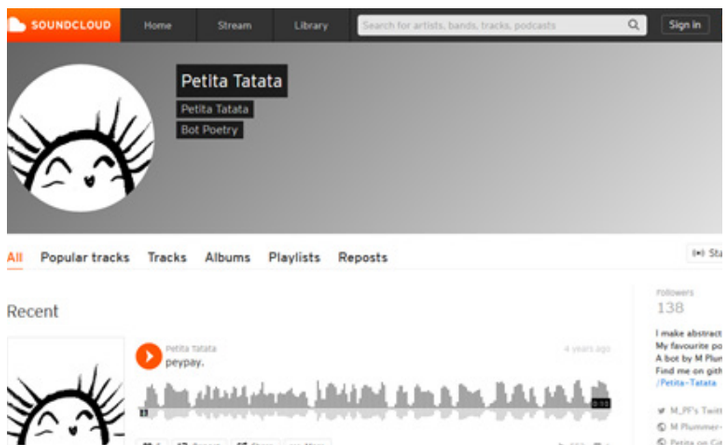

Figure 2:

A screenshot of soundcloud.com/petita_tatata

Petita Tatata (2016) is an artbot that generates abstract poetry recited in a synthetic voice that is disseminated on the music sharing platform Soundcloud. The artbot is one of my own works exploring figuration. Additionally, it experiments with interfacing with Soundcloud as a site for artbots, which had not yet been explored by the artbot community. The artbot's software architecture consists of a software application (coded in Python) for generating text-based poems. It interfaces Google Translate using a software component called gTTS. This component makes it

possible to send text to the Google Translate service for processing through a requested language, and to get in return an audio recording of that text read out in a synthetic voice. The architecture also interfaces Soundcloud through its API, through which it programmatically posts these audio files onto the platform." (Plummer-Fernandez, 2019) Plummer-Fernandez's *Petita Tatata* emerged as a bot on Soundcloud. Thus, in order for this work to continue its life, the work depended on the online service provided by the Soundcloud platform. This artbot also utilized Google's Text to Speech service. Google's changing this service to make it a paid service the end of *Petita Tatata*.

Petita Dumdum Techa (2016)

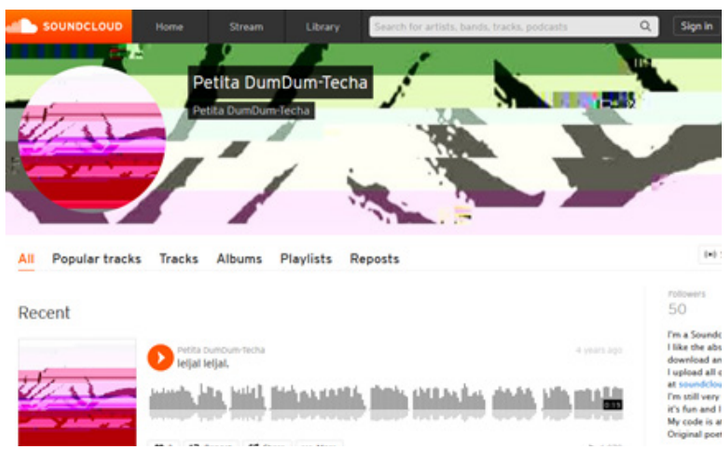

Figure 3:

A Screenshot of http://soundcloud.com/petita-dumdum

Petita Dumdum Techa downloads the recorded poems of *Petita Tatata* and processes them through audio software to automatically augment these with electronic drums and synthesizers. The poems are turned into abstract electronic music and posted to Soundcloud." (Plummer-Fernandez, 2019) Artist Memo Akten's *Petita Dumdum Techa* (http://www.memo.tv/works/petita-dumdum-techa/) emerged as a Soundcloud bot, just like *Petita Tatata*. This artbot accompanied Plummer-Fernandez's *Petita Tatata* Soundcloud bot that we looked at above. As *Petita Tatata* was terminated, Memo Akten's *Petita Dumdum Techa* was also terminated.

Case Study: *Hip Hop Radio Archive Bot*

Internet artist Darius Kazemi's artistic practice is based on producing artbots. One of the last works produced by the artist is the *Hip Hop Radio Archive Bot*, which produces 60-second clips, randomly selected from the Hip Hop Archive.

This artbot work by Kazemi has been archived using the web archiving software Conifer[2] as part of our research for this article. This archiving makes it possible to keep the clips produced in the past. The work's fragility when faced with the changes in web technologies is not resolved through this method.

Figure 4:

A Screenshot of https://conifer.rhizome.org/osmans/hip-hop-radio-archive-bot

2
'Conifer' is a web archiving service that creates an interactive copy of any web page that you browse, including content revealed by your interactions such as playing video and audio, scrolling, clicking buttons, and so forth. https://conifer.rhizome.org/

Artbot internet artworks require the services of the company as they employ the services of that company in realtime, as we saw in the examples and case studies above. When these services are no longer available, it becomes impossible to sustain these works. It becomes obvious that these works cannot be passed on to future generations as they are produced. Furthermore, as with the work ADM8 by RYBN, the termination of the work might constitute the identity of the work. Only documentations of these works remain behind, as is the case with performance artworks.

"The artwork is represented primarily in the form of depictive or descriptive documentation, such as a series of photographs, written reports, videos, or screenshots. This option is chosen for artworks that cannot be represented well in an online exhibition on the web, are technically damaged beyond repair, or are lost or deleted. It is also used for works where documentation was the intended final state. Declaring an exhibition piece to be "documentation" always implies a change of material; for example, websites being shown as screenshots, performances as lens-based video or screencast, etc." (Espenschied and Moulds, 2019)

Performance Art and Documentation as a Preservation Method

> "Documentation –a work's physical remnant or trace is created and used in different ways, depending on its use, perspective and timing. In performance and digital art, documentation has become the focus of conservation and presentation strategies." LIMA.[4]

4
Documenting Digital Art https://www.li-ma.nl/lima/article/documenting-digital-art

"I think of all new media installations (and not just online works) as more of performances– performances that last years and that keep going. After that, only the documentation remains. Of course documentation could never evoke the same feelings as the work itself. However, that is also the advantage of documentation. Because documentation does not attempt to evoke the same 'feeling' as the work and the viewers do not expect such a thing. It just attempts to give 'information.' On the other hand, even 5-10 years later when the work is presented in the same technical way as the original, the viewer's expectation is to feel the work exactly as it was. But in that new era, 5-10 years later, maybe that is not even possible. I don't think *Learning to See* or ULTRACHUNK will have the same impact in 10 or 100 years. But they have an impact 'today.' And honestly, that is what matters to me. Even if something is to be conserved, what is more important to me is the history of the works. Or their impact at the time they were made, how they directed the discourse. And if necessary, their position on the trajectory when seen in 10, 100, 100 years."

Memo Akten, Computational Artist[5]

Performance art is a live art form, created at a specific place and time. The viewer can witness the creation of the work while being present in the same room or environment as the artist. They can observe the beginning of the performance, see the process of the work and often become a part in the artwork. If it is

5
Quoted from the interview with the artist Memo Akten by Osman Serhat Karaman, within the framework of the Technological Arts Preservation project.

a durational performance artwork they can leave and come back at another time to observe how the performance is processed. They can witness and view each step of the artwork before their eyes, in a specific time period. As an ephemeral art form; there are different approaches to how to archive these artworks: document and potentially preserve by re-staging.

While performance art is becoming a more common form of art slowly acquired by museums and institutions, there is the problem of how to reactivate live or ephemeral artworks in order to engage new audiences with a now canonized history. The goal of most museums in activating these archives is, to create an engagement with the audience to an art form that is still not very well understood by the audience. While we disregard the liveness of the work by these archives, they serve in legitimizing these artworks in the eyes of institutional and academic pursuits.

More institutions started acquiring live artwork as a gesture of commitment to artists who are creating ephemeral time-based artworks. Although they are cautious, museums acquire mostly multi-performance documents such as photography, video film or installation (Lawson et al 2019) These acquired artworks are curated as statements by institutions. The spectacle these live works bring to the viewers, artists and artworkers together creates an engagement and an opportunity for the different actors to be involved in creation of these works. The documentation may or may not reflect what really happened during the performance. Although it is assumed that the documentation of the performance event could serve as a record it could also be reconstructed. (Auslander, 2020) Performance art started as a rebellious form against the materiality and acquirability of physical art objects, a lot of canonized names of performance art were not very fond of the idea of re-staging or reenacting their performances. Artists of the 1960s and 1970s sought to make work that could not be commodified and reflected the idea of being bought by institutions and museums. (Richards, 2010) As acquiring performance art went beyond owning the production of the work in scores or objects related to the live performance, the question of how to acquire the idea of an artwork was raised. Various artists and institutions created different individual guidelines. Collectors got involved with these artworks mostly because of their conceptual backgrounds and the nature of acquiring a live artwork meant a more established exchange between the artist and the collector. This creates a shared experience and an engagement, creating a communication. The question comes to how to re-stage or re-enact once the work is acquired by an artist.

Flux: Scores/scripts/instructions

In order to think more in depth about re-staging the first approach is to often think about what is happening in the action. Scores, scripts and instructions are models of performance writing. They are methods to reproduce an artwork with words. Most scores are legible enough to be able to activate performance works but at the same time with each “artist” / “participant” the work changes. Reproducing an ephemeral artwork with only semiotic expressions the performances do not become the commodified objects but the words do. Can performance artworks be envisioned and reproduced with only instructions? Are these really enough to communicate with the work?

A number of artists created scores and instructions on how to repeat their artworks. One example is Kaprow's *18 Happenings in 6 Parts*. Kaprow's approach in scripting was to secure the transmission of the choreography in a faithful and clear way of his will. (Lepecki,

2012) During the performance he was trying to make sure the performers would do the actions in a formal manner, the way he envisioned. He wanted to make sure it was possible to re-do the performance following the script from its choreographic performativity formally moving performers bodies. Compared to other happenings Kaprow and the performers prepared by regularly scheduled rehearsals for the performance. (Buchloh and Rodenbeck, 1999) The center of live events is temporal in nature and the contexts of reception and experience of the audience is institutionalized in re-staging of a performance. This happening took place in Reuben Gallery owned by Anita Reuben, a commercial avant-garde center, looking to draw in a more avant-garde crowd (Marter, 1999). This assemblage aesthetic is an example of this medium entering the institutions.

On the other hand, according to some scholars such as Peggy Phelan performance can only exist in the present and it cannot be documented, saved and attempted to enter the economy of reproduction or it will lose its ontology (Phelan, 1993). Time-based artworks are meant to exist for a limited audience at a specific place and they are meant to be immaterial. For an art medium that needs the presence of viewers and happens in a specific time and place, repeating the performance changes the work. By re-staging or re-enacting a performance artwork is no longer the same as the first time it was performed. Each time a performance work is re-staged the chances, consequences and situations change and the interactions vary both between the artist and the audience and between the artist and the artwork. This repetition can never be the same as the first performance and thus is always in some ways different even if the actions are repeated. One can bring the memory back but cannot bring the memory to re-happen. A performance artwork repeated is never the same work as the first time it is performed.

Canonization of an artwork can be achieved by archiving the artwork so that scholars, artists and the public can access the work. It means we need to find the right ways to remember the artwork. This does not necessarily mean we need to repeat the artwork in the same way it existed before. This is not possible. We need to think of ways to bring a spirit to the works. "Such decisions need to be made on a case-by-case basis after careful consideration of what constitutes the work's essential characteristics." (Westerman, 2017)

Conclusion

Museums are institutions dedicated to preserving, conserving and archiving artworks. Their goal is making the artworks immortal by extending and restoring their lifetime. Most museums function as educational and research spaces and restore lives. But in this aim for preservation, performance art, which is only meant to live for the moment changes form and loses its spirit. How the re-staged and re-enacted performances are communicated, remembered and forgotten is controlled by the museums. When documenting a performance the main question is not how to but for what purpose (Pavis, 1982). These are very important points on how representation is crucial to remembering. What is being omitted and missing from the narratives are the spirit of the works when re-staged or re-enacted when acquired by the museums. Commodification of ephemeral works may not align with the neoliberal aims of institutional archiving but better strategies of remembering will help institutions to have better reputation.

In connecting these two different mediums of art, net art and performance art, our goal was to reflect on the ephemerality and immateriality of net art that is not always considered as the essence of these artworks. Net art turning the internet into a space of performance, implies a

relationship between how people relate to the machines and one another, where on the other hand live performance art implies a relationship between how people relate to one another and the artist. This relationship is a very important factor for both works. In this aspect for mediating net art we shouldn't be limited to strategies that apply only to digital art but have to consider the liveness of these artworks.

In this context, we need to consider the documentation of net artworks, going beyond the re-exhibition as a sum of rules or instructions, technical qualities, screenshots, or capturing to keep the work live. This rethinking requires the correct positioning of the artist's intention, what they problematized, the context of the work, and their place in art history.

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THE ARTIST'S INVOLVEMENT IN THE PRESERVATION OF TECHNOLOGICAL ARTWORKS: ARTIST - COLLECTOR DIALOGUE AS A MEANS OF KNOWLEDGE PRODUCTION

İpek Yeğinsü

The preservation of technological artworks is generally perceived to be more complicated compared to traditional media, such painting and sculpture. The preservation of traditional artworks is based on processes targeting the work's material composition, but media artworks also necessitate a careful assessment of the range of media they can be presented in without losing their essential qualities (Noordegraaf, 2013, p. 123). The following observation by Bernhard Serexhe on ZKM's official website is an immensely accurate summary of the challenge at hand:

> "Only recently have we become aware of the significance for media art, of the rapid renewal of hardware and software. Within just a few years, even with the best possible maintenance, the technical components of a work of media art become defect, obsolete, no longer compatible, and replacements are no longer available. Every further development of hardware and software brings with it a change, or even loss with respect to the possibility of presenting a work. The resulting short »shelf life« of digital artworks renders the hitherto valid collection criteria of longevity, authenticity and intrinsic value, absurd, and demands adaptations in curating and preserving practices which necessitates a basic reevaluation of the four main tasks of collections and museums-collecting, preserving, research, and communication".[1]

The preservation of a media artwork composed of old technologies is particularly problematic as its components may have already become obsolete, and if the artist is deceased, he or she cannot be consulted regarding the potential solution. However, if the work is relatively new and belongs to a living artist, its preservation plan can be created via a close collaboration between the artist and the collecting party, whether the latter is a single individual or a large scale institution. If the collector is informed about the potential technological pitfalls, and the artist is responsive to the collector's needs, this dialogue can become one of the most rewarding learning experiences for both parties. In this way, the collector would have a much better understanding of how the artwork shall be preserved and exhibited in the future, while the artist would be able to address the unexpected glitches and upgrade the work's technology without compromising artistic expression. This collaboration would

1
https://zkm.de/en/keytopic/conservation-of-media-art

also produce knowledge that could help improve the existing preservation models and contribute to the emergence of a common professional language in the field. This, in turn, would further facilitate collaboration.

The article begins by identifying the preservation challenges faced by the collectors of technological artworks. It continues by overviewing some preservation models devised by experts, institutions and the artists themselves, assessing the role of the artists' direct involvement within each context. It concludes with some observations on how these resources can be useful for individual collectors as well.

Challenges Faced by the Media Art Collectors

Colin Post (2016) summarizes the challenges in the preservation of media artworks as:

> "1) rapidly obsolete hardware and software, rendering portions or all of the artwork inaccessible after just a few years;
>
> 2) interactivity and a lack of fixity, making it difficult to separate the 'work' from its reception, or to even consistently define what the 'work' is;
>
> 3) complex combination of analog and digital components, many of which may be site-specific or configured for a certain exhibition space".[2]

The first problem is the most imminent of all, as the pace of technological change has been increasing exponentially since the turn of the millennium; this is why collectors, including some leading museums, have been struggling to find ways to preserve their 20th century time-based art collections. In the past, a technology such as the videotape remained in place for decades, and so did the players and screens used to access the information these tapes contained; today, a smartphone is replaced by a new and 'better' version of itself at least every two years.

One may argue that contemporary digital devices are less problematic for they are designed more 'holistically', i.e. to store, access, and transfer the information to each other within one single system; but this statement is only valid in relation to hardware. The issue is much more complicated in relation to software, for each new device requires an upgraded version of the software used by its previous versions; a program written for a smartphone from two years ago might or might not function properly in the new model. This is why smartphone companies send regular software updates to their users, but these only target the operating systems and mainstream applications, and they often function poorly on older hardware. When a custom-made software such as an artist-written program is concerned, such updates often render those programs obsolete, let alone making them perform better. Furthermore, digital file formats and their incompatibility with new hardware and/or software have already been a serious problem for many years; the existence of such a great variety of video and sound codecs in art collections, old or new, demands an even more urgent course of action if these collectors want to preserve certain artworks from the early digital era.

The second challenge is more closely related to the documentation practices. A media artwork's interactive nature and/or its reliance on an assemblage of technological components requires a rethinking of its presentation format in relation to every exhibition, and since such works only truly exist while in actual operation or only when they are interacted with, their documentation should also involve these plural versions functioning in different environments and contexts. Curatorial interpretation is key when the

2 https://artiststudioarchives.org/2016/03/07/research-reflections-preservation-of-new-media-artworks-in-the-care-of-the-artist/

artist is not available for direct consultation regarding this matter; here, the curator's task is to contextualize the work in relation to that artist's entire body of work and to the broader art historical context surrounding it. It is also important to note that such challenges also exist in relation to Performance Art or Installation Art; however, these categories or genres have been around for much longer, and in the majority of the institutions collecting them, the infrastructure necessary to handle their preservation is more established compared to that of media arts, often involving departments specifically dedicated to the former's conservation and documentation.

Evidently, the third problem is closely interrelated with the previous two: if elements composing a media artwork do not become obsolete at the same pace, then some of its components may be expected to die before others, and this raises several questions regarding how the artwork should be exhibited in the future. For instance, if an artwork is originally composed of a screen, a computer and a sculptural element all of which are also visible elements of its final version, what is the collector supposed to do if the original screen is broken and a substitute is unavailable? Shall he or she open up the screen and place a new tablet or a monitor underneath its old frame? What if the computer, originally a decade-old laptop, stops working and it needs to be replaced with a new device? Shall the computer remain intact and an external player be added to the assemblage, hidden somewhere in the background? Or shall the video file be presented in a separate screen/player combination, with the original and non-functioning assemblage presented next to it with a note about its original state? In that case, would the visual experience be the same with the original? Each of these issues must be addressed separately in relation to each and every media artwork, and this operation requires close collaboration with the artists to reach success. In fact, Bonnet (2015) observes that the high variety of components in media artworks "pushes the boundaries of traditional preservation methods and requires insights from both the artist and the curator alike to determine the future viability of re-staging the piece"

This overview also indicates that media arts preservation relies on plural fields of expertise for successful implementation. Perla Innocenti (2012) explains that media arts preservation is "an interdisciplinary area", and points at "the potential benefits of cross-domain digital preservation partnerships and collaborations between cultural institutions" (p. 79). She believes that such collaborative experiences are crucial for the development of "the interdisciplinary foundations of a scientific framework for digital art preservation" (p. 81). As the following section illustrates, various examples of such collaborations exist, and some have even resulted in the emergence of useful and widely accepted standard preservation models, and, despite all their differences, all these efforts require the artist's direct contribution one way or the other. Even once such collaborative networks are in place and the specialists are able to agree on a common set of professional standards, the artists ultimately remain as the best sources of information with regards to the preservation of their own artworks.

Preservation Models Based on Collaboration

Since the late 1990s and early 2000s, many scholars have been advocating a collaborative approach towards the preservation of media artworks, and the direct involvement of the artists in the preservation process. In his conference paper titled "Longevity of Electronic Art", Besser argues as early as 2001 that it is important to "have both curatorial and artistic input as to what parts of the work are most important to save (and in what fashion)". For Besser, preservation should consist of "trying to ascertain what the work really is, trying to make the critical portions of it persist over time, and saving ancillary materials that

become critical to understanding that work", and all these steps require the artist's in-depth knowledge and guidance; this is why he expects the artists' direct involvement to become the mainstream practice among museums, and supports his argument with various remarks by other scholars (Ibid.). Similarly, García and Montero Vilar (2010) observe that "the mobilization and cooperation of entities such as museums, collectors, foundations, and other institutions in favour of the preservation and restoration of digital art is not enough", and they suggest that the best way to combat technological obsolescence is "involving the artist in the documentation, preservation and restoration processes". According to Post (2017), "the existing literature on the preservation of digital and new media artworks routinely advocates for the need to include the artist in the preservation process, and to work with artists at all points in the life cycle of the art object" (p. 719). Guerrieri's interviews with museum professionals (2019) also illustrate that "museums have gotten into the practice of interviewing artists about their work", and that they consult the individuals who have previously collaborated with the artist if he or she is out of reach.

Experts have been devising models for media arts preservation that can be used by various actors in the field. One of the seminal works is the book titled *Permanence through Change: The Variable Media Approach* (2003) by Jon Ippolito, Alain Depocas and Caitlin Jones. The volume published by the Guggenheim Museum and the Daniel Langlois Foundation for Art, Science, and Technology, is an ambitious attempt at offering a standardized, measurable preservation approach while also responding to case-specific problems. The authors refer to the Variable Media Network as "a flexible platform whereby organizations can collaborate on various levels, choosing the type of contribution that suits their specific needs" (2003, p. 68-69). This study is particularly important for three reasons: first, it is based on a combination of theoretical research, field data and emulation tests. Second, the resources that emerged from it, including the interactive questionnaire, are publicly available on a website[3] which asks both the artists and the museum specialists to submit data into the system to improve the model. Third, it relies on the artwork's behavioral characteristics rather than its media components, which makes it useful independent of the medium in question.

Another model developed within the same year, Matters in Media Art (MMA), was initiated by a consortium of experts working at the New Art Trust, MoMA, SFMoMA, and Tate (Dekker, 2013, p. 161-162). This model addresses issues like acquisitions and loans in addition to preservation and installation, and it delineates a three-step process featuring "pre-acquisition, accessioning, and post-acquisition" (Ibid.). However, MMA approaches the artwork as a finished product, and it might be applicable only partially if the artwork is open-ended or configured in such a way that it only gets complete when exhibited (Dekker, 2013, p. 163). Jean Bridge and Sarah Pruyn's creative and futuristic approach might offer an antidote to this shortcoming; in their article "Preserving New Media Art: Re-presenting Experience" (2009), they observe that the existing preservation techniques are far from reflecting the artworks' dynamic and creative aspects, and they suggest that "simulation strategies with the aesthetic, mechanics and dynamics of the video game platform" can be used to recreate the experience the artworks were able to deliver once they were operational. According to the authors, artists and game designers can work together to build these "interactive iterations", although they also admit that this solution brings with it other complex issues related to authorship rights and funding.

3
https://variablemedia.net/e/index.html

Preservation models envisioned by institutions working with media arts offer useful alternative approaches as well. Proposed by the V2_ Organisation, Institute for the Unstable Media in Rotterdam, the Capturing Unstable Media Conceptual Model (CMCM) is one such endeavor (Dekker, 2013, p. 159). Aimed at archiving and preserving "newly created electronic art installations, rather than recreating or preserving existing works" (Ibid.), and based on data obtained from case studies, the model is described on V2's official website as "an ontology with a multi-hierarchical and object-oriented structure of interrelated concepts or classes". Like the Variable Media Approach, its target user profile includes "a wide variety of actors and institutions"[4], and its main purpose is to facilitate information exchange between the artists and the collectors. Moreover, in this approach, the artwork's creative production stage has priority over its final version, for the former is considered to be where "the interaction between the work and the stakeholders" becomes most evident (Dekker, 2013, p. 163). Other models like LIMA's Artwork Documentation Tool[5], on the other hand, address the artists directly and offer them an instrument in their communication with the collecting parties. Inspired by the Variable Media approach, this model facilitates the institutions' work as well, since the standardization process begins at ground zero, i.e. the artists. Its shortcoming, however, is that it might not be applicable to the artworks already in the collection whose creators are beyond reach. Finally, the implementation of a standard preservation strategy might also be one of the elements in a much broader shift in the institutional policy. The Minneapolis Institute of Art (MIA) conducts its own media arts preservation projects in collaboration with public institutions.[6] By participating in the National Digital Stewardship Residency in Art Information (NDSR|Art)[7], the institute implemented new collection management guidelines and improved its technological infrastructure for future conditions. Most importantly, the team embarked on the mission of improving the condition of their Time-based Media Art (TBMA) collection with hardware and software updates, backup procedures and condition checks before troubleshooting actually occurred, at an early stage of the collection's expansion (Ibid.).

In addition to the institutional attempts presented above, some artists envision their works' future forms themselves; these visions may either become manifest in intuitive experiments, or systematic attempts at devising their own standard preservation models, some of which are later adopted by other artists and specialists in the field as well. Colin Post's study on the artists' preservation habits reveals interesting findings regarding this issue.[8] The author tries to answer the following questions:

> "RQ1. How do new media artists conceive of the preservation of their artworks?
> RQ2. Do preservation concerns arise in the process of creation?

4
Ibid.

5
https://www.li-ma.nl/lima/article/artwork-documentation-tool

6
https://new.artsmia.org/art-artists/research/case-studies/preserving-mias-time-based-and-digital-media-art

7
http://ndsr-pma.arlisna.org

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Post, C. (2017). "Preservation practices of new media artists: Challenges, strategies, and attitudes in the personal management of artworks". Journal of Documentation, 73(4), 716-732. DOI 10.1108/JD-09-2016-0116

RQ3. How do preservation challenges manifest in the ongoing maintenance of an artwork?" (Post, 2017, p. 717).

In his pursuit for answers, Post adopts Media Archaeology[9] as his theoretical framework, for he believes that "developing a systematic means for characterizing how new media artists in the present use specific pieces of hardware, software, and other technologies can inform recovery projects for artworks lost to time" (2017, p. 720). He does a snowball sampling of seven artists for an empirical, in-depth study of their archiving practices (Ibid.), and he concludes that the challenges they go through are similar although their individual habits vary greatly (2017, p. 729). Like the other experts, he emphasizes "the need to develop relationships between institutions and artists to address preservation challenges that arise early on in the life of an artwork"; most importantly, he argues that institutions should guide the artists in their preservation efforts by making their expertise available to them as well (2017, p. 730).

In his study "Keep it alive or let it die: new media art, curating and the art market"[10] (2016), Pau Waelder asks the artists a different question: do they actually want their works to be preserved? Of the 500 artists that he surveyed, 12% state that preservation is an unnecessary endeavor since each work has its own life cycle, while approx. 22% declare they do not have the resources to afford such an effort. He also adds that nowadays, artists are compelled to consider the issue of preservation, for media art is much more integrated into the broader contemporary art market compared to the past. Nevertheless, he believes that not preserving an artwork is still a legitimate option and it should not be dismissed altogether. Evidently, the collecting parties should be informed in advance about it as it might affect their final decision to acquire the work, another situation that would benefit from close communication between the artist and the collector.

One of the most influential preservation models devised by the artists themselves belongs to Rafael Lozano-Hemmer. In his essay dated 2015 and titled "Best practices for conservation of media art from an artist's perspective"[11], he directly addresses his fellow artists as if writing them a letter. He begins by showing his empathy towards the common difficulties experienced by his colleagues and offers them some friendly advice. However, his key observation is the following: "As you know, there are a plethora of existing initiatives to preserve media artworks, but these are always from the perspective of the institutions that collect them. While most institutional programs include excellent artist-oriented components like interviews and questionnaires, the programs are all a posteriori, almost forensic, as they look at the work in retrospect, as a snapshot of time". In other words, he suggests that artists

9
Here, Post refers to the volume edited by Erkki Huhtamo and Jussi Parikka titled "Media Archaeology: Approaches, Applications, and Implications" (2011). The term "Media Archaeology" defines an emerging scholarly territory that studies today's digital technologies by examining the layers of their development throughout history.

10
https://www.pauwaelder.com/keep-it-alive-or-let-it-die-new-media-art-curating-and-the-art-market/

11
https://github.com/antimodular/Best-practices-for-conservation-of-media-art

shall not leave the institutions alone either, for their contribution would help the institutions complement the preservation narrative that they are already able to trace in retrospective. On the other hand, the artists' contribution to the preservation literature can also take place indirectly, as in the case study conducted by Diego Mellado Martínez and Lino García Morales regarding the preservation of an artwork by Daniel Canogar.[12] Martínez is the Project Manager at Canogar's studio, so he has first-hand access to the works' technical characteristics. What makes this example particularly important is the ability of the artist's technical team to produce knowledge on media art preservation that can also guide the institutions in their preservation efforts, and this is best reflected in the authors' concluding remarks: "Finally, this paper wants to highlight the fact that producers and specially engineers should be taken into conservation teams. Not only for his or her deep knowledge of a technical matter-but for having developed what the artwork calls new media. He or she is the ideal professional for restoration of these artworks'' (2017, p. 276)

Conclusions: Implications for the Individual Collector

As this overview illustrates, regardless of their basic philosophy, standardization methodology and the institutional context they emerge in, media art preservation models agree that the artists' involvement is an indispensable component of their successful implementation. Artists contribute to these systematic efforts in various ways ranging from providing field data to formulating the preservation principles themselves. The institutions are generally assumed to have better resources to implement these strategies compared to the individual collectors, but they still face some serious difficulties. In some respects, their task can even be more complex than that of the individual collectors due to the size of their collections, their long-term financial or legal commitments and bureaucratic structures, which might make their ability to respond to the changing preservation paradigms relatively slow. Furthermore, as media art conservation is already an emerging field, the majority of the existing conservation professionals already come from other backgrounds; as Guerrieri (2019) observes, in the USA, "most time-based media conservators were trained in other media and ultimately fell into the field". This partly explains why Lozano-Hemmer (2015) still places the key responsibility on the artist's shoulders: "If a piece fails the collector needs to know exactly who to call and have a support network. If they don't it is possible they will never invest in media art again. Often artists make networks that include their galleries, trusted technicians or AV companies".

Individual collectors and the galleries they work with can adopt some of these systematic preservation models and adapt them to their specific needs, but the establishment of a strong dialogue between the artist, the gallery and the collector is even more vital within such contexts. If the artists are receptive to the collectors' feedback on the technical problems they experience with the artwork and try to solve them without changing the artwork's essential qualities, individual collections can become fruitful sites of learning and experimentation for the artists. Vice versa, if the individual collectors keep an open mind towards some unconventional strategies the artists suggest in an effort to preserve the artworks' characteristics beyond their existence as physical objects, they have a chance to contribute to the preservation literature that could be taken as reference for future endeavors.

12
https://ge-iic.com/ojs/index.php/revista/article/view/505/790

In fact, as John Ippolito says, “In order to salvage the rich array of creative practices born during the last century, society has to move from preserving media to preserving art. In the process, we will have to view change not as an obstacle but as the means of survival” (2014, p. 46). Evidently, such a dialogue will also produce knowledge that can be translated into the institutional sphere.

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THE SOFTWARE ASPECT OF PRESERVING DIGITAL ART

Cemal Yılmaz

In order to understand the technical challenges and issues regarding the preservation of software-based digital art, one needs to first understand the root causes of the problem. To this end, we begin with a brief description of the hardware and software stack present in today's computing platforms.

At a very high level, the hardware and software stack is organized in a layered manner. At the bottom of this hierarchy, we have the hardware layer. The hardware layer consists of components, such as CPU (central processing unit), RAM (random access memory), and I/O (input/output) devices, and is responsible for executing low-level machine instructions. On top of the hardware layer, we have the software stack, which is organized into three layers; operating system layer, application support layer, and application layer. The ultimate goal of this layered architecture is to provide an increasingly higher level of abstraction from bottom to the top of the hierarchy. That is, each layer in this architecture is responsible for hiding the details of the lower levels from the upper levels. The operating system layer (e.g., Windows 10, Linux, and Unix), which resides right on top of the hardware layer, makes the hardware transparent to the applications, so that applications do not need to deal with the complicated details of the hardware components in order to operate. Similarly, the application support layer, which consists of components, such as development environments, window managers, and user interfaces, makes the underlying operating system transparent to the applications, so that applications are not affected by the changes in the operating system. On top of the application support layer, we have the application layer where the applications we use on a daily basis, such as Web browsers and social media applications, operate.

Software-based digital art typically resides in the application layer, benefiting from all the abstractions provided by the underlying layers. Although this helps develop better, faster, and more reliable software components in art projects, it also creates dependencies between the artwork and the underlying layers. When this is coupled with the fact that the artwork has no control over the hardware and software stack, it amounts to a proliferation of maintenance issues (if care is not taken). In particular, the underlying layers can change. Their interfaces and semantics can change. The way they interact with each other can change. And, they may even become obsolete. In the presence of such changes (note that this is not a question of if, but when), the artwork needs to be maintained in a timely manner by accommodating the changes to ensure a longer term preservation.

In this essay, we introduce the concept of preservability assurance to refer to all activities and tasks, which focus on providing confidence that digital art will have a long-term preservability. Next, we discuss a number of preservability assurance activities. Note that not all of these activities may be meant to be carried out by non-technical stakeholders. Our point of view, however, is that non-technical stakeholders in art projects, such as artist, should at the very least understand

the preservability issues and risks, and be knowledgeable, at a high level, about possible solution approaches, so that they can make better managerial decisions when it comes to balancing the preservability concerns with artistic expression. The suggestions made by this work can be developed by researchers, thought by educational institutions, such as universities, and made practical and promoted by art institutions, such as museums.

Last but not least, for this work we are solely concerned with the preservability assurance of software components in art works. As software is quite different from the other artifacts in art projects, such as hardware, the discussions in this paper may not readily be applicable for them.

Archiving vs. Maintaining

Simply archiving the executables and/or the source code belonging to a piece of software may not be enough for preservation as all the dependencies the software has (i.e., the underlying layers, including the hardware layer) may also need to be archived. Although storing the software stack (compared to storing the hardware stack) is relatively easy as software does not wear out, software needs hardware to run on. And, keeping redundant copies of hardware will go as far as the last copy wears out. Regularly maintaining software components in digital art to accommodate changes in the software and hardware stack, especially in the presence of disruptive technologies, is, therefore, a more effective and reliable strategy for ensuring long-term preservation. The longer the maintenance is delayed, the more challenging and costly it will be, thus the more the risks become reality. This is mainly due to the accumulated technical debt (Tom et al., 2013) – a concept used in software engineering to reflect the implied cost of additional rework caused by ignoring issues or implementing easier, but improper solutions for them.

Note that software is intangible. One cannot touch and feel the shape of a piece of software. It simply runs in the background, orchestrating the hardware. Therefore, software can be maintained without modifying its externally visible behavior, thus without at all affecting the artistic expression of the artwork.

Preservability assurance, but when?

Most (if not all) of the related works in the literature solely concerns preserving digital art after it has been created. This, however, seems to be the exactly the same mistake we, as software engineers, used to make. In particular, we used to think that quality, such as preservability, is something that needs to be addressed after the systems have been developed. After decades of failed software projects, we, however, came to the conclusion that this does not work and that quality is something that needs to be addressed right from the beginning. Preservability concerns regarding digital art is no exception. Therefore, preservability assurance shall be an integral part of any digital art project right from the beginning. Waiting until after artwork has been created to address the preservability concerns, can be too little, too late.

Preservability assurance, but by whom?

All the stakeholders in an art project, including the artists, should contribute to the preservability assurance activities, given that preservability is indeed a concern; not all artists may consent to preservation. One can, however, argue that the creativity of an artist should not be restricted due

to some technical issues. By all means, we agree with that. We, however, observe that artists often work with technical stakeholders in art projects, such as software engineers. We, therefore, believe that they, as non-technical stakeholders, should be provided with guidelines, approaches, and tools, so that they can make better managerial decisions when it comes to balancing the preservability concerns with artistic expression. It is, indeed, the artists themselves in the end, who will decide the level of importance that should be attributed to the preservability concerns.

Preservability assurance, but how?

In the software industry, it is not uncommon to have non-technical managers – a role, which is most likely to be played by an artist in a digital art project. As expected, they may have difficulties in evaluating the value and/or consequences of the technologies used in development. To help non-technical managers with their business decisions, we, as the software engineering community, have developed the concept of software governance (Chulani et al., 2008). The ultimate goal of software governance is to quantify the business value of each software module or even each line of code, such that non-technical managers can make better decisions or take educated risks. Consequently, similar approaches can also be developed for preservability governance to help non-technical stakeholders in art projects evaluate the benefits, risks, and the costs of the design decisions made during development.

One frequently exercised practice in software governance (and also in other related activities) is to use software metrics (Fenton, 1991), which aim to quantify different quality attributes of software systems. From the perspective of preservability assurance, one example type of software metrics that can be used is portability metrics (Washizaki et al., 2004), quantifying the ability of running the same software in different environments. These metrics can be used to evaluate various characteristics of portability, including installability, replaceability, and adaptability. Furthermore, as many of these metrics can be extracted from source code as well as from documents, such as requirements and design specification documents, they allow the assessment of the preservability risks even at the very early stages of development. Note that portability is important because one way to preserve digital art can be to port it to a different hardware and software stack (by, for example, replacing obsolete layers).

Software governance approaches are typically developed with the needs of especially the non-technical stakeholders in mind. For technical stakeholders in art projects, we also have a wide spectrum of approaches that they can use for preservability assurance. Next, we briefly discuss some of these approaches. Note that, since the requirements in art projects typically come from the artists, they can enforce the types of the approaches to be employed in the project.

From the perspective of software engineering, preservation generally falls into the category of software maintenance (Bennett et al., 2000). And, software maintenance, for the most part, cannot be carried out in the absence of source code. Therefore, it is of at utmost importance to maintain a repository (such as git (Git, 2020)) of not just the codebase, but also the different artifacts, such as documents and test cases, produced during development. All forms of documentations, including software requirements and design specifications, are

of great practical importance as the maintenance team for a piece of art is likely to have a high turnover rate.

Considering the nature of digital art projects, as the requirements are likely to change frequently during development, following agile development processes, such as Scrum (Schwaber, 2002), can be a better fit. At a very high level, the motto for agile processes is “Delivery quickly. Change quickly. Change often.” One dilemma, however, is that agile processes value working software over comprehensive documentation (Fowler et al., 2001). Therefore, agile projects typically have little or no emphasis at all on documentation. In agile projects, the source code itself is considered to be the documentation. This necessitates that the source code needs to be clean, simple, and easy to understand, which, in turn, necessitates frequent refactoring - a technique to restructure the internal structure of a piece of software (often for the purpose of improving the maintainability) without changing its externally visible behavior (Mens et al., 2004). Therefore, all the stakeholders in an agile project, including the artists, shall recognize the value of refactoring and accept all the implied costs (e.g., additional time and effort required for refactoring).

Developing and maintaining test cases is also vital as they need to be run to ensure that recent maintenance activities do not adversely affect the functionality and performance of the software system. All forms of testing, including unit testing, integration testing, system testing, performance testing, and the regression testing (Myers et al., 2004), shall be exercised as they address different quality assurance concerns.

Another approach that can be used to check for regression errors is to have some assertions (Rosenblum, 1995) embedded in the source code. In a nutshell, an assertion is a condition that needs to hold true at runtime. Violating a valid assertion indicates that the system deviates from its expected behavior. Another quite practical property of assertions is that they can be turned on and off at will. For example, they are typically turned off before the system is deployed. Therefore, having assertions, especially the ones regarding the critical functionalities of a digital art project, is a good practice as these assertions can be turned on during preservation activities to make sure that these activities do not have any adverse effects on the artwork.

An advanced form of asserting expectations can be achieved by employing the design by contract approach (Mitchell et al., 2001). In this approach, a software module is shipped with a contract, specifying not only what the user should expect from the module, but also what the module expects from the user. The contracts are expressed in the form of preconditions, postconditions, and invariants, specifying what is to be expected before, after, and during the executions of the modules. The contracts are also executable. That is, a contract can be activated to determine whether it is breached at runtime, which indicates that the system does not work the way it is intended. Digital art can be distributed with executable contracts, which not only help detect regression errors during maintenance activities, but also help determine whether an art installation works as expected. Note that, in the presence of a breach, since the parts of the contract being violated will be known, using executable contracts can also help reduce the space of potential root causes for failures, which, in turn, can greatly improve the turnaround time for

bug fixes.

Likely contracts can even be automatically discovered by collecting data at runtime and analyzing the collected data using, for example, artificial intelligence and statistical approaches, to infer behavioral patterns (Ernst et al., 2001). The behavior of digital art can then be checked automatically against these observed patterns to increase the level of confidence after the maintenance activities and/or art installations. Although the representativeness of the discovered patterns is restricted by that of the data used for the analysis (i.e., observed behavior may not precisely specify expected behavior), many empirical studies strongly suggest that event rough approximations can be of great practical help to software engineers (Podgurski, 2003).

Another approach that can significantly improve the preservability of software components in digital art is to design and implement these components in a highly cohesive and loosely coupled manner. In software engineering, cohesion describes how strongly the contents of a module are related to each other, whereas coupling (i.e., dependency) describes how strongly a module is related to other modules (Bass et al., 2003). While increasing cohesion helps get well-defined modules, reducing coupling helps these modules to be standalone, both of which play an integral role for preservability assurance. More specifically, it is typically easier to replace a software module with another module providing the same or similar functionalities, when the module to be replaced is a highly cohesive and loosely coupled module.

To materialize these design ideas, software design patterns (Gamma, 1995) can be used. The rationale behind software design patterns stems from a simple observation that there are some reoccurring design problems in software engineering. The ultimate goal of the design patterns is to determine these reoccurring problems, solve them in an efficient and effective manner, and document the solutions, such that they can readily be adopted in different contexts and projects, rather than solving these problems from scratch every time they are faced. As software engineers, we have developed and documented a large number of software design patterns. Not only the existing design patterns can be leveraged in art projects, but also specific design patterns for preservability assurance can be developed.

