A Manual for the Display of Interactive New Media Art

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1 Introduction

New media is not new. New media, in the amplest definition, has existed since humanity decided to switch from cave walls to clay tables to wood panels to canvas. The biggest difference now is that today's new media do not take centuries to appear, but instead new ones appear every few years. Effectively, paradigm changes occur yearly now. Not only that, but what we currently define as new media art is intertwined with our daily life in a way that canvas, and even radio and television, did not.

This project is the practical application of my PhD studies at the University of Sunderland. During my time in the UK, I became interested in new media art; however, I noticed a lack of interaction in exhibitions. From this initial realisation, I moved to attempting to find resources aimed at interactive new media works and realised that the only practical guide was Clive Gillman's