In addition to the design patterns, we have also developed a wide range of software design principles (Sommerville, 2011). Some of the important design principles from the perspective of preservability assurance are 1) anticipate obsolescence, i.e., plan in advance for potential changes in the hardware and software stack; 2) design for testing and debugging, i.e., design the system, such that testing and debugging can be automated to the extent possible; and 2) design for portability, i.e., design the system, such that it can run on as many different computing platforms as possible by, for example, using open standards rather than proprietary technologies.

When it comes to portability and managing dependencies, perhaps the most effective technology to be used is the virtualization technology (Campbell et al., 2006). At a very high level, virtualization can be defined as running a virtual instance of a system on another system. By using this approach, digital art can be distributed in the form of a virtual machine (an emulated equivalent of a computer system) or in the form of a virtual container (a lighter weight virtualization technology), where all the dependencies, including

the hardware and software stack, are pre-installed. Therefore, deploying a virtual machine (which is typically a straightforward task) automatically deploys everything required by the artwork to operate. Note however that virtualization is not a solution for all the issues we have been discussing so far. After all, a virtual machine is good as long as we have a host platform (e.g., a host machine and a host operating system) supporting the virtualization technology used by the machine. That is, virtualization technologies can change over time and they too can become obsolete.

We have so far focused solely on the internal dependencies they may be possessed by a software system. Digital art can also have external dependencies. For example, an artwork may depend on an information source available on the Web or an artistic expression may depend on certain properties of existing technologies (e.g., “the speed of the internet”). As is the case with internal dependencies, the nature of these external dependencies can change over time. For example, the information source, on which an artwork depends, may become obsolete or the characteristics of the data being published by this source may change or the properties of the technologies may change, e.g., the internet can get faster. These changes not only can create some technical issues, but also may greatly harm the artistic expression. To alleviate these issues, one approach that can be used is mocking (Mostafa et al., 2014). In particular, mock objects can be created for the external dependencies that are likely to change and these mock objects can then be distributed with digital art. In this context, although a mock object replaces an original object, it does not nothing but replay pre-recorded results. Going back to the external information source example, a mock object can automatically be created by capturing the messages being exchanged by the art work and the information source and then these messages can be replayed as needed to reproduce the same artistic expression without requiring the presence of the actual information source - a frequently-used approach known as capture and replay (Zeller, 2009).

The software engineering community has for quite a while been dealing with the same or similar issues, with which the art community struggles to ensure the long-term preservation of software-based digital art. We believe that this presents a win-win situation. On one hand, many of the technologies and processes developed by the software engineering community can readily be employed to preserve digital art. On the other hand, the art community can offer us novel problems and challenges to address. In any case, preservability assurance shall be an integral part of any digital art project right from the beginning and art works shall regularly be maintained.

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DIGITAL OBJECTHOOD

Dragan Espenschied

This article aims to provide guidance on how to conceptualize digital objects for the purpose of digital art preservation. None of the techniques described below are meant to replace existing processes, but hopefully can serve as a guide and framework for planning the long-term preservation of, essentially, software.

A “digital object” is often thought to be identical with the physical boundaries of the media it is stored on—for instance “disks” or a “computer”—or with digital simulations of traditional media—such as “digital file”, “folder”, ZIP “archive.” However, these artifacts, usually produced by an artist in one way or another, can only be regarded as pieces in an assemblage of performative digital environments, in which many other artifacts, most of them not produced by an artist, need to be aligned. Described below is a process to identify object boundaries and artifacts, and their roles in the preservation process.

This essay is written from the perspective of Rhizome, a non-profit organization which was founded in 1996 and has existed online at rhizome.org that collects net art, and at the time of writing, manages more than 2000 works in its ArtBase collection, in addition to its other activities. The works are frequently included in online and gallery space exhibitions; they are supposed to be accessible on the web at any time. How Rhizome’s preservation team treats artworks is based on the fundamental idea that digital art needs to be historicized, that a collected artwork cannot exist as a perpetually new entity or a mere concept that needs to be re-instantiated constantly. Instead, the moment a work enters a collection, it is regarded as a manifestation created for a certain environment, both technically and culturally. Another important consideration for Rhizome is the economic feasibility of preservation activities: the preservation of no digital object is ever completed, maintenance is always required. The less maintenance required for any particular artwork, the more a collection of digital art can grow, and the more that collection will be able to represent the swiftly evolving fields of digital art and culture—which is a core part of Rhizome’s mission.

Instead of artistic curation, this article predominantly discusses the curation of software. While there is considerable overlap in between the two disciplines, our focus will be on the software part with a rather clinical treatment of artworks, wherever this is possible.

Performative Objects

Any object needs to be defined by its boundaries, and by its differentiation from anything else that exists. This is also true for works of art. Whenever a work of art is moved, for instance, from one exhibition gallery to another, from one computer to another, or through time via preservation or restoration, its well-understood objecthood makes these activities possible and successful. A misconception of an artwork’s objecthood will render them impossible, or cause them to fail in the future.

The need of object boundaries to be defined, rather than allowing the boundaries to reveal themselves “naturally” has caused issues for the preservation of digital art, and consequently the collection it is a part of, as well as its function in building careers for artists. This is mainlydue to the fact that what computers present—or rather, perform—as objects does not easily translate to useful definitions of what a boundary is. It is helpful to remember that most things that appear to happen inside a computer are staged to make them accessible.

A digital image visible on screen is *not* an image but rather the result of a string of symbols *interpreted* as one. A digital file appearing on a computer desktop as a single unit that allows for object-like manipulation can actually be distributed across several local and remote storage devices, which in turn might be abstracted and virtualized. Even the famous “zeroes and ones” that are supposed to be the most minute and truthful things within a computer are merely assigned to two otherwise meaningless symbols, so that binary numbers can be more easily imagined when using a computer to do math.

The perception and understanding of all that is inside the computer as any kind of “object” is only rendered possible through layers of idioms and staging. Once the computer is turned off, the object is gone. The main consideration for the preservation of a digital object is not so much that it can be “stored” or “located” (as metaphors from archival practice may suggest), but that it can reappear when the system is turned back on. This means that computer performance needs to become 1) reproducible and 2) portable—or simply put: it needs to not be tied to a specific computer or class of computers.

In the context of art institutions, administrative and economic issues have to be taken into account as well: It must be possible to own and steward an artwork, and have it play well as an item within a collection. If maintenance of an artwork is too resource intensive, preservation will ultimately be deferred, or carried out at the expense of the needs of other items in the collection. This is detrimental to the value of the overall collection.

For the purpose of this discussion, our focus will be on artworks that are purely software. Two pieces from Rhizome’s ArtBase can serve as examples. The first is *Bodies© INCorporated* by Victoria Vesna from 1996, a mock corporate website allowing visitors to create a 3D body for themselves, after agreeing to terms and conditions that force them to forfeit all rights to their creation. (Connor, et al., 2019, p.64) The project makes use of VRML (Virtual Reality Modeling Language) in order to render interactive 3D graphics in the web browser. Today’s web audience has no means to easily run the software required to access this piece. (Figure 1) A second example is *The Web Stalker* by I/O/D from 1997, an artist-created browser that, instead of rendering web pages as the user navigates them, reveals structural diagrams and streams of code as it moves through the web mostly autonomously. (Ibid., p.74) The software does not work on contemporary operating systems and due to changes in web protocols, it cannot connect to most regular websites anymore. (Figure 2) Both works have a history of being included in gallery space exhibitions, but at their core, both can be regarded as artist-created software.

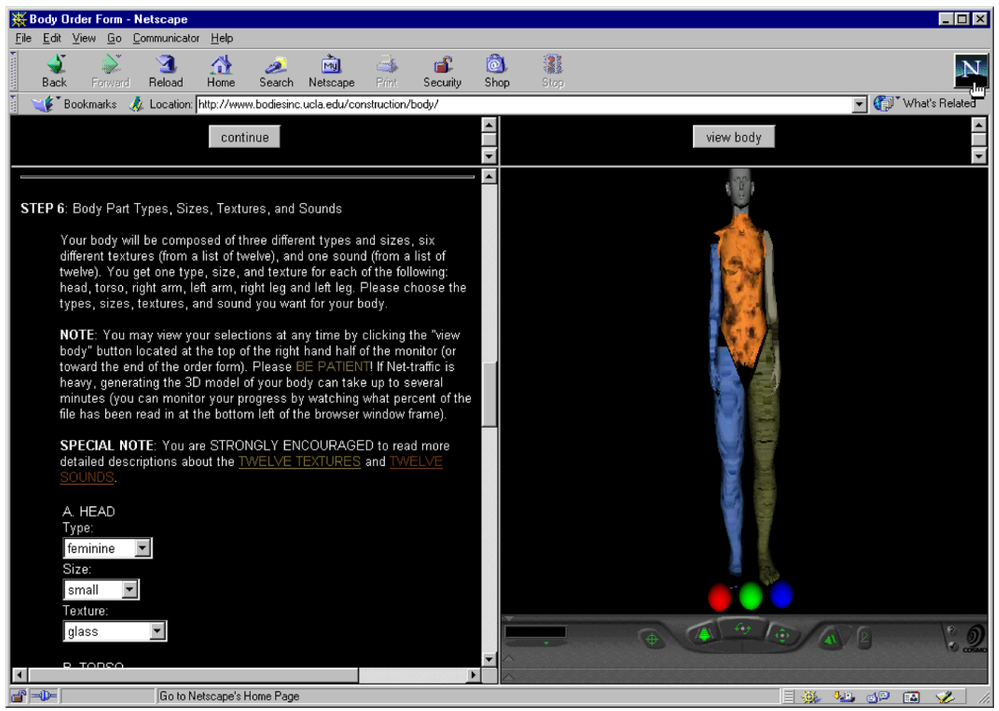

Figure 1: Victoria Vesna: Bodies© INCorporated, *1996. Screenshot, 2018, Netscape Communicator 4.7 and CosmoPlayer 2.0 on Windows 98.*

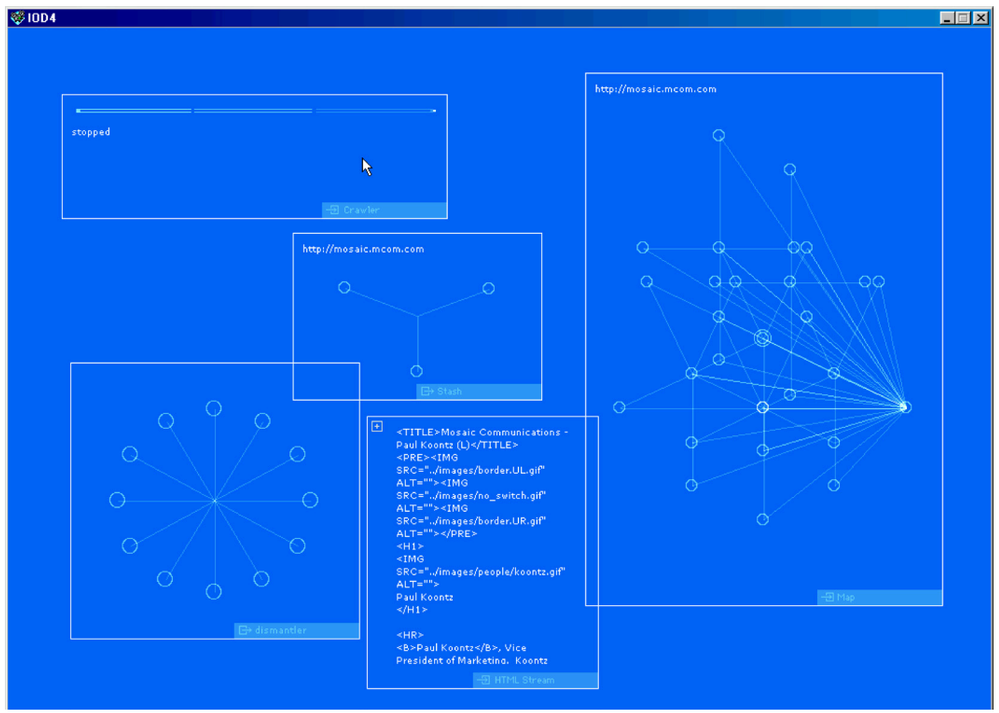

Figure 2: I/O/D, The Web Stalker, *1997. Screenshot 2017, Windows 98.*

The Acts of Production and Transfer

Two pretty common events are often responsible for defining the boundary of a digital object in almost accidental and frequently misleading ways. First off, creating an object instills an idea of what has been done in the creator, and secondly, the transfer of the object to another location—say, into a collection—instills an idea in the recipient's mind about what has been received. For instance, an artist might create a website using a set of applications like a text editor to write code, a graphics package to prepare images, or a browser for viewing and testing. The work the artist is doing resembles drawing graphics, designing a site structure and interactions, and writing in a set of computer languages. The artifacts produced could be transferred either separately or bundled together in a project file or directory. However, none of these will make any sense without a *target environment*, a system or set of systems the work was created to be performed with.

Through their work, the artist has only added a tiny amount of artifacts on top of an astounding software stack consisting of an operating system, hardware drivers, default resources such as system fonts, icons, libraries of interaction patterns, file format interpreters, and so forth. The artist had no role in creating any layer of this stack and might not even pay much attention to them. If a museum collects the work, the artist would hand over what their understanding of the object is, namely, the artifacts they created. The target environment is at risk of becoming implicit because the work performs just fine at its new location, since at the time of transfer, both the sender and the recipient are very likely to be using similar computer systems. With the website having been created to be accessible to a wide audience without bespoke technical requirements, the resulting lack of friction can lead to the work becoming *technically decontextualized*.

Even if instructions on the setup of an environment are provided, they would be prone to blind spots. Since changes in common interaction patterns or the availability of standard software and documentation in the future cannot be predicted, the likelihood that the instructions will become useless quickly is pretty high. For instance, an analysis of 100+ artist-provided instructions on the operation of CD-ROM artworks from the transmediale collection, all created around the turn of the century, proved that none of them contained actionable information that could not be inferred from just knowing the artwork's production date. For instance, many pieces require to be operated via a mouse, a once common pointing device that has largely been replaced by trackpads and touch screens. Yet none of the descriptions mentions a mouse. Instead, technical components like processor models or the amount of memory required to run the artwork are enumerated. (Figure 3, Figure 4) From today's perspective, this information does not pose any limitation or constitute a meaningful guidance, since computers generally have gotten so much more powerful that components are not even available anymore in the listed units of measurement, such as megabytes. (Espenschied, Rechert, et al., 2013)

README.TXT

README TEXT:

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aisforapple.net v. 2.0
Technical & User notes

CONTENTS

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1. Mac Users
2. PC USers
4. Browser Users
3. The creators

1. MAC USERS

To start the presentation, open your CD directory and execute "applemac.hqx."

The Mac version is stored as an .hqx and so you may require a file translator, such as Stuffit Expander, for them to be recognised as an application. (http://www.stuffit.com/expander/index.html)

Minimum Requirements:
G3 Processor
128 MB RAM
800 x 600 resolution

Preferred Requirements:
G4 Processor
256 MB RAM
1024 x 768 resolution

Figure 3: Example text file with technical instructions for CD-ROM in transmediale collection. Screenshot, 2013, author's archive.

Read me !

About the CD-ROM

- To use preferencially with a **G3/G4 Macintosh .**

- The opening of the file "Start CD" needs a long time !
(seems blocked for 15 secondes)

- **Save** and quit the current software on your computer before opening the CD-ROM.

- If you try on your CD-ROM reader, the "Start CD" perhaps doesn`t work or the vidéos run too slowly. Hybrid CD reader (DVD + CD R W) are probably too slow to run the CD properly.

The CD-ROM works well if you copy the folder "Julien Maire" on your hard disk. (500 MB / 5 mn).

-If the "Start CD" doesn't work on your computer, you can run the vidéos only (QuickTime in "Julien Maire" folder).

Figure 4: Example text file with technical instructions for CD-ROM in transmediale collection. Screenshot, 2013, author's archive.

Going one step further, if information on the target environment would have been provided, such as “requires Mac OS 8.5,” that information itself would not make the artwork run again. Mac OS 8.5 would need to be actually available, ready to be started up. An artwork acquired with a misguided boundary could require a tremendous amount of effort to restage in the future. With the original target environment missing as a reference point, the behavior of the software would need to be approximated from documentation or via code analysis, and reproduced for a yet unknown target environment. In the worst case the software would need to be rewritten from scratch.

In another scenario, the artist might hand over to the museum the complete computer and peripherals the work was created and tested on. The computer’s storage would then contain traces of the work process, possibly a browser history pointing to online manuals, personal messages, beta versions of the work, even deleted files. Below all this, of course, there would be the hardware itself, with specific components, and the complete local software stack.

On the receiving side, this could lead to a boundary definition including all of these components, resulting in the actual artwork becoming *technically over-contextualized*. Managing the information contained in such a development snapshot requires lots of resources, with little to gain from a preservation perspective, and considerable privacy implications towards publicly showing or lending the work. The institution’s ability to grow its collection would be harmed because too many resources would need to be spent on the maintenance of mass-produced components that appear tightly connected with the artwork. A typical expression of that misconception is the meticulous cataloging of technical specification and component names of standard computer parts, assuming that the artist deliberately selected or combined them, and that in the future equivalent replacement parts would be needed. However, the exact make and model of, for instance, a hard drive or a memory element in most cases hardly make any difference for an artwork’s performance or its artistic integrity, and can be considered well within the variability that most digital artists are comfortable working with. In the same vein, listing any software present on a system might seem like a safe bet, but likewise increases the risk of the object becoming too hard to manage. For preservation purposes, it doesn not make sense to know about every single system component.

Finally, there is a class of artifacts that might provide a core component of an artwork’s performance, yet is impossible to hand over or even transport at all, because it includes remote resources outside of the control of the artist or the collecting institution. Typical examples would be public interfaces to databases or software services like Google image search, Google maps, Vimeo embedded videos, a Twitter

timeline, or perhaps streams from public web cameras, all providing material to be processed by the artwork.

Each of these resources located on the other end of the network is a computer system in its own right but can neither be fully examined or copied. These resources are part of the object, but their performance can only be observed, and possibly captured in part. The object becomes *blurry*, because its boundary is defined to contain an artifact that is impossible to be fully captured or described.

It can be easily understood that once a remote resource becomes unavailable or is changed—when it loses its technical function—, the artwork might stop performing. The same can happen if a remote resource loses its cultural function. For instance, artworks that are using the Twitter API to extract political messages from the platform today might not be able to find any in the future if political discourse moves to another service or topics shift so far that processing via the artwork becomes meaningless—even if the API should remain fully compatible with the artwork's requirements.

Technical Context and Abstractions

If an object is defined by a bundle of possibly blurry artifacts in a performative environment, what is a reasonable tactic to define fitting shapes for these artifacts? It has proven productive to place whatever is within an assumed boundary of an artwork into a different environment and observe its performance. This is basically a simulation of the technical landscape changing over time. (Rechert, Falcão, Emson, 2016) Using the examples previously discussed, in case of a website like *Bodies© INCorporated*, artifacts could be moved to a new default server, or if handed over as a server image already, that could be moved into a default virtual machine. The internet connection could be disabled, and different browsers be used to access the site. In case of a custom software for desktop usage like *The Web Stalker*, the program could be tried in different stock operating systems, with networking disabled or enabled. The errors observed through these willful re-contextualization actions will surface preservation risks and hint towards a meaningful boundary definition. For instance, *Bodies© INCorportated* will not display correctly unless a browser supporting VRML is used to access it, so it makes sense to build an environment based on Windows 98 with a legacy Netscape browser and the CosmoPlayer plugin installed. If the work exhibits gaps and dysfunctional parts when the environment is disconnected from the internet, it probably loads data from remote websites—these could be encapsulated in a web archive. Step by step, the object's boundary can be grown or shrunk.

The distinction in between items that are mass-produced and unique provides a further guide for using the right abstractions: Operating systems are mass-produced and provide standardized, normalized access to hardware components. Applications are mass-produced software items that package the operating system's basic functions in high-level, more user-friendly units. Unique artifacts, as

created by artists, are built on top of that layer. The construction of an object therefore is defined by how a specific setup differs from the mass-produced standard setup. (Suchodoletz, Rechert, 2013, “pyramid diagram”)

For example, an operating system like Windows XP is incredibly complex and cannot be fully described or understood, unless there is an organization powerful enough to manage that knowledge, such as the company Microsoft. Even with the stupendous amount of resources available, Microsoft has to discontinue support for older products, and obviously memory institutions won’t be able to step in and carry on developing Windows XP. However, this operating system can be collected as an object on its own and be held readily available to be performed at any time—using dedicated hardware, virtual machines, or emulators.[1] Such a *base environment* consists of a virtual disk image and abstracted instructions on how to make the system start up. Once this is established, any artifact that has the option of being performed with Windows XP can be described as a series of modification steps deliberately applied to that base environment’s disk, as a series of overlay disk images that only record the difference to the previous disk image. (Valizada, Rechert, et al., 2013)

It might make sense to manage steps in between the base environment and the combination with the unique artifact. (Ibid.) For instance, adding a legacy web browser that supports the discontinued CosmoPlayer plugin could be used to perform many different artworks which require that plugin, and remove the need to install and configure this component each time a work requiring CosmoPlayer would be encountered. Best preservation results are achieved in a balance of summarizing as many components as possible in a single artifact while keeping enough flexibility for changing the makeup of the object in the future by only switching out artifacts. The goal should be to just require documentation on how the artifacts are connected, but not the exact details on what they contain. From a previous example: the Windows XP default install does not need to be accompanied by information about all the tools and features it provides. Instead, its usefulness in the collection is expressed in relation to other items, by instances of the operating system providing an adequate base environment for artworks.

Handling Blurriness

To prevent artworks from breaking when remote resources are disappearing or changing, technical records of the interactions between local and remote systems can be captured during their operation and used as a substitute of the remote system’s performance. In this scenario, actual “full” performance and artifacts that behave like documentation are getting mixed and the boundary is tightened: any activities for which no data exchange

1
For a discussion on the differences between these modes of software execution, see Rosenthal, 2015.

has been previously captured will not be possible anymore.

In the case of *The Web Stalker*, the software was created to connect to arbitrary websites. Even though it is supposed that this artist-made browser largely disregards the content of websites and instead focuses on their structure, the technical landscape of the web has changed too much since 1997 for this process to work. Most of today's websites are served via the encrypted HTTPS protocol, which *The Web Stalker* cannot use. On top of this, instead of declaring their layout and structure in static HTML code that a browser can read and interpret, websites have become more like applications based on the programming language JavaScript, which the browser needs to actually execute. Of course *The Web Stalker* is not equipped to do this. The software needs access to legacy websites for its performance. When presenting the work in 2017, Rhizome knew about a handful of live websites that had not been updated for at least a decade and would produce the desired results with *The Web Stalker*. The web addresses of these sites were presented as a list to visitors of the work to input into the software. These unmaintained sites were at the risk of being either deleted or upgraded to formats and protocols inaccessible to *The Web Stalker*. To prevent the issue of having no data anymore to feed into the artwork, web archive captures of the remote sites were created using a crawler. A web archive capture is working on a website's surface level: it contains a record of requests a browser like *The Web Stalker* would send to the site, and the responses it would get in return and then interpret. Such a record of machine-to-machine interactions can be used as a mock for a remote system that has become unavailable: network requests are intercepted and matched with pre-recorded responses.

As a result, the object's performance has become more determined: The software will not be able to access an infinite number of websites anymore, but it will be restricted within a select set. Yet this reduced performance range will remain reproducible. The object still remains classified as blurry, because the software and the web archive are separate artifacts, and new web archives could be added in the future to increase the range of performance. The local software still contains all its performative potential, remote systems are abstracted. The object's overall performance is located on a scale in between full performance and documentation. (Espenschied, Rechert, 2018)

Orchestration

Once an object is meaningfully bound and divided into artifacts, the artifacts should remain stable and not be expected to change anymore. What can be expected to change is the orchestration framework required to then restage the artwork by recalling its performance and providing a bridge to the current technological and cultural environment.

For *Bodies© INCorporated*, two software environment artifacts are required: one holding a web server with the project's site, and a

second one for viewing it with Windows 98, a Netscape browser, and the CosmoPlayer plugin. When a visitor wants to access the artwork, these two environments will have to be launched and connected in a simulated network. The environment's simulated input and output devices, such as screen, keyboard, or pointing device, must be translated to the user's current devices. *The Web Stalker* requires a software environment that is operated by users to be launched, too, but instead of a second environment acting as a server needs a replay mechanism for web archives in the simulated network.

At Rhizome, these processes are managed using Emulation as a Service (EaaS), a software preservation framework developed as an open source project at the University of Freiburg, Germany. The same framework can be used on cloud computing infrastructure for online exhibitions, computers in gallery space (Figure 5), and on regular workstations or laptops.

Matching a Mission

The presented approach to the preservation of digital art, when thoroughly applied, might appear to challenge some assumptions about how digital art is made, what its role is, and how it should be preserved. Is focusing so much on compartmentalization and the "environment," which is composed of pretty mundane and boring stuff such as Microsoft Windows, default fonts, and system error messages, happening at the expense of deep understanding of the artwork? And why should digital art be preserved in an "artefactual" state anyway, when the rich tradition of New Media proves that artworks can exist in much more fluent ways?

Of course, no preservation method is ideologically neutral. Many are actually designed to resemble previously existing preservation practices used for painting or time-based media, many are adopting certain artistic positions from conceptual art or performing arts, they might have been established in a time with lots of economic resources available or during austere times, optimized for sales on the art market or for free distribution.

Overall, the preserving institution's position on the future role and value of the digital art it aims to preserve is the biggest defining factor on how objects are conceptualized. As laid out in the early paragraphs of this article, computers always require fictional, staged elements to make sense to their users. This also applies to matters of digital preservation. The computer is a fertile ground for concepts that can be performed: It can perform bitstream preservation akin to a classic museum vault, it can perform migration in the style of time-based media, or ephemerality like in performance art, or source code for people who are into conceptual art, or vernacular distribution for those who are intrigued by folk art—and for each of these ideas provide metrics that can be tweaked, until the preservation appears successful.

This is why it is important for an institution to formulate its view on artwork longevity,

its understanding of the media it deals with, and the abstractions it is using to take care of its collection. There are no right or wrong approaches, only ones that demonstrably align with an institution's mission, capabilities, and resources, and ones that don't.

With the ArtBase, Rhizome holds a collection of digital art and net art multiple times larger in number than that of some of the world's leading museums, and needs to maintain it with a fraction of the resources available to larger institutions. The clear breakdown of objects into artifacts and the framework for reenacting them allows to solve typical preservation issues for many artworks at once: instead of fixing individual pieces after for instance most of the audience starts using a new version of the Chrome browser, fixes are applied on the framework level.

The sometimes highly collaborative practice of net art also has produced constellations in which parts of an artwork are distributed across different institutions or commercial platforms, or remain stewarded by the artists. Rhizome then provides only a part in the preservation infrastructure puzzle, for instance a software environment with a specific legacy browser. The presented approach makes this possible. (Rhizome, 2019)

All of this covers mostly technical aspects. As the emulation framework translates a legacy technological context to a contemporary one, artistic curation is required to translate an artwork to a contemporary cultural context.

Preservation alone does not explain why an artwork is relevant today, or why it was considered relevant in the past. But exhibiting work in legacy software environments automatically brings with it numerous contemporaneous ideas about digital culture, offering an opportunity to discuss the historic role of older pieces, helping illustrate paths of cultural development that were abandoned later or perhaps have unexpectedly become industrialized. What is more, providing access to an artwork in an emulator does not prevent a new version of the piece being made that fully exploits the latest 4k screens, VR equipment, Google Maps API, or whatever else. It will merely enable us to compare the work in question with its previous variants.

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SHOULD VIDEO GAMES BE PRESERVED IN ART MUSEUMS?

Murat Durusoy

The emergent idea of video games as art possesses several similarities with “Digital Art” per se. Originated in the 20th century and gained popularity in the ’90s, today, Video Games have become an industry worth 120 billion dollars. With 2 billion gamers around the world, gaming has become a cultural phenomenon. What will it take for video games to be considered as “worthy” for museums? What affirmed art forms have similarities with video games? Should any billion- dollar industry products be creditable for preservation? What are the similarities that video games share with digital art, music, and cinema? Or should there be any? Are we asking the essential questions? In this essay, I will be inquiring about the possibility of museums to preserve games and the induction of games as part of our cultural heritage.

Museums and Games - Foundations

Encyclopedia Britannica defines a museum as:

> “An institution dedicated to preserving and interpreting the primary tangible evidence of humankind and the environment. In its preservation of this primary evidence, the museum differs markedly from the library, with which it has often been compared, for the items housed in a museum are mainly unique and constitute the raw material of study and research. In many cases, they are removed in time, place, and circumstance from their original context, and they communicate directly to the viewer in a way not possible through other media. Museums have been founded for a variety of purposes: to serve as recreational facilities, scholarly venues, or educational resources; to contribute to the quality of life of the areas where they are situated; to attract tourism to a region; to promote civic pride or nationalistic endeavor, or even to transmit overtly ideological concepts. Given such a variety of purposes, museums reveal remarkable diversity in form, content, and even function. Yet, despite such diversity, they are bound by a common goal: the preservation and interpretation of some material aspects of society’s cultural consciousness.”[1]

What distinguishes games from other sorts of activities is described by Celia Pearce in the journal Visible Language as below:

1
Emphases by the author.

"-***Parameterized play*** consisting of rules by which a group of players agrees to abide for the duration of the game.

-***A goal*** is sometimes expressed as a series of sub-goals that collectively lead to a meta-goal.

-***Obstacles*** that create challenges for achieving the goals.

-***Resources*** initially provided to players at random or symmetrically, but later more often as rewards for overcoming obstacles.

-***Consequences***, which come in the form of either rewards or penalties.

-***Information:*** both known and unknown to the players; progressive information that is revealed over time; and randomly generated information, such as a dice throw or a dial spin." (Pearce, 2006)

Clashes with the Art World

What is remarkable about the concept of a game is how performative it is. A game is not a game unless someone plays it. In short, to achieve the game's goal, you limit yourself by the rules and use the resources at your disposal to overcome the obstacles thrown in your way, and by doing so, you face the consequences of your actions which may put more obstacles between you and the goal. This systematic nature of games generates associations with recently acknowledged art forms, most distinctly digital/interactive art that we see more and more in museums and galleries.

Video/computer games have more in common with musical scores than art and digital art. Nevertheless, with digital art, games share a common "language", the "language of the software" or briefly, computer code. Yet digital art pieces do not necessarily need active participation in their way of working or their processes. Video games, like musical scores, need to be played or performed. A musical score can be appreciated at rest, but its true power manifests itself when it is activated by players into a unique event. (Pearce, 2006)

I am not saying that all the games should be tried to be preserved and considered as art, that would be unreasonable, but not all paintings or sculptures are art per se. Computer games come in all different types and styles, including mobile games, console games, multiplayer games, MMORPGs, strategy games, single player shoot'em ups, sandbox games… etc. But, the main reason why computer games are overlooked as art is not how diverse they are and they can be analyzed in two intertwined parts. First is the issue of authorship, which may scare the run of the mill art critic. The second is the perception of computer games as "low culture".

Even though there are game directors that people follow, the most obvious example would be Hideo Kojima, where the effective product is the performance. In a newspaper article entitled "Sorry MOMA, but games are not art" journalist Jonathan Jones claimed that games could never qualify as an artistic expression: "The player cannot claim to impose a personal vision of life on the game, while the creator of the game has ceded that responsibility. No one 'owns' the game, so there is no artist, and therefore no work of art". (Jones, 2012).

"It is a comment that returns us to that first Impressionist exhibition," says Stuart Keith, "where the critic Louis Leroy cruelly lampooned

the works on display as uncultured blobs of paint on dirty canvases.” The point Jones misses is that people who know games, namely, “game connoisseurs”, can differentiate between a Hideo Kojima game (Metal Gear Solid) and a Shigeru Miyamato game (Super Mario). This is where the cultural standpoint kicks in. Generally, people regard video games as a whole entity; they tend to place games into one category. Not all games are for everyone. I might never get the thrills of a “Battle Royale” game like Fortnite, yet according to analytics firm SuperData, the 2018 revenue of Fortnite reached $2.4 billion - the highest annual revenue figure in gaming history by its reckoning. But a game like Journey may carry me through an intellectual and emotional path, and at the same time, move me all the while expressing complex ideas. For example, I cannot stand Salvador Dali's artworks, whereas Rembrandt paintings are much more to my taste.

Games, Art and Museums

“The history of the game as art begins with Marcel Duchamp” (Thomas, 1988) As an avid chess player, we can examine the dynamic aspects of his earlier works, such as *Nude Descending a Staircase No.2* of 1912 as movements in a chess game. More importantly, the attitudes displayed by the works of Duchamp and the Dadaists enabled other artists to create artworks that play with the spectator intellectually.

> “The anti-artist presents his or her work as a 'move', cast not as an artistic statement but as a question: "Is this art?" The viewer then makes a move either by accepting the object as art or by setting forth his or her opinion on the extent to which it is art. Such a situation lends itself to a two-party discourse on the nature of art, reminiscent of two players interacting in a game format. “ (Thomas, 1988)

Talking about art, games, and museums takes us to a place where the terminology becomes complicated, as we may be talking about games in general, video games, art games, or game art. Even though we are talking about video game preservation in museums in this essay, it may be good practice to take insights from other forms of games and interactive art that are being showcased in museums and attempt to come up with feasible strategies for video games within the context of museums.

When we look at exhibitions and artworks from the 1950s and onwards, we can see a clearer trend in the rise of interactive artworks and computer-aided installations. From Öyvind Fahlström’s ever-changing variable paintings to exhibitions like *Cybernetic Serendipity*, interactivity and other elements relating to games began to be engraved into works of art. The fundamentals of games and the medium of games began to be “remediated” (Bolter & Grusin, 2003) to other mediums of art. For instance, Fluxus artists’ “mail art” is a game in itself. This remediation’s first step starts with the exhibition of, or therefore the rejection of exhibiting Duchamp’s *Fountain*. As a chess player himself, Duchamp made a bold move that no one expected to be played against the art world in 1917. He made a groundbreaking achievement that shaped art moving forward. The rules of the game have changed; this work opened up a whole new chapter in the history of art.

Art museums are institutions by their very nature. Therefore, anything goes into institutionalized museums, which may or may not be a bad thing in itself. Nevertheless, an institution is a “dispositif”, an “apparatus”. Looking through the lens of the notion of “dispositif” will render our vision clearer regarding the inclusion of video games as an art form to museums, or the art world,

whether it may be necessary or not. Even though the term ‘being’ was coined by Michel Foucault, he never made a complete definition of the term. Agamben points out in "What is an Apparatus?" that Foucault came close to define “dispositif” in one of his interviews as “the network that can be established between laws, architectural forms, scientific statements, philosophical, moral and philanthropic propositions.” By assigning “apparatus” a dominant strategic function, Agamben points out that an apparatus is about a certain manipulation of relations of forces, “either to develop them in a particular direction or to block them.”

> “The apparatus is thus always inscribed into a play of power, but it is also always linked to certain limits of knowledge that arise from it and, to an equal degree, condition it.
> The apparatus is precisely this: a set of strategies of the relations of forces supporting, and supported by, certain types of knowledge.” (Agamben, 2009)

If we look at the institution “Museum” as an apparatus, once we swap the word “apparatus” with “Museum” we can understand more clearly that the museum itself is the network that is established between discourses, architectural forms, laws, administrative measures, etc. Therefore, the museum has a dominant strategic function. The museum is precise; it is a set of strategies of relations of forces supporting, and supported by, certain types of knowledge with a certain type of admission criteria.

In order to be able to grasp and exhibit the essence of this “New Media”, museums are altering their approach to the medium. The conventional norms of media studies are not sufficient when considering new media works, because in “New Media”, audiences become interactive users, interpretation becomes an experience, representation becomes simulation, the consumer becomes a participant and, maybe the most important of all, “work” becomes “play”.

Games in Museums

Exhibiting New Media is not new for art museums. From early themed exhibitions like Cybernetic Serendipity in 1968 until today, new media art has been around for some time. Video games, in particular, are conserved mostly in thematic physical museums, such as the Computerspielmuseum in Berlin. Another common conservation ground is the players' rooms, consoles, computers, or web pages. These are mostly for archival purposes without any curatorial approaches. The ones that were curated in one way or another, whether we call them “art games” or “games as art”, or “interactive installations, managed to be exhibited in museums. These archives of video games act as “standing-resources that need to be activated or opened up via narrative curatorial approaches. This situation can be regarded as a threefold cycle. First, a rejection of the artifact as art (an obvious example might be Impressionism and their rejection from the Salon), then acquiring the “artifact” through the walls of the museum, like in a cabinet of curiosities and creating a feeling of otherness. And when the feeling of otherness passes, finally creating and curating a narrative experience from these artifacts in an exhibition.

If we take this threefold cycle as a blueprint for exhibiting and preserving artworks in museums the question of whether video games should be preserved in art museums becomes irrelevant. Hence, the relevant question becomes: “When and how will video games be preserved in art museums?”. To answer this question, one must try to understand and analyze

the ways in which the preservation process is handled with new media artworks in museums.

With the emergence and the propagation of digital art, issues surrounding it, such as the preservation of digital art, along with other ethical, economic, and institutional issues began to be discussed. Pip Laurenson summarizes the issues from the perspective of the museums and suggests five questions to be asked when thinking about the conservation of software-based arts.

> "1. Significant properties – Are there significant properties for software-based works which are distinct from those associated with time-based media works of art more generally?
>
> 2. Artistic medium – Is there anything different in understanding the relationship between the medium and the work of art for software-based artworks?
>
> 3. Parameters of change – Is there anything unique to software-based artworks which challenges the way in which we understand the parameters of acceptable change for more traditional time-based works of art?
>
> 4. Risk – Is there anything specific about the way in which risks are identified and mitigated for software-based artworks?
>
> 5. Expertise – What are the relevant notions, locations, and scope of the expertise needed to support software-based artworks?" (Laurenson, 2016)

These questions generally revolve around the sustainability of the artworks over time. Unlike the decisions to be made while preserving conventional artworks, both artistic and economic choices increase in number when it comes to software-based artworks. Museums cannot preserve software-based artworks and videogames by themselves. To be able to preserve such artworks, a participatory effort is required from both museums and the artists. Artists and developers should be able to transfer and transmit the knowledge of requirements and instructions of their artwork, on the other hand, museums should be able to cover the hardware costs and provide essential storage for the longevity of the artworks. In this age of consumer products, technologies, and materials will become obsolete, no matter how careful we may be; this is simply unavoidable for museums and institutions. "That such products become part of artworks means conservators are fighting a battle that cannot be won by opposition to change and strict notions of authenticity, but rather finds success through elegantly coping with and managing acceptable degrees of change."(Paul, 2016) To be able to overcome this obstacle, a dialogue between the artist and the museums should exist for a deeper understanding of the intricacies of the medium in the long run.

Conclusion

> "As more and more people from a broader spectrum of the population make games, the boundaries of what constitutes gameness shifts. And as the boundaries of what constitutes art have grown increasingly broad, the overlap of these two cultural domains was destined to happen with increasing frequency and volume." (Sharp, 2015)

The research question for this essay, regarding whether video games should be preserved in art museums, is an easy question to answer for the ones who are aware of the general tendencies regarding both digital artworks and video games. This essay aimed to set the ground for further and much harder questions than the one posed, regarding how we are going to preserve video games, in what format, along with what might be suitable strategies

towards decaying hardware, obsolete programming languages, threatened decay in storage media. These difficult questions are posed to be answered and they require further research.

What does not require further research is the ability of video games to gain a place in the art world and the potential of some to be regarded as artworks. The history of computer games began in small computer laboratories which, generally, were occupied by a certain social class, namely, white and male computer science students. Anthropy points out that "In the 1960s and 70s, universities like MIT and Southern Illinois University contained computers and computer networks that were available for student use. Most of these games existed on the school network and were played and contributed to by only those people on the network" (Anthropy, 2012). With the dissemination of the tools, knowledge, and wide-spread accessibility of the technology, nearly anyone with a basic understanding of computer code, might develop video games. This enables the medium's growth and improvement of its vocabulary for new manners of artistic expression and experimentation. As more and more people begin to make games, more intersections with the art world will occur, and the cultural impact of video games by their own right will be a factor that museums will not be able to disregard for preservation purposes.

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SURROGATES AND SAMPLES: PRESERVING VIRTUAL ENVIRONMENTS

Selim Balcısoy

Ivan E. Sutherland, who is considered to be one of the founders of Virtual Reality, begins his groundbreaking paper with the following statements:

> "We live in a physical world whose properties we have come to know well through long familiarity. We sense an involvement with this physical world which gives us the ability to predict its properties well. For example, we can predict where objects will fall, how well-known shapes look from other angles, and how much force is required to push objects against friction.
>
> We lack corresponding familiarity with the forces on charged particles, forces in non-uniform fields, the effects of non-projective geometric transformations, and high-inertia, low friction motion. A display connected to a digital computer gives us a chance to gain familiarity with concepts not realizable in the physical world. It is a looking glass into a mathematical wonderland." (Sutherland, 1965)

From the early days of computing, Human-Machine Interaction is improving with the advance of input/output devices and novel interaction techniques. These improvements in interaction techniques lead users to accomplish more tasks with computers in their business and daily life. The ultimate goals are to:

- augment our daily life with ubiquitous and wearable computer systems for navigation, communication and entertainment.

- use 3D interactive systems to assist users in performing complex tasks in work environments for medical, maintenance, and training purposes.

Some aspects of such a future are becoming reality with the emergence of different key technologies and advancements in science: Mobile Computing, Global Positioning System, Computer Graphics, Virtual Reality and Computer Vision. Similarly, art and design are utilizing these new technologies

for news ways of expression. As is the case with every technological new tool, there is a danger of extensive use without substantial content and theory leading to kitsch and gimmickry.

The term Virtual Environment spans audio, video, tactile and olfactory interactive computer generated content. Creating virtual environments is a complex task; it requires robust, flexible and real-time software architecture. It should support multiple software libraries to animate and render virtual objects and perform the virtual environment simulation. Once we have such a system, we can begin to add some real elements into it, using dynamic video panels with diverse geometric and material properties.

In this essay, we are exploring how to preserve artworks that are created in virtual environments. In order to do so we have to consider the virtual environment technologies and interaction techniques separately. We are proposing novel ways for both in the following sections and focusing on how virtual humans can become a mediator between real and virtual environments from a preservation perspective.

Preserving Virtual Environment Technologies

Mobile terminals and workstations with multitouch or 2D Graphical User Interfaces (Windows, Icons, Pointer, Menus) allow ordinary people to interact successfully with business, communication and entertainment software applications to perform daily tasks, such as business tasks (filing, spreadsheet), communication (e-mail, web surfing), or entertainment (game playing).

Current workstations equipped with off the shelf 3D graphics software allow users to create 3D objects or full environments with mouse, keyboard, pen or dials, and experience these environments through a monitor. Such interfaces have their limitations on the 3D interaction domain, as 2D interfaces are not suitable to visualize and manipulate 3D objects.

Research on 3D interaction techniques lead to new input and output devices such as magnetic trackers, sensor gloves and Head Mounted Displays (HMD). With the emergence of Virtual Reality (VR), users get immersed into Virtual Environments (VE) using these interfaces. However, they are not up to a perfect 3D immersion and have several serious limitations to be accepted as common interfaces to work with. Therefore, most of the VR applications are still in research and development level. Only few applications are used to perform limited and restricted real-world tasks. On the other side artists have started to use the existing VR tools to full extent and promising works started appearing.

In general, every virtual environment system contains three important elements: input devices, simulation, and output devices.

Input Devices

Input devices in VR allow a user to interact with the 3D synthetic environment. Therefore, they are focused on user movements. Input devices span from a basic 2D mouse, which can be used to navigate in a VE with additional menus to guide an avatar, to a full body motion capture system based on magnetic trackers, which will let a user perform natural and unique gestures.

For mixed environments, there are two important types of input devices, one for user input similar to VRs, and another one to register and track

elements of the real environment. The second task requires a more complex sensor system, often based on computer vision techniques.

One other important issue is mobility, in VEs users may walk or fly by a joystick long distances without physically moving themselves, however, in a mixed environment the user is part of a real environment also, therefore their mobility is limited to the available real environment. Most of the time, input devices have limited operational range, due to their cumbersome cables and weight. Therefore, a successful mixed environment system has to provide non-invasive registration and tracking techniques, which will ensure natural and free movement of a user in the mixed environment.

Simulation

A simulation system registers commands or position changes from input devices, and updates the state of the simulation by triggering responses to changes. It also handles low level libraries for 3D animation and rendering. Some VR systems do contain autonomous elements like autonomous virtual humans or autonomous cameras, controlled by external Artificial Intelligence or Expert systems. The simulation system handles information flow from and to those systems also.

Latency and related synchronization issues are very important to ensure the perfect illusion of merged real and synthetic environments. A successful simulation system provides synchronization mechanisms to encounter such problems.

Output Devices

Output devices, monitor, Head Mounted Display (HMD) system or haptic display, render the virtual environment mostly from the user's point of view. An AR system has similar major elements (input, simulation and output), however, there are some very important differences in how an AR system is developed compared to a VR system.

Output systems are considered different from a VR setup, as the merge of real and virtual elements into a mixed environment are performed by or through the output system.

- Optical see-through HMD systems.
- Video see-through HMD system.
- Monitor based systems.

The main difference between VR and AR is where the user perceives themselves. In VR, the real world is replaced by the simulation and the user perceives themselves in a completely synthetic environment. AR adds virtual objects on top of a real scene, therefore the user perceives themselves in a modified real environment. In order to create a correct illusion of such a mixed environment, real and virtual worlds should merge together perfectly.

The Issue of Preservation of Virtual Environment Technologies

Preserving virtual environment technologies can lead to an impossible challenge, as the hardware and software platforms where artists and designers are developing their output will be receiving no maintenance from the companies in a few years.

One strategy to preserve hardware components is procurement of monitors, HMD, computers etc. in large quantities, where the artwork can function as intended by the artist. Similarly, for the software platforms preservation strategies focus on getting hold of the simulation software code and recompile

it for contemporary hardware platforms. Both cases are unable to provide a long-term perspective on how artworks can be preserved over hundreds of years with many practical limitations.

If we are only looking into hardware and software preservation, a solution would be to create a duplicate of an existing artwork with high fidelity sampling. Similar to audio or visual performances, one can sample inputs and outputs of a complex system and recreate the visual or audio output trustworthy. A carefully designed sampling strategy would require novel ways to capture workings of an artwork. Moreover, there is technical work to be designed and developed on how the captured data is stored and how the reconstructed artwork is going to be presented in its new format. This strategy has a major limitation in that it does not take into consideration how participants are interacting with the system but focusing only on technological aspects.

Preserving Virtual Environment Interaction Techniques

Interaction is defined as mutual or reciprocal action or influence. In the real world, everything and everybody interacts with each other. The most simple form of interaction is the physical one, where objects follow Newtonian mechanics rules of collision and support. The physical interaction changes the physical properties of an object, but does not cover semantic interactions. When we are considering technological artworks from the technological perspective, an all-around approach should consider the interactions in a mixed environment, as the artworks can span over different immersivity levels.

Several methods have been developed for developing interactions inside a homogenous Virtual Environment (VE), and between an application and its user. However, in mixed environments real objects and participants are not controlling an application through a Graphical User Interface, they become part of the environment. This important augmentation of VE simulation requires new interaction techniques inside the simulation.

Interaction in virtual environments is a well-covered topic. In general, a user is controlling his avatar and/or the simulation over a graphical user interface with a pointing device. In some cases, an avatar is controlled by a motion capture system also. By navigating in the environment and selecting/modifying some objects, users interact with the environment and its elements. Users are represented as rigid 3D objects or articulated virtual humans, or they operate without any representation at all.

Interactions with computer generated environments is a wide research topic, as whenever a computer is used, there is an interaction, even if the environment is limited to a 2D Graphical User Interface. With the emergence of affordable 3D computing, users want to experiment with Virtual Environments, and as an ultimate goal perform real work, or assistance in daily life.

Conventional 2D interaction techniques like WIMP (Windows, Icons, Menus, Pointer) are not up to delivering natural interactions in a 3D environment. Therefore, Virtual Environments are still not widely used in real work or daily life.

Several methods have been developed for interactions inside a homogenous Virtual Environment, and between an application and

its user. Several research groups (Mine 1997), (Wexelblat 1995), (Szalavari 1998) worked on novel interaction techniques and tools for virtual environments:

- Adaptation of 2D techniques in 3D,
- Usage of new input devices and trackers,
- Direct manipulation,
- Physical mnemonics,
- Gestural actions.

These techniques have some limitations:

- No reference to actual working habits in a real environment,
- Lack of haptic input and feedback,
- Cumbersome input devices.

As reported by Balcısoy et al., mixed environments allow users to interact with 3D environments in a natural way and employing virtual humans as mediators between real and virtual worlds will overcome some limitations of virtual environments. (Balcısoy, 2000)

There is a clear need for a natural way of interacting with and designing a virtual environment. A mixed environment will allow users to be in a real environment and perceive the world as it is. Studies have shown that using some type of real environment (objects, room) helps them to accomplish real work tasks.

In mixed environments, users are part of the environment, in other words, they are their own avatars.

We grouped mixed environments under two types:

- Real elements are visualized in a virtual environment as windows of reality and can have avatars like navigation and object interaction capabilities.

- Virtual elements are blended into a real filmed scene in an augmented reality context.

The main result of that work is that usage of mixed environments employing virtual humans as mediators between real and virtual worlds will result in creation of interaction techniques assisting some real work or novel entertainment content.

Interactive technological artworks do have humans as participants or as observers in the human computer interaction loop. This implies that any system which has to duplicate any existing virtual environment should mimic the real world with acceptable accuracy.

In this essay, we are proposing three interaction techniques where we use virtual humans as mediators between the real and virtual world. These interaction techniques are first introduced by Torre and Balcısoy (2000) and incorporated into different virtual and mixed environments since then.

- Direct manipulation of objects to interact in a mixed environment.
- Virtual Humans as mediators in mixed environments.
- Employing a virtual human as an avatar to interact in a mixed environment.

Direct manipulation of objects to interact in a mixed environment

A Virtual Set changes in a real scene trigger actions in a mixed environment. These changes are caused through direct manipulations of objects in the mixed scene by participants. Human participants can operate on real objects, which are tracked by a vision sensor. Better the scope of the sensor more interactions can be planned. Moreover even if a change is recognized we need a set of rules to understand the change. Here we can identify two important problems of understanding of a real scene:

- Registration of a change in the real scene: Changes in a real scene such as transformations of objects, changes of color, geometry or topology should be registered by capable sensors and fed to the mixed environment simulation.

- Mapping this change into the mixed environment: Correctly registered changes, will be mapped in the environment as animations of existing objects.

Virtual Humans as mediators in mixed environments

Given a defined environment and a set of rules we can plan interactions in a mixed environment, where we track specific changes in the scene. A virtual human in a mixed environment will enrich the experience and, make it more realistic in several ways:

. *Perception of time:* Every movement we make takes time, and we are accustomed to experience such “delays” in real life.

. *Perception of 3D space:* When we let virtual objects to fly around in a mixed environment it is difficult to estimate their correct 3D position in space. In a similar setup to our mixed reality setup, virtual pieces would change their places by themselves, by employing a virtual human, we can track her movements and have a longer time to follow which piece is played from where to where.

. *Perception of opponent:* A virtual human can be programmed or guided to speak and perform facial and body animation according to a situation. With adequate natural language understanding capabilities and AI modules a virtual human can mimic a real opponent or team member in several scenarios.

Employing a virtual human as an avatar to interact in a mixed environment

Performing precise operations in a virtual environment is a difficult task. The input devices are not accurate enough, there is a lack of haptic feedback and direct modification requires complex interaction techniques. We propose employing semi-autonomous virtual humans performing precise operations on combined objects (objects made of real and virtual parts) in a mixed environment.

Employing a virtual human has the following advantages:

- *Precise Positioning:* VE's do not necessarily relate to the real world. It can be difficult to estimate actual size and distance. All the transformations in a VE must follow consistent rules to deliver a consistent 3D experience for the user.

- *High Visual Realism:* Employing virtual humans will lead to a population of the mixed environment with realistic human-like embodiments, thus increasing believability and visual realism.

In conclusion, the development of an interactive virtual environment to experiment with the perception and consciousness is a challenging task. Firstly, there is a need for a flexible software platform, VR engine, to connect and integrate different media, behaviors and hardware. Secondly there is a pressing issue of limited development time and resources.

We have identified two key features required to enable designers to build experimental VE's to preserve technological artworks:

The first feature is that recognition is key to using the human body as an interface by itself. Recent advancements in machine learning allows near to perfect human action recognition using off the shelf cameras. Based on this recognition data it is possible to record how participants are interacting with and within a virtual environment.

The second feature is spatio-temporal perception enhancement. As computing systems get more powerful, there is virtually no delay for even very demanding computations, therefore users may lose the feeling of time in other words a realistic delay. Similarly, it can be difficult to estimate actual size and distance in virtual environments as reported by several researchers previously, as all the transformations in a VE must follow consistent rules to deliver a consistent 3D experience for the user. One way to solve the perception issue is to mimic nature's time and space relations. However, as the data we are planning to represent and interact is difficult to relate to any natural phenomenon, we think that it would be better to develop tools to enable researchers and designers to define spatio-temporal rules of the VE freely.

Finally we would like to list few key concepts to be considered for carefully preservation of virtual environment artworks:

- Hardware to software programming/Software to software programming

- Recombinant system/smart/intelligent

- Remembrance recognition system

- Information/video tracking/manipulation system

- Movement and gestural material generation of a human/cyberhuman system

- System recognition/system analysis

- A set of commands as a virtual gesture/a set of commands as navigable sound.

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A STEP FOR WEB-BASED DIGITAL ART PRESERVATION: UNDERSTANDING WEB ARCHIVING

Zeynep Pehlivan

The web plays a crucial role by providing information for all types of events, opinions, and developments within society. Presently, it constitutes a mirror of the population that uses it. However, the web has an ephemeral nature, e.g. new information replaces older information constantly without any notification, leaving a significant gap in our knowledge. That's why archiving the web has become a cultural necessity to preserve the knowledge for the next generations. Web archives which contain up to billions of pages versions obtained by crawling, represent thus a huge information source, inherently greater than the web itself. This makes web archiving an active and interdisciplinary research area since the early 1990s. A survey on web archiving initiatives (Gomes et al., 2011) showed that there are 42 initiatives spread across 26 countries (Figure 1).

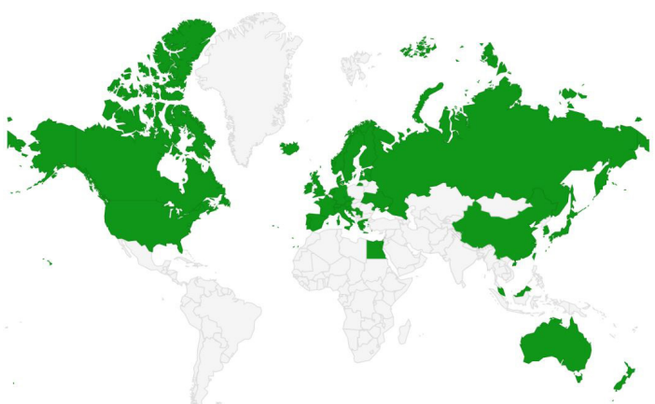

Figure 1:

Web archiving initiatives around the world

Internet Archive[1] is the pioneer web archive founded in 1996 as a non-profit company in San Francisco, USA, with the aim of maintaining a historical record of the World Wide Web. As of 2018, the Internet Archive was home to 40 petabytes of data, where web archives make up about 63% of that. At the same time, in 1996, in Europe, Kulturarw3[2] was initiated by the Royal Library of Sweden. Nordic Web Archive was started as an independent forum by national libraries of Denmark, Finland, Iceland, Norway and Sweden, founded in 1997. Sharing research works in the area of collecting, preserving and accessing web archives was its aim. In 1995, the National Library of Australia (NLA) started to collect and preserve Australian publications, regardless of the format. The aim of Preserving and Accessing Network Documentary of Australia (PANDORA (Koerbin, 2004))[3] is to select and preserve Australian online publications and websites that they consider as significant and valuable for long-term preservation.

1
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2
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3
http://pandora.nla.gov.au/ accessed 23th September 2020

Increasing number of national web archives, diversity of existing works ended up by the establishment of the International Internet Preservation Consortium (IIPC)[4] in Paris in 2003 with 12 participating institutions. The aim is to develop common standards, tools and techniques for web archiving. One of the characteristics of IIPC is to develop open source applications like Heritrix crawler.

By almost arriving at the silver jubilee of web archiving, there are still numerous open issues such as crawler optimization, storage models, etc. An overview of main issues is presented in different works (Brugger & Milligan, 2019), (Hockx-Yu, 2011), (Masanès, 2006). The aim of this article is to present each of these steps and discuss the issues.

Understanding Web Archiving

In this section, we are going to present different steps of web archiving from content selection to long-term preservation. Figure 2 provides a high level overview of the key steps.

Figure 2:

Key steps in web archiving

Content Selection and Curation

Any kind of preservation effort begins with the question of "what content to preserve?" (Milligan et al., 2016). The question remains inescapable for digital preservation, especially for web archiving. Today, we know that it is impossible to maintain a complete archive of the web, or even a part of it, containing all the versions of the pages because of web sites' politeness constraints and limited allocated resources (bandwidth, space storage, etc.). Thus, content selection becomes an important step which shapes our knowledge of the past and can impose different technical choices for the next steps.

There are basically a few distinct approaches to web archiving: bulk archiving, domain archiving and thematic archiving (Masanès, 2006). An example of bulk archiving is the approach of the Internet Archive, trying to archive as much of the public web as possible. This approach provides a broad but shallow collection: websites are only crawled, in some cases, a few times a year, and only to a certain depth. Domain archiving consists of archiving identified domains, such as example.com, where the crawler fetches all the web content at that domain. For example, national libraries, like British National Library, French National Library (BnF), use top level domain archiving (e.g. .fr, .uk). Even this restriction is not enough to have a broad and deep web archive. Thus, most of web archiving initiatives creates also thematic (event-based or topic-based) archives focused on specific

4 https://netpreserve.org/ accessed 23th September 2020

topics as French literature, the United States National Elections, Paris attacks etc. The archivist must first identify the domains or websites, web pages, social media accounts, hashtags etc. for that topic area, and create a list called seed list. The seed lists are used as an output for the crawlers as explained in the next section.

Crawling

Crawling, also known as harvesting, refers to automating the process of collecting web pages by using software, also called robots or crawlers. Web crawlers are typically defined as “a system for the bulk downloading of web pages” (Olston & Najork, 2010). Crawler downloads all the web pages addressed by a given set of seed Uniform Resource Locators (URLs), extracts the hyperlinks contained in the pages, and iteratively downloads the web pages addressed by these hyperlinks. Heritrix[5], Apache Nutch[6], HTTrack[7] are a few examples of web crawlers. Several institutes (Bibliothèque Nationale de France, State Library of North Carolina etc.) use the Internet Archive’s Heritrix crawler (Liu & Fan, 2011) which is a fully configurable and free web crawler.

In order to maintain the archive up-to-date, crawlers must revisit periodically the pages and update the archive with fresh versions.

5
https://netpreserve.org/ accessed 23th September 2020

6
http://nutch.apache.org/ accessed 23th September 2020

7
http://www.httrack.com/ accessed 23th September 2020

However, the crawler can not revisit a site and download a new version of a page too frequently because it usually has limited resources (such as bandwidth, space storage, etc.) with respect to the huge amount of pages to archive. In fact, it is impossible to maintain a complete archive of the whole Web, or even a part of it. Thus, all web archives are incomplete (i.e they do not contain all possible versions of all the URLs). The concept of “too complete” is introduced in (Brugger, 2012). The author argues that the web archive is incomplete since something is probably missing, but it is too complete in the sense that more different versions may exist of the same source. Besides description of collection level incompleteness, we can also introduce the archived object level incompleteness. Today, web pages do not contain only the text but also images, videos, social media posts etc. To be able to access the archived page as a whole object, these sources should be also archived.

Social media, such as Twitter and Facebook, provide an important data source in social science research e.g. ((McCormick, 2017), (Mejova, 2015), (Sloan & Quan-Haase, 2017)). Their popularity and great potential as an historical data source for further research made them also an important source for web archiving initiatives. However, there is no existing standard to collect and preserve social media data, different methods are used by web archiving initiatives including traditional web crawlers, application programming interfaces (APIs) or purchasing from official data sellers. Different “open-source” applications and libraries

are developed to archive tweets by APIs like Twarc[8], Social Feed Manager (Littman et al., 2018)[9], TAGS[10], Digital Methods Initiatives[11], TSViz (Rios et al., 2017). All these approaches, mostly respond to one-shot requests and require that the researchers in social science or web archivists to be able to code. On the other hand, none of them, except (Littman et al., 2018), takes archiving issues into account like preservation. From an institutional archiving point of view, just getting raw data from API is not enough. Because a social media post, e.g tweet, can contain other objects like images, videos or URLs. To guarantee its authenticity, each of these objects should be archived and made accessible.

Storage

Storage refers to the process of retaining archived websites on a storage medium securely and reliably. The WARC (Web ARChive), a file format for the long term preservation of digital data, is the predominant format in web archiving and is an ISO standard (ISO, 2017). The principle is that all interactions between a browser (web client) and a website (a web server) are recorded in a WARC file.

8
https://github.com/DocNow/twarc Accessed 30th July 2019

9
https://gwu-libraries.github.io/sfm-ui/ Accessed 30th July 2019

10
https://tags.hawksey.info/ Accessed 30th July 2019

11
https://digitalmethodsinitiative/dmi-tcat Accessed 30th July 2019

One WARC file consists of multiple WARC records that in turn consist of a record header and a record content block that contains all kinds of formats such as HTML, audiovisual files,images. It also preserves data gathered from social media APIs based on HTTP transactions. It is important to note that the WARC is a protocol-oriented archiving format, each HTTP interaction being archived as request and response records embodying the entirety of the transaction, including transfer specific headers. Understanding and accessing these records requires, on top of the WARC format and content themselves, the understanding of the protocol specifics. That situation is pretty well controlled when it comes to typical web page archiving, the vast majority of resources being accessed by URL through an HTTP derivative. Typical shortcomings such as chunk-encoding removal are well known and accounted for in access tools.

At INA, the DAFF (Digital Archiving File Format) is developed and used (Drugeon 2005). The description of the format is well outside the scope of this article, but suffice to say it is not a transaction-oriented archiving format. In the DAFF each content is archived in a record, independently of the protocol serving it, and identified by its statistically unique SHA-256 digest. Metadata are normalized in a different record in a way that any protocol can lend itself to, including Ex nihilo contents from extractions or conversion.

Access Methods

The success of the web however is based largely on easy access to all kinds of resources. Thus, we can assume that the success of a web archive will be measured by the access tools the archive provides. As web archives contain timestamped versions of web pages crawled at different times, they open up

different opportunities for users. Thus, accessing web archives is more challenging than accessing the web.

The best known way of accessing web archives is the “Wayback Machine”[12]. It is a collaborative project between Internet Archive and Alexa Internet launched in the fall of 2001 and allows users to see captured versions of web pages over time. However, it requires the users to know beforehand which URL to search. For a given URL, the results are displayed in a timeline according to their crawled dates that the user can browse as seen in Figure 5. The other methods currently provided are well-known web access methods: full-text search and navigation within a requested time range.

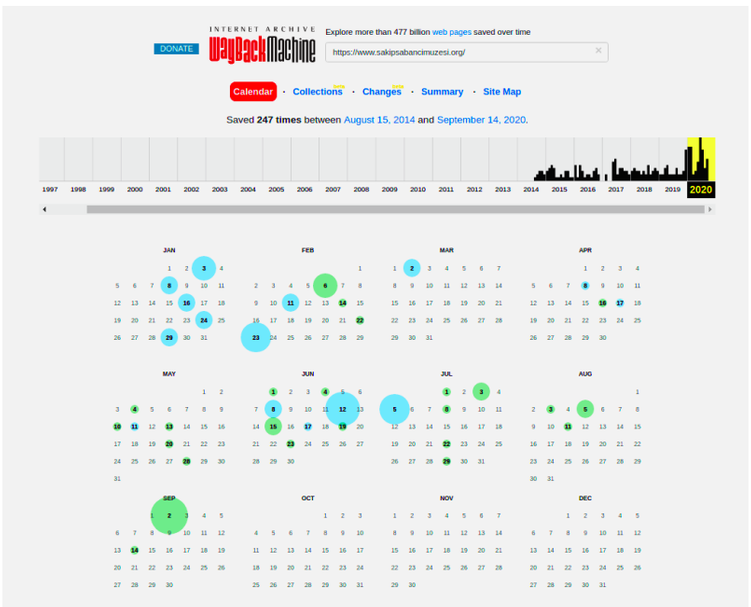
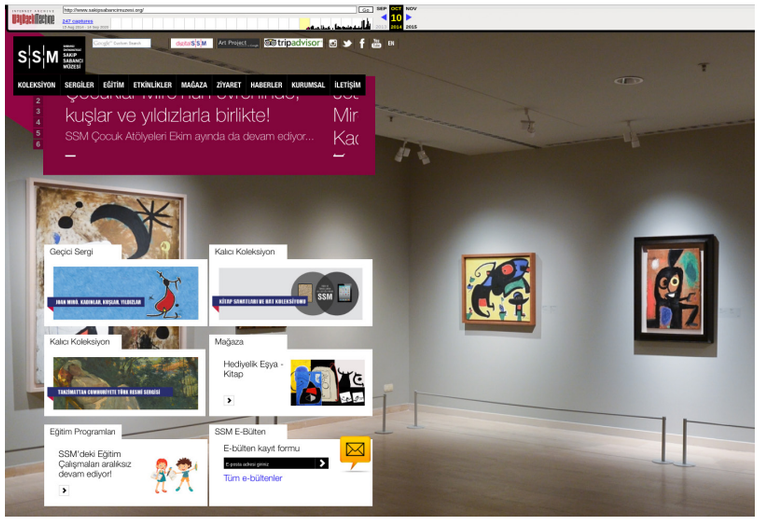


Figure 3:

Wayback Machine user interface (a). Search results (b). Archived page at 10th October 2014



Full-text search consists of using a keyword search on a search engine that returns the documents containing one or more keywords in the query ordered through a ranking function. Even this basic search method can not be applied directly to web archives, because, in the context of web archiving, the search process should handle time related constraints besides keywords one. Web search engines have been extremely successful in enabling users to easily formulate their search goals through an arbitrary list of words, and to quickly receive ranked lists of links to relevant web pages. Unlike in the web, an URL is not unique anymore in web archives. Different versions of the same page can be relevant for a query and this can lead to the first page of results containing redundant information. In web archives, not only the pages content is evolving over time but also the linking structure. As the pages are not crawled exactly at the same time on the real web, that leads the users to browse from one page to another where both pages have never appeared at the same time on the real web.

12
https://archive.org/web/ accessed 26th September 2020

Different projects and national libraries investigate more sophisticated visualization of archived data for a few years. UKWAC (British National Library Web Archives) has new features, such as showing results as a thumbnail of snapshots, like 3D Wall or n-gram visualization which visually enrich the users experiences. WebART (web archive retrieval tools) project[13] proposed new interfaces that display word frequency, co-word analysis. Recently, the Archives Unleashed Project[14] (Ruest et al., 2020) that aims to improve scholarly access to web archives proposes very promising tools as seen in Figure 6.

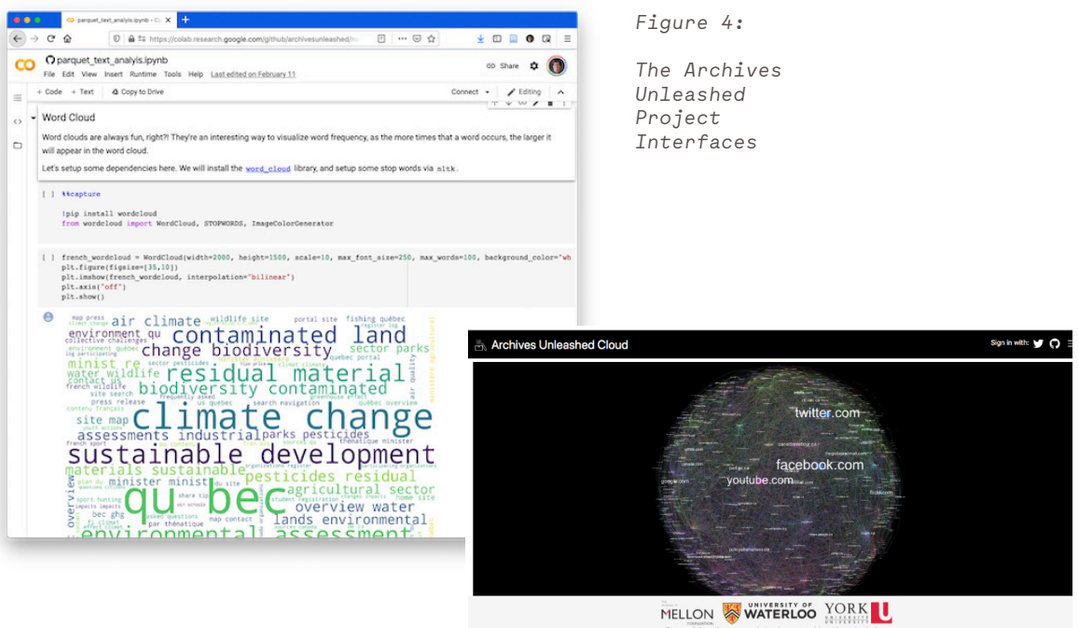


Figure 4:

The Archives Unleashed Project Interfaces

13
http://www.webarchiving.nl/

14
https://archivesunleashed.org accessed 26th September 2020

Preservation

It consists of the processes that ensure the continuous accessibility of web archives over time. Preservation systems should be designed by taking the threats like media, hardware and software failures, component obsolescence etc. into account. Once the archived content has been ingested into the system, it is also important to keep a trace of the actions that were taken to preserve the content in question in the preservation metadata.

Given the rapid changes in technology, the biggest challenge about long-term preservation of web archives is technological obsolescence in which software programs and other technologies can be superseded by a newer one and consequently old technologies and software become out of use. Two main strategies exist: migration and emulation. Migration consists of transferring data to the newer system formats so that the archived data can be accessed with the new technologies. Migration can lead to an important computational cost and brings the risk of losing some parts of the original data. On the other hand, emulation implements new software (emulator) to mimic the functionalities of the obsolete technology.

Another important point is to choose the relevant digital preservation and metadata standards e.g. OAIS (CCSDS, 2002), Dublin Core (DCMI Usage Board, 2006), PREMIS (McKinney, 2016), MODS and METS (Guenther & McCallum, 2003). OAIS is the first and widely used reference model on digital data preservation which became a standard in 2002. One of the key elements of this model is the fixity which guarantees that the digital object in the archive has not been modified since its deposit and it can be computationally

verified. As discussed in (Acker & Kreisberg, 2020), social media providing activity streams and allowing user engagements with multimedia and multitemporal content brings a challenge to the OAIS-based understanding of digital preservation.

Discussions

Most of the web archivists are aware that they can not archive all the web at once. This is why seed lists become really important and so many curators work to provide a complete seed list at archiving institutions. Different seed lists may lead to very different archives even if they want to archive the same thematic. On the other hand, the exact same two lists archived by using the different crawlers, even the same crawler with different settings, can create totally different archives. To better understand how the web archive collections are created, all the metadata related to different choices (depth of the crawl, revisit schedule, seed list etc.) should be also archived for future analyses.

Although the web crawling techniques are well studied as they are the core of search engines, they are not developed for archiving purposes and cause technical problems like temporal incoherence. It occurs when pages change their content during the crawl of an entire collection. This is a potential issue even for web sites of moderate size due to the dynamic structure of web. It changes continuously in an unpredictable and unorganized manner. For larger collections, e.g. domain level, it is more evident to observe incoherence as a full crawl can take days or weeks to complete. According to (Ayala, 2020) the lack of a proper definition of quality is indicative of a larger problem in the field of web archiving. The author argues that we have technological tools to build web archives but no conceptual tools to understand them.

Basic access methods for the web, like full-text search, are powerful enough for casual users, who search the web for general information and represent the largest proportion of web users. However, the web archive users profiles consist of historians, journalists, lawyers, students etc. more than casual users. Furthermore, the main reason for using web archives is research activity: web archive users need to analyze, compare and evaluate the information. In order to achieve this, web archive systems need to provide tools to execute more complex queries.

Legal deposit is a legal requirement that a person or group submit copies of their publications to a repository, usually to a national library. Most of the national libraries are protected by digital legal deposit law[16] which allows them to crawl and archive the web pages without the website owner’s permission. On the other hand, to preserve web-based digital artworks, archivists should work with the artists to collect information on artists’ intentions

15
Digital legal deposit is the extension of legal deposit law to cover electronic publications and internet content.

16
https://conifer.rhizome.org/

to make sure they understand what the work really is and how it is meant to be shown. As mentioned in (Grau et al., 2019), the classical web archiving approaches can document the interface design of an artwork's homepage and give access to it, but this does not always automatically archive the entire artwork, let alone its creative process and technology. It is also questioned the nature of digital art work as a preservation object in (Grau et al., 2019):

> "Many digital artworks are fundamentally about the viewer's experience and the metamorphosis of a site via viewer interaction. Since the object is the experience, how can a museum collect that experience, define it, preserve it? And even more importantly, does it even make sense to do this with a media that is so variable, or unstable?"

Therefore, for digital art, different projects have been developed, e.g. scientific-based (Archive of Digital Art, the Variable Media Questionnaire), collaborative (Artelectronicmedia.com), institutional (V2, Rhizome Artbase, Media Art Festival Archives) and commercial (Sedition, Niio). Rhizome is also proposing a conservation tool called Colloq, that helps artists preserve social media projects not only by archiving them, but by replicating the exact look and layout of the sites used, and the interactions with other users. Recently, Rhizome took over permanent stewardship of Webrecorder.io and proposed Conifer which is a web archiving service that creates an interactive copy of any web page that users browse, including content revealed by their interaction.

Conclusion

Web is changing different aspects of our lives: our way of communicating, sharing and gathering information and also our way of making art. Since a while, lots of institutions are trying to find appropriate approaches to preserve web-based data including artworks. Web archiving technologies have been studied for more than 25 years and as an open, easily usable and accessible method, they can be used to archive web-based digital artworks as an initial step.

The aim of this work was to provide an overall view to web archiving and its issues to better analyze the web-based digital artworks preservation. We presented the steps of web archiving selection, crawling, storage, access and preservation and discussed the technical challenges. The most challenging part is that in order to be preserved, the web-based art-works have to be altered in their mediality and cannot be persevered in the state-of-being and the artist originally developed them in (Grau et al., 2019). The accessibility and preservation of web-based digital artworks for future generations remain as an interesting research area with many open questions where the artists, the archivists and the software developers should collaborate to find solutions.

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MEDIA ARCHAEOLOGICAL RECONSTRUCTION OF MEDIA AND DIGITAL ARTWORKS: PRACTICAL CASE-STUDIES

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Morgane Stricot
Matthieu Vlaminck

Due to the obsolescence of software and hardware, digital and media artworks have relatively short lifespans compared to other artworks. With this type of artworks, reacting is not an option. As Bruce Sterling already pointed out in 2001: “When a piece of software decays, it does not degrade like a painting, slowly and nostalgically. When a software fails it crashes; it means the *Blue Screen of Death*”[1] (Sterling, 2001). The conservation of digital and media artworks knows only one rule: namely, proactivity. This is just basic computer forensics common sense: if there is too much time between two conservation efforts, the technological gap will be too big to compensate in to make the artwork operate again. The knowledge, the skills, the people and the machines will be long gone. The article titled *Act (and not react)*, published by Morgane Stricot in 2014, gives an overview of anticipation strategies which, in a nutshell, can be summarized as follows: “The answer to the question when *we should act* is simple: when everything is going well.” (Stricot, 2014). That is, when the artwork is performing properly in its initial hardware and software ecosystem.[2] It also means when the operating system or proprietary software is still supported by the companies that created it, when hardware pieces are still commercialized and the artist is available for questions. This is the most convenient time to anticipate future technological changes and ask the artist about

1
See the transcript of Bruce Sterling’s keynote address at «Preserving the Immaterial A conference on Variable Media» which took place at the Solomon R. Guggenheim Museum, New York, on March 30-31, 2001.

2
Ecosystem is defined here as the whole material, frameworks, tools and libraries on which a piece of hardware or software (often both) is built on. It defines the inter-dependencies that exist between all these components. Sometimes it only takes one of the components to disappear for an ecosystem to collapse.

the possibility of migrating the artwork to other formats. This initial version provides us with an essential reference point before considering any conservation strategy. Its thorough documentation, its storage in proper condition, the backup of any software components and the purchase of spare parts are paramount in order to preserve the artwork in its initial state. Regular inspections and technological watch are necessary to monitor the condition of the artwork and carry out updating or encapsulating treatment as soon as a software or hardware component is about to become obsolete. To maintain the behavior and aesthetics of the artwork as closely as possible to the initial version, the technological jumps have to be as small as possible. The loss of the initial version resulting in a long period of inaction renders any conservation effort risky. Indeed, this inaction increases the risk of technological discontinuities: the incompatibilities between the two technological ecosystems drive the conservation professionals to imitate the behavior of the artwork with contemporary technologies rather than migrating it.

And yet, digital and media artworks have begun to disappear, along with their precious archives and related knowledge. This paper does not concern whether we acted soon enough or not, or whether these types of artworks received enough attention from their contemporaries—it is not about what we should have done. What is done is done, or rather not done in this case. Let us focus instead on what we can do now, which is to retroactively anticipate. In this paper, we describe our experiences in duplicating and reconstructing computer-based and analogue video artworks. Firstly, we demonstrate how we apply the duplication as a retroactive preventive conservation strategy to prevent early acquired artworks from disappearing. Then, encouraged by the results of this strategy and inspired by an artistic research-driven approach, we delve into the matter in which we lead experiments in media archaeological reconstruction for disappeared artworks. Finally, we include three practical cases to present the outcomes of this experiment and how using media archaeological reconstruction helped us achieve different aims whether it is documentation, exhibition purposes or research. The common thread running through this article is a wish to answer the significant question of how we can absorb formerly new knowledge and make it accessible to future generations.

Media Archaeological Reconstruction, or the Second Original

> “All the variable media strategies, including re-interpretation and emulation, or considering artworks as scores or recordings, are arguably based on an immaterialist conception of art where the ambition is to preserve the ‘soul’ of the artwork, not the material ‘body’. Even when the material conditions of the work are considered important or decisive, the hardware is often sacrificed.” (Guez, Stricot, Broye & Bizet, 2017)

These updating processes often bring about changes in the behaviors and aesthetics of the artwork, even though they are mostly manageable. However, this updating strategy leaves no room for historicity and chronology, thus preventing new generations of artists from becoming part of their own media technical landscape.

According to Emmanuel Guez, French media theorist, media archaeologist and a specialist on Friedrich Kittler, these preservation methods destroy the original code/material relationship by focusing the care only on the source code. In his “Summaries of digital arts conservation and restoration”, he argues that the notion of original writing seems to have disappeared. Indeed, by using the reproducible nature of computer files and the possibilities of obtaining significantly identical effects with different languages, artworks’ codes are rewritten or reinterpreted for preservation purposes:

> “It is true to say that any program can be reduced to binary and, at the end, to differences in electrical voltages. In this sense, no work is ever obsolete. But every digital art artist is first and foremost the explorer of his media, in this case the code, the material and the networks. The sensible effects of the artwork result from a dialogue between the human and the machine which is reflected in the very act of writing.” (Guez et al, 2019, pp. 70).

Consequently, how can we, as conservation professionals, sneak into the code and change it to fit a newer media technical environment for which it was never meant for. There is nothing neutral about the code, the computer or the media the artists used. They translate either how they envisioned future technologies, how business models or political strategies of the industrial world influenced their productions. Emmanuel Guez refers to digital artworks as a stack of media archaeological layers:

> “Any work of digital art is a writing whose possibilities are conditioned by the machine. In a computer, these conditions correspond to a stack of software, the lowest level of which allows the transition from symbolic to real, i.e. electronic and electrical equipment. Ontologically, a digital writing, artistic or not, whether it is sound, image, text or gesture, or all of it at the same time, is based on a succession of layers,

> which not only renders possible, but also gives it meaning. However, the particularity of the digital artwork is that it is dependent on the rules of the industry that apply to all layers. This is particularly true for the network-based arts. A digital artwork is then nothing more than the product of a relationship between the creations of an industrial world - that is, an economic, legal, techno-scientific and political world - and an artist who has ventured to explore its effects." (Guez, 2019)

How can we narrate this relationship through the reconstruction of disappeared digital and media artworks? The *second original* is a possible answer. This concept, born within the art collective PAMAL_Group (Preservation & Art - Media Archaeology Lab), focuses particularly on the so-called *original* and what can be narrated through its reconstruction.

PAMAL_Group is a European artistic group composed of artists, media theorists, conservator-restorers and engineers[3] and creates its own artworks based on disappeared or severely damaged digital artworks. Its artistic research seeks to render visible the vulnerability of an art form that is highly dependent on industrial logic. All of the collective reconstruct artworks are as close as possible to the original materialities of the artworks, sometimes in a deficient way, in order to point out technological discontinuities or dying ecosystems. The *second original* is defined by the collective as a media archaeological reconstruction of an artwork that has disappeared, or is considered obsolete, with its original writing and reading machine (i.e. the hardware and software). This reconstruction does not exclude either emulation or simulation, which can be used to recompose a particular part of the artwork.

The ZKM | Center for Art and Media Karlsruhe is applying this concept as a complementary conservation strategy for disappeared digital and media artworks from its collection, among other preventive and proactive strategies.

The ZKM started collecting and producing digital artworks in 1989. At that time, there were no standardized approaches for the management of digital and media art collections. The maintenance of the artworks was mainly based on individual specialists with very specific knowledge of some of the artworks. The ZKM has now been working for years to transfer this knowledge, distributed to many individuals among years of communication via email, printed documents scattered over different locations and every other piece of information into a sustainably structured documentation. With a committed interdisciplinary team, the ZKM is

3
Currently, the group is based in Avignon, Orléans and Paris, France, Vienna, Austria and Karlsruhe, Germany and is composed of Stéphane Bizet, Lionel Broye, Armandine Chasle, Emmanuel Guez and Morgane Stricot.

closing the documentation gaps for the 169 computer-based artworks and about 100 analog video sculptures and installations in its collection. The ZKM is following a cross-disciplinary/cross-department model, which is the most effective model for such large media and digital art collection. Two departments share this responsibility: Wissen (Collection, Archives & Research) and Museum and Exhibition Technical Services. Our cross-disciplinary team is composed of specialists coming from different fields such as computer science, art history, restoration and engineering with specific knowledge in cybernetics, historical computers and operating systems (MAC Classic, SGI, DEC ...), software development and electrical engineering. Since its creation, the ZKM has always been a center for experimentation in exhibition scenography, presentation and mediation of digital and media artworks. It is only natural that the conservation of its digital and media art collection is following the same path. We have always been encouraged and free to experiment and transform researches and theories into hands-on procedures for the collection.

An article published in 2018 for the 15th International Conference on Digital Preservation (iPres18) details the experience gained experience in preserving existing artworks with their initial software and hardware components by using the duplication strategy:

> "First, it is worth pointing out that we usually try to maintain artworks in their historical technological environment as long as possible. Not necessarily with the computer acquired along with the artwork, it can be the same model or at least a computer from the same period compatible with the initial operating system. […] To keep old artworks alive, the ZKM based its preservation strategy on the mantra "Lots Of Copies Keep Stuff Safe".[4] This means we are always trying to accompany the artwork with a spare ready-to- run computer and spare hardware/peripheral if needed (mouse, camera, sensor, screen etc.). Instead of keeping the backups on our servers and magnetic tapes, we additionally implement them on spare computers in order to create multiple, identical, and functional examples of the entire hardware-software environment" (Heiss, Stricot & Vlaminck, 2018).

This duplication strategy, namely, coupling the redundant data backup and the purchase of spares, is considered as preventive conservation. This strategy is implemented in the conservation practice of the ZKM for several reasons. First of all, the ZKM has a large stock of spare parts for computers and CRT monitors as well as backups of old operating systems, plugins, drivers, libraries and other software components that make it possible to apply this strategy to its collection. Then, by duplicating, no breaking changes are made to the software environment or peripherals avoiding

4
See program Lockss, based at Stanford University Libraries, 2004.

thus any alteration of the artworks' behaviors and outputs. This also has the additional benefit of removing time-pressure in case of a breakdown during exhibition. As a matter of fact, testing the backups on their assigned equipment prior to breakdown prevents the later discovery of unknown hardware specificities, incompatibilities or license key issues. Since early-acquired artworks are documented afterwards, this duplication strategy is the easiest way to gather this missing information.

The artworks, preserved in this state, present the public with the opportunity to experience the artwork in its initial state, when it was created, with its wear and tears, glitch and bugs. These are also an entry point into software studies, media theories and media archaeologies. Unfortunately, most of the time, the historical versions of the artworks are only exhibited in house because of their high fragility and dependency to industrial hegemony. The ZKM's facilities, skills, resources, spares and tools are required to install and furthermore maintain these artworks in exhibition. Thus, at the same time, systematic proactive preparation of the artworks' migration to contemporary computer systems and software is carried out. We have to be pragmatic in order to allow other museums, which might not have these resources, to have access to the collection. Therefore, for loan purposes and future exhibitions, updated versions closest to the initial version are created within newer media technical environments for easier handling, installation and maintenance. This version is usually created with the help of the artists, while the historical version is still in working order.

To create an updated version of an art piece, no documentation can prove to be more efficient than the initial artwork itself. That is the reason why media archaeological reconstruction is used as a complementary conservation strategy besides duplication and migration. In cases where the historical version no longer works or no longer exists, it is repaired or rebuilt from scratch with historical parts. This repaired or rebuilt artwork is considered as a *second original*. This archive's purpose is to provide a reference point. We need to have a first-hand experience of how the artwork operates and looks/sounds like in its given historical software-hardware ecosystem. This experience is paramount in order to compare the results of forthcoming updating processes.

Practical Cases: *Yuppie Ghetto with Watchdog, White Devil* and *Border Patrol* by Paul Garrin and David Rokeby, 1989-1995.

In 2017, the ZKM initiated a general assessment of its collection to target early-acquired artworks without documentation. Since the ZKM did not establish conservation and management policies at the moment of acquisition, several artworks were documented afterward with the help of the artists and the members of the technical team working at the ZKM since 1997. Three artworks by Paul Garrin[5] and David Rokeby[6] have been rescued thanks

4
See program Lockss, based at Stanford university libraries, 2004. URL: https://www.lockss.org [accessed 6 April 2020]

to this assessment: *Yuppie Ghetto with Watchdog* (1989-1990), *White Devil* (1992-1993) and *Border Patrol* (1994-1995). The first two are ground-breaking interactive LaserDisc video installations and the third uses a revolutionary Macintosh video tracking system.

Yuppie Ghetto with Watchdog and *White Devil* were both exhibited in 1994 for Paul Garrin's first New York show *Watch Your Back* in which he investigated the potentials of surveillance. Eleanor Heartney described the works as follows:

> "In *Yuppie Ghetto with Watchdog*, an upscale cocktail party proceeds before a picture window beyond which are visible various scenes of urban terror. Flickering images of police battling rioters or fanning out across eerily deserted streets fail to evoke any response from the giggling, well-dressed couples who raise their champagne glasses. Meanwhile, just in front a snarling German shepherd appears on a video monitor. Keyed to the viewer's movements in the space, the dog becomes ever more vicious and loud as one approaches. In the second video piece, *White Devil*, a large screen offers a night scene of an elegant suburban mansion bursting into flames. Just below the viewers' feet the image of another watchdog (this time, a pit bull) paces across a bank of 12 video monitors set into the floor [Fig.1]. Again, it is our movement that galvanizes the dog into action, and he lunges mercilessly toward us, following us as we move from one side of the installation to the other." (Heartney, 1994)

Figure 1:

Screenshot of the video file of White Devil*'s digitized LaserDisc titled "Left" (time code 00:11:35)*

Both artworks are using Sony LaserDisc players 1550, the only serial-controlled LaserDisc players that can do an instant *jump cut* to any clip with +/- 100 frames. *White Devil* is more complex as the six LaserDisc players are mounted as pairs.[7] Coupled with time base correctors, the jumps between active and queued pairs of LaserDisc players are indistinguishable; the dog moves smoothly and follows the

5
Paul Garrin is part of the second generation of American video artists whose work combines technological innovation with pungent social critique. Paul Garrin, who began working with video while at the Cooper Union School of Art in New York, served as assistant and collaborator with Nam June Paik beginning in 1981.

6
David Rokeby is an artist acknowledged for his early work *Very Nervous System*, used to translate physical gestures into real-time interactive sound environments.

7
Two LaserDisc players for the left, two for the center and two for the right monitors.

visitor through the twelve monitors. For both artworks, premises of David Rokeby's *Very Nervous System* are implemented. This system can track a person's movements in a large space. A CCTV video camera sends images to a computer that analyzes consecutive frames to detect motion and presence. Using custom-made electronics and software, David Rokeby's system allows to display different sets of clips according to the visitor's position within a zone. The *Very Nervous System* in its final development is used again for *Border Patrol*. David Rokeby describes the work as follows:

> "The piece was made up of a wall, topped with razor-wire, with multiple embedded screens in its face. Four robotic cameras were mounted on the wall, each with a secondary tracking camera. [The] software located heads within the images of the tracking cameras and directed the robotic cameras to follow the heads as precisely as possible. The robotic cameras were very fast and had very long imposing lenses on them. Spookily, as the camera followed you, you were always looking directly down the "barrel" of the lens. The images from the robotic cameras were displayed on the embedded screens, and once the system had locked onto a head, crosshairs would form and the sound of sub-machine gun fire would rip out of the hefty subwoofers behind the wall." (Rokeby 2020)

Stationary cameras function as visual sensors to the *Very Nervous System (VNS)* interface by David Rokeby that controls the positioning of robotic "snipercams" which lock onto moving targets (the viewer's heads) and "fire shots" (audio of gunshots). The viewer sees his/her image on video monitors, set into the face of the wall, in the crosshairs of the snipercam. Each of the four autonomous snipercams can track up to 32 individual objects and monitor their status.

There was no documentation for these three artworks: the setup had been made by Paul Garrin from his memory each time the artworks were installed. The sixteen crates containing the three artworks were opened in March 2018. A first inventory of the material was made and the computers were inspected. Unfortunately, all Macintosh and Amiga computers were badly damaged by the storage: computers' CMOS batteries had leaked acid on other components, residual dust, highly hydrophilic, had formed a thick layer that was difficult to remove and more dramatically, most of the hard drives were out of order. As there were no established conservation policies at the time of acquisition, no compulsory backups or archival copies had been made: the artworks' software ecosystems had been stored on computers and put into storage. Therefore, the condition report was unequivocal: the data of Paul Garrin's artworks was lost. The lack of documentation was even more dramatic: sixteen crates of equipment without any wiring diagram or documentation of the behavior. A full reconstruction of the artworks was necessary. Paul Garrin, without whom a reconstruction would have been impossible, was contacted. In the opinion of both the artist and the ZKM team, the easiest way to understand the complexity of the artworks was to set them up and make them work as they originally did. Indeed, even though Paul

Garrin had sent us clips where the quirky behavior of the LaserDisc playback could be seen, the artworks could not be reconstructed from scratch if we did not experience it first. Consequently, a one-year research project with Paul Garrin was initiated in 2019 in order to make a media archaeological reconstruction of the three artworks.

After a complete inventory of the contents of the crates, a rescue plan was drawn up to preserve all the hardware and software components still available. The original LaserDiscs were digitized. Disk images of the floppy disks were made. The reading heads and other dirty components of the LaserDisc players as well as the Macintosh computers were cleaned. *Yuppie Ghetto with Watchdog*'s Macintosh Quadra 605 was not powering on. The power supply was exchanged. The fans were spinning but there was no sound or display. This generation of Apple computers do not boot if the CMOS battery is depleted, as it maintains the time, date, the hard drive configuration and other settings in the CMOS memory (Complementary Metal-Oxide-Semiconductor). This battery was therefore replaced as well. The computer was still not booting. After close examination of the board, two damaged capacitors were identified and replaced. The Macintosh computer was finally booting. The 1992 Quantum hard drive was, as expected, not found by the Macintosh boot manager. This type of hard drive used by Apple is well known for failing, quickly. The hard drive was then frozen for 24 hours in order to unlock the metal components, without success. As a last attempt, the hard drive was opened in a safe space to see if the mechanism could be unlocked by hand. At that point, there was no doubt anymore about the poor condition of the hard drive and the impossibility to recover the data: the rubber supposed to dampen the read /write head had melted over time and had become completely gooey. Instead of bouncing slightly, the back of the head was trapped in this slime. Even though this rubber was cleaned and replaced, the drive remained unreadable. The hard drive was therefore replaced with a compatible one as well as the floppy drive in order to reinstall the operating system MAC OS 7 with the original floppy disks. The floppy disks were stored in the same conditions than the hard drive and yet were still readable. Meanwhile, Paul Garrin had found a backup of the program on 3,5 floppy disks in its archives. The disk image was easily implemented in the computer as the software is mostly self-contained. The whole setup of *Yuppie Ghetto with Watchdog* was tested in May, 2019, with a LaserDisc player Sony 1550, a CCTV black and white camera and the original custom-made VNS interface and LaserDisc. Due to the lack of documentation, the calibration of the software was not possible. The original setup was tested again in November, this time with Paul Garrin on site [Fig.3]. This hands-on experience proved to be a really fruitful process, as a lot of small but significant technical details were remembered by Paul Garrin during the setup. The wiring diagram, prepared remotely with him, was completed and the control flow between the video camera and the LaserDisc through the interface was identified. The software content, components and calibration were fully documented and the artwork's behavior was recorded.

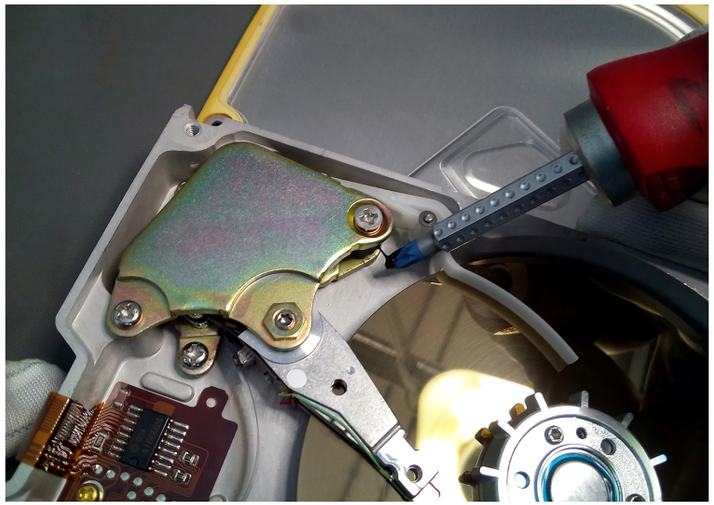


Figure 2:

Detail of the melted rubber of Yuppie Ghetto with Watchdog*'s hard drive.*

Having the experience of *Yuppie Ghetto with Watchdog* made the repair of the computer of *White Devil* faster. The Macintosh hosts the same program made by David Rokeby with new features. As the dog is displayed on twelve screens, a section of the program is used to define eight motion zones within the installation room.

Each zone is linked to a matrix. This matrix is where the clips to be displayed by the LaserDisc players are identified according to their zones. Different sets of clips are shown according to the visitor's position within the zone and their degree of aggressivity (how much they move in that zone). The sets of clips are made according to a branch tree model.

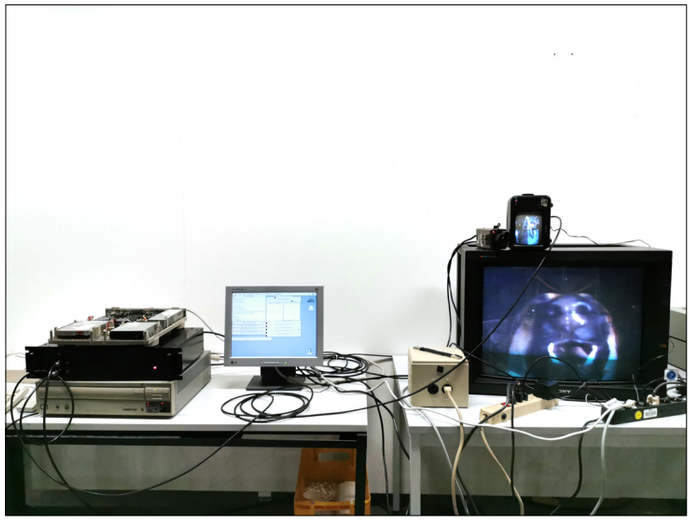


Figure 3:

Overview of Yuppie Ghetto with Watchdog

By Paul Garrin during the setup in November 2019. On the left: Macintosh computer, LaserDisc player, VNS interface and software IntAct 4 opened. On the right: monitor with the German shepherd, CCTV camera and preview monitor.

It means the system is non-linear. There are eight sets of clips for the eight zones and one set for transition. The transition set allows the dog to move from one zone to another and follow the visitor's movement. All the six LaserDisc players were checked in October, 2019, in anticipation of Paul Garrin's arrival at ZKM. Five of them were in working order but rather unstable. One was out of order. The LaserDisc player of *Yuppie Ghetto with Watchdog* was borrowed to replace it as no spare parts had been found on time for the setup in November. For the sake of this test only three CRT 4:3 monitors were used instead of twelve, each video being split by four with video wall processors. The exhibition copies of the LaserDisc found in the crates of the artwork were displaying the dog. The historical setup was a success, aside from some random jump cuts due to the LaserDisc players' age. Again, everything was precisely documented with the help of Paul Garrin.

The Macintosh LC475 of *Border Patrol*, had surprisingly withstood time better than the two Quadra 605. The hard drive showed signs of fatigue but was still in working order. A complete disk image was made and transferred to another more stable hard drive. The Amiga 2000 computers on the other hand, had suffered more. These computers, displaying the targets on the embedded screens of the installation, were operating at the time in their transport fly cases covered with foam inside. With time, the degraded foam had created a thick toxic dust layer inside the Amiga computers. This dust was carefully and completely removed from all the components of the computer. Once the dust was removed, the damages of CMOS battery acid leaking were discovered [Fig.4]. Damages were different according to each computer, ranging from a small spot on a blank area of the printed circuit board to extensive damage to the central processing unit. Two power supplies were no longer working and finally, all hard drives were unreadable except for one. Two functional Amiga computers were made out of the four. This was nevertheless enough to build one operational system for the historical setup since the artwork operates with two identical and parallel systems. In November, *Border Patrol* worked for five minutes before experiencing technical difficulties due to US/EU power frequency conversion. But as Paul Garrin said: ‘it was only low-tech problem solving now’.

The reconstruction, step by step, of each artwork, is now precisely documented and the final reconstruction is considered as an archive. This archive is allowing us to understand the works better and to undertake a possible transition to contemporary media that’s as close as possible to this historical version for exhibition purposes. A reconstruction of these artworks with the help of new technologies to imitate the same behavior in a hand-size computer could have been faster. It is also possible that to solve the transition to contemporary media we may need to emulate the behavior of the legacy hardware.[8] But without this media archaeological reconstruction, some paramount knowledge would have been lost. Afterward, it was clear that a direct transition to contemporary media would have risked losing the character of this unprecedented system. Indeed, these three artworks are retrospectively paramount for the history of interactive computer-based video art. Paul Garrin and David Rokeby created and designed custom-made software and hardware to bend the technology of their time to do what the industrial world was not able to offer at that time. The technology they needed did not exist so they created it. How artists envisioned future technologies is what media archaeological reconstruction intends to explore.

8
For example, as we cannot do copies of LaserDisc, a side research project was opened to find ways to not only digitize the LaserDisc but to image them. So far, the data of LaserDisc are digitized as analogue and linear video files. The cue points for each predefined clip of the dog for *Yuppie Ghetto With Watchdog* and *White Devil* is contained in the data on the computer. It’s therefore critical that the LaserDisc frame codes (as data files) are carried out over the digital capture in order not to lose the correlation of the clip locations already defined in the software. The research project seeks to create a system for capturing LaserDisc with the frame codes. This goes along with the desire to develop a LaserDisc emulator. The research project Domesday86 could lead to promising results: https://www.domesday86.com/ [accessed 6 April 2020]

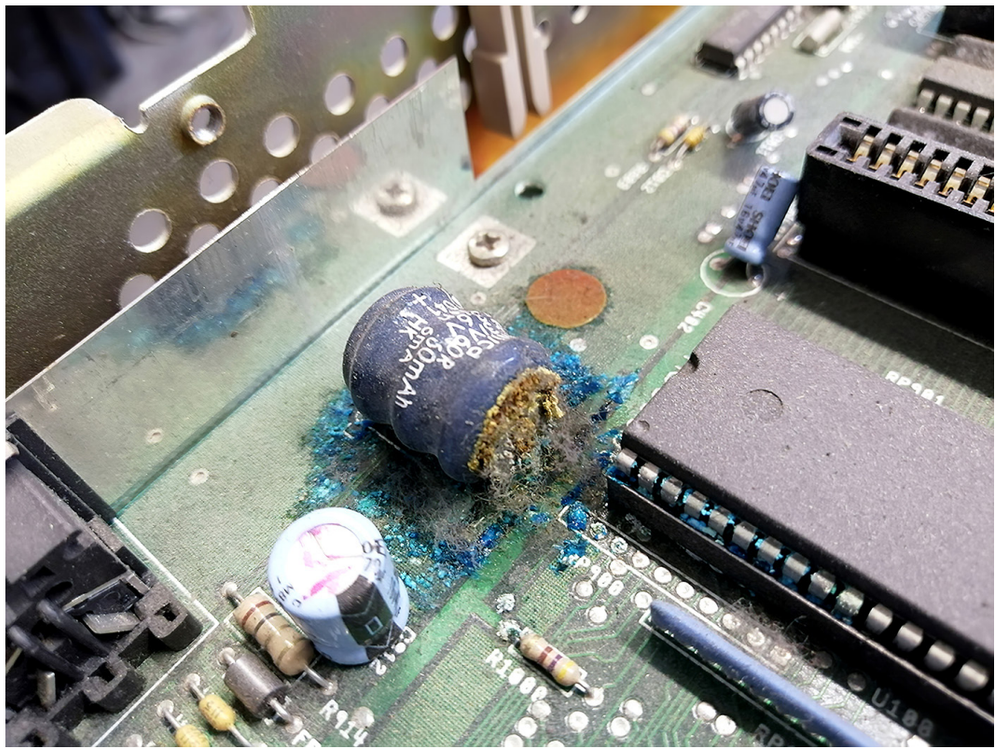


Figure 4:

CMOS battery acid leaking on one of Border Patrol's *Amiga computers. (Vlaminck, 2019)*

Practical Cases: *Wipe Cycle* by Ira Schneider and Frank Gillette, 1969 and *Track/Trace* by Frank Gillette, 1972

Between June 1, 2017 and January 28, 2018, the ZKM presented the exhibition *Radical Software. The Raindance Foundation, Media Ecology and Video Art*, curated by George Barker, Judith Bihr and Margit Rosen:

> "The exhibition presented video works and installations by a pioneering group of American artists and thinkers, the "Raindance Corporation", which was founded in 1969 as a media think tank and video collective and renamed the "Raindance Foundation" in 1971. In addition to their artistic interests, the members primarily pursued the goal of challenging the monopoly of commercial television and creating a media counter-public sphere." (Rosen, 2017)

For this exhibition, the curatorial team wanted to include two installations that are considered groundbreaking for video art. The first is *Wipe Cycle* by Ira Schneider and Frank Gillette [Fig.5], which was first shown at the exhibition *TV as a Creative Medium*, opened in May 1969 at the Howard Wise Gallery in New York, one of the first exhibitions worldwide to show TV and video art, and second, *Track/Trace* by Frank Gillette from 1972 [Fig.6].

Figure 5:

Wipe Cycle *by Ira Schneider and Frank Gillette, 1969 and* Track/Trace *by Frank Gillette, 1972.*

Figure.6: Track/Trace

Frank Gillette, 1972/2017, Copyright 2017 by Franz J. Wamhof

As none of these works existed anymore, the ZKM was faced with the challenge of reconstructing these two historical video installations based on documentary materials such as text descriptions, drawings, videos, and the memories of the artists themselves.[9] Actually, it was not a surprise that there were no preserved examples of these installations, since from a conservation point of view, early video art does not differ from early computer-based art. For video art as well as for computer-based art, the equipment was rarely attributed to the artwork. Most of the time, in the early days of video art, when the use of video equipment was rare, the artworks existed for a limited period of time, for example art festivals or special events in galleries. Once dismantled, the used equipment was going back to where it had been borrowed or rented from. During this time, very few artists could afford to assign the equipment they had used to a specific artwork. The technology was simply too expensive. Video art was considered more like a performance rather than a piece for collectors or museums, although there are exceptions such as Nam June Paik. In some of his works he used media equipment like monitors as sculptural parts of his artworks.

9
The reconstruction was initiated by Margit Rosen as scientific adviser and produced by Daniel Heiss, IT engineer.

Unlike the artworks of Paul Garrin, there was a certain amount of documentation available for *Wipe Cycle* and *Track Trace* that presented a clear image of “what it should look like”. Especially a video recording from the original setup of *Wipe Cycle* in New York in which Ira Schneider describes the artwork while standing in front of it, as well as a drawing that was released in the exhibition catalog of *TV as a Creative Medium*[10] [Fig.7] helped a great deal. This drawing can be regarded as a very good example of efficient documentation. It formed the basis from which the reconstruction of *Wipe Cycle* could be started from as it describes the exact behavior in a clear and understandable manner. In addition, several interviews were conducted with the artists, by phone and in person, to clarify most of the ambiguities. Ira Schneider sent a drawing describing the technical setup of *Wipe Cycle* in its initial form. Although it was only a rough draft it provided important findings on the original technical implementation.

Wipe Cycle consists of nine monitors in a three by three matrix on which a mix of a live camera image, the same image delayed in time, video recordings and live television programs can be seen. The displayed images change their positions in the TV matrix in a fixed choreography and in addition, a blank image moves counterclockwise around the outer monitors, the so-called wipe cycle.

10
See the exhibition brochure for *Tv as Creative Medium*, Howard Wise Gallery, 1969. *https://monoskop.org/images/4/4a/TV_as_a_Creative_Medium_1969.pdf* [accessed 25 April 2020]

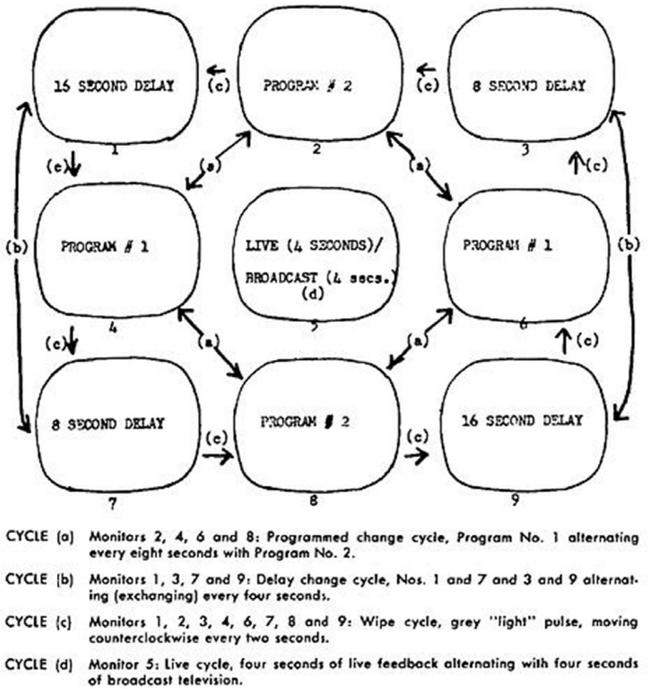


Fig.7: Diagram for Wipe Cycle *describing the choreography and timing of the signals switch between the TVs.*

Exhibition brochure, TV as a Creative Medium *(Howard Wise Gallery, New York, 1969)*

On the other hand, *Track/Trace* plays with the shift of time and space. Three cameras record the area in front of a pyramid of fifteen CRT monitors from different perspectives. The active camera is switched periodically every three seconds. The recorded camera signal is then delayed on four levels of the TV pyramid: four seconds, eight seconds, twelve seconds and sixteen seconds. Thus, on the single monitor forming the first level of the pyramid is the live signal of the active camera, on the two monitors of the second level is the same signal with a four seconds delay, then on the three monitors of the third level with eight seconds and so forth till the fifth level. This way you can see yourself, when standing in front of the pyramid cycling through five different time levels from three different perspectives.

After the initial phase of intensive research, the various technical possibilities needed to be evaluated as to how the reconstruction could be carried out technically. Two aspects were taken into account, which, from the point of view of an actively exhibiting museum, should actually be considered as equally important. The visual impression, the characteristic of the work should be as close as possible to the initial, but at the same time it is essential to ensure stable and ideally maintenance-free operation in the exhibition. It quickly became clear that two main issues had to be solved for the reconstruction of both installations. On the one hand the playback of a live camera signal is delayed by X seconds and on the other hand automatically controlled routing of different input signals to different output signals.

As shown in Figure 8, in the initial setup of *Wipe Cycle* [Fig.8], the time delay component consisted of three ½-inch video tape recorders (VTR). A first VTR is directly connected to the camera and delivers the live video signal to the TV in the middle. It also records the camera signal onto the magnetic tape, which is then routed over the deflection roller to the next recorder, where it is played back. These video tape recorders are placed at a certain distance from each other. The time needed for the recorded image to travel from one machine to another actually creates the delay of the camera signal.

The longer the distance between the devices, the longer the time delay.

Two other tape devices played two pre recorded videos in an endless loop, which was not commonplace at the time. These reel-to-reel players consist of a full tape reel on one side and an empty one on the other side. During the playback, the full reel gets spooled off and the empty one becomes full. After the tape is finished, one has to rewind the tape before playing it again. So a device was used that automatically recognized when one tape reached the end so it could automatically be rewound and started the playback again. In addition to this, a live TV signal was also displayed.

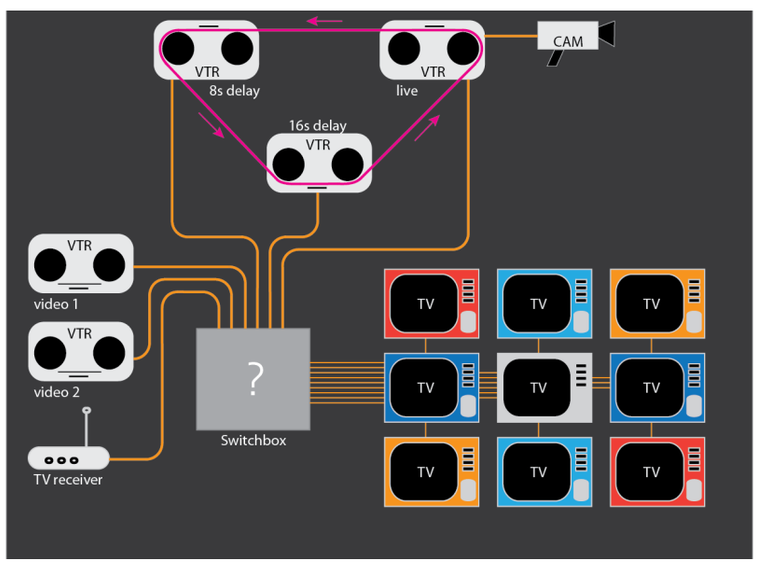


Figure 8:

Schematic overview of the original setup of Wipe Cycle, 2017.

(Heiss, 2017)

All the signals were then fed into a switching component. The technical drawing from Ira Schneider represents this switching component as a motor that rotates a rod. The rod had screws attached to it in different positions and while it rotated, the screws were touching electrical contacts that were triggering the switching of the video signals from one output to the other. To understand this part of *Wipe Cycle*, we did a virtual reconstruction of this device by building a 3D model of the mechanical part [Fig.9] and an electronic circuit diagram based on the described behavior and components that existed at that time[11] [Fig.10].

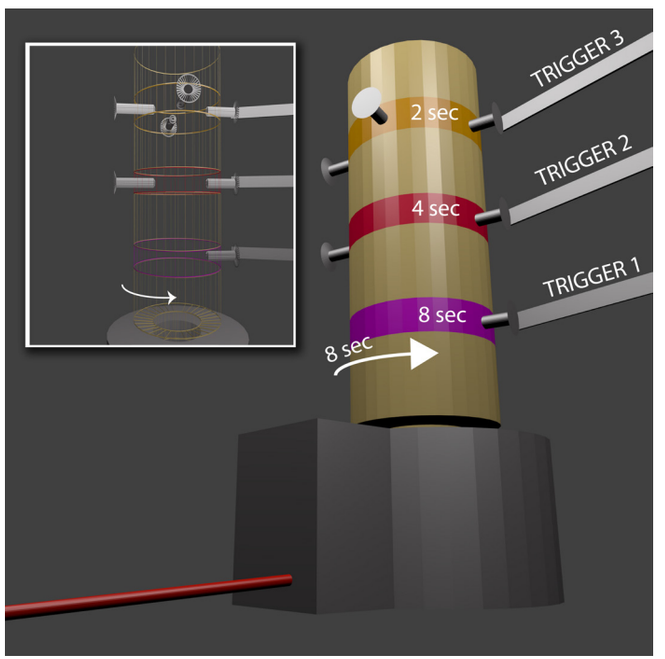


Figure 9:

Virtual reconstruction of the mechanical clock of Wipe Cycle according to the description of Ira Schneider.

(Heiss, 2017)

11
Only a limited selection of integrated circuits were available at that time: Integrated Circuits had just begun to be developed at that time, but in 1969, there were already integrated flip flop ICs.

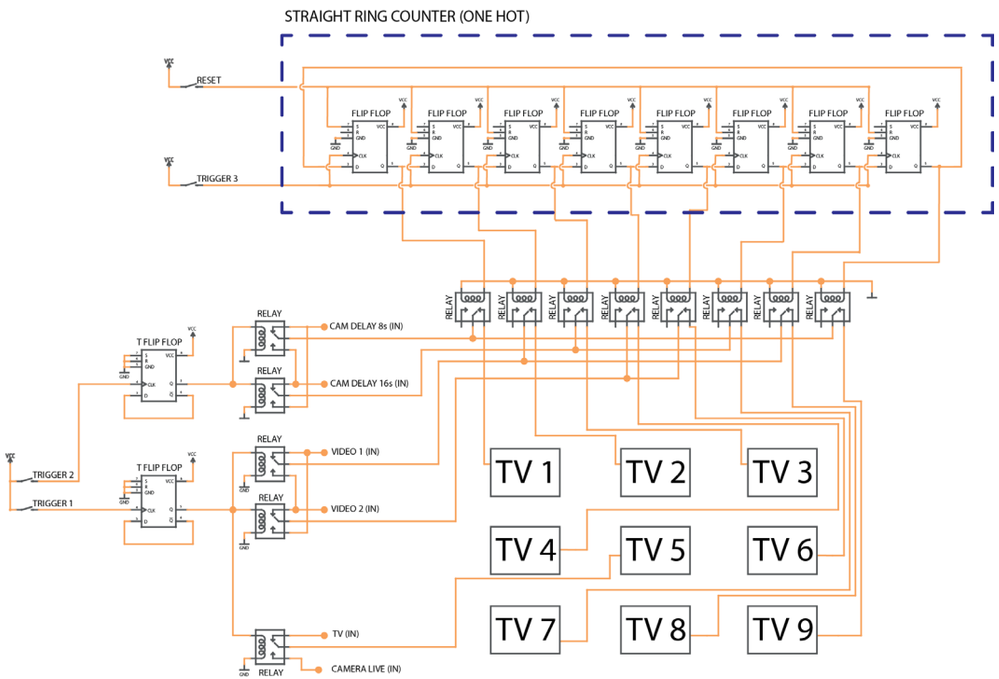


Figure 10:

Electrical circuit diagram of the clocked signal distributor of Wipe Cycle *as described by Ira Schneider.*

(Heiss, 2017)

So basically, mechanically produced electronic impulses triggered two toggles flip flops to change their states. Depending on the states of the flip flops, five relays switched the video signals to the corresponding TVs. For the rotating blank image (the wipe cycle) eight additional relays were triggered one by one, with a straight ring counter (one-hot counter) consisting of eight flip flops, which disconnect each of the outer TV individually one by one from the source signal.

With this reconstruction, the original setup was now fully understood, although it had never been the goal to use it during the exhibition. Indeed, according to the artists themselves, this original setup was extremely unstable and broke all the time during exhibitions. They had to remain with the installation constantly to repair it. For future exhibition purposes, the new setup should be able to run for 24/7 without supervision.

Ira Schneider had reported two other reconstructions in 1989.[12] Dieter Sellin carried out these reconstructions with the help of VHS video recorders. He remembered that this solution had also been unstable due to mechanical problems. Furthermore, Ira Schneider also provided a software that was developed by a student of the Technical University of Berlin.[13] However, this application, which could be installed on one or more computers,

12
The first reconstruction was at the Kongress Halle in Berlin and the second in Kölnische Kunstverein.

13
See *Digital Wipe Cycle* V.9 by Lukas Müller in 2015.

was discarded because it imposed too many restrictions on the components that could be used. Another solution had to be found.

After some tests, the Raspberry Pi minicomputers, in combination with the open source software Gstreamer[14], proved to be perfectly suited to seamlessly connect analog TVs with digital image processing. In this setup, the images recorded from a network camera are received over Ethernet, processed and afterward displayed on the composite video output of the Raspberry Pi. At the same time, this small computer can receive an IP TV live stream from TV channels from the Internet without antenna or cable TV connection. Two additional Raspberry are just used as simple video players, that of course have no problem with looping endlessly. The six resulting video signals are routed through a custom-made crosspoint video switch based on an IC that is capable of routing the six outputs to any of the nine monitors. The chip gets the control signal from a micro-controller that has the fixed sequence of the original switching choreography flashed onto it.[15] The result is, according to Ira Schneider and Frank Gillette, very close to the initial version in many aspects—especially the rollover when switching from one signal to another, which looks very much as if it is done mechanically.

One very useful module of the new setup is this delay unit[16] that was later used for the reconstruction of *Track/Trace*. Indeed, the development of universally applicable modules based on easy accessible hardware and open source software to close the gap between analog video sinks and modern video sources makes it now possible to use ready-made modules for other similar situations. By implementing tasks like time shift on video feeds, programmable switching between video signals, on-the-fly image processing and video wall signal distribution, this set of modular combinable entities can imitate many concepts and effects that were used in video art during the last century.

While the media archaeological reconstruction is useful to understand the initial setup as much as possible, the migration of part of the media technical ecosystem is required to find more sustainable solutions in exhibition. But it does not necessarily mean erasing the past. Take the example of the components such as the video tape recorder setup used to produce the time delay in *Wipe Cycle* or the LaserDisc player used to jump to a defined frame in a video in *Yuppie Ghetto with Watchdog* that were replaced with modern

14
Gstreamer is a super modular and flexible framework to work with audio and video. You can build pipelines to stream, route, convert and process video signals in uncountable ways.

15
The crosspoint matrix switch is based on the Fairchild FMS6501 IC, which can route twelve composite inputs onto nine outputs in a programmable way. The mapping of the inputs onto the outputs is controlled via 12C for example with a microcontroller like an Arduino. The code which was implicitly included in the mechanical device through the position of the screws is translated into a simple and easy to understand Arduino code.

16
The command to implement the delay is very simple. It's a Gstreamer pipeline buffering a defined amount of video frames into RAM before it plays them. The magical buffering is done by the queue object in the pipeline. Gstreamer is modular by design and can be used from the command line as well as C library and since a few years there is also a port to RUST. The cost for one delay node is now around 55 Euros. The code is open source and easy to implement.

software and hardware components. Firstly, they do not interfere with the rest of the technical equipment and secondly, they are a readable translation of the initial media technical environment. One can read out of the modern code, how the initial system operated, and therefore preserves it for the future. This explicit translation is only made possible if it is based on a media archaeological reconstruction of the artwork rather than on the direct interpretation of the artwork's output behavior.

Virtual Sculptures by Jeffrey Shaw, 1981

Given the under-representation of early computer-based artworks and analog video installations/sculptures in art institutions worldwide, considered by many as the result of belated awareness for this art form, pioneering and emblematic artists of early digital and media art have begun to approach museums for donations. This was, among others, the case of Jeffrey Shaw, digital art artist and founding director of the ZKM. On December 12, 2018, Jeffrey Shaw, offered the opportunity to the ZKM to acquire, as a donation, five of its early artworks he considers as his milestones,in order to ensure their longevity. The pioneering augmented reality installation *Virtual Sculptures* (1981) was part of this donation:

> "In the late 1970s, Jeffrey Shaw and his Eventstructure Research Group partner Theo Botschuijver embarked on a series of computer graphic and augmented reality experiments that were inspired by two technologies: first, an age-old illusion technique called 'Pepper's Ghost' that dates back to the 16th century - a technique that uses a see-through mirror to create 'ghost' images that seemingly float in space; second, the pioneering virtual reality head-mounted display (HMD) invented by Ivan Sutherland in 1968, which he called the 'Sword of Damocles'.
>
> Their first artwork that resulted from their joint research was *Virtual Sculptures* in 1981. It utilized an Apple II computer to create the 3D computer graphic imagery, a tripod mounted CRT monitor fitted with a Fresnel lens and see-through mirror and an interactive design that allowed the viewer to rotate and tilt this monitor so as to discover animated computer-generated virtual objects floating some meters away at different locations in the physical exhibition space. This artful apparatus prefigured the augmented reality (AR) systems that were introduced into the market some twenty years later and which are currently a fast-developing industry. (Lin, 2020).

The initial version of *Virtual Sculptures* no longer exists. The ZKM has agreed with Jeffrey Shaw to acquire the artwork as an archive and create a media archaeological reconstruction for research purposes. During this process, Jeffrey Shaw simultaneously created an updated version of the disappeared artwork. Both iterations of *Virtual Sculptures* are using the same construction that is as faithful to the initial as possible: 12" black and white CRT monitor, Fresnel lens, see-through mirror, two Apple game paddles and a tripod assembly. The difference became apparent when it came to the replication of the appearance of the animated computer graphic images, which were

simple low-resolution wireframe objects. While Jeffrey Shaw used newly programmed images, we started a challenging media archaeological reconstruction of the graphics with an obsolete Apple II computer and its old graphic library.

Figure 11:

Apple II+ computer with two 5,25 Floppy disc drivers, two Apple game paddles and a floppy emulator.

(Stricot, 2019)

The reconstruction started with the purchase, on ebay, of one of the first mass-produced personal computers: an Apple II+ as shown in Figure 11. Produced in 1979, this obsolete computer needed some repair to be operational for the reconstruction. Unlike today's computers, the manual of the Apple II+ with all the schematics and documentation about the operation and maintenance of the machine is easily accessible. After reading this manual, the damaged parts of the Apple II motherboard were identified: ten computer chips, including RAM memory and a slot contact. Two video chips were unfortunately not repairable. A second (and malfunctioning) Apple II+ was ordered to salvage the working chips and implement them in the first one in order to make one fully functional device.

For the software part of the installation, Jeffrey Shaw and Larry Abel (software developer) had used a niche library, only known by an informed public at the time: the subLOGIC A2-3D1 animation library.[17] The next step of the reconstruction was then to source, install and learn the subLOGIC 3D library used to create the simple low-resolution wireframe objects of Virtual Sculptures. Jeffrey Shaw and Larry Abel did not keep any data, cassette or disk with the library or the 3D objects. By chance, Bruce Artwick, the founder of subLOGIC Corporation, had uploaded on archive.org the floppy disk image (.dsk)[18] and "a scan of a photocopy of a manual for subLOGIC's A2-3D1 routines for drawing 3D graphics on an Apple II".[19] In the description, it is made clear by Bruce Artwick that this manual contains enough information to be able to use the program as the software is pretty unusable without this documentation.

17
subLOGIC Corporation is an American software development company. It was formed in 1975 by Bruce Artwick while attending the University of Illinois at Urbana-Champaign and incorporated in 1978 by Stu Moment. subLOGIC created the flight simulation program FS1 for the Apple II in 1980. The company produced software other than flight simulators, including children's educational software, 3D graphics software for CP/M, the A2-3D1 animation library for the Apple II, the X-1 video card and 3D graphics software for the PC, and *Night Mission Pinball* (1982) which was originally for the Apple II and ported to the Atari 8-bit family, Commodore 64, and MS-DOS.

18
The software was distributed either as a cassette or a disk, with a typewritten label "SUBLOGIC 6502/APPLE II 3D GRAPHICS"

19
See https://archive.org/details/sublogic-a2-3d1-animation-package-photocopy/mode/2up [accessed 6 April 2020]

This manual is composed of 92 pages of pure mathematics. One could expect that you have to know basic mathematics to be able to code 3D, but today's software manages to make you forget this fact, thanks to the user-friendly interfaces. Given the Apple II's age, this interface is therefore not in existence: one needs to have advanced space mathematics knowledge and everything must be programmed line by line, in assembly language. Assembly language is a low-level programming language designed for a specific type of processor. This type of programming is a tedious process since each operation must be performed at a very basic level. While it may not be necessary to use assembly code to create a computer program nowadays, learning assembly language provides useful insight into the way processors work.

This project is still in progress. Once the program is rewritten, it will be implemented on the Apple II+, either by using the original duo floppy disk drives from the computer and two floppy disks[20] (one floppy disk containing the system, DOS 3, one floppy disk containing the artwork's program) or by using a floppy emulator[21] (more reliable today then actual floppy disks) [Fig.11]. The ZKM also acquired two original Apple II game paddles [Fig.11] which are needed to register the two-axis rotation of the viewing device. The updated version is also using these original Apple II game paddles by hacking them a bit to connect them to a modern computer.

Before we can finally experience the initial software, an experiment with the optical system of Virtual Sculptures was conducted with Jeffrey Shaw[22] and shown during the exhibition *Negative Space* from March 4, to August 11, 2019 at the ZKM. This version of the artwork is a demonstration of the optical system only, without the interaction with the public. Instead of the tripod assembly, a wooden structure was built to host the half-transparent mirror and the Fresnel lens [Fig.12]. A video of a simple low-resolution wireframe cube was displayed on a 12" monochrome CRT monitor with a digital video player [Fig.13]. This demonstration already presents a good impression of the system.

The media archaeological reconstruction of this artwork, both a precursor of modern augmented reality and an upgrade of the ancient 'Pepper's Ghost' optical method, highlight the innovative and pioneering aspect of this early interactive system. This is also a chance to gather more knowledge about previous technologies and further bring together the Apple II community in Europe. Many artists used Apple II technologies in the 80s, such as Chris Marker, the French filmmaker and artist, whose artworks are part of the Centre Pompidou in Paris. The reconstruction of *Virtual Sculptures* is likely to be exemplary

20
See the website to purchase floppy disks.

21
Floppy Emu is a floppy and hard disk emulator for classic Apple II, Macintosh, and Lisa computers. It uses an SD memory card and custom hardware to mimic an Apple floppy disk and drive, or an Apple hard drive. The Emu behaves exactly like a real disk drive, requiring no special software or drivers.

22
The demonstration version was initiated by Jeffrey Shaw and produced by Manfred Schmider, Morgane Stricot, Mona Ulrich and Matthieu Vlaminck.

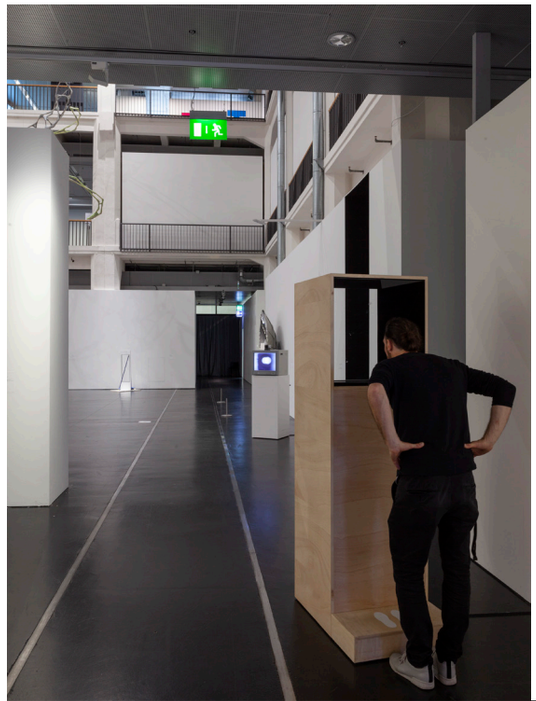
for the history of computer science in regard to digital artistic creation, as well as the study of the possibilities developed by Apple and used by the artists at that period. The reconstruction by the Poptronics research group of *Dialector*[23], an early artistic artificial intelligence developed by Chris Marker on Apple IIGS, or the acquisition of Chris Marker's Apple II creations on 5,25 floppy disks by the Cinemathèque Française[24] are good examples of the current enthusiasm in the field.

Conclusion

It could be said that we have a really strong materialist approach. As a matter of fact, this position is at times putting us in difficult situations, however this historical *curiosity* is motivated by the need to preserve not only artworks but also knowledge. This media archaeological approach is a unique opportunity for ZKM workers and researchers to experience the artwork's conception and learn more about the artists' techniques and methods to explore and sometimes hijack certain technologies' prior purposes. Since these artworks are repaired, partially or completely rebuilt with spare parts, the tacit practical user knowledge is passed on from one generation to another. For example, knowledge such as how to install MS DOS with a floppy, how to boot an Amiga, how to repair an Apple II, how to create a mechanical delay with tape recorders or how to create an interactive LaserDisc are now explicitly archived.

23
See http://dialector.poptronics.fr/ [accessed 6 April 2020]

24
See https://www.cinematheque.fr/ [accessed 6 April 2020]



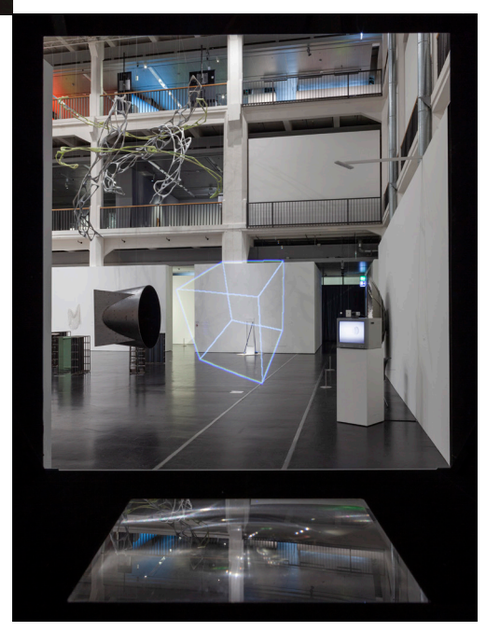


Figure 12 and 13:

Demonstration version of Virtual Sculptures *during the exhibition* Negative Space.

Wooden structure (left) and view of the cube floating in the exhibition space through the half-transparent mirror (right), 2019.

Indeed, one of the advantages of media archaeological reconstruction is that it helps preserve the artwork as much as the industrial heritage. The industry is not preoccupied with preserving its knowledge and use. Technology and industrial museums were created in order to fill this gap. These institutions ended up with dead, inert machines under showcases as examples of the information and media technology heritage, which was a plastic heritage. Because artists used the machines of their time to construct discourses and fulfill particular purposes, the art museums that collected their artworks (hardware and software), became by accident the only places where concrete forms of past media can be viewed and experienced in action. The machines perform what they were meant for (and sometimes, even more than that).

Can you imagine what would happen if all these artworks were updated all the time? The theory of regular and contextual updating is a functionalist theory. Under the pretext of wanting to preserve the accessibility of artworks, this strategy becomes the discreet accomplice in the race for innovation and commercial profits. Contextual reconstruction aims at all costs to find the current equivalent of an older technology both in its function and in its concepts (thus eliminating all materiality and any notion of media technical environment). In our opinion, the goal of conservation and restoration is not to try to guess what the artwork would have looked or sounded like if artists had access to contemporary technologies.

To make is to know, to rebuild is to learn. To reconstruct artworks, even as an informative form, is to reappropriate the knowledge, the technical and technological hopes and dreams of former artists and ‘make whole again valued knowledge from our singular contemporary cultural memory. Once exhibited, these pieces enter the collective memory through the viewers’ experience and become knowledge transmitters for those who build them. A layer of materiality when reconstructed – and even more when unreconstructed – narrates this moment where the tension between past, present and future technologies meet.’ (Stricot, 2017)

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CASE ANALYSIS: A TAKE ON NET ART WITHIN THE FRAME OF WEB BIENNIAL

Bengü Gün

> "As the space of multiple threading and interaction, Internet provides a structure that would die once downloaded to a computer, constantly be renewed, and in this sense, continuously reformulate the reality within another reality." Genco Gülan (Acar, 2008)

The advent of computer use in everyday life has inspired many artists in numerous ways. As new technologies began to address the needs in the society, artists used technology to understand and question both the society and the culture (Harrison, 2008). The computer, however, is not a mere tool for the artists (Popper,1993), and technology is not merely an interface conveying the artwork in question to its audience. Frank Popper (1993), in his book *Art of the Electronic Age*, has examined the relations between art and technological developments in terms of Futurism, Dadaism, Constructivism, Kinetic and Cybernetic Arts, stating that contemporary technological art has been inspired by conceptual art as much as other disciplines, such as photography and cinematography (Harrison, 2001).

After pre-internet data transmission systems such as *videotex* and later, the internet, became a significant part of our lives, a new world opened up for artists' processes of thinking and producing, leading to the emergence of new approaches, most significantly, in the conceptual realm. Net art was actively produced by artists beginning from the 1970s until the 2010s. Although nowadays the internet and its interfaces feature a different sort of aesthetic, when we look at artworks created as net art, we mostly see interfaces in *flash* aesthetics of the 2000s. With the contemporary opportunities provided by coding and technology, artists have begun producing a diverse range of artworks by incorporating technologies such as virtual and augmented reality, artificial intelligence and machine learning, into their conceptual processes.

In order to analyze all these processes, first, let us turn to the universal history of the nets: Vannevar Bush presented the preliminary ideas about an internet when he mentioned *Memex*[1] machine in his article titled "As We May Think" (Bush, 1945) in *The Atlantic Monthly*. Inspired by the concepts of nets and forming connections, Douglas Engelbart was propelled by the idea that human IQ could be "augmented" by machines. The same article also inspired both Ted Nelson and Andries van Dam. Indeed, Nelson and van Dam provided a method of data reading which was not only linear but also dynamic and interactive, by using the definition of *Hypertext* for a completely indexed data system in 1963.

1
Memex is an imaginary and analog machine designed by Vannevar Bush. It is a concept based on the idea that data could be conveyed via links and hypertexts just as in the human brain.

Made public in 1967, Hypertext went on to constitute the fundamental language of the general network with *Hyper Text Markup Language / HTML* (Bayram, 2019). Together with these pioneers, English computer scientist Tim Berners-Lee invented the *World Wide Web (WWW)* which was made public in 1991, and which he designed with HTML in order to improve the communication in European Organization for Nuclear Research (CERN), his workplace at the time.
The world of nets developed by scientists, which was a culmination of mutual inspiration, changed the course of the arts, along with all other fields. Such a platform connecting people all around the world provided not only artists with new possibilities, but also curators and museums with novel methods for exhibiting, and their outreach to a wider audience (Harrison, 2001).

In 1994, WebLouvre (it was later named WebMuseum due to a legal conflict) which was one of the pioneers of virtual museums was established by Nicolas Pioch, a French student, and won *Best of the Web Award*[2]. Through the medium of WebMuseum, which employed the collections of the Louvre Museum but had not been initiated by the museum itself, an expanding archive of artworks was thus created first including the Louvre Museum collections, and then, other museums. The Artchive[3] founded by Mark Harden towards the end of the 1990s began to contribute to WebMuseum from 1995 onwards. Including the artworks and objects which had a significant place in the historiography of art, this archive became a pioneering educational source for the period on the general network.

During the same period, many museums affiliated with universities opened their own websites while establishing “virtual museums” with no connection whatsoever to museums. For instance, established by Jonathan Peter Brown of London Southbank University in cooperation with Virtual Library museums pages (Bowen, 1997) under the network server of OUCL (Oxford University Computing Laboratory) in 1995, *Virtual Museum of Computing - VmoC* exhibition was visited by hundreds of visitors (Bowen, 2010).

The conference, “Museum Collections and the Information Superhighway” in Science Museum in London, England led by John Griffiths on May 10, 1995 and the ongoing conference series, “Museums and the Web” organized by David Bearman and Jennifer Trant since 1997, gave way to a discussion and knowledge-sharing platform by bringing together the works of museums, curators and artists working in this field (Bowen, 2010). Although the priority of the museums at the time was merely transferring physical data into the Internet medium, contemporary understanding of “the virtual museum” has come to mean a space exhibiting virtual works that are the works of General Net Art, that are physically non-existent, as its title also suggests (Öge, 2008).

2
The archive of the website can be accessed here: http://www.sai.msu.su/wm/

3
Although it has not been updated for a long time, the archive can still be accessed via http://artchive.com/ftp_site.htm

It is important to make note of here the pioneer artists who pushed the envelope, made innovations, and opened exhibitions:

Olia Lialina (*My Boyfriend Came Back from the War*, 1996), JODİ (*Good Times*, 1996), Vuk Cosic, Mark Napier (*Schredder*, 1998), Andy Deck (*Open Studio*, 1999) and Amy Alexander (*The Multicultural Recycler*, 1996). One of the exhibitions which could be regarded as an earlier example for the period, *Eurinome's gambit/Chaos in Action*[4] met the audience for five days starting from November 4, 1997 via general network. Artist Genco Gülan, who was invited to this exhibition by curator Fulya Erdemci, participated in the exhibition by creating an artwork with the help of Prof. Ufuk Çağlayan at the Computer Access Research Laboratory of Boğaziçi University, Gülan's alma mater, due to the lack of technological resources at the time. Based on interactive works by artists from all around Europe, the project thus became the foundation for Istanbul Contemporary Art Museum, founded by Genco Gülan in 1998 (Graf, 2008).

The Formation of the Web Biennial

In order to understand and evaluate the origins of the movements and the initiatives in the history of art, firstly, it is important to observe the conditions of the period in question. Most of the time, the institutions and initiatives emerge to fill a gap in a manner that is shaped around the limiting conditions of the period. We need to envision the circumstances and conditions of both Turkey and the rest of the world at the end of the 90s to be able to fully grasp the story of www.istanbulmuseum.org, which was a pioneering effort to render the Web Biennial possible. This was a time when starchitects were designing cultural spaces and museums, structures that in turn transformed into works of art themselves, and sometimes, the architecture itself came to the fore in place of its inhabitant institution. This was the period of Guggenheim Bilbao, designed by Frank Gehry and opened to visit in 1997, and of Milwaukee Art Museum, which was designed by Santiago Calatrava and opened in 2001. The origin of the Web Biennial, www.istanbulmuseum.org, was established by Genco Gülan at the end of the 90s, since there were no contemporary art museums in Turkey at the time. The initial problems to be handled when a museum is to be founded relate to the content, that is, the collection and an actual physical space to house it, as illustrated in the examples I have mentioned above. Due to the technical and economical impossibilities of the period to establish such a space, Genco Gülan's project emerged as a portable contemporary art museum, and focused primarily on physical sign boards advertising the museum (see Figure 1). The period in question witnessed numerous improvements and developments in technology and electronic communication; as such, the museum became a virtual museum initiative, getting rid of the notion of a physical space. This restructuring also aimed to illustrate that museums can be realized independent of sponsors, juries, large institutions, physical spaces and cities (Gülan, 2005). Istanbul Contemporary Art Museum, with both its mission and content, was founded directly as a space showcasing virtual works. In its quest to explore how a museum

4
Eurinome's gambit/Chaos in Action, curated by Evgenija Demnievska, 1997.

without a physical space could come to exist, it revealed the core need for such a museum.

Figure 1:

Contemporary Art Museum Signboards, Taksim Square, Istanbul

Web Biennial began its activities with the exhibition titled *Reload* in 2002. Without a selection committee or any contact with the artists, the exhibition exhibited a selection of artworks sent to the e-mail address provided. Genco Gülan describes the selection as follows: “This was a give-and-take among artists, a free movement of ideas, the full independence of 256 colors, an eye candy finger funfair, and a temporary Republic in virtual space… Yes, temporary, because as Hakim Bey says, virtual space offers us a freedom that is merely temporary.” (Gülan, 2011). The Web Biennial took place in the years 2002, 2003, 2005, 2007, 2012, and 2014. The revival of the biennial in 2020, on the other hand, exhibited the selection of a curator for the first time. Curator İpek Yeğinsu designated four galleries and exhibited the digital works online in the exhibition she titled *Apeiron*.

Genco Gülan likens net art intrinsically to live art (performance art). According to Gülan, both performance art and net art are temporary and transient; they do not *work*, or remain active, without the audience.[5]

The temporality of net art is due to the core issues at the heart of technology. As Lin Hsin Hsin said in her presentation at “Museum and the Web Conference” in 1998: “Unlike wine, technology depreciates with time; what is new today quickly dissolves into ether without warning. Searching for the coolest, hottest and newest in an embedded web of technologies has increasingly become more difficult, exponentially. [...] In the digital era, conservation of the ‘material’ is no longer an issue, however, conservation of equipment or archiving an old release of the software for an outdated hardware supported exhibit can be outlandish.” (Hsin Hsin, 1998).

Due to numerous issues such as server problems, domain name changes, the work being connected to a live source, broken links, the development of different browsers and taking place of older ones, many works which were exhibited in the Web Biennial can no longer be accessed. When we visit the website today through any web browser, we are unable to access the 2002 edition at all, while 67 of 156 works from the 2003, 2005, 2007, 2012 and 2014 editions remain accessible still. Yet, thanks to the Wayback Machine[6] feature, it is now possible again to

5
Interview with Genco Gülan on Zoom by Bengü Gün, 04.09.2010, 12’09’’, Istanbul

6
Wayback Machine is a digital time capsule developed by the Internet Archive, a nonprofit organization. It allows visitors to see how websites looked like in the past.

access and experience the works by selecting the year they were exhibited in.

Another pressing issue today is Adobe's announcement that it would not support Flash Player as of January 2021, its medium software that is not supported by many popular web browsers anymore. In the announcement made on the Adobe website, the evolution of open source standards such as HTML5, WebGL and WebAssembly, along with the growing preference of even prominent browsers to use other open source plug-ins were cited as the main reasons behind this decision. In fact, this process of extinction began when Apple announced that it would not be supporting Flash during the launch of iPhone 2G's due to compromises in security, along with its unsuitability to touch screens (McNamara, 2020). Steve Jobs' open letter dated April 29, 2010, "Thoughts on Flash"[8], where he explained that Flash was inadequate and out-of-date, sped up the process. Although many institutions, artists, animators, and game developers archived their works executed in Flash following the official statement by Adobe in 2017, a considerable amount of content still remains unarchived. Today, Adobe suggests that all users remove Flash from their computers, due to security reasons. In a nutshell, this means that many projects we experienced, and are operated in Flash, can no longer be experienced.

As such, this brings us to a fundamental debate on net art: the question of how to preserve works, as well as which works to preserve and therefore bring into the present and the future. There are differing opinions on this matter. On one hand, due to the dynamic and participatory nature of the Web, how net art works would be archived and preserved on the Web is an involved and time-consuming matter. Fortunately, there are creative and talented groups of people who prioritize this, and share their concerns with the public.

Archiving and Documentation

There are basically five stages in archiving web-based artworks: Selection and Curation, Crawling, Storage, Access, and Preservation. (Pehlivan, 2020).

Archiving the Web via search engines, as I mentioned above, is as ancient and deep as the Web itself. After World Wide Web Wanderer in 1983 and Aliweb in 1993[9], Internet Archive became an important actor as a nonprofit library open for participation, archiving the general network since 1996 (Bowen, 2010). As I previously mentioned, it is now possible to see most of the websites of the past, thanks to the Wayback Machine[10]. In order to establish an international network and set general standards, International Internet Preservation Consortium (IIPC) was founded with the participation of 26 countries, by the Internet Archive in 2003. Rhizome[11], a pioneering institution both in born-digital art, and contemporary art historiography on digital technologies and the internet,

8
The full text can be accessed here: https://web.archive.org/web/20200430094807/https://www.apple.com/hotnews/thoughts-on-flash/ (27 December 2020)

9
www.aliweb.com

10
www.archive.org creates mirror images of the websites from the past and provides a retroactive vision. The Wayback Machine feature allows you to access the past image of any website you want. https://archive.org/web/

initiated the ArtBase Project in 1999. ArtBase is a universally accessible digital art archive of Rhizome. Many works with potential historical significance such as software, codes, websites, moving images, games and browsers are being revived thanks to this project.

Another project which retains its relevance is the Webrecorder Project, founded in 2014 in order to focus on developing independently open source tools and software. Conifer[12] (previously Webrecorder.io) of Rhizome is another universally accessible platform that archives a true copy of any website that its users take a glance at, and is used to create interactive images of them. It is one of the most up-to-date tools which traces the movements that the user wishes to be recorded for archiving and replaying the digital art with its *Replay*[13] feature. It can successfully archive embedded videos and 3-D graphics, the most complex movements on websites and social networks. It is an open source platform that allows users to do their own curation and share it on their websites.

Variable Media Questionnaire is another tool developed for preserving not only the past, but also the future of websites by establishing the right connections, and constituting a questionnaire intended to preserve digital artworks. Another significant institution working in this field is DOCAM (Documentation and Conservation of Media Arts Heritage)[14]. DOCAM is one of the oldest institutions working on documenting, conserving and cataloging digital artworks, as well as establishing a terminology for these works. In addition, another pioneer platform of the field, INCCA (The International Network of Preservation of Contemporary Art)[15] has been enabling information-sharing for preserving contemporary art with its wide network since 1999.

These institutions have been working for a number of years, and the question of how web based artworks could be carried into the future and what kind of methods could be employed to do so remains a dynamic field of study. Each artwork requires a distinct method, and for the method in question to be determined, a certain set of questions should be answered: Should we preserve a live version of the artwork by reviving it on its new platform, or should we use the historic version of it? Is the artwork connected to the hardware it was shown in or is it more of a software artwork? While the aforementioned platforms offer some of the best practices and examples of archiving artworks, there are still different methods that could be employed in this field.

First of these methods is emulation, that is, reviving the artwork via an emulator program imitating the software that the artwork was built with. Aiming at transforming this process into a service that is accessible to all, and reviving the artworks in their original media, bwFLA Emulation as a Service (Eaas), an open source project, is among the tools being used

11
https://rhizome.org

12
https://conifer.rhizome.org

13
https://replayweb.page

14
https://www.docam.ca/en.html

15
https://www.incca.org

by the institutions. Another method is to recreate the artwork with new methods and software. One other method which requires more time and resources is to reinterpret the artwork considering the features of its period.

These were among the matters discussed in the e-symposia section within the Web Biennial, where artists and curators communicated through correspondence, via a *Java*-based program. In the symposium that took place on January 19, 2006, within WB05, the subject of archive was discussed: “To Archive or Not to Archive”.[16] Ryanne de Boer summarizes archiving as follows: “Archiving is a system of finding something again easily and it is only its artist who could archive an artwork in the best way possible.” In the same symposium Marcus Graf talks about how an archived artwork and the actual artwork could not be identical.

Many artists prefer to produce their artistic output on the general network precisely due to its temporality and ambiguity. For example, Genco Gülan, in the e-symposium of 2006, said that the criterion for net art is that it is non-archivable.[17] According to him, the temporality of the work constitutes its main focus. It rejects evaluation of the work in any classification. Web Biennial did not prefer to archive any of the works, except for the e-symposia. Due to the increasing disuse of Flash, many institutions and curators are putting great effort into conservation matters. In “Net Art Anthology”[18] project of Rhizome’s digital preservation unit, which began in 2016 and ended in 2019, a sample preservation effort was conducted for 100 significant selected works of art, and these works were exhibited online. In this scope, these works of art, mostly through the use of *Webrecorder*, could be experienced again and detailed information about the story and history of the works were presented. At the same time, a detailed catalogue was published and sixteen works of art were selected to be showcased in The Art Happens Here: Net Art’s Archival Poetics, an exhibition at the New Museum, New York.

Another application worthy of mention is Blue Maxima’s Flashpoint, an open source application developed to archive the online gaming sector and animations in particular. Through this application, seventy thousand games and eight thousand animations have been revived. This multifaceted program can be downloaded via websites that also include detailed information on how to use it, and is open for public use.[19] Ruffle[20] is also an open source software emulator written in the Rust programming language, which allows for Flash-based works to be played again. In a statement made on November 19, 2020, Ruffle announced that it would work within the Internet Archive and could be played in browsers included in

16
The e-symposium titled “To Archive or Not to Archive”: https://webbiennial.org/panel3.html

17
“My criteria for creating net-art or performance is- they need to be non archivable!”, *To Archive or Not to Archive*, e-symposium, the contents of the panel can be reached here: https://webbiennial.org/panel3.html

18
https://anthology.rhizome.org

19
https://bluemaxima.org/flashpoint/

20
https://ruffle.rs/#

Webassembly (Safari, Google Chrome, Internet Explorer, Firefox) without a Flash Player plug-in. This is promising news for many works to be preserved and carried into the future.

In conclusion, extensive research and discussions on archiving Net Art are ongoing. Thanks to these studies which are mostly conducted by artists or curators, and the large and devoted groups of individuals who ensure that these efforts are technically possible, creative works in a field that is under the domain of technology magnates were able to reach the present day and be recorded. Although no archival work was undertaken by the Web Biennial, it still remains in a position accessible enough to the infrastructure that rendered it possible, and is able to revive past artworks. An extensive research on the works that have been exhibited as part of the Web Biennial until present day, as well as the revival of a careful curation of said works, could ensure that this significant heritage remains accessible for future generations.

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CONSERVATION OF DIGITAL ARTWORKS: ANALYSIS OF THE WORK *VARIABLE* AS A CASE STUDY

Canan Arslan

Art, dissociated from the object, has taken on a shifting, performative, and interactive form in the Digital Age that we are in. These changes observed in artworks have necessitated a new approach to conservation that enables the constant evolution of the artwork over time rather than the traditional approach that focuses on conserving the object. In developing this new approach, methods including forming the notation of the artwork for conservation, considering the opinions of the artist are employed.

The notation of the artwork is the total of the formal directions that the artist has produced in the case that the artwork should be reconstructed; as such, the artwork is approached as a music partition and the notation enables a reinterpretation of the work in the future within the framework created by the notation. The artwork can be recreated with the artist's permission if the artwork is to be re-exhibited. To conserve and pass on to the next generations digital artworks which are by definition in-flux, the notation, as well as documentation of the artist's intention, their interpretation, and the artist's testimony, are required. This information can be gathered using the "Variable Media Questionnaire" and through meeting with the artist.

In the theoretic section of this essay, the Media Art Notation System (MANS) developed by Richard Rinehart and Variable Media Questionnaire developed by John Ippolito will be examined. In the case study, the artwork by artist and academic Selçuk Artut *Variable* will be analyzed to create a notation system and the results of the questionnaire filled out with the artist will be studied to determine Artut's intention and interpretation in exhibiting the work.
Digital art, which reflects the reality of the times that we are in, brings together art, science, and technology and is thus impacted by technological changes. In other words, the head-spinning pace with which technology changes creates rapid changes in the digital arts. Digital art, which includes different forms such as internet art, software art, computer-driven installations, performance art, is formed by short-term, multi-piece, technical, and shifting structures; the rapid outdating of the media formats used in these forms renders traditional documentation and conservation approach inapplicable. Furthermore, digital art has dissociated from materials and the artistic object has been replaced by artistic processes or systems. That is to say, art has been liberated from the boundaries of the object and has transformed into a performative process. This has made it impossible for the conservation methods used for traditional art to be applied to digital art. Thus, the conservation, documentation, and preservation of new media works require the development of new methods.

While conservation is defined as the series of precautions taken to maintain cultural heritage for long periods, digital conservation is defined as a series of activities that guarantee constant access to digital materials for as long as needed. (Falcao & Ensom, 2019: 232) Traditionally, the

conservation of the object has been the focus while today, the purview of conservation has been expanded to include information on the content of the objects and their use. (Munoz-Vinas, 2012: 29) As digital art relies on complicated technologies, in conserving these works, the focus has been the artist's intention in creating the work and the viewer's experience of the work rather than the physical object. In other words, the perspective on conservation has shifted; instead of avoiding change, dealing with constant change has become the goal. (Ippolito, 2003: 113)

An important aspect of media art that includes technology and process-driven elements is its spatial and performative structure. People working on the conservation of time-based media artworks collaborate with artists, technicians, galleries, and curators to determine what constitutes the artwork, how it needs to be exhibited and how the artist would want to see the work conserved. Determining the characteristics of the work produces the frame within which changes that will be made to the artwork can be determined. These changes can be observed in changing a component to carrying the work into a new medium. While working with the changes, the changes that need to be made to exhibit the work, the technical history of the work, and the essence of the work need to be negotiated. To sustain a balance, detailed documentation of the original system and the changes that were made need to be recorded. Documentation is key to comprehending the content of an artwork and its evolution over time. (Falcao & Ensom, 2019,p. 233)

The performative structure of digital art and the changeability that exists at its core is parallel to the performing arts and music. As such, to retain the integrity of media arts beyond a piece of specific equipment, a mechanism that is similar to the notation system in music is appropriate. (Innocenti, 2013: 227)

In a music work, the original work is defined by a specific notation, which is a series of instructions. The performers perform the work, abiding by these instructions and in this process, they are free to interpret to a degree. In digital artworks, the digital code which is the group of instructions that conducts the actions or events serves as the notation itself. (Rinehart & Ippolito, 2014: 8) However, in contrast with the "digital code", the notation should be legible independent of the media. The artist interprets the notation and activates the artwork.

Just as attempting to conserve the first musical instrument with which a classical music work was first performed, or keeping the stage decor that was used for an opera production for a future rendition of the work is both nearly impossible and unnecessary, conserving the hardware for a digital artwork is equally needless. What needs to be conserved is the notation that is the foundation of the artwork, which includes the artist's explanations about the work, their instructions, diagrams, and notes.

The durability of an artwork is based on its relationship with the medium. For example, Sol LeWitt's *Wall Drawing 146* from 1972 could be seen as a work that is hard to conserve as it comprises drawings made directly on the wall. (Figure 1) However, LeWitt wrote universal instructions with which the drawings could be adapted to other spaces.

Figure 1:

Sol LeWitt, Wall Drawing 146. Solomon R. Guggenheim Museum, New York.

LeWitt's directions for wall drawings, including "10 lines of 10 inches covering the whole wall equally" and "all two-part combinations of blue arcs from corners and sides and blue straight, not straight and broken lines", have made it possible for these works to be redrawn, painted, and recreated in different parts of the world for more than forty years. LeWitt's wall drawings continue to exist not because they are durable, but because they are changeable. In these kinds of works, permanence means destruction. New media art, which has transitioned from the object to the process, can continue to exist "not because they are durable like stone, but because they are mutable like running water." These kinds of changeable artworks are independent of the medium and can be transformed into a new medium when their original format is no longer in use. (Rinehart & Ippolito, 2014: 7-11)

With this essay, the objective is to contribute to the discussions on the conservation and preservation of digital art, outline the approaches that exist today and that will emerge in the future. The proposition is that taking the performative and changeable characteristics of the performing arts and digital art, both art forms have a specific notation system and that this notation should be retained as a document; artist Selçuk Artut's work from 2017, *Variable*, was then used as the basis for a digital partition work. Furthermore, an interview with the artist was conducted within the framework of the Changing Media Questionnaire based on the work *Variable*, discussing whether using only a notation system in the preservation of a work would be sufficient and the importance of emotion that the artist wants to relay in the recreation of the work.

Formal Notation Approach

Contemporary artists today develop new methods and tools to create and exhibit artworks and to facilitate relay of these works to future generations. The artwork is no longer a painting on the wall or an immovable sculpture on a pedestal and has taken an performative, interactive, mobile structure that requires setup. Contemporary artists borrow objects or ideas from the quotidian and transform these into creative expressions that are interactive and which promote participation.

Museums, curators, and collection managers are faced with the necessity of developing new methods to conserve, preserve, and archive these creative artworks.

In digital artworks, the essence of the artwork is the “source code.” The source code is defined as the group of computer instructions, written in a programming language that people can comprehend. Engel and Wharton defend that the analysis of source code resembles the chemical composition of a painting in a certain sense. (2015: 91-101) The language and platform choice, the coding form and structure, or comments on the code is the artist’s reflection of their application and intention. The analysis of the source code also makes possible the reproduction of the work and its migration to other technologies and thus carries vital importance. (Dekker & Falcao, 2015, p. 7)

The source code is written in a specific programming language and is kept in a file. Computer programmers who are fluent in the programming language in question can understand it. However, as programming languages emerge and disappear very quickly, new programmers would not be able to access the disappearing language. The digital code that is a series of directions in digital artworks is specific to the context and would function differently across hardware and communication systems. In other words, digital code is not legible beyond the media that it seeks to preserve. Thus, in conserving and reproducing digital artworks, the formation of a digital notation system that resembles music notation appears as one of the most dependable methods today. (Rinehart, 2014, p. 2)

As noted before in this work, “mutability” is the defining quality of digital media. The solution to conserving digital culture is not to make permanent this mutability with traditional conservation methods but is rather to conserve the primary structure of the medium to prevent its destruction.

New media art and music are similar in that both have a performative and mutable structure. A musical piece retains its integrity even when it is played on different instruments due to its fundamental partition. For example, while works by famous composers such as Beethoven, Mozart, and Vivaldi are played on different instruments in a variety of forms, when we hear the works, their composer is obvious to us. Software-driven digital art is similar to music in this sense; the artwork is based on algorithms. The computer language, system, and software form the main infrastructure supporting the work. In other words, the artwork is a design based on this infrastructure and it constantly changes and ages rapidly.

Considering the similar aspect of mutability between performance arts and media arts, media arts require a mechanism to retain its integrity independent of specific equipment, quite like the notation system in music. Notations are a series of directions that the composer has formed for the performance of the music. Following these directions, the performers can perform the work numerous times and they are free to a degree to interpret. The notion of partitions in music is replaced by the artist and to a degree the curator when applied to media arts. The task of the artist is to interpret the notation. (Muntadas, 2012, p. 156)

However, to truly perform a work at a later time, keeping the notation does not suffice. The suggestions of the writer or the writer need to be retained for an interpretation of the notation. Without these personal comments and suggestions, the notation solely represents a system of symbols.

(Roeder, 2004, p. 11-12)

Notations and artist commentary also define the nature of the work in all performing arts including not only music but also dance, theater, and opera. The notation of a work of theater is the text and the authenticity of the work depends on the artist's degree of abiding by the artist's intention. In operatic works, there is a libretto in addition to the musical notation. The composer sets a time and a place as directed by the circumstances of the times in which they write the work. The libretto includes directions on the movements of the artists on the stage, the costumes they wear, the emotions they communicate to the viewer. The formal notation of the work consists of the musical partition and the text. For example, an opera that Mozart wrote in the 1800s can be adapted to our day at a different space and place, using different decors and costumes, even adding contemporary elements to the subject matter. Remaining loyal to the formal notation, the work retains its authenticity and it can be re-performed differently a hundred years later.

In a notation system for media art, information on the date of its first rendition, the title of the artwork, dimensions, subject matter, the people or entities involved in the making of the artwork, the entities who contributed to the content of the work, the owner or representative of the work, ID number, the location of the work, entities responsible for restructuring the work and information on other intellectual property rights can be included. (Rinehart, 2007: 186) In other words, the notation of an artwork is like their ID document and functions independently of the medium.

In addition to the information on the identity of a work, the artist's personal opinions on the reinterpretation of the work, their intention, and suggested conservation strategies should be kept for the conservation of digital artworks. Within this context, interviews conducted with the artist in the framework of Variable Media Questionnaire are of critical importance.

The Variable Media Approach

The Variable Media Approach is a paradigm first developed by John Ippolito in 1998 in order to find solutions for the problems that the staff encountered when cataloging, exhibiting, and conserving the wide collection of film and media art that the Solomon R. Guggenheim Museum held in New York. (Hanhardt, 2003, p. 7-11)

The Variable Media Approach posits that the creators of the works are the protagonists in making decisions on the evolution of the work over time. The Variable Media Questionnaire is a tool that helps determine how the artists expect their works to be recreated in the future if they are to be recreated. The Variable Media Questionnaire examines the behavior of every artwork, independent of its medium. Some artworks are installed differently every time they are exhibited. Some artworks can be performed. The survey includes different questions to collect information on the behaviors of artworks that can be reproduced, copied, interactive, coded, and web-based. However, artwork can exhibit more than one behavior. For example, Mark Napier's work *net. flag* (2002) features interactive, coded, and web-based characteristics. Thus, all the questions that analyze these behaviors need to be answered by the artist. (Ippolito, 2003, p. 111)

The Variable Media Questionnaire is used to determine conservation strategies, supporting artists in determining the most appropriate strategies for their works. Should the physical entities that constitute the work be stored? Or should the digital files or

physical structures that constitute the work be emulated? (emulation) Or should the changes that could take place in the physical appearance of the work be accepted, migrating the medium that the work uses to contemporary standards? (migration) Should the equipment of the artwork be replaced by different hardware that has the same social or metaphoric function? Should a performance be reformulated for reinterpretation in a different space and time? (Ippolito, 2003: 47-53)

In short, the variable media paradigm supports artists in defining their works independent of the medium and also makes it possible for the work to be transformed when the medium in which the work was created is no longer in use. Artists have the opportunity to express freely how they would like to pass on their works for future generations.

In the next section of this essay, artist and academic Selçuk Artut's work *Variable* will be examined to create a formal notation. Furthermore, taking the variable media survey as a point of departure, the questions that were directed to the artist will help determine what kinds of changes are allowed by the artist for future re-exhibitions of the work and which aspects need to be kept the same.

Methodology

First of all, the relevant literature on the subject was examined and within the framework of the information collected, the Media Art Notation System (MANS), developed by Richard Rinehart, was used as the foundation to create a notation for the work *Variable* by Selçuk Artut. To form the partition in this case study, the MPEG- 21 DIDL XML language was used. Within the framework of MPEG-21, complicated digital objects are presented in the Digital Item Declaration Language (DIDL). DIDL, based on a series of abstract notions, is determined by XML (Extensible Markup Language), which helps create flexibility and expandability, making it possible to create notations for digital artworks. (Bekaert et al., 2003: 324)

Furthermore, 21 questions prepared as directed by the Variable Media Questionnaire (2003) developed by John Ippolito were used (Appendix 1) and the answers from this questionnaire were used to make inferences on how Artut would want to have Variable preserved and conserved. When these questions were being prepared, Variable's inclusion of software, its interactivity and installation-driven nature have driven a grouping of the conservation in terms of software, interactivity, and hardware. When these sections are being examined, how the work's behavior, emotions, and appearance can be exhibited in a different medium (emulation); how the original work's technology can be migrated to contemporary standards without deviating from the essence of the work (migration); and whether a reinterpretation of the work that stays true to the essence of the work can be made were discussed.

Case Study: *Variable*

Variable is an interactive, electronic artwork created by Selçuk Artut in 2017. In the work, 9 Raspberry Pi computers are used, connected to a local network, using a machine learning algorithm. The communication between the computers are facilitated through the OSC protocol. The installation comprises 8 screens installed on 60 x 170 cm stainless steel sheets mounted on the wall; the sheets are polished so that they can reflect the objects in the space; there are very thin fluorescent tubes placed between the screens, acting as separators. Next to the main structure is a 5-inch LCD screen placed inside a box, providing

information on the work. When the button underneath this screen is pressed, a new heading, as well as an artist's statement on this heading, appear on the screen through the machine learning algorithm. (Figure 2) (selcukartut.com)

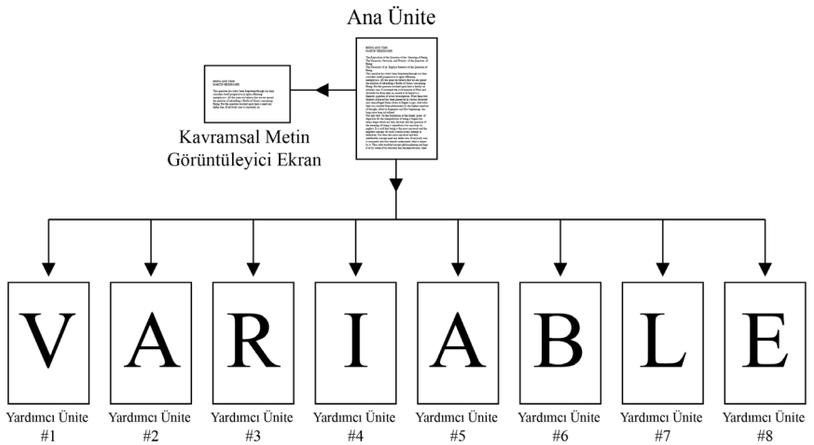

Figure 2:

Selçuk Artut, Variable, Structure of Information Flow

Statements formed by the computer, based on Martin Heidegger's *Being and Time* constitute the artwork. The text of *Being and Time* has been taught to the machine learning system and as the viewer touches the button, the system automatically begins to create new original content. (Artut, 2019: 173) Artut says that he was inspired by the complexity of Being and Time and through the algorithm, Heidegger's text is further complicated and transformed into new thoughts on the structure of the being. These expressions are all incomprehensible and confusing, similar to some artist statements. The artwork is a critique of the boundaries of algorithms on the one hand while reflecting on the ontological questions of post-structuralism. Furthermore, the artist also critiques the at-times incomprehensible nature of the art world. (Schwab, 2017)

In this work, the Media Art Notation System (MANS), developed by Richard Rinehart, has been applied to the work *Variable* and a notation for the work has been formed. Within this notation, the title and the name of the creator are included; no one else has contributed to the formation of the work; it was created in 2017; the language of the work is English and it has semantic content. Furthermore, the work is interactive and has been created through coding. It is an installation work with 60 x 170 cm in dimensions. All rights are reserved by the artist and it was first installed at the Zilberman Gallery. A document that includes a link to an image of the work and technical information has been prepared and a suggestion of keeping this document in case of future exhibitions of the work has been made. (Appendix 2)

Furthermore, questions from the Variable Media Questionnaire, developed by John Ippolito, have been directed to the artist and the artist's intention, opinions, emotions about the preservation and conservation of the work have been recorded. As *Variable* is a software-driven, interactive installation, the questions based on these qualities have been directed to the artist.

Artut responded to questions about the conservation of the work; he communicated that the files for the original software should be conserved in an external hard drive as well as a cloud-based storage system. Furthermore, he noted that the algorithm's pseudocode structure can be conserved on a paper-based medium. Within the context of this work, a formal notation for the work as an algorithm pseudo-case has been created and its conservation on paper has been suggested. The artist also draws attention to the fact that programming languages could lose their validity and proposes that to create a similar language in the future, the original software needs

to be transformed into algorithmic meta-language to extend the conservation life of the work, the software needs to be transformed into updated versions consistently. Also, he indicates that all kinds of changes to the infrastructure are possible as long as the appearance of the work does not change and the intellectual framework of the work is also presented. (Artut, 2020). As is made clear in Artut's words, artworks that have a clear and open idea at the core are not altered by changes to the physical and technical appearances. They can be repeated in different contexts in different materials with different content. (Baeza & Maloney, 2012, p. 163) In this framework, artworks need to be considered as a series of directions rather than a single authentic object when conserving these types of media-driven artworks and when presenting them with permission from the artist. (Rinehart, 1990, p. 3)

Variable is an interactive, electronic artwork. As the work is based on the viewer adding a new title and concept to the schema of the work, Artut thinks that the work cannot be exhibited without interaction as it would not have the same impact. As with other interactive artworks, such an approach would cause the loss of direct experience. Furthermore, as the work exists at the moment of experience, when the interaction disappears, the meaning of the work is lost and only a material accumulation remains. (Muntadas, 2012: 155) The artist also asserts that the work is exhibited in an aesthetic form using the structure and that the viewers cannot interact with a copy of the work as this would cause the loss of value in alternative constructions. In response to the questions of whether the medium of the work can be updated to make interaction possible, Artut proposes that a touch button rather than a mechanic button may be used as well as a sensor that would be activated by the presence of the viewers. The artist also adds that he would not want another person to interpret his work. (Artut, 2020).

Digital artworks become one with the spaces in which they are exhibited. These kinds of artworks can lose their auras, their impact when reinterpreted or exhibited in a different space. As Artut's *Variable* is an idea-driven work, the work comprises the artist's statements and is independent of the space. Artut states that the work can be exhibited in any space, even the street. He asserts that the dimensions of the work are appropriate for his intentions and that he does not view changing these dimensions in a positive light.

In parallel to the rapid changes in technology, art has also been transformed and has taken on a variable, performative, and interactive structure. In the conservation of digital artworks, the artist's intention and their statement about the making of the work, and the viewer's experience of the artwork have become the focus rather than the conservation of the physical object. Variability is at the core of digital art. Instead of trying to conserve the originals of digital artworks, accepting the variability and dynamism at the core of these works and developing a conservation strategy that abides by this structure is critical. In digital artworks, the presented work is temporary and what remains permanent are the instructions. Thus, artists are charged with conserving the synthesis and formulas of the work, just like scientists, instead of trying to conserve the materials and the equipment.

Digital artworks exhibit different behaviors and thus, the methods of preservation and conservation are different. The Variable Media Questionnaire has been developed to help artists select the most appropriate conservation strategy to collect information on the different behaviors of artworks

that can be reproduced, copied, interactive, web-based, coded, and performed. Artist Selçuk Artut's *Variable*, which has been examined in this essay, needs to be conserved as an intellectual structure, as has become clear through questions directed towards the artist about the work's software, interactivity, and equipment and the artist's answers. Furthermore, interactive artworks exist at the moment of interaction and as each experience is unique, when the artwork loses its interactive characteristic, its whole meaning would disappear, which was a conclusion reached through the questionnaire.

As with all digital works, the essence of Selçuk Artut's work is the digital code. However, as the digital code does not have any meaning beyond the medium, the necessity for a a notation system emerged from the responses of the artist to the "Variable Media Questionnaire" and this notation system, in addition to the artist's intention and statement, needs to be conserved.

According to Artut, the biggest risk to the exhibition of the work in the future is damage to the software files and the software's loss of function. The artist proposes that in order to minimize this risk, the data should be conserved in an external hard drive or a cloud-based storage environment and the algorithmic pseudocode should be conserved on paper. The formal notation system that was formed as part of this work was proposed to be used as a pseudo code.

In conclusion, to conserve the digital artworks that exist today and to be able to entrust these works to future generations, the notation based on the identity of the work and the information that includes the artist's intention and artist statement need to be conserved. Only then will the artist's self-expression be sustained, even when the technology changes.

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Appendix 1: Variable Media Questionnaire

Software

Storage: Should the original files for the work be kept?
Emulation: Should the original software be transformed into algorithmic metalanguage to form a similar version in the future?

Migration: Should the original software be converted to regularly updated versions?
Reinterpretation: Could the original software be replaced with a different protocol that can give the viewer a similar experience? Could a different algorithm be used?

Interaction

Storage: When the technology of the work does not allow the audience to interact with the original form, could the work be exhibited without interaction?

Emulation: Could viewers interact with a copy of the work?

Migration: Should the medium of the work be upgraded to make interaction possible?
Reinterpretation: Should the work be reinterpreted to engage?

Installation

Storage: Are there any things to conserve from the artwork's hardware?

Emulation: Could the work be duplicated using computers of different brands?
Could LED lamps be used instead of fluorescent lamps?
Migration: Could it be used on higher resolution

screens? Could different screens be used instead of LCD screens?

Reinterpretation: Could the work be exhibited in any venue?

Does changing the dimensions of the work affect the expression of the work?

Should the metal plate where the artwork is installed be replaced when it loses its shine? When the artwork is reconstructed, could different sensors be used instead of buttons to facilitate the interaction?

Appendix 2: Variable Media Notation System

```
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xmlns:profile="http://www.mpeg.org/mpeg21/Profile-Specs"
xsi:noNamespaceSchemaLocation="http://www.mpeg.org/mpeg21/schemas/didl.xsd">
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<dc:language>English</dc:language>
<dc:rights>Artist</dc:rights>
</STATEMENT>
<STATEMENT TYPE="urn:mpeg:mpeg21:did/statement-types/text/plain">
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<dc:type>Encoded</dc:type>
<dc:type>Interactive</dc:type>
<dc:format.extent>60x 170 cm, largest component</dc:format.extent>
<dc:publisher>The artists</dc:publisher>
<dc:language>English</dc:language>
<dc:rights>All rights the artists</dc:rights>
</STATEMENT>
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<ITEM>
<DESCRIPTOR>
<COMPONENT>
<RESOURCE
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TYPE="image/jpeg"/>
<DESCRIPTOR>
Artwork installed Zillberman Gallery, Istanbul, 2017
</DESCRIPTOR>
                                </COMPONENT>
</DESCRIPTOR>
<DESCRIPTOR>
<STATEMENT TYPE="urn:mpeg:mpeg21:did/statement-types/text/plain">
Variable is an interactive artwork that utilizes machine learning algorithms in its
creative structure. Composed of eight screens animating a display of eight letter
words, with the touch of a button Variable invites visitors to recompose the artwork's
title and its artistic statement. This interactive art piece was inspired by the
complexity of Martin Heidegger's philosophical book "Being and Time". Being and Time
was trained to a machine learning algorithm to generate paragraphs made of three
sentences at any request.
</STATEMENT>
</DESCRIPTOR>
<COMPONENT>
<RESOURCE>
The sub-component parts of the Variable include:
Façade (60x 170 cm)
8 viewing monitors
database computer
database files
fluorescent lights
button
LCD monitor
Machine learning algoritm
</RESOURCE>
</COMPONENT>
</ITEM>
</CONTAINER>
</DIDL>
```
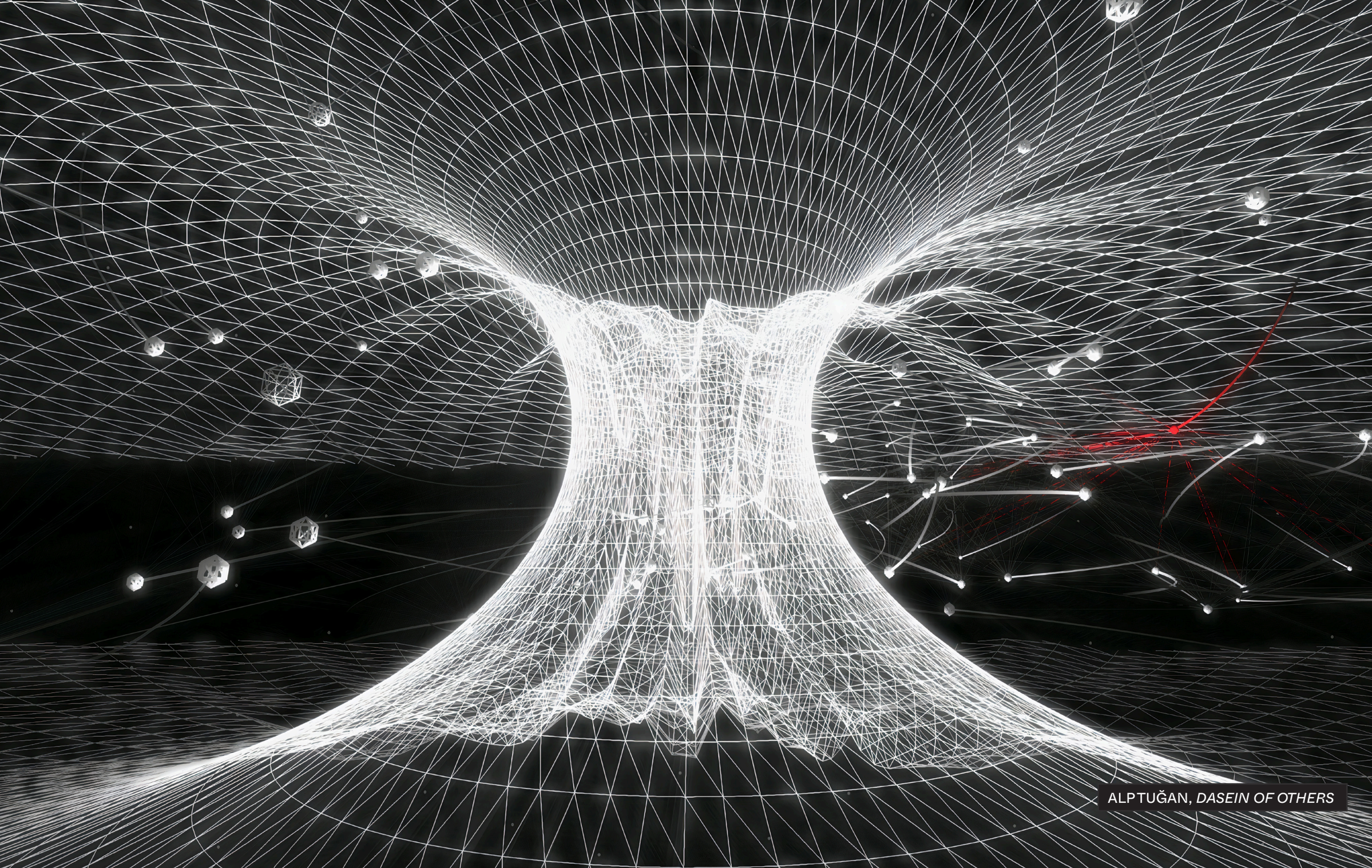

ARTIST INTERVIEWS

🗁 Alp Tuğan

Alp Tuğan is interested in creative coding practices, generative art, interaction design and sonic arts. Tuğan contributes to various exhibitions and events with his audiovisual projects. His articles on sound technology were published at "Volume Sound & Technology Magazine" between the years 2006-2009. He is the member of a live coding duo called RAW. Tuğan has also been teaching creative coding, interactive arts and sound design classes at Özyeğin University in Istanbul since 2015.

www.alptugan.com
www.rawlivecoding.com



ALP TUĞAN, *DASEIN OF OTHERS*

NAME OF THE PIECE:

Dasein of Others

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Yes. It was exhibited at a generative art and coding festival called *Emergent Behavior* in Israel on 28-10-2020.

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

It's an audiovisual installation that could be called under generative art. The display resolution and aspect ratio can be adjustable up to maximum 1920 x 1080 pixel.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION? HAS THERE BEEN ANY SOFTWARE, HARDWARE AND PROCESSING-PLAYBACK EQUIPMENT USED IN THIS PRODUCTION? IF YOU DO NOT WANT TO GIVE EXACT DETAILS, PLEASE ROUGHLY EXPLAIN WITHOUT ANY SPECIFICATIONS.

Dasein of Others is produced using generative art practices. It has mainly two main components as aural and visual narrative. The sound composition is produced by using live coding techniques via an open-source platform called Sonic Pi. The visual part is a custom autonomous application built with openFrameworks C++ creative coding development toolkit.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

The artwork should be kept with the current hardware and system that involves the actual computer itself, currently installed operating system, the custom application built for the artwork and the source code of the audiovisual program. The digital resources should also include necessary application frameworks, documentation, and IDE.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

Random access memory (RAM), hard disk, cooler system, the case of the computer or any other physical parts of the hardware can be replaceable if the new hardware system is compatible with required software and operating system for the custom application works properly.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

As long as the visual and aural content is preserved aesthetically, any hardware update could be acceptable.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

If the source code of the artwork was modified or was updated by someone that I didn't give consent, I wouldn't acknowledge the artwork anymore as mine as mine work of art.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

The custom application supplied with the artwork doesn't require advanced technical knowledge. A regular technical individual who is capable of installing software on a computer can easily set up the digital artwork.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

A stereo sound system, a digital display device, relevant cable and connectors and the computer itself that is running the custom application dedicated to the artwork.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

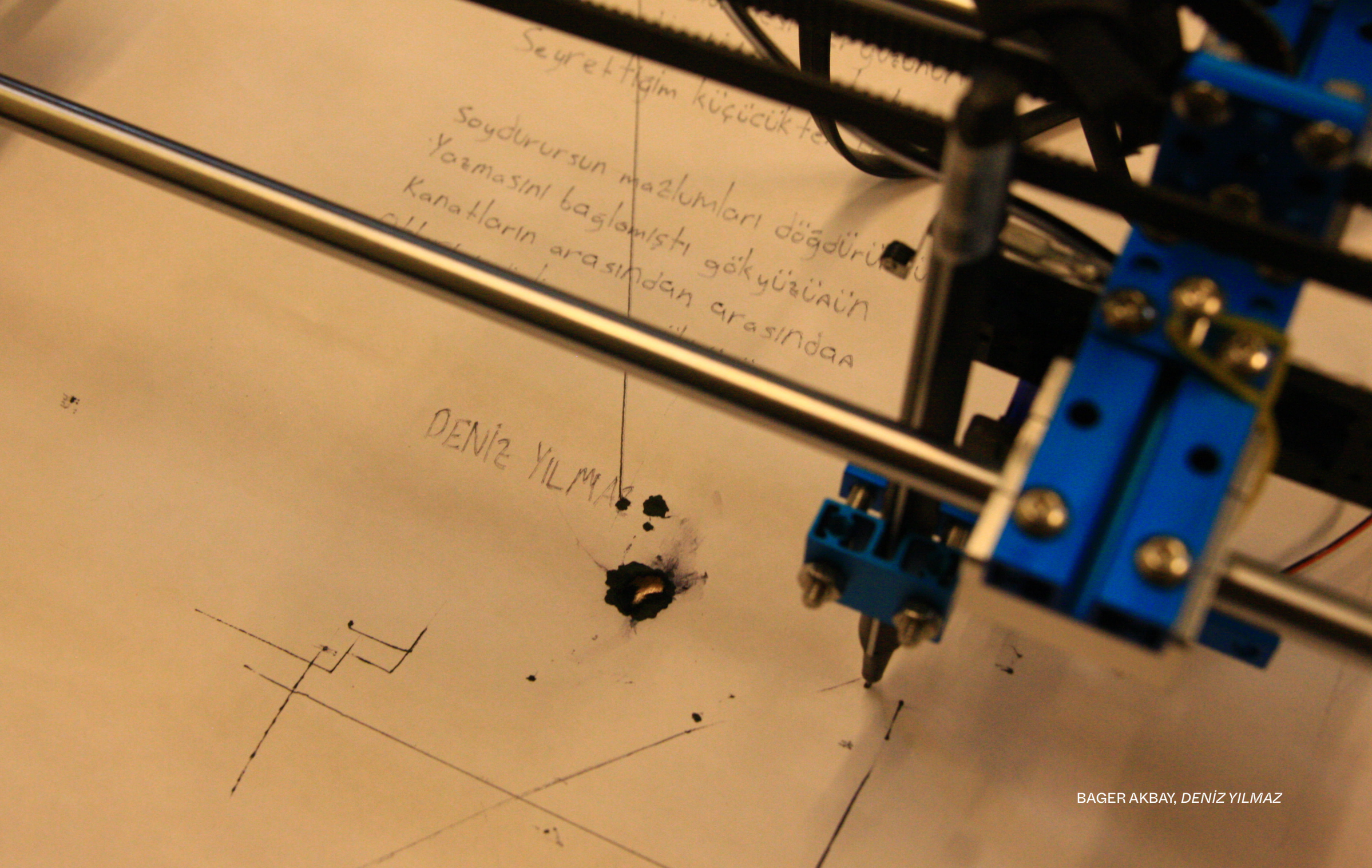
The artwork should be placed onto the ground and there should be enough space for the viewers to let them wander in front of the display surface.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

The digital display device should support at least 1920 x 1080 (width x height) pixel resolution. The projection surface should be in flat structure and physical display dimensions should be at least 3.5 x 2 meters (width x height).

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

Dasein of Others uses a three-dimensional coordinate system in a virtual space. There is a structural "Catenoid" shape in the middle of this virtual space. The particles wandering around this structure also move through x, y and z coordinates. Therefore, if a holographic display system was available in a hundred years of time, the installation could be projected from in the middle of the exhibition space and visitors could also experience the installation by walking around it. And also, the sound speakers could be distributed around the exhibition space to create an immersive experience for the viewers. Finally, I might prefer updating the whole audiovisual system in order to build more immersive experience for the viewers in the future.



BAGER AKBAY, *DENİZ YILMAZ*

Bager Akbay

Bager Akbay studied Communication Design at Istanbul and Interface Cultures at Linz Art University, Austria. After his studies at Black Theater as an actor and puppeteer, Bager started to give lectures at various universities in his field and provides consultancy to companies within the education and design fields in the last 10 years, and creating artworks at his studio iskele47, Istanbul.

NAME OF THE PIECE:

Deniz Yılmaz

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Amber Festival, Istanbul (2015)
Contemporary Istanbul, Plugin Section (2015)
Tüyap Art Fair, Istanbul (2016)
Istanbul Offline Poetry Festival (2018)
Various Makerfaires (2016-2018)

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Installation. 1m x 1m x 1m.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

Processing, GCode, Arduino was used.
The first version included a simple CNC Machine, the second version used Makeblock XY Plotter + Raspberry PI.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

Algorithm and a machine writing the output on a paper with a pen with humanlike speed (20 to 60 characters per minute) and style with a machine style body.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

Coding language could be any language.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

Machine should be a machine from the 1950s to the 2010s. It should be a plotter type.
It should be an accessible machine with no makeup.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

Without paper and pen, different speeds (esp. high speed).

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

It is preferred to be running on open hardware and software and it should be easily replicated by anyone.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

Basic programming and plotter knowledge is sufficient.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

A table and electricity.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

Table for the machine and some space for extra paper, pen and poems. A wall with framed poems would be nice.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

No.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

It could probably be hard to find plotters that are not too fast and too high-tech!

BÜŞRA TUNÇ, *SURUHU*

🗁 Büşra Tunç

The work of architect and artist Buşra Tunç focuses on perception and experience in space. Her interdisciplinary approach creates ambient atmospheres, which need to get experienced to unfold their aesthetic narratives. Tunç designs spatial experiences, which appear like realms of light, where frequency, intensity and colour temperature fuse with auditory patterns. The composed soundscapes assemble noise, sonic acts and human voice.

The body of her architecture is built through a modified reuse of profane industrial materials to question their normative contexts and functions which determine our everyday life. Her engineered physical structures breathe the old heritage of vast megalopolises and forgotten factory sites, creating a tension between the in- and outside to provide gateways into other spheres. The experienced realities take the audience through levels of intimacy and creative thrill by stimulating visionary imaginations.

www.busratunc.com
Artwork: www.busratunc.com/project/suruhu

NAME OF THE PIECE:

SURUHU

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Nakilbent Cistern, Istanbul, 2016

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

It is a spatial installation using light, water, sound, 12 channel lighting control table, mechanical leverage, projector, computer software.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

This installation was set in the Nakilbent Cistern, which was built to meet the water needs of the city. It was thus based on a re-enactment of the cistern's origin story. The cistern, having been distanced from its own function with the city's changing water needs throughout history, has turned into a gallery today. *SURUHU* aims to render experienceable the historicity of this functional relationship that the space establishes with water, its relationship with time and memory. The installation was filled with diluted water yet it could still be walked on. This atmosphere allowed one to experience space not as a container or a carrier in which objects are placed, but as a full being, with its own climate and its own body. The homogeneous light source filtered from the end of the space creates a spatial infinity effect and recalls the water and cistern networks under the city which are not limited to the walls. The light also intensifies the visibility of water, which is the main element of the work. The light in the form of a single line that rises and falls vertically presents a compressed story of the water flowing from the cistern over a long period of time.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

This site-specific installation can be re-installed as long as the exhibition space itself exists. It cannot be adjusted to any other space. In the case that it is reproduced in the same space, it will not be the same as it will include different circumstances. When the technical equipment used is turned off, meaning when it is disconnected from electricity, the work itself is no more. The work owes its material structure to the light, water and sound. Its conservation is dependent on the existence of these technical aspects.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

The technical equipment could be subject to change considering their specification remains the same. Assuming that such aspects that give the work its character like diluted water, light, the vibration of the sound system remain the same, the work could be set up again with an entirely different technical infrastructure.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

It is impossible for the exhibition venue to change. It can only change assuming the technical specifications of the equipment remain the same.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

If it were repeated in a manner that would alter its spatial experience.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

The participant is one of the key components in this performative work that envelopes its visitors and is only completed through their experience of it.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

The work involves such technical structures as light and sound systems, projections, construction of water pipes, mechanical lift systems and their control, along with timer software and their operation, all of which require considerable technical competence.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

6 pieces of cinematic lights, water fogging system, reference speakers, 12 channel lighting control table, mechanical leverage, 6000 Ansilumen projector, computer software.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

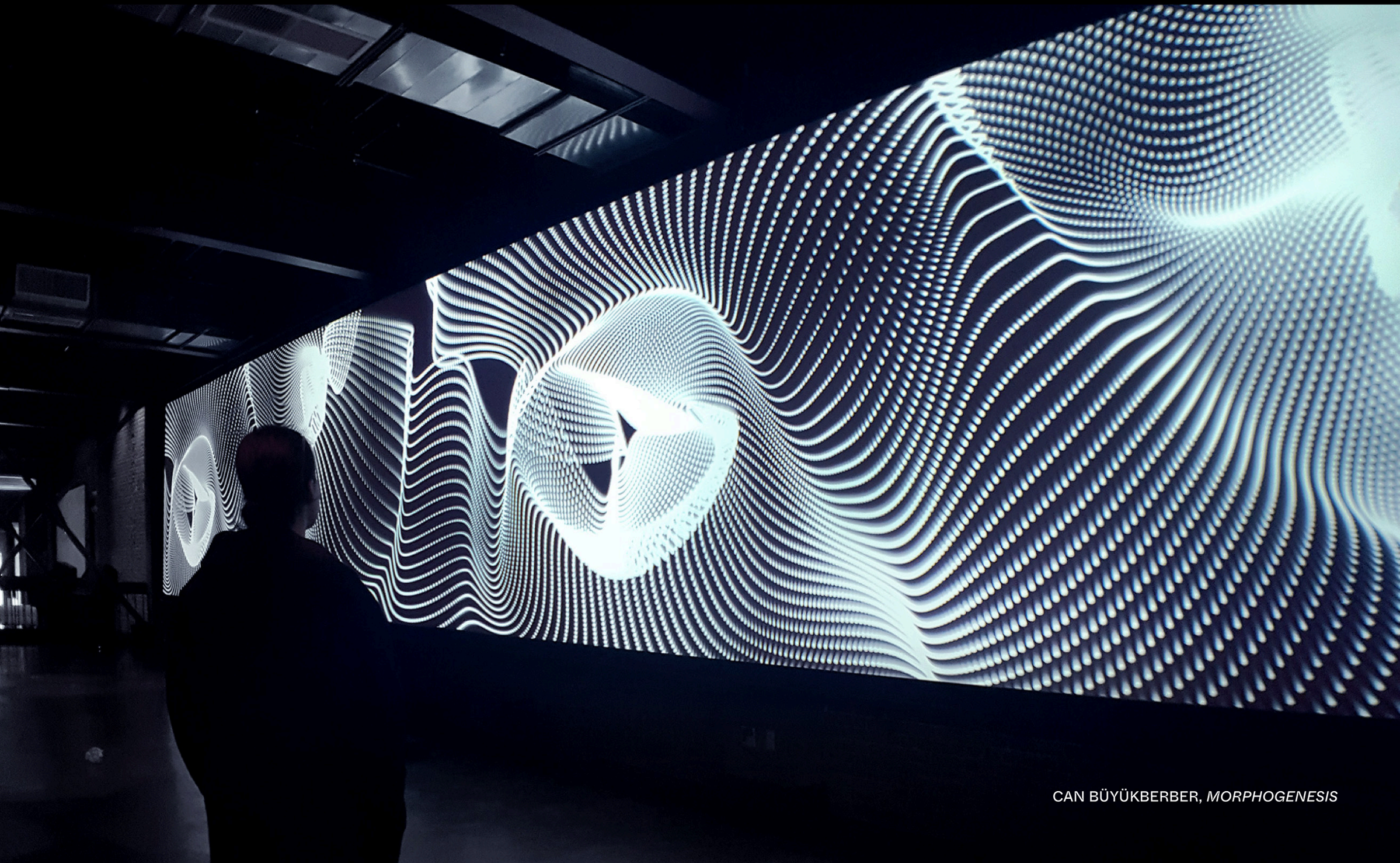
Table for the machine and some space for extra paper, pen and poems. A wall with framed poems would be nice.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

The work involves a sound system that emits high-frequency bass frequency in a manner that vibrates the ground. This system would have to keep operating.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

An instruction manual for the re-staging of the work would have to be prepared. As it is a performative artwork relying on the exhibition space, experiences of the visitors and their senses, it is possible to assume that it would have similar effects in the future. However, it’s difficult to foresee how human senses and experiences will evolve in time.



CAN BÜYÜKBERBER, *MORPHOGENESIS*

🗁 Can Büyükberber

Visual artist and director Can Büyükberber (b. 1987 in Izmir) creates immersive audiovisual experiences that are embodied in physical and digital spaces. His practice consists of experiments with various media such as virtual-augmented reality, projection mapping, geodesic domes, large- scale displays and digital fabrication.

Driven by an interdisciplinary thinking and curiosity which extends to art, design and science, Buyukberber's work often focuses on human perception, exploring new methods for non-linear narratives, geometrical order, synergetics and emergent forms. Aiming to build captivating and abstract universes, he uses increasingly complex structures which are perceived as a multi-sensorial feeling and turns the conceptual into the experiential, blurring the sense of scale and presence in physical and digital environments.

With a background in Physics and Visual Communication Design (BA), he has received his Master of Fine Arts (MFA) Degree in Art & Technology from San Francisco Art Institute as a Fulbright Scholar. He has been selected to Autodesk's Pier 9 and Adobe's Augmented Reality Artist Residencies and has worked at the state of the art workshops to produce innovative XR projects. His audiovisual works that utilize geodesic domes, virtual reality headsets and architecture have toured museums, galleries and media art festivals around the world, including exhibitions and screenings at ZKM, Karlsruhe ;Ars Electronica, Linz; SAT, Montreal; Sonar D+, Barcelona; California Academy of Sciences, Exploratorium and Dolby Gallery in San Francisco; Akbank Sanat, Istanbul; Art Futura, Rome; MUTEK.JP, Tokyo; ZeroSpace, New York City; collaborations with musical artists such as Grammy-Award winning rock band Tool, Shigeto and Czech Philharmonic Orchestra.

www.canbuyukberber.com

NAME OF THE PIECE:

Morphogenesis, 2016

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Selected exhibitions:
2016, *Symposium IX*, SAT, Montreal, Canada 2017,
Sonar+D, Barcelona, Spain 2017,
Digital Creatures, Art Futura Roma, Ex Dogana,
Rome, Italy 2017,
Open Codes: Living in Digital Worlds, ZKM,
Karlsruhe, Germany 2018,
MUTEK.JP 2018, Tokyo, Japan
Morrison Planetarium, CalAcademy, San Francisco,
USA

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Audiovisual piece for Fulldome and Virtual Reality

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

Morphogenesis has been exhibited with a variety of media and different installation techniques such as panoramic displays, VR headsets and geodesic domes. The key factor that made the audiovisual content so flexible for multiple settings was using a 360 degrees rendering technique called “equirectangular imagery”. The equirectangular source material has been adapted to numerous spherical and flat displays with changing aspect ratios based on the specifications of the location it’s been presented in.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

There are multiple formats of the audiovisual content and digital print files that I keep on my Google Drive space for future presentations. The main files are a jpeg sequence for fulldome presentations (nearly 60 gbs), an equirectangular video file for VR, a panoramic video file for projection installations and high resolution still renderings for large digital prints accompanying the VR presentation.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

I think as long as it is one of these immersive presentations, the piece works as it is intended.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

Morphogenesis has been produced as a spatial experience for its viewers whether it is presented as a physical installation using projectors or a virtual reality headset. Exhibiting the piece without this context, on a small scale flat screen or on a web browser which doesn’t utilize its immersive format would be an injustice to the work.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

A high compression to the original renderings and audio by the exhibitors or presenting the work with glitches or low frame rates does really upset me and I see that as a disservice to the artistry.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

Especially in the fulldome presentations (since it resembles a collective VR experience in contrast to VR's isolated setting) I see the communal experience as a valuable component of the piece, before and after.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

Geodesic dome projections usually use multiple high lumen projectors, a playback system and surround sound equipment. Many places that exhibit such work has or hires a technical team that can handle the physical installation part. The artist usually provides a 1:1 ratio spherical audiovisual content.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

One of the best places *Morphogenesis* was exhibited is Satosphère, the permanent dome environment that the SAT (Society for Arts and Technology) has in Montreal.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

The SAT has this ideal presentation: A 4K projection array, the surround sound system in a completely dark dome environment with a soft surface and cushions where the viewers can lay down comfortably and their peripheral vision is completely immersed in the imagery.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

It would be really great if the video formats are still playable in the future and I am curious to see how we will be transcoding all these media to the future formats. If softwares of the future can reproduce a version of the piece for the future volumetric displays where we can walk inside of it without headsets or a brain computer interface could run it directly on the viewers visual cortex, the task of the intended immersion would be complete.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

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WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

One of the best places *Morphogenesis* was exhibited is "Satosphère" , the permanent dome environment that the SAT (Society for Arts and Technology) has in Montreal. A pioneer in the field of immersive creation, the SAT inaugurated the Satosphère in October 2011: the very first permanent immersive modular theatre, dedicated to artistic creation and visualization activities. With a diameter of 18 metres and a height of 11.5 to 13 metres, this dome forms a 360-degree spherical projection screen and can accommodate up to 350 spectators. The Satosphère's key points Modular screen configuration : 180°, 210° and vertical 230° by 360° 18m in diameter 11.5 to 13m high 8 video projectors 157 speakers (from https://sat.qc.ca/en/satosphere)

🗁 Candaş Şişman

Candaş Şişman is an artist, who uses digital and mechanical technologies as a medium for expression. Directed by his curiosities, Şişman's works touch many different fields such as immersive and multisensory installations, sound, kinetic sculptures, animations and audiovisual performances. Candaş Şişman aims to manipulate our notion of time, space and motion by his work, using digital and mechanical technologies.

In 2011, he co-founded Nohlab, a studio producing interdisciplinary experiences around art, design & technology. Since 2014 he has given lectures about soundart in various universities and he is also a member of NOS Visuals, which is a collaborative platform that creates real-time, sound-reactive audiovisual performances.

He has received Honorary Mention from Prix Ars Electronica and Jury Selection Award from Japan Media Arts Festival. He participated in many exhibitions and festivals, such as Venice Architecture Biennale and Todaysart. The artist lives and works in Istanbul.

Artist website: www.csismn.com
Artwork: https://csismn.com/I-P-O-cle

CANDAŞ ŞİŞMAN, *I-P-O-cle*

NAME OF THE PIECE:

I-P-O-cle

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Experientia, Château de Lunéville, France, 2019
ECHO Exhibition, Proun Gallery, Moscow, Russia, 2018
Optical Illusion of the Body, National *Museum of Fine Arts*, Taichung, Taiwan, 2017
Bam Festival, Liege, Belgium, 2016
MAPP'ing, E-fest digital culture festival, Tunis – Tunis, 2014
Scientific Inquiries, Koç University Campus, Istanbul, Turkey, 2013

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Light Installation, lenses, light, mirror, sound, container, fog, 1200 X 240 X 240 cm.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

The most important component of my project, the lenses, were custom made for this project. We manufactured the lenses by attaching tailor-made glass and Fresnel lenses. Also, the hanging system was made with magnetic systems since it allows millimetric adjustment. The rest was envisioned as rental equipment. Therefore, I would ask for the following equipment to be provided in the exhibition space:
directional light source, full dome mirror, subwoofer, player for sound, hazer machine.
The hanging system and lenses will be provided by me, and they will include custom lenses (12 piece or more) and a hanging system.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

Everything could be rented again or reproduced.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

The light source could change as long as it is as directional as it gets, lenses could change as long as they are made of tempered glass and Fresnel lens, the sound system could change as long as it has a powerful subwoofer, the space could change, though it needs to be 12-meter long and 3-meter wide. The Hazer machine could change, but it needs to be one that does not jeopardize public health and is appropriate in terms of its scent. And lastly, the mirror, too, could change, as long as it is circular, and has a diameter of at least 50 cm.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

Equipment and space are all subject to change. Yet, the essential principle of the work remains the same and it is a minimum 8 lenses creating a spatial experience, together with the smoke and sound frequencies. For this to be achieved, lenses should be arranged successively with a calibration that they can carry the light while refracting it for 10 meters until the mirror at the end.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

If the essential principle of the installation (as I have explained above)

changes or any component (light, sound, smoke or lenses) is missing, it would be something else, and not the artwork I have envisioned.presenting the work with glitches or low frame rates does really upset me and I see that as a disservice to the artistry.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

This is an experiential project. Therefore, the audience becomes a part of the experience itself. Yet, it is not possible for the audience to alter the project with their intervention since it is not an interactive work. It is to be experienced only.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

The best case is that I install and calibrate the lenses but still, it is something I can handle remotely. For example, I was able to follow the process for the exhibition in Russia without actually going there. The equipment (lights, sound and hazer equipment) should certainly be of high quality. In addition, the space should be in accordance with the minimum specifications I have provided. The installation team should be experienced in the installing process of physical installations (for the adjustment of lenses) and there must be another team for technical equipment (for lights, hazer and sound).

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

A directional light source, such as Raptor Spot DTS. The light should be like a beam. A full dome mirror with a diameter of 80 cm or more. A subwoofer, for instance the JBL 2x 18' 1600W Bass Speaker. A player for sound, such as the Crown CDi 2000 Amplifier, and Sony DVD player for the audio player. The general dimensions of the space can be 1500 X 350 X 260 cm, though I can adapt my installation into different spaces… The space should be totally dark, and the whole space should be dark gray including the walls, floor and the ceiling. Also, there will always be smoke in my installation, absorbing smoke from the other spaces. So perhaps black curtains, fabrics as well. A Hazer machine for time adjustment. Its really important to have a time adjustment; we will test how many times we should run this for best quality in smoke density…. And we should keep that density during exhibition. That's why it's really important to have detailed time adjustment. Also, another important aspect about this machine is the smoke liquid quality…. It should not smell too much and disturb the audience. We should find the best quality of fluid for this machine.
A technical team will be necessary to help with setup, which will take 4 days. I will need 4 days for the setup and calibration of lenses. But before I arrive, hazer, light, space, electricity, sound system, ceiling for hanging should be prepared in advance. After I am in the space, I will hang the lenses and calibrate them. This is the same for sound and light. As for the hanging system, I’m using magnets to hang the 12 custom lenses to the ceiling. So I need an iron flat pipe (it should be square) or an iron flat surface in the ceiling, to stick magnets. Magnets are great to calibrate the location of the lenses. Also, steel rope is needed for hanging. The iron pipe or the surface should hang on 2.6 meters in height.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

The work requires its own space. Since it uses both lights and smoke, it needs to be isolated from other spaces or works around it. Therefore, the best way to exhibit is that it has a large room of its own. This room should be sound, smoke, and light-proof. It should have sufficient ceiling height, the sound and light equipment should be of high quality. The level of smoke is vital because if there is too much or too little smoke, the light beam becomes invisible. Therefore, the smoke intensity should be optimum, that is, the level in which the light beam can be seen the best. The hanging system and the point of junction should allow millimetric adjustment. Because I use too high and too low sound frequencies in the project, some parts of the space start to vibrate with certain frequencies and this led to unwanted vibrating noise. It should be determined which parts of the physical space start to vibrate for each frequency, and these parts should be fixed accordingly. Thus, the space should be a continuous, single section (if it constitutes of multiple sections, it becomes open to vibration). Crown CDi 2000 Amplifier, and Sony DVD player.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

The light is vital, it is crucial to have directional light, the light value should be high, it shouldn’t be pale. The sound system is very important, since I use too high and too low frequencies and it is a sound composition aiming at the vibration felt sensually rather than heard, a high quality sound system is a must. The Hazer machine should be time-adjusted, because the intensity of the smoke should stay at the same level constantly so that the light could stay visible all the time. The scent of liquid in the hazer machine is important. It should be a liquid that wouldn’t disturb people and be harmful for health.

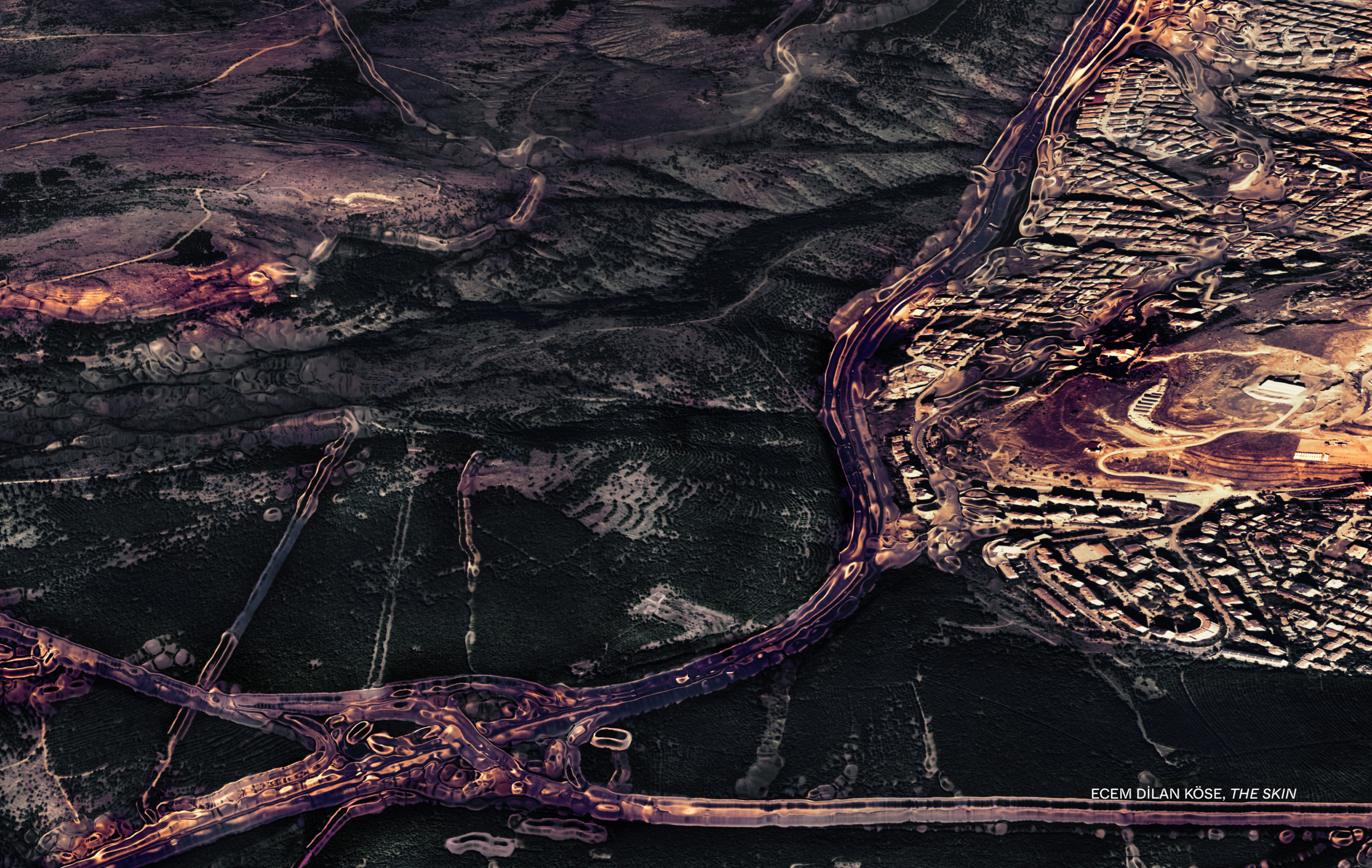
IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

I don’t know. And, it is not that important for me.

🗁 Ecem Dilan Köse

Ecem Dilan Köse (b. 1990) graduated from the Bilkent University Interior Architecture Department and works as an artist producing visual works in search of texture. Köse often matches the textures she researches in different scales to make sense of experimental videos in conceptual frameworks. Traces of her background in architecture and dance can also be observed in her artistic practice. Following the completion of the NLP program in ECNLP, Köse has adopted programmatic methods on how to transfer some of the meanings found in her own interior world to her works. Her artistic practice is mostly based on similarities and integrations between digital and organic elements in constant search of flow and transformations, informed by her study of marbling techniques. Her installations and works have been exhibited in many festivals and fairs including Sonar Festival and Contemporary Istanbul. Köse has recently begun to work under the name RESOLE along with her artistic collaborator Ahmet Ünveren, designing live audiovisual performances and installations.

www.ecemdilankose.com



ECEM DİLAN KÖSE, *THE SKIN*

NAME OF THE PIECE:

The Skin

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Contemporary Istanbul 2019, Plugin

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Video art, 7:16 , LED screen installation , 4352 x 2052 px.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

The production consists of a video manipulation study, using satellite images. Besides, some generative images were used such as After Effects, Da Vinci, Touchdesigner, Ableton.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

The screen resolution and size are important in case of re-display. The work has been studied in accordance with the sRGB color scheme. In case of a changing technology, the same color information is expected to be provided.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

The size of the screen can be changed by keeping the ratio constant, audio devices can be changed provided that they do not lose their quality.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

The artwork has been calibrated to a non-standard extent. For this reason, the resolution ratio cannot be changed. It cannot be exhibited silently. It cannot be displayed in a different color diagram. The opening scene of the work cannot be shortened. Although it is a video, the work has been designed in a large-scale spatial integrity. For this reason, I do not prefer it to be displayed on a screen smaller than the human size, even if the ratio is not distorted.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

When the video editing changes, when different images are added on the scenes, when the main images are subjected to various manipulations.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

Basically, because it is not an interactive work of art, people are only present as experiencers. But the experience style of the work has been designed. For this reason, it must remain within a defined area.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

In an area similar to the room described, the installation should be made by a technical staff who has a good command of video-broadcasting technologies so that there is no time lag between sound and image.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

LED screens with seamless screen connection details should be installed. The pixel pitch should be a maximum of 2.6 mm., surround sound system.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

An exhibition area of 6 m x 4 m x 3 m in dimensions. There should be elevated levels where people can sit on or enough hygiene that they can sit on the floor. The sound should reach the sitting area in a controlled manner, from all directions. The positions of the sound monitors should be placed according to the seating arrangement.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

A minimum of 2K image quality, horizontal installation, 2176 x 1026 px.

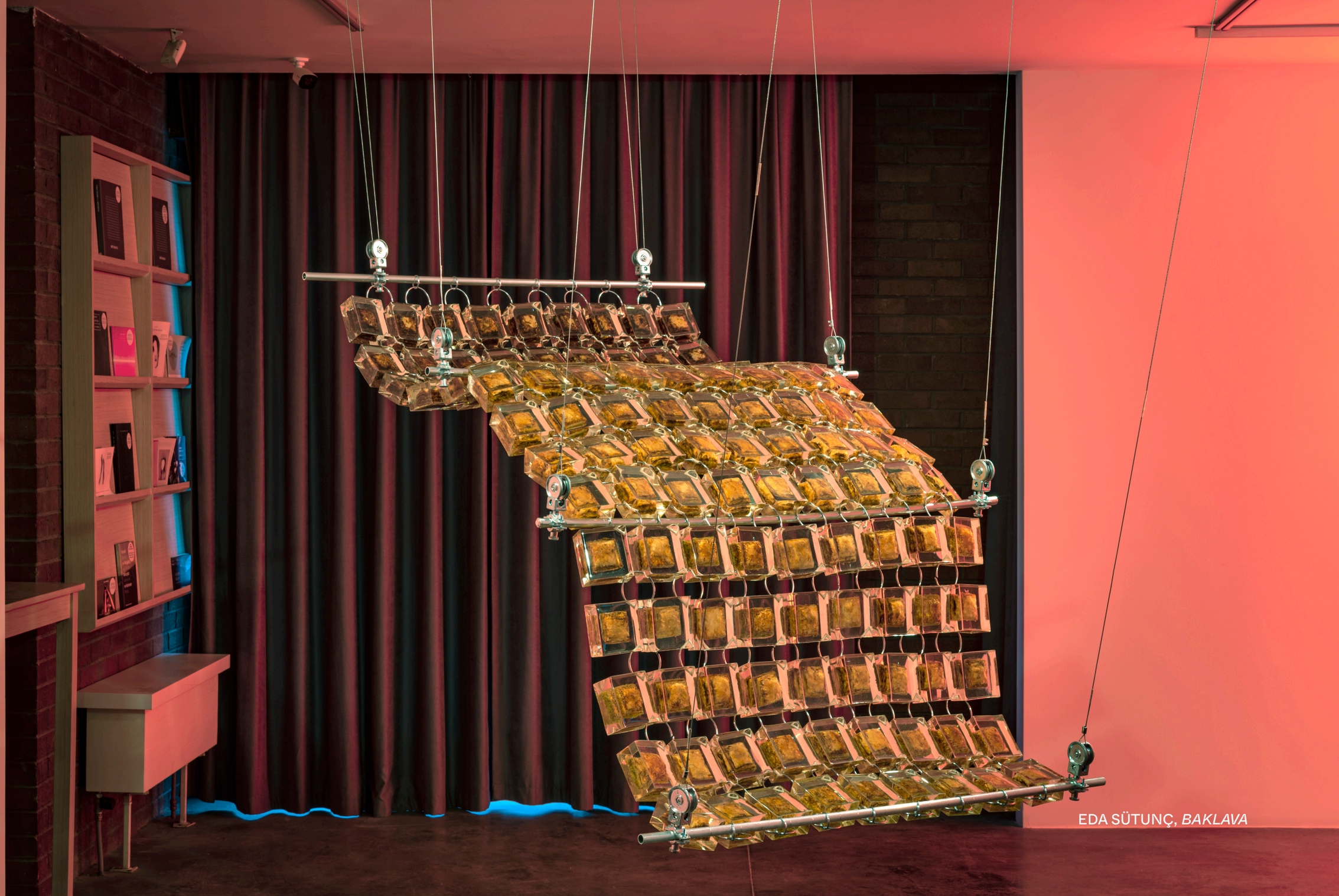
IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

I think it can be broadcast on glasses or biochips. In this case, it is okay if the image is straight or curved. I do not think that the work loses its quality of being a spatial installation in the case of a direct and uninterrupted display to the human mind. However, in such a scenario, if a person sees an unrelated environment in which he/she is simultaneously experiencing the work or watches the video by adding it to the environment he/she is in, this may not be a desirable situation since it will go beyond the designed experience.

🗁 Eda Sütunç

Eda Sütunç (b. 1992) received her BA from Koç University, Istanbul and completed her MFA degree at the School of the Art Institute of Chicago, with a Dean's Scholarship. By leveraging developing technologies and modern tools inspired by the ideals of industrialization and mechanization, she explores the meaning of gender, culture, race and humanism. The unique use of different mediums in her work aims to foster a dialogue across performance art, video, sculpture and sound. In 2017, Eda won the second prize in the Celeste Prize, UK. Her work has been part of exhibitions in Germany, the Netherlands, United Kingdom, Serbia, Turkey and the United States and is part of various collections. She currently resides in Istanbul and holds teaching positions with leading institutions and universities in Turkey. Sütunç is pursuing a PhD degree in Communication at Kadir Has University, Istanbul.

www.edasutunc.com



EDA SÜTUNÇ, *BAKLAVA*

NAME OF THE PIECE:

Baklava, 2017-2020

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Future Looms (Solo Exhibition) - November 6-December 27, 2017 at Sanatorium, Istanbul, Turkey.

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Kinetic Sculpture (Resin, baklava, chrome suspension pipe and spring, DC motor, Raspberry Pi, cable) 160 x 100 x 5cm.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

Firstly, I produced the sculptural part of the project. For this part I had to find out the right amount/timing of specific chemical components which would ensure that the organic materials stay fresh and not decay, at least visually. After overcoming this challenging part, I moved on with the rest of the installation. On the edge of each preserved baklava sculpture in resin molds, I drilled holes to connect them to one another. I attached each unit with the other individual sculptural parts with chrome plated springs. In the second part of the project, I wanted the baklava rug to look as if it was flying on air. I created a system that enabled the sculpture to suspend from the ceiling and move upwards and downwards in a loop. For the flying part, I used a DC motor and a Raspberry Pi that creates a cyclic motion for the rug to look as if it is flying.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

I believe every element in the work has a set of attributes that are integral to the identity of the work.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

For the sculptural part, I think any re-creation or imitation would change the conceptual meaning of the work. In the instance that the artwork decays in time, I think this is supposed to happen and we should not replace it. The work will live through its documentations. This decay is more meaningful for the concept of the artwork than re-creating parts for an archival purpose. For the functional part on the other hand, the DC motor and the Raspberry Pi can be replaced if they stop working. In this case, I'd imagine the archiving professionals could create a system that makes the sculpture move in the same principle I set, without using the technology of today. I guess I have a machine/human dichotomous thinking here. I use technology as a tool that supports my work. The DC motor and the raspberry Pi are instruments that support the conceptual system of the work and thus can be replaced if they can be with a system that supports the installation in the same manner.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

During the exhibition I was asked if the motor part of the sculpture could be detached from the installation. The buyers inquired if the sculpture could be hung on the wall instead. I think this case summarizes an impossible/unacceptable change example for this work. In the case of the Baklava sculpture, I am against any change that would alter the conceptual background of the project.

WHEN WOULD YOU NO LONGER RECOGNIZE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

I think this question is very similar with the question that inquired about the essence of my artwork. In the case of Baklava, the conceptual framework would change if it was re-created even for archiving purposes. It would alienate me from the artwork and change the conceptual background of the whole project. In the case of needing to change the DC motor system or Raspberry Pi I am open to using a system that works with the same principle.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

This artwork is not interactive in the form that it requires the spectator to achieve its purpose. But I still formulate the installation of *Baklava* as an interactive installation. It requires the viewer to walk in and around it. It is “performing” in a way, flying all day for the spectator to respond and requires this interaction to realize itself.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

The exact measurements between the strings need to be applied, that is, 20 cm from the first string to the next, 55 cm from the second to third and 66,5 cm from the third to the last string. As it is a very heavy installation, if the ceiling is made of sheetrock the installation personnel needs to fix the work onto the real construction so that it is safe to be experienced by the public.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

We don’t need an exhaustive setting for this installation, only electricity, proper lighting and silence.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

For exhibiting this work, we need a standard ceiling height. I would like the strings to be the same length as I planned them to be in a room that has a ceiling height from 275 cm to 350 cm. The installation needs to have proper lighting. I don’t think we need a seating area but if we have a space to rest, it would be nice to experience the artwork. We need some space to walk around the artwork so the smallest room should be at least 4 x 4 meters.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

This work does not require an extra audio visual equipment. The ideal conditions for exhibiting the work is a sound proof space where the viewer can hear the sound of the machine and walk around the installation.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

Baklava is an experimental artwork for which I used organic objects. My aim in this work was making these individual sculptural organic artworks immortal. Baklava sculptures are supposed to look fresh as if they have just been bought from the store and kept inside the resin. In this respect, I am hopeful that they will look the same as the day I created them. If I am wrong and these sculptures are more ephemeral than I foresee them to be, the only way to know about this artwork will be through the images and documentations from the exhibitions. In the case of the baklavas deteriorating, I can imagine printed images of the work and video documentation of how it was experienced inside the gallery.

Lara Kamhi

Lara Kamhi's (b. 1987, Istanbul) artistic practice operates at the edge of perception. By transgressing the borders between fields of visual story-telling, sound, light art and site-specific installation, she creates and captures immersive image spaces, soundscapes and narratives in which she explores and investigates the confusing conflict between appearance and truth. Projecting on or through form and animating as if from within, her technological yet intuitive approach plays and experiments with visual boundaries.

Kamhi studied Theatrical Studies at University Sorbonne Nouvelle Paris-III and Film Studies at the American University of Paris before obtaining her Film and Television BA at Istanbul Bilgi University. She then pursued her higher education at Slade School of Fine Art (UCL) in London where she obtained her MFA degree in Fine Art Media and won the Julian Sullivan Award for high achievement.

In 2014, she founded an independent art initiative named Prizmaspace where she curated an exhibition series comprising ten shows focusing on site-specific, immersive and cinematic approaches with emerging & established artists coming from filmmaking backgrounds. Since 2010, Kamhi has exhibited and screened her works in galleries, festivals, museums and public spaces nationally and internationally.

www.larakamhi.com

LARA KAMHI, *CITYSCAPE*

NAME OF THE PIECE:

Cityscape

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Seeing in The City exhibition, Guildhall Art Gallery, London, United Kingdom, 2012
MADE Mobility for Digital Arts in Europe across public screens in Istanbul, Turkey, 2012
Ten Diez Movement, Magma, Tenerife, Canary Islands, 2012
Pilevneli Project, Istanbul Turkey, 2012
BYOB, Pera Museum, Istanbul Turkey, 2015
Light is There Where We Are Not, Cultural Transit Foundation, Yekaterinburg, Russia, 2015
Wavelengths, Europalia Arts Festival, Les Halles, Brussels, Belgium, 2015
Interference, Medina of Tunis, Tunisia, 2018
Istanbul the Lights Festival - Contemporary Istanbul, across public screens, Istanbul, Turkey, 2020

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Abstract video with variable exhibition sizes, an originally 1920 x 1080 mp4 or mov file.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

The work was initially shot as a tracking shot of the city seen from the top of a London bus. Through re-projecting the captured image successively onto the camera's lens with the help of a projector's directional beam and some additional filters, I portrayed the real as a flux of colours, forms and lights. In order to accentuate this initial effect, I have used After Effects and slightly pixelated the overall result.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

The work is a digital moving image, therefore a digital preservation would be needed.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

The work can be screened in many ways, including being re- projected through lenses and in various directions to gain additional layers of abstractions throughout these organic and tactile processes. Therefore, the whole content is in a way replaceable or reusable to create new works.

WHAT CHANGES ARE POSSIBLE/IMPOSSIBLE OR ACCEPTABLE/UNACCEPTABLE?

The work itself can be used as a material for a future work. Although not a process entirely changing the work's core essence, it enables for its visual language to be rendered down into many others.

WHEN WOULD YOU NO LONGER RECOGNISE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

Never. It is the process of transformation that I am initially interested in. Therefore, unless intentionally taken and reused by another artist to create a response, the whole transformative journey of the work emerges from its core essence.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

The work is created to be screened and viewed in a physical space. Unless an additional layer of interaction is

created for its future exhibitions, the public experiences it as a mere viewer and listener.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

The answer will completely vary according to the space the work will be installed in. As a preference, I like to see the work on a small led screen vertically installed between two walls, at the corner of a room or as quite the opposite; a large video projection covering an entire wall.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

The answer again varies in regards to the space and context the work will be displayed in. The most important part would be additional materials to hide connections, such as cords and hanging parts in order to make them dissolve within the exhibition space.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

The work's optimum presentation would be in a completely darkened area with a lot of space for walking around in case the piece is shown on a large scale. If the work would be shown on a small scale, the space should then preferably be a narrow and small dark room, creating a sort of intimacy between the viewer and the piece itself.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

The best immersive result is obtained through sharper image and sound; yet so far, the work also showed convincing results with lower quality equipment. The priority then inevitably becomes to find equipment enabling a discreet display within the overall space.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

I imagine viewers as experiencers and the visual space of the work shifting into a mentally physical space where experiencers could be sensually immersed within the flux of colours, forms and lights the work portrays.

Onur Sönmez

Onur Sönmez is a designer based in Munich. His current works aim to critically explore human computer collaboration and digital / physical materialities. His works have previously been exhibited at the Venice Biennale of Architecture, Saatchi Gallery, London, Sonar+D, Istanbul, Transmediale Berlin, Contemporary Istanbul and Ars Electronica Festival (2005, 07, 08, 09, 10, 12, 13, 15), among others.

http://onursonmez.com/

ONUR SÖNMEZ, *HERO* ヘロ

NAME OF THE PIECE:

Hero ヘロ

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Hero ヘロ was exhibited at Sonar+D Festival in Istanbul, on April 6-7th 2018.

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Hero by Onur Sönmez, Motoi Shimizu and Sinan Tınar is a 15-minute site specific collaborative audio-visual performance, which comprised visual and aural aspects, namely the 3d model of a life-sized whale displayed vertically on a monumental screen, accompanied with the improvisational soundscape which was performed live. The work was designed for the 24 x 6 meter long, 3968 x 960px display of the Zorlu Performing Arts Center, Istanbul.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION? HAS THERE BEEN ANY SOFTWARE, HARDWARE AND PROCESSING/PLAYBACK EQUIPMENT USED IN THIS PRODUCTION? IF YOU DO NOT WANT TO GIVE EXACT DETAILS, PLEASE ROUGHLY EXPLAIN WITHOUT ANY SPECIFICATIONS.

Hero was a collaborative project between artists who agreed on a fundamental intended vision and brought their respective experiences and artistic practices for the work. I was animating a rigged, life-sized 3d model of a whale in 3ds Max and rendering several transparent image sequences via V-ray. Motoi Shimizu was using TouchDesigner and a midi-controller during the performance to real-time map, manipulate and generate visual effects over the pre-rendered footage I provided. Sinan Tınar was using a modular synthesizer setup to create the soundscape. The output of the modular synthesizer was also used as an input to TouchDesigner in order to sync real-time visual effects with audio, when desired.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

Hero ヘロ was designed to be a calm experience for the visitors. It was imperative for us to provide a relaxing moment during a chaotic indoor music festival. The sense of scale and the proximity of the visitors to the screen were really important in order to deliver the intended message and feeling. As long as the work retains its free, relaxed and improvisational flow, and as long as it has a life-sized whale as its main protagonist, it is open to variations in the future.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

Hero ヘロ is essentially a very flexible project, as long as the physical screen dimensions are large enough to fit an adult whale. The audio / PA system, modular synthesizer setup, screen resolution, real-time software we use and performance duration are all open to change.

WHEN WOULD YOU NO LONGER RECOGNISE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

While reflecting on this question, I realised that the central aspect of this work for me was the specific choreography of the whale. So in this manner my main relationship with this whale was through its movement. As I had researched its specific movements and speed extensively, it was imperative to me that the movements of this whale were completely life-like and realistic, almost frame by frame.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

With the idea that it would be performed during a highly stimulating aural and visual performance hall, *Hero* aimed to represent a calm, transformative process for us and it is mainly based on abstract memories we had. During its creation, we often discussed how most of the large scale installations on view at media art festivals tend to be exhausting and flashy and that we wanted to make something on the other side of the spectrum. We ultimately wanted the visitors to feel relaxed and peaceful.

We observed that many viewers from the audience tended to experience the work either sitting or lying down, which was both somewhat unexpected and appreciated. Moving forward, I feel that this may be considered an integral part of the work as well, that it provides a calm, tranquil recluse during a busy and involved event.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

For me, it's imperative that the work appears on a monumental screen and that it is installed from the ground up. As is the case with an aquarium, it should materialize in a way that is adjacent to the floor, either vertically or horizontally. I feel that if it were to be displayed on a screen descending from the ceiling, this would compromise the mood and intention of the work.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

Minimally, this work would require 24 x 6 meter long high resolution LED panels.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

I think the basis of this project is not dependent on future technologies, I believe that it is important that it provides a moment of reflection to whoever would like to experience this work for fifteen, twenty minutes in the future. There is something to be said about the sense of scale regarding this work, in that the scale of a whale is ten, fifteen times the size of the average human, which is an astounding and fascinating thing to behold, that a living being of this size and posture is even in existence. So I think that if the work should be exhibited in the future, as long as the scale is preserved, it retains its core meaning.

Ozan Türkkan

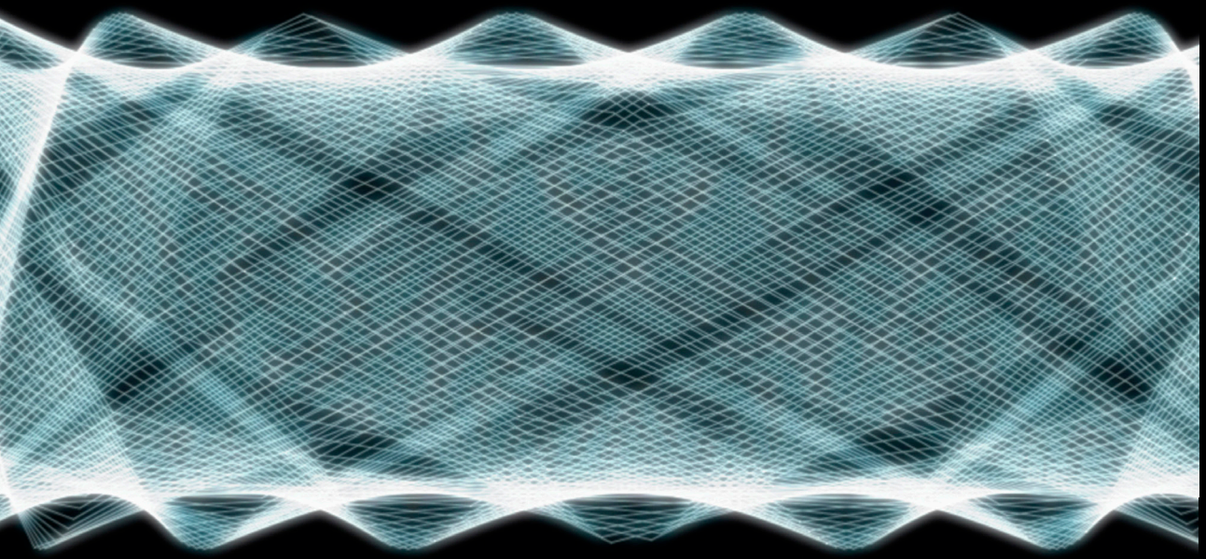
The work of Vienna based new media artist Ozan Türkkan (b. 1980) is situated at the intersection of art and technology. His work is centered on experimental digital media with a focus on generative and algorithmic computer art, fractal geometry, mixed reality experiences, interaction and motion as a reflection of the impermanent nature of existence, human and social behaviour. He uses technology as a canvas to create innovative and engaging digital art installations. He likes to explore the many-folded boundaries between science, art and new technologies, and combining different media elements in a creative process.

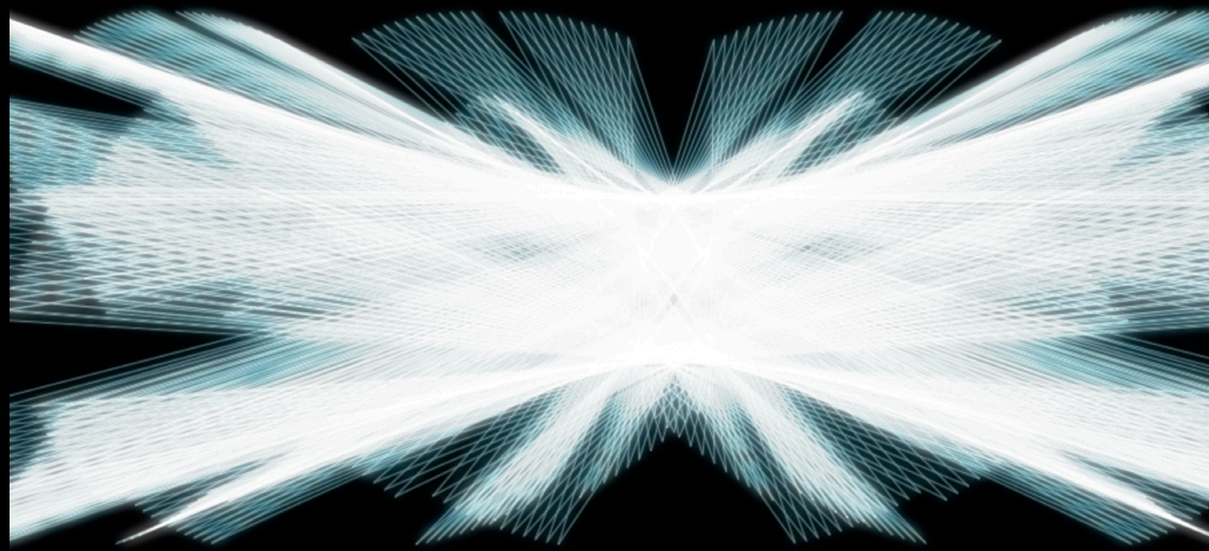
Before the very first steps in digital media, he studied and practiced various art disciplines in Philadelphia, Salamanca and Barcelona in collaboration with numerous institutions, and art centers. After he graduated from The University of Salamanca, he received his Master degree in Multimedia at BAU (Escola Superior de Disseny, Universitat Central de Catalunya) in Barcelona, where he lived and worked many years as a new media artist.

His work has been exhibited in Art Centers, Museums and Galleries such as the Santa Monica Art Centre, Barcelona, Reina Sofia Museum, Madrid, Centre of Contemporary Art Luigi Pecci, Florence, Torrance Museum, Los Angeles, Victoria House, London, Lincoln Center, New York, Banannefabrik Luxembourg, Europalia Art Festival, Brussels, Les Brigittines Contemporary Arts Centre, Brussels, Museum of Contemporary Art, Belgrade, Santral Istanbul, Akbank Art, Istanbul, Gallery Mitte, Barcelona, LOOP Videoart Festival, Barcelona, Rotterdamse Schowbourg, WUK, Vienna…

Living in numerous cities throughout his life Ozan Turkkan has developed a sense of multiculturalism and cosmopolitanism characterised his works. Complicated structures, conflicting and coexisting colours and diversity constitute a parameter to push the artist to underscore a complex field which is converging around art, new technologies and the sciences of nature.

www.ozanturkkan.com





OZAN TURKKAN, *ALFA OMEGA ALFA*

NAME OF THE PIECE:

Alfa Omega Alfa

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Punto y Raya Festival, Museo Reina Sofia, Madrid, 2011

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Single channel digital video, 03:52 in duration, featuring generative, creative coding.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

Abstract moving image composition produced with generative images created by using an Open Source software (Processing, https://processing.org) and the sound composed simultaneously.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

Composition and sound.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

Different kind of screens or projection techniques for the screening.

WHAT CHANGES ARE POSSIBLE-IMPOSSIBLE OR ACCEPTABLE-UNACCEPTABLE?

I don’t know even if its possible.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

Actually it is.

As I have been observing that the piece is changing as the public changes, since it’s very connwected to the perceptions.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

It's quite simple actually; minimum required size of screening in a total dark screening hall and a decent sound system.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

Dark screening room with a minimum required size of screening and projection equipment, and a sound system.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

A totally dark screening hall with the dimension of around 12m x 12m, 6m projection screen or LED screen, sound system, easy access with no seating possibilities required.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

HD image quality required. Video format: mp4 with h-264 video codec. Required screening format: 16:9 widescreen.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

Vastly different projection or screening techniques may be possible, but preserving the essence of the composition with the integration of sound is necessary.

Refik Anadol

Refik Anadol (b. 1985, Istanbul) is a media artist, director, and pioneer in the aesthetics of machine intelligence. His body of work locates creativity at the intersection of humans and machines. In taking the data that flows around us as his primary material and the neural network of a computerized mind as his collaborator, Anadol paints with a thinking brush, offering us radical visualizations of our digitized memories and expanding the possibilities of architecture, narrative, and the body in motion. Anadol's site-specific parametric data sculptures, live audio/visual performances, and immersive installations take many forms, while encouraging us to rethink our engagement with the physical world, its temporal and spatial dimensions, and the creative potential of machines.

www.refikanadol.com

REFİK ANADOL, *INFINITY ROOM*

NAME OF THE PIECE:

Infinity Room: New Edition

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

49 cities, every continent except Antarctica between the years of 2015-2020.

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

4M x 4M x 4M, custom built architecture, audio/visual installations, 4 channel projectors, 4 channel sound, custom software, custom media server.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

Main concept uses 7 chapters of 7 unique noise algorithms developed in VVVV Project is using a custom computer shader with 4 channel camera inside the 3d built environment. Each scene focuses on unique parametric geometry created by particles or lines. Playback system based on DDS image sequence for a perfect FPS results. Image sequence is first loaded into the GPU buffer and read by 5 frames preload. 4 channel quadraphonic sound designed by Kerim Karaoglu in custom software and recorded in lossless format.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

The core software is key to preserve. I think architecture of the room, projectors and lens may change in time due to the limited supply of technology. As a plan b, the entire experience was also recorded in Apple ProRes 4444 format in double resolution.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

Projectors, lenses and over all room dimensions are crucial but can be redesigned without losing the main immersion discourse and context.

WHAT CHANGES ARE POSSIBLE/IMPOSSIBLE OR ACCEPTABLE/UNACCEPTABLE?

Size of the room, minimum luminance and resolution of the projectors, media server playback logic and sound quality.

WHEN WOULD YOU NO LONGER RECOGNISE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

When it’s completely destroyed or trans-formed into something completely different in terms of its experience.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

Always. My fundamental approach to public art comes from the core value of making art for anyone, any age and any culture.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

If I’m alive or my studio team is available, we do the installation by ourselves. In order to see the details, please see the diagram on the next page.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

4 Channel 15.000 luminance WUXGA projects, ultra-short throw lenses, custom media server, custom software for player, 4 channel sound.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

Please see the diagram on the next page.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

Please see the diagram on the next page.

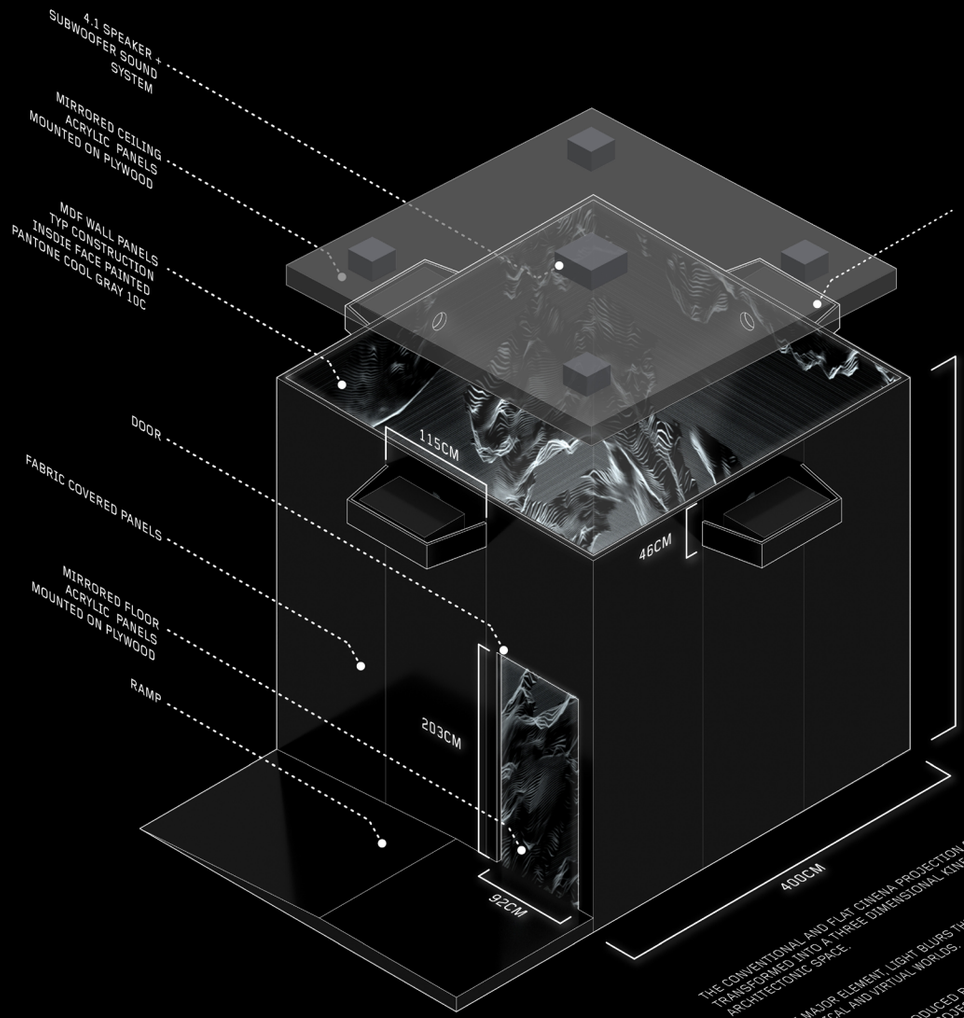
IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

Can still survive. Probably with much exciting projection technology, better resolution but I do hope still it can survive it’s discourse and context regardless of technology.

AUDIO/VISUAL PERFORMANCE

INFINITY ROOM

REFIK ANADOL STUDIO



THE CONVENTIONAL AND FLAT CINEMA PROJECTION SCREEN IS TRANSFORMED INTO A THREE DIMENSIONAL KINETIC AND ARCHITECTONIC SPACE.

AS THE MAJOR ELEMENT, LIGHT BLURS THE BOUNDARIES BETWEEN THE PHYSICAL AND VIRTUAL WORLDS.

A DUALITY IS PRODUCED BETWEEN THE SIMULACRUM SPACE CREATED BY THE PROJECTIONS, AND THE PHYSICAL SPACE WHERE THE VIEWER STANDS.

THE PARTICIPANT'S AWARENESS OF PHYSICAL SELF IS TRANSFORMED BY THE IMMERSIVE ENVIRONMENT.

AUDIO/VISUAL PERFORMANCE

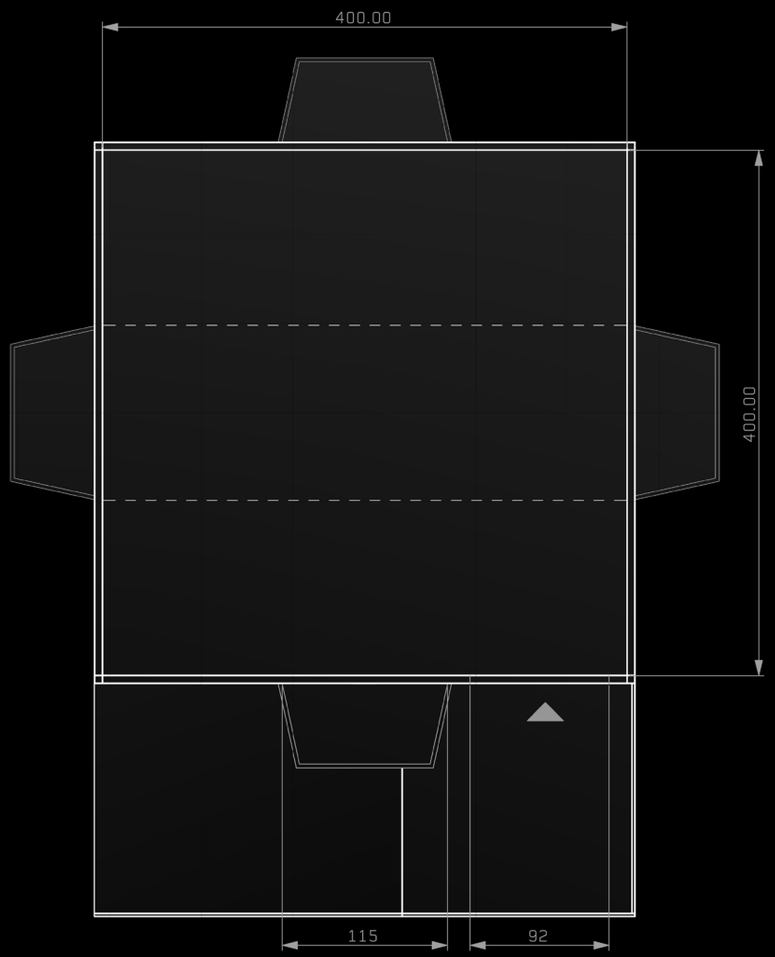
INFINITY ROOM

REFIK ANADOL STUDIO

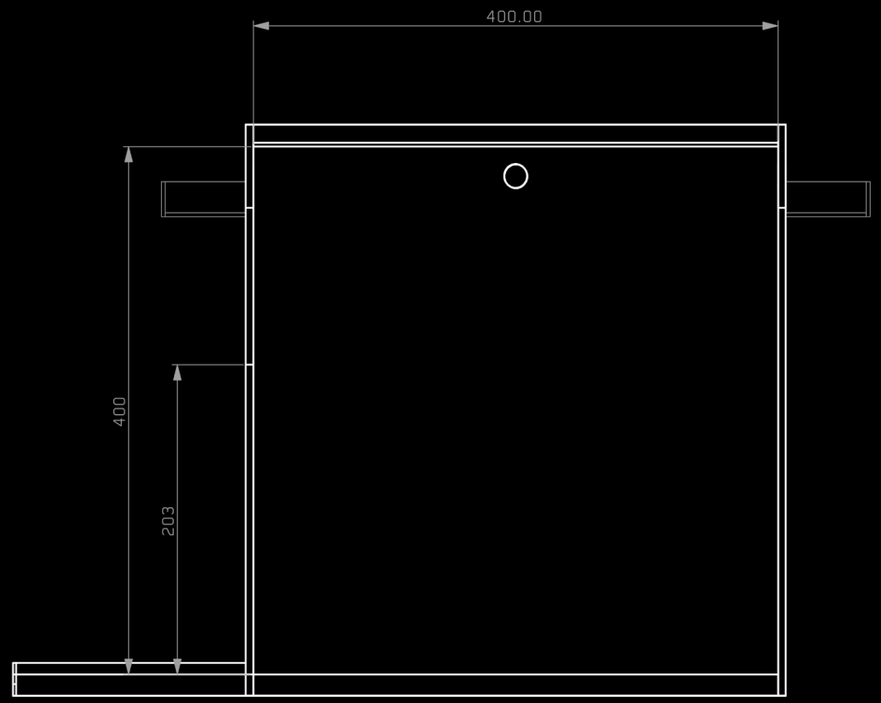
TECH LIST

PROJECTORS	EPSON PRO L1505UNL LASER WUXGA	4 QTY
LENSES	SHORT THROW #2 ZOOM LENS (ELPU04)	4 QTY
SOUND	LOGITECH Z906 SPEAKER SYSTEM	1 QTY
MEDIA SERVER	CUSTOM MEDIA SERVER	1 QTY

CUBIC INFINITY ROOM NOTES:
EXTERIOR WALLS, INTERLOCKING FOR EASY
ON SITE ASSEMBLY
MIRROR ACRYLIC MDF BACKED PANELS
FOR FLOOR AND CEILING
PROJECTOR TRAYS ATTACH TO WALLS IN
FRICTION SLOT FRICTION JOINT + CABLE
CONNECTED TO CEILING TOP



01 CUBIC INFINITY ROOM PLAN
N.T.S.



02 CUBIC INFINITY ROOM SECTION
N.T.S.

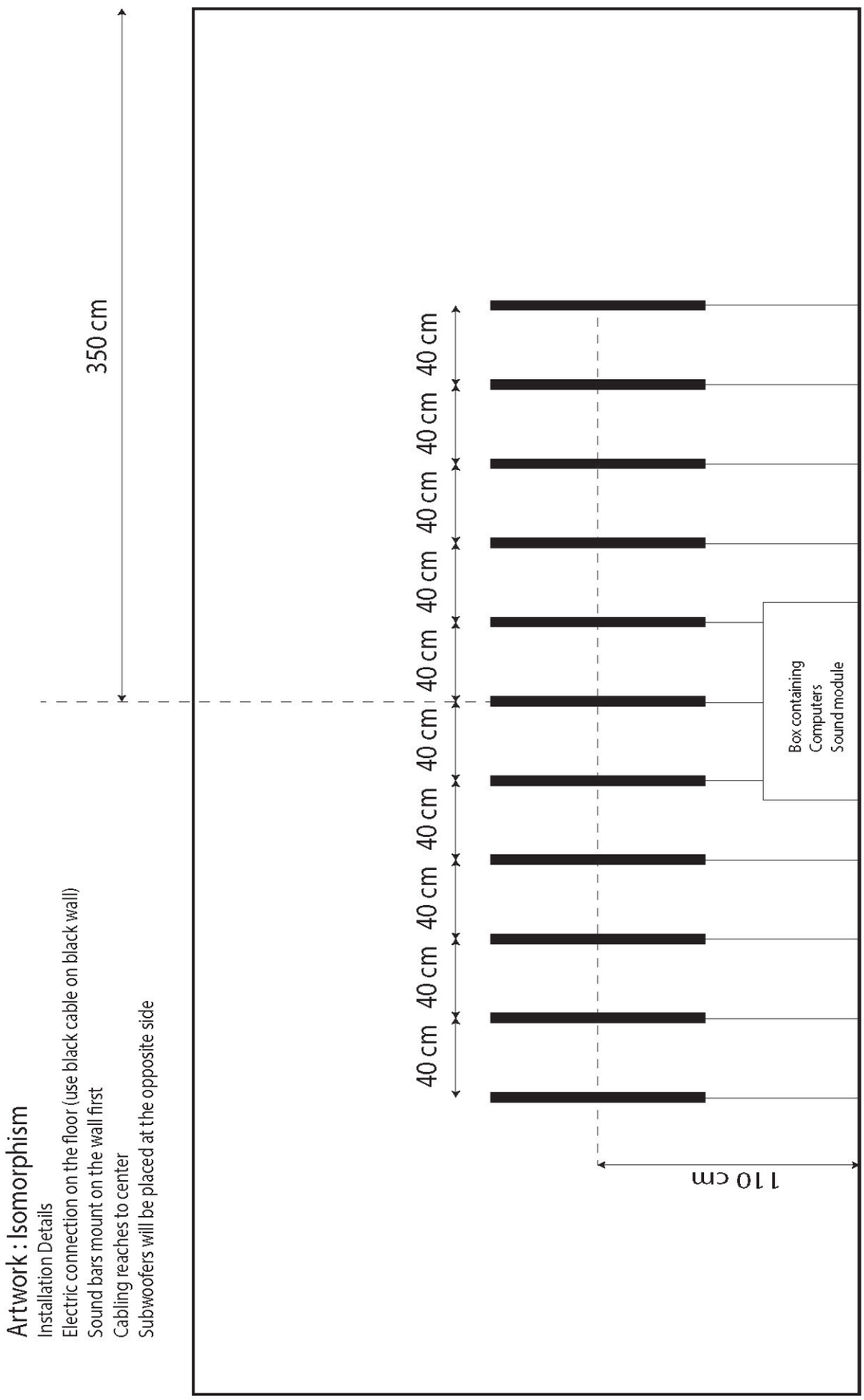
Selçuk Artut

Selçuk Artut’s artistic research and production focus on theoretical and practical dimensions of human-technology relations. Artut’s artworks have been exhibited at Dystopie Sound Art Festival (Berlin, 2018), Moving Image NY (New York, 2015), Art13 London (London, 2013), ICA London (London, 2012), Art Hong Kong (Hong Kong, 2011), Istanbul Biennale (Istanbul, 2007), and received coverage at Artsy, Creative Applications, CoDesign, Visual Complexity, CNN GO. He holds a PhD in Media and Communications from European Graduate School, Switzerland. Currently, Artut is a faculty member at the Visual Arts and Visual Communication Design Program Sabancı University, Istanbul where he mainly teaches Sound and Interaction courses. He has been releasing several albums as a member of a Post-Rock Avantgarde music band Replikas since 1998. In 2016, he founded RAW with Alp Tuğan, an audio-visual performance group which produces works through creative coding and live-coding techniques. Artut is artistically represented by Zilberman Gallery, Istanbul.

www.selcukartut.com
@selcukartut

SELÇUK ARTUT, *ISOMORPHISM*

Setting Up with Dimensions



Artwork : Isomorphism
Installation Details
Electric connection on the floor (use black cable on black wall)
Sound bars mount on the wall first
Cabling reaches to center
Subwoofers will be placed at the opposite side

NAME OF THE PIECE:

Isomorphism

HAS IT EVER BEEN EXHIBITED? IF YES, WHEN AND WHERE?

Solo Exhibition at Gallery Zilberman, Berlin, 2019.

CAN YOU SPECIFY THE CREDENTIALS OF YOUR PIECE? MEDIUM, SIZE, GENRE ETC.?

Sound Installation, 11 channels, software. The physical requirements are a quiet room (4 m2) along with a bench. The technical equipment is 11 soundbars with subwoofers (any brand), minimum 11 channel. The sound output audio module is a computer with Supercollider Environment installed.

HOW DID YOU PRODUCE THE ARTWORK? WHAT WERE THE MEANS OF PRODUCTION?

The art piece performs itself according to an algorithm that was programmed in SuperCollider Sound Programming Environment. In terms of physical conditions concerned, there are eleven sound actuators hardwire cabled to a sound module running on a computer. Please find the detailed information in the next pages.

WHAT IS THE ESSENCE OF THE WORK TO BE PRESERVED FOR IT TO BE INTACT FOR THE FUTURE?

This art piece is composed of multi channel speakers (eleven) with a generative code running to create the sound composition. Even though the source code is supplemented exactly here in the document, I am certainly aware of the fact that not only the software environment will disappear in the long run but also the operating system where the current hardware configuration is running on. For those who are going to apply any conservation on this piece has to be aware of these following criteria, the main intention should be to preserve the visitor's experience, visitors need to be provided with a suitable comfort to safely sit on a bench and experience the piece inside a quiet room, sound speakers need to have perpendicular orientation on the wall, so the speakers' rectangular longitudinal shape needs to be preserved. The information screen placed inside the system box may be located at any place convenient under the condition that it is visible to the visitors. The system box and any cable may be hidden elsewhere. A sufficient bass frequency supplier (in this case, it was a subwoofer) has to be supplemented.

WHICH COMPONENTS ARE REPLACEABLE WITHOUT THE WORK LOSING ANY OF ITS ESSENCE AND PHYSICAL REPRESENTATION?

All of the physical entities can be replaced with equivalent components.

WHAT CHANGES ARE POSSIBLE/IMPOSSIBLE OR ACCEPTABLE/UNACCEPTABLE?

There has to be a comfort provided for the participant to sit to listen to the artwork. The sound has to come through an ear level location.

WHEN WOULD YOU NO LONGER RECOGNISE OR ACKNOWLEDGE THE ARTWORK AS YOUR WORK?

If the basic sine wave signals are not superimposed on each other with a sequential

order according to Fibonacci sequence frequency values, the piece may not be recognized as my work.

WHAT STAND DOES THE PUBLIC TAKE? IS THE PUBLIC AN IMPORTANT PART OF YOUR PIECE?

Attendance is important. If a similar room dimension will be preferred, the public's experience may be enhanced through accepting a small group of people, say, maximum three at a time.

HOW IS THE WORK OPTIMALLY INSTALLED? WHAT SHOULD BE THE TECHNICAL SPECIFICATIONS OF AN INSTALLATION PERSONNEL?

Sound actuators should be indexed since there is a sequence of order with their locations. Technical team should be aware of sensitivity for sound clarity.

WHAT TECHNICAL FACILITIES ARE NEEDED TO DISPLAY THE WORK?

A computer with an operating system that is able to run sound specific algorithms is required, along with a sound module with multiple channel outs, and an isolated room with minimum sound interference.

WHAT DO YOU THINK IS AN OPTIMUM PRESENTATION? CONSIDER THE REQUIREMENTS FOR THE EXHIBITION SPACE (DIMNESS, DIMENSIONS, SEATING POSSIBILITIES, ACCESS)?

A relatively large space (10 m x 10 m) with hundreds of sound actuators aligned next to each other. In this case, participants would have separate seating positions in the center of the room.

IF YOUR WORK REQUIRES AUDIO VISUAL EQUIPMENT, WHAT SPECIFICATIONS DO YOU THINK SUCH DEVICES SHOULD MEET (IMAGE QUALITY, FORMAT AND SHAPE)?

There is a necessity for installing a screen in order to inform guests about the performance schedule. The piece does not perform non-stop, there are intervals between new iterations of compositions. On the other hand, the audio equipment should preferably be selected with a high degree of clearness. All the cabling, if necessary, should be orderly installed to keep the scene as minimal as possible.

IMAGINING IN A HUNDRED YEARS OF TIME AHEAD, HOW DO YOU FORESEE YOUR WORK TO BE EXHIBITED?

I am assuming that the basic physical properties of human species will not be altered drastically. If every living human will be able to hear from a sound source located in a room using their natural ears, the sounds in a physically surrounded environment should be placed in adjacent coordinates. The sounds should initialize simply, but with the addition of frequencies that are configured with sequential Fibonacci values, the piece becomes eerie but at the same time comfortably inviting. Essentially, I place great importance on the experience that takes place within the environment with its unique sound structure.

EVENTS
in partnership with Digilogue

Technological Arts Preservation Lecture Series 2019-2020

20 NOVEMBER 2020
WEB ARCHIVING: COLLECTION OF THE "NOW" FOR THE "FUTURE"

ZEYNEP PEHLIVAN -
RESEARCH ENGINEER, INA

Due to the growing importance of the World Wide Web, archiving the web has become a cultural necessity in preserving knowledge. Thus, many national libraries around the world have undertaken steps to archive and preserve the Web. Web archives which contain up to billions of pages versions obtained by crawling, represent a huge information source, inherently greater than the web itself. This makes web archiving an active research area with numerous open issues like crawler optimization, storage and access models, etc. The aim of this talk is to present the state of the art on web archiving in the world, challenges related to crawling, accessing and preservation. As a case study, Pehlivan presents in detail the web archiving platform at INA that consists of 80 billions of contents, with over 1 billion tweets and 2 million hours of videos.

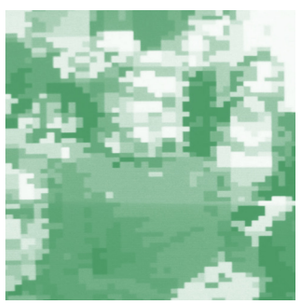
20 NOVEMBER 2020
HIGH FIDELITY WEB ARCHIVING FOR ALL WITH WEBRECORDER

ILYA KREYMER -
SOFTWARE ENGINEER,
WEBRECORDER PROJECT

Ilya Kreymer elaborates on web archiving tools (ReplayWeb, Webrecorder Desktop, Conifer) developed as part of the Webrecorder Project, delving into the high-consistence archiving abilities of these tools in archiving websites with case studies.

23 OCTOBER 2020
TELEMATIC MEDIA-ARCHAEOLOGICAL PERFORMANCE: THE AFTERLIFE OF THE MINITEL NETWORK

PAMAL GROUP
(PRESERVATION & ART - MEDIA ARCHAEOLOGY LAB)
LIONEL BROYE -
ARTIST & MEDIA ARCHAEOLOGIST
ARMANDINE CHASLE -
ARTIST
MORGANE STRICOT -
MEDIA AND DIGITAL ART CONSERVATOR



This presentation is based on the article “The Afterlives of network based artworks”, and the performance presents the reconstruction of the Minitel network, almost 10 years after it disappeared in France. Minitel was, at the time, sort of an alternative to the Internet in France.

20 NOVEMBER 2020
MODELING NET ART PROVENANCE: A NEW APPROACH TO THE INTERFACE OF RHIZOME’S ARTBASE ARCHIVE

LOZANA ROSSENOVA -
DESIGNER AND RESEARCHER,
RHIZOME

This talk focuses on Rossenova’s collaborative doctoral research project with digital arts organisation Rhizome. The project aims to develop a theoretical and practical approach towards the redesign of the interface of Rhizome’s historic archive of net art – the ArtBase. The performative and processual characteristics of net art works do not easily conform to the modes of classification and provenance description traditionally employed in cultural heritage collection management systems. How can the archive’s design and infrastructure address such challenges? In this talk, Rossenova discusses the value of taking a multidisciplinary approach – looking to archival theory, digital preservation and software studies, in order to develop a critical design practice and shares some of her research findings. Rossenova specifically discusses her collaborative work with art historian Dr Karin de Wild, which explored the application of the W3C PROV Data Model (originally developed for expressing data provenance on the web) to the case of net art and the description of provenance for artworks in the ArtBase.

18 SEPTEMBER 2020
PRESERVATION OF VIRTUAL REALITY ARTWORKS: ARTIST INTERVIEW

MEMO AKTEN -
COMPUTATIONAL ARTIST,
ENGINEER AND COMPUTER SCIENTIST

Virtual reality is a complex environment with many different components that need to be taken into account when developing preservation strategies. Aside from software and supporting documents, the entirety of the VR content (3D Models, 360 Video, Software) require different preservation approaches. The preservation strategies of art and culture institutions tend to focus on the preservation of hardware. However, an art institution with VR artworks in its collection would need to truly grasp the content of the work prior to developing preservation strategies. This talk delves into how we may be able to preserve all VR systems including software and ensure they remain accessible with Memo Akten's work titled *Fight!* as its focal point.

20 NOVEMBER 2020
SURROGATES AND SAMPLES: HOW TO PRESERVE VIRTUAL ENVIRONMENTS

PROF. SELIM BALCISOY -
SABANCI UNIVERSITY

The technological infrastructures and the respective levels of experiences reality required for virtual environments have been changing in an irreversible manner since the 1990s. This talk focuses on the possible technological solutions to preserve these works through case studies.

19 JUNE 2020
LEVERAGING CLOUD-BASED GPU VIRTUALIZATION FOR SOFTWARE-BASED WORKS OF ART

BEN FINO-RADIN -
MEDIA ARCHAEOLOGIST AND CONSERVATOR,
SMALL DATA INDUSTRIES

The exhibition and display of software based works of art that have demanding graphics requirements can be challenging. Dedicated hardware can be expensive, requires maintenance, and limits accessibility of the work to in-person experiences only. In this event, Fino-Radin presents developments in the field of GPU powered cloud virtualization platforms that are redefining the limits of how one can exhibit and provide access to software-based art, and share how Small Data Industries is leveraging these technologies to make art more accessible.

15 MAY 2020
HOW TO CARRY TECHNOLOGICAL ART INTO THE FUTURE

ASSOC. PROF. SELÇUK ARTUT -
SABANCI UNIVERSITY
OSMAN SERHAT KARAMAN -
DIGITAL PRESERVATION MANAGER,
SAKIP SABANCI MUSEUM
ASSOC. PROF. CEMAL YILMAZ -
SABANCI UNIVERSITY

Artworks that both rely on technology in order to ‘work’ (such as software and hardware) and to be produced (such as video, sound, image, code, virtual reality, augmented reality, hybrid mixes of digital and physical) are increasingly becoming part of art collections. The question of how these artworks may be carried into the future considering the rapid pace of changes in technologies emerges as a tough question faced by all cultural institutions with a mission to preserve cultural heritage.

Sabancı University Faculty Members Selçuk Artut, Cemal Yılmaz and Sakıp Sabancı Museum digitalSSM Coordinator Osman Serhat Karaman discuss these issues as part of the “Technological Arts Preservation” project they initiated. Questions such as “Why and how should we preserve technological artworks?”, “What role does software play in conserving technological artworks?”, “Would the updating of technologies employed by artworks in the face of rapidly changing technologies sacrifice the originality and historicity of artworks?”, “What are the main responsibilities of the artist in preserving technological artworks?” and “What are the ethical guidelines?” are discussed and answered.

28 FEBRUARY 2020
STRATEGIES OF KEEPING IT LIVE: CONSERVATION OF PERFORMANCE

LOUISE LAWSON -
TIME-BASED MEDIA CONSERVATOR, TATE MODERN

The presentation focuses on the challenges of preserving and conserving performance-based artworks as they enter, live and evolve within a collection. Exploring how within conservation there needs to be a shift to protect and sustain our relationship with the unknown outcome and embrace this; accepting that such artworks cannot be easily wrangled into our existing processes and that within conservation they are asking or pushing us to do something different. The talk highlights the current work and how our conservation process has become a living and evolving one in response to the nature of these works and the challenges they present with a focus on documentation, looking at how such works are currently documented and captured, touching on new modes of documentation as digital technologies develop.

17 JANUARY 2020
ARTISTIC PRACTICE BETWEEN THE MONUMENT AND THE DOCUMENT, ARTWORK AND THE ARCHIVE: UNEQUAL CONDITIONS AND GLOBAL ASPIRATIONS

VASIF KORTUN - CHAIRMAN,
FOUNDATION OF ARTS INITIATIVES

Vasıf Kortun touches on such questions as whether “new” technology truly exists, and if it does, what it means; how do the artist, curator and institution remain honest to the document and work of art in a time of constant physical and digital update, along with what the ethical guidelines are. Kortun delves into whether the real question may be the inability to lose the works and the archives, rather than losing them; and how we may be able to regard questions pertaining to preservation strategies where financial support is insufficient, and both institutional and technological possibilities are limited.

22 DECEMBER 2019
MEDIA ARCHAEOLOGICAL RECONSTRUCTION OF MEDIA AND DIGITAL ARTWORKS: PRACTICAL CASE-STUDIES

DANIEL HEISS -
SOFTWARE ENGINEER,
MORGANE STRICOT -
MEDIA AND DIGITAL ART CONSERVATOR,
MATTHIEU VLAMINCK -
MEDIA AND DIGITAL ART CONSERVATOR,
ZKM | CENTER FOR ART AND MEDIA KARLSRUHE

Due to obsolescence of software and hardware, digital and media artworks have, compared to other artworks, a short lifespan. In recent years, artworks have begun to disappear, letting their precious archives and related knowledge dying with them.

Media archaeological reconstruction or “second original” is defined by PAMAL (Preservation and Art – Media Archaeological Lab) as a duplication or reconstruction of an artwork that has disappeared or is considered "obsolete" with its original writing and reading machine (i.e. the hardware and software). This reconstruction does not exclude either emulation or simulation, which can be used to recompose a particular part of the work. This reconstruction can be considered an archive of the work itself. Its advantage is that it helps preserving the artwork as much as the industrial heritage.

ZKM (Center for Art and Media) is applying this complementary conservation strategy for its collection to promote the conservation of its media and digital artworks in their historical technological environment. Technology and code as a form of expression are not neutral. Media archaeological reconstruction gives the public a unique chance to see concrete form of past media in action. Through practical case studies, Virtual Sculpture (1981) by Jeffrey Shaw, Yuppie Ghetto With Watchdog (1989-90) by Paul Garrin and Wipe Cycle (1972) by Frank Gillette and Ira Schneider, we will explore how is this strategy applied and which aims does it fulfill according to each case study.

22 DECEMBER 2019
PRO-SPECTIVE ARCHAEOLOGIES: TRAVELLING THROUGH DEEP TIME OF THE MEDIA INTO TO POSSIBLE FUTURES

PROF. SIEGFRIED ZIELINSKI -
THE EUROPEAN GRADUATE SCHOOL

The seemingly paradoxical abstract mixtum compositum that is prospective archaeology consists of a practice that operates in accordance with two opposing arrows of time. One of these arrows is oriented vertically into the deep time of cultures that still remains to be explored and that, for me, is forever remade by virtue of interdependencies in the relationships among the arts, sciences and technologies. The other arrow points from the now into an enduringly and unremittingly opaque future. Where the utopian potential of media-archaeological activity and its associated artistic practices resides is in the possibility of bringing these two arrows of time into relation with one another, such that the passengers inside this particular time machine aren’t torn apart in the process. To keep on seeking and finding in the old only the locus of multiplicities and particularities which are no longer accessible because no longer existing is boring and inevitably leads to a profound melancholy. But to learn and intellectually profit from the heterogeneity and wealth of relations in past constellations, for the sake of future presents, is an alluring challenge. Only in this way can our experimental time machine become a generator of surprises.

15 NOVEMBER 2019
PRESERVATION OF SOFTWARE-BASED ART

PATRICIA FALCAO -
TIME-BASED MEDIA CONSERVATOR, TATE MODERN

Artworks with digital components started to make their way into the Tate Collection in the mid-90s. These were initially audio or video components, but since then digital components are part of almost all the time-based media artworks in our Art Collection. We categorise artworks that use the media of film, video, audio, software and performance as time-based media and Tate has had a section specialised in the conservation of these artworks since 1998. Over this period, Time-based Media Conservation has approached the preservation of these works as opportunities for research in the preservation of the different media. We have used the acquisition and display moments to develop our knowledge of the technical aspects of these works, to increase our understanding of the production processes and the different ways in which artists use the different media, the relation of the media to the artworks as well as the technologies available for preservation. All these aspects are essential to define the object of conservation, and to understand what needs to be preserved. In 2019 the Tate Collection owns over 600 artworks with digital components and we are acquiring about 30 new works per year. This trend is likely to increase, as is the number and type of technologies conservation will need to support. This paper will address these multiple aspects from the view of the Time-based Media Conservation Department at Tate, and we will discuss the strategies that we have put in place, and how we were able to develop them. This will highlight the importance of the research currently taking place both within Tate, with artists and their teams and with external experts on different fields.

15 NOVEMBER 2019
THE SOFTWARE ASPECT OF PRESERVING DIGITAL ART

ASSOC. PROF. CEMAL YILMAZ -
SABANCI UNIVERSITY

In this talk, Yılmaz approached the problem of preserving software-based digital art from the perspective of software engineering and software-related technologies. Yılmaz begins with a quick introduction of the software and hardware stacks available on today's general-purpose computing platforms and briefly discusses the sources of the technical issues regarding the preservation of software-related art. Next, he demonstrates that some of the issues faced in this domain are the very same as (or similar to) the ones that software engineers face in their own projects, thus the same and similar solution approaches, which are often referred to as technical preservation, emulation, migration, cultivation, hibernation, and deprecation in the context of software preservation, can be leveraged. Then, Yılmaz argues that there are also some domain-specific technical issues waiting to be resolved, which may draw the attention of software and system researchers in both the academia and industry. Finally, Yılmaz concludes with some simple yet quite practical and effective guidelines that can profoundly increase the chances of preserving digital art for decades to come.

15 NOVEMBER 2019
FROM COLLECTION TO REPERTOIRE

DRAGAN ESPENSCHIED -
PRESERVATION DIRECTOR, RHIZOME

The preservation of net art requires an approach quite different from traditional objects, time based media, or conceptual art. With works located in between fine art and performance art, it is sometimes difficult to define what their boundaries are, in what technological and cultural context they need to exist, and how they can be historicized. Preservation Director Dragan Espenschied of Rhizome, a born-digital arts non-profit founded in 1996 on the internet, will introduce strategies and productive abstractions to handle the institution's ever-growing holdings of 2000+ net art pieces.

23 MAY 2019
AGE OF INFORMATION - THE WAY FORWARD FOR TECHNOLOGICAL ARTWORKS

ASSOC. PROF. SELÇUK ARTUT,
SABANCI UNIVERSITY

Like all technology-related realms, methods pertaining to how works of art will be carried into the future bring along further questions in today's art world. The questions of which preservation methods will be employed and how remain crucially important both for artists, art institutions and collectors. Faced with rapidly changing technologies, involved and interdisciplinary research need to be undertaken in order to establish a number of guidelines that will ensure that contemporary works of art will be preserved in a consistent manner. In his talk, Artut departs from his own artistic practice and experiences in the field as an artist who produces works that involve technology, and explores how artworks may be carried into the future.

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Alp Tuğan is interested in creative coding practices, generative art, interaction design and sonic arts. Tugan contributes to various exhibitions and events with his audiovisual projects. His articles on sound technology published at "Volume Sound & Technology Magazine" between the years 2006-2009. He is the member of a live coding duo called RAW. Tugan, also has been teaching creative coding, interactive arts and sound design classes at Özyegin University in Istanbul since 2015.
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Bager Akbay

Bager Akbay studied Communication Design at Istanbul and Interface Cultures at Linz Art University, Austria. After his studies at Black Theater as an actor and puppeteer, Bager started to give lectures at various universities in his field and provides consultancy to companies within the education and design fields in the last 10 years, and creating artworks at his studio iskele47, Istanbul.

Ben Fino-Radin

Ben Fino-Radin is the founder of Small Data Industries, a New York based lab dedicated to safeguarding the permanence and integrity of the world's artistic record, by supporting and empowering people. Before founding Small Data Industries, Ben served as Associate Media Conservator at the Museum of Modern Art (MoMA), where in addition to the conservation of digital art, he managed the design and development of the institution's digital repository. Prior to this, Ben led preservation initiatives at Rhizome as their Digital Conservator. He holds a MSLIS and MFA in Digital Art from Pratt Institute, and has served as an adjunct at NYU's Moving Image Archiving and Preservation program.

Bengü Gün

Having studied at Bogaziçi University, Business Administration Department, Bengü Gün chose a path in cultural heritage management and wrote her M.A. thesis on Musical Instrument Museums Collection Management Policies with a merit based scholarship at Koç University.

Between 2007-2011, she worked as a management consultant at Peppers & Rogers Group for different companies including Dubai Culture Foundation, focusing on developing the organizational strategies and on how to develop a cultural hub in the UAE. In 2011, Bengü worked as Membership Manager at Istanbul Museum of Modern Art. She is one of the founders and director of Mixer Art Gallery (www.mixerarts.com), which was founded in 2012 and became quickly one of the most dynamic contemporary art centers that support emerging talents. She is now working as the director of Gate 27, which is an international artist in residence program located in Istanbul and Ayvalık. While working also on independent curatorial projects, Bengü teaches Gallery Management classes at Yeditepe University in Istanbul within the Arts and Culture Management department as a guest professor since 2019.

Büşra Tunç

The work of architect and artist Büşra Tunç focuses on perception and experience in space. Her interdisciplinary approach creates ambient atmospheres, which need to get experienced to unfold their aesthetic narratives. Tunç designs spatial experiences, which appear like realms

of light, where frequency, intensity and colour temperature fuse with auditory patterns. The composed soundscapes assemble noise, sonic acts and human voice.

Cemal Yılmaz

He received the B.S. and M.S. degrees in computer engineering and information science from Bilkent University, Ankara, Turkey, in 1997 and 1999, respectively. In 2005, he received the PhD degree in computer science from the University of Maryland, College Park, MD. Between 2005 and 2008, he worked as a researcher at IBM Thomas J. Watson Research Center, Hawthorne, New York. He is currently an associate professor of computer science in the Faculty of Engineering and Natural Sciences, Sabanci University, Istanbul, Turkey. His research interests include software engineering and software quality assurance.

Can Büyükberber

Visual artist and director Can Büyükberber (b. 1987 in Izmir) creates immersive audiovisual experiences that are embodied in physical and digital spaces. His practice consists of experiments with various media such as virtual/augmented reality, projection mapping, geodesic domes, large- scale displays and digital fabrication.
With a background in Physics and Visual Communication Design (BA), he has received his Master of Fine Arts (MFA) Degree in Art & Technology from San Francisco Art Institute as a Fulbright Scholar. He has been selected to Autodesk’s Pier 9 and Adobe's Augmented Reality Artist Residencies and has worked at the state of the art workshops to produce innovative XR projects. His audiovisual works that utilize geodesic domes, virtual reality headsets and architecture have toured museums, galleries and media art festivals around the world, including exhibitions and screenings at ZKM, Karlsruhe ;Ars Electronica, Linz; SAT, Montreal; Sonar D+, Barcelona; California Academy of Sciences, Exploratorium and Dolby Gallery in San Francisco; Akbank Sanat, Istanbul; Art Futura, Rome; MUTEK.JP, Tokyo; ZeroSpace, New York City; collaborations with musical artists such as Grammy-Award winning rock band Tool, Shigeto and Czech Philharmonic Orchestra.
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Canan Arslan

Born in 1983, Canan Arslan graduated from the Italian High School in 2001 and continued her undergraduate studies at Istanbul Bilgi University Faculty of Communication Management of Performing Arts Programme. Arslan worked at the Stage Management and Dramaturgy departments of Istanbul State Opera and Ballet, and completed her postgraduate studies on Performing Arts Management at Bocconi University, Italy. Arslan completed her doctoral studies at Marmara University Department of Communication Sciences with her dissertation titled “Interactivity in Digital Arts”. Canan Arslan is currently a faculty member at Doğuş University Department of Communication Sciences and a part time instructor at Istanbul Bilgi University, teaching on art, communication, social media, new media, media theories at undergraduate and graduate levels, continuing her research in these fields.

Candaş Şişman

Candaş Şişman is an artist, who uses digital and mechanical technologies as a medium for expression. Directed by his curiosities, Şişman’s works touch many different fields such as immersive and multisensory installations, sound, kinetic

sculptures, animations and audiovisual performances. Candaş Şişman aims to manipulate our notion of time, space and motion by his work, using digital and mechanical technologies.

In 2011, he co-founded Nohlab, a studio producing interdisciplinary experiences around art, design & technology. Since 2014 he has given lectures about soundart in various universities and he is also a member of NOS Visuals, which is a collaborative platform that creates real-time, sound-reactive audiovisual performances.

He has received Honorary Mention from Prix Ars Electronica and Jury Selection Award from Japan Media Arts Festival. He participated in many exhibitions and festivals, such as Venice Architecture Biennale and Todaysart. The artist lives and works in Istanbul.
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Daniel Heiss

Daniel Heiss works as a developer for ZKM on projects that involve digital art conservation and technical solutions for modern media art projects. He graduated in computer science from Karlsruhe Institute of Technology with a specialisation in distributed sensor networks and robotics. His expertise includes historic computers like SGI based systems, the cut points of electrical engineering and computer science, as well as frameworks for computer vision and other interactive interfaces usually used in media art.

Dragan Espenschied

Dragan Espenschied (born 1975, Germany) is a home computer folk musician, net artist and digital culture researcher. Since 2014 he has led the preservation department at Rhizome. In this position, he established emulation, web archiving and linked data as institutional practices, and developed new approaches for preserving and presenting works of net art online and in gallery space.

Ecem Dilan Köse, a.k.a. RESOLE

Born in 1990, I graduated from Bilkent University Interior Architecture. I am an artist who produces visual works in search of texture. I often match the textures I research in different scales and make sense of the experimental videos in conceptual frameworks. The traces of coming from the architectural discipline and having a long dance history can be observed in my works. After the NLP program I completed in ECNLP, I use programmatic methods on how to transfer some of the meanings I have found in my world to my works. My installations and works are exhibited in many festivals and fairs such as Sonar Festival and Contemporary Istanbul. My works are mostly based on similarities and integrations between digital and organic elements. As a result of my marbling works, which I have studied for a long time, I am always in search of a flow and transformation. As a result of the time I live, I concentrate on analyzing the transition period to digital without being detached from nature and producing it in a fluid way. Recently, I have been carrying out my work under the name of RESOLE with my art partner Ahmet Ünveren. We design live audiovisual performances and installations.
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Eda Sütunç

Eda Sütunç (1992) received her BA from Koc University and completed her MFA degree at the School of the Art Institute of Chicago with dean's

scholarship. By leveraging developing technologies and modern tools inspired by the ideals of industrialization and mechanization, she explores the meaning of gender, culture, race and humanism. The unique use of different mediums in her work aims to foster a dialogue across performance art, video, sculpture and sound. In 2017, Eda won the second prize in the Celeste Prize in the UK. Her work has been part of exhibitions in Germany, the Netherlands, UK, Serbia, Turkey and in the United States and has found place in different collections. She currently resides in Istanbul and holds teaching positions with leading institutions and universities in Turkey and is pursuing a Phd in Communication at Kadir Has University.
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İpek Yeğinsü

Born in 1981 in Istanbul, İpek Yeğinsü is a graduate of I.M.I. Liceo Scientifico Italiano in Istanbul. She received her B.A. degree in International Relations (2004) and her M.A. degree in Anatolian Civilizations and Cultural Heritage Management (2007) from Koç University. She worked as the Director of the Borusan Art Collection, the Manager of the ArtCenter/Istanbul artist residency and the Exhibition Coordinator of Borusan Music House under the umbrella of Borusan Holding and Borusan Culture and Arts Foundation (2007-2013). She was also a member of the Borusan Contemporary's founding team. In addition to her work for various galleries and art institutions, Yeginsü has been continuing her projects as an independent curator and writer since 2013, and she curated exhibitions for several venues including Bilsart, Anna Laudel, Labirent Sanat, Galeri Bu and Kare Sanat. Her interviews and articles appeared on platforms such as Sanatonline, Sanatatak, Lebriz, Artful Living, RH+ Magazine, Izlekler, Istanbul Art News and Unlimited Rag. Yeginsü is an adjunct faculty member at Kadir Has University Faculty of Communication and a Ph.D. candidate at Özyegin University Department of Design, Technology and Society. She is a member of AICA Turkey and amberplatform.

Lara Kamhi

Lara Kamhi's artistic practice operates at the edge of perception. By transgressing the borders between fields of visual story-telling, sound, light art and site-specific installation, she creates and captures immersive image spaces, soundscapes and narratives in which she explores and investigates the confusing conflict between appearance and truth. Projecting on or through form and animating as if from within, her technological yet intuitive approach plays and experiments with visual boundaries.
Born in 1987 in Istanbul, Kamhi has studied Theatrical Studies at University Sorbonne Nouvelle Paris-III and Film Studies at the American University of Paris before obtaining her Film and Television BA at Istanbul Bilgi University. She then pursued her higher education at Slade School of Fine Art (UCL) in London where she obtained her MFA degree in Fine Art Media and won the Julian Sullivan Award for high achievement.
In 2014, she founded an independent art initiative named Prizmaspace where she curated an exhibition series comprising ten shows focusing on site-specific, immersive and cinematic approaches with emerging & established artists coming from filmmaking backgrounds. Since 2010, Kamhi has

exhibited and screened her works in galleries, festivals, museums and public spaces nationally and internationally.
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Louise Lawson

Louise Lawson is Conservation Manager for Time Based Media Conservation at Tate. She is responsible for the strategic direction, development and delivery of all aspects relating to time-based media conservation at Tate. This requires working across a wide range of projects and programmes: exhibitions, displays, acquisition, loan-outs and collection care initiatives such as the development of a digital repository. Her current research is focused on the documentation and conservation of performance-based artworks within Tate Collection.

Lozana Rossenova

Lozana Rossenova is a digital designer and researcher, based in London and Berlin. She is completing a PhD degree at the Centre for the Study of the Networked Image at London South Bank University, in collaboration with Rhizome, a leading international born-digital art organization based in New York. Her research focuses on questions related to presentation and performativity in Rhizome's online archive of net art - the ArtBase. Lozana is particularly interested in open source and community-driven approaches to digital preservation infrastructure. Besides her academic work, Lozana works with art and/or technology organizations in helping them plan and implement digital archive solutions, or develop new pathways of interaction for challenging user workflows.

Matthieu Vlaminck

Matthieu Vlaminck is a junior digital and media conservator at ZKM. He recently graduated from the Ecole Supérieure d'Art d'Avignon in Visual Arts. He also holds a diploma in programming/network and in music (cello). His current specialization is the preservation and restoration of 3-D computer-generated cinema models especially Star Trek ships. Matthieu's research focuses on the preservation of digital art, notably on third-party products as part of artworks (maintenance/adaptation of historical and obsolete commercial software/API for the sake of art preservation), and the archiving of artworks using 3-D visualization.

Morgane Stricot

Morgane Stricot is a senior digital and media art conservator at ZKM and a researcher at PAMAL (Preservation & Art - Media Archaeology Lab). She studied the preservation of complex digital objects during her master degree in Conservation of Media and Digital Art at Ecole Supérieure d'Art d'Avignon, France and during her research fellowship at the Still Water New Media Art Lab of the University of Maine, USA. Her research focuses on the contribution of media archaeologies as a complementary theory for the conservation and reconstruction of media-technical works of art.

Murat Durusoy

Born in Istanbul, Durusoy graduated from his undergraduate studies as an engineer from Sabanci University. He achieved his M.A degree from the same university's Visual Arts and Visual Communication Design department with a thesis entitled ''Rise of Subjectivist Photography in Digital Era; Can There be Photography after the Post-Modern Image?''

in 2010 with his advisor Murat Germen. His lens-based media works were exhibited both locally and internationally.

His artistic work is represented by C.A.M. Gallery, Istanbul. He is a partner at the distinguished design company Design In Situ. He teaches and researches at Bahçesehir University and Isık University about photography, visual language, and media studies. His research and writings dwell around the themes of Lens-based images, Virtual Photography, In-Game Photography, Game Studies, and Media Art Studies. He lives and works in Istanbul, Turkey.

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Onur Sönmez

Onur Sönmez is a designer based in Munich. His current works aim to critically explore human computer collaboration and digital / physical materialities. His works have previously been exhibited at the Venice Biennale of Architecture, Saatchi Gallery London, Sonar+D Istanbul, Transmediale Berlin, Contemporary Istanbul and Ars Electronica Festival (2005,07,08,09,10,12,13,15), among others.
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Ozan Turkkan

Vienna based new media artist, Ozan Turkkan (1980) is working at the intersection of art and technology. His work is centered on experimental digital media with a focus on generative and algorithmic computer art, fractal geometry, mixed reality experiences, interaction and motion as a reflection of the impermanent nature of existence, human and social behaviour. He uses technology as a canvas to create innovative and engaging digital art installations.

He likes to explore the many-folded boundaries between science, art and new technologies, and combining different media elements in a creative process.

Before the very first steps in digital media, he studied and practiced various art disciplines in Philadelphia, Salamanca and Barcelona in collaboration with numerous institutions, and art centers. After he graduated from The University of Salamanca, he received his Master degree in Multimedia at BAU (Escola Superior de Disseny, Universitat Central de Catalunya) in Barcelona, where he lived and worked many years as a new media artist.

His work has been exhibited in Art Centers, Museums and Galleries such as; Santa Monica Art Centre Barcelona, Reina Sofia Museum Madrid, Centre of Contemporary Art Luigi Pecci Florence, Torrance Museum Los Angeles, Victoria House London, Lincoln Center NY, Banannefabrik Luxembourg, Europalia Art Festival Brussels, Les Brigittines Contemporary Arts Centre Brussels, Museum of Contemporary Art Belgrade, Santral Istanbul, Akbank Art Istanbul, Gallery Mitte Barcelona, LOOP Videoart Festival Barcelona,

Rotterdamse Schowbourg Rotterdam, WUK Vienna…
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PAMAL Group

PAMAL_Group is currently made up of Stéphane Bizet, Lionel Broye, Armandine Chasle, Emmanuel Guez and Morgane Stricot. They are developing a media-archaeological artistic practice based on a media-archaeological practice of conservation and restoration of digital art and literature. PAMAL_Group creates its own works from network-based digital artworks that have disappeared or been severely damaged due to the obsolescence of networks as well as computer software and hardware. Its work seeks to make visible the vulnerability of an art form that is highly dependent on industrial logic. All the works that the collective reconstructs, as close as possible to the original materialities, sometimes in a deficient way, are treated as archives.

Patricia Falcao

She is a Time-based Media Conservator with a broad interest in the preservation of the digital components of contemporary artworks. She has worked at Tate since 2008, and currently works in the acquisition of time-based media artworks into the Collection. She currently collaborates with Tate's Research Department in the Reshaping the Collectible project, looking at the preservation of websites in Tate's context, as well as working with Tate's Technology team to continue to develop Tate's strategy for the preservation of high value digital assets. Patricia completed her MA at the University of the Arts in Bern with a thesis on risk assessment for software-based artworks. She continues to develop research in this field in her role as a Doctoral Researcher in the AHRC funded Collaborative Doctoral Program, between Tate Research and the Computing Department at Goldsmiths College, University of London. The subject of her research are the practices of software-based art preservation in collections, by artists and in the gaming industry.

Refik Anadol

Refik Anadol (b. 1985, Istanbul, Turkey) is a media artist, director, and pioneer in the aesthetics of machine intelligence. His body of work locates creativity at the intersection of humans and machines. In taking the data that flows around us as his primary material and the neural network of a computerized mind as his collaborator, Anadol paints with a thinking brush, offering us radical visualizations of our digitized memories and expanding the possibilities of architecture, narrative, and the body in motion. Anadol's site-specific parametric data sculptures, live audio/visual performances, and immersive installations take many forms, while encouraging us to rethink our engagement with the physical world, its temporal and spatial dimensions, and the creative potential of machines.
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Selçuk Artut

His artistic research and production focus on theoretical and practical dimensions of human-technology relations. Artut's artworks have been exhibited at Dystopie Sound Art Festival (Berlin, 2018), Moving Image NY (New York, 2015), Art13 London (London, 2013), ICA London (London, 2012), Art Hong Kong (Hong Kong, 2011), Istanbul Biennale (Istanbul, 2007), and received coverage at Artsy, Creative Applications, CoDesign, Visual Complexity, CNN GO. He holds a Ph.D. in Media and Communications from European Graduate School, Switzerland. Currently, Artut is a faculty member at the Visual

Arts and Visual Communication Design Program Sabanci University, Istanbul where he mainly teaches Sound and Interaction Courses. He has been releasing several albums as a member of a Post-Rock Avant Garde music band Replikas since 1998. In 2016, he founded RAW with Alp Tugan, an audio-visual performance group which produces works through creative coding and live-coding techniques. Artut is artistically represented by Zilberman Gallery, Istanbul
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Selim Balcısoy earned his Ph.D. degree in Computer Science at Swiss Federal Institute of Technology, Lausanne (EPFL) in 2001. Between 2001 and 2004, he worked as a Senior Research Engineer at Nokia Research Centre in Dallas, USA. Dr. Balcisoy has been awarded with a U.S.A. patent and is author of over 50 scholarly articles. He conducts research on augmented reality, data visualization, and cultural heritage. Dr. Balcisoy is a full-time faculty member at Sabancı University since 2004 and a cofounder of VisioThink, Inc., established in 2006.

Siegfried Zielinski

Siegfried Zielinski is Michel Foucault Professor of Media Archaeology and Techno-Culture at the European Graduate School in Saas-Fee (CH), honorary doctor and professor of the Budapest University of Arts. He was chair of media theory at Berlin University of the Arts, and director of the Vilém Flusser Archive (till 2016). He was founding rector (1994–2000) of the Academy of Media Arts Cologne and rector of the Karlsruhe University of Arts & Design (2016-2018). Zielinski has published numerous books and essays mainly focusing on the archaeology and variantology of the relations between art and media. In cooperation with Peter Weibel he is also a curator of large format exhibitions at the ZKM Karlsruhe, such as ‘Vilém Flusser and the Arts’, ‘Allah’s Automata’ (both 2015), ‘Dia_Logos - Ramon Llull and the Combinatorial Arts’, ‘Art in Motion - 100 Masterpieces with and through Media’ (both 2018). Zielinski is a member of the Berlin Academy of Arts and the North-Rhine-Westfalia Academy of Sciences and Arts.

Vasıf Kortun

Vasıf Kortun (1958) is a writer, curator and educator whose works focus on contemporary art, art institutions and exhibition practices. Kortun has served as the founding director of SALT, Platform Garanti Contemporary Art Center, Proje4L and the Center for Curatorial Studies, Bard College. Among the biennials Kortun has curated are the Taipei Biennial (with Man-Ray Hsu, 2008), 9th International Istanbul Biennial (with Charles Esche, 2005), and the 3rd International Istanbul Biennial (1992). Kortun received the Curatorial Excellence Award from Center for Curatorial Studies due to his “experimental approach and openness to novel thinking in challenging contemporary art world, and pushing its national and international parameters above and beyond local and global developments”. Kortun has authored numerous articles focusing on art and visual culture in Turkey for international and periodical publications. Among his latest publications are 20 (SALT, 2018), and *VOTI: The Union of the Imaginary / A Curators’ Forum* which he co-edited with Susan Hapgood and November Paynter, researching the international online discussion platforms of curators during the late 1990s. (Walther König Books, 2016)

Zeynep Pehlivan

Zeynep Pehlivan is a research engineer at the National Audiovisual Institute of France (Ina). She holds a Ph.D. degree in Computer Science from the University

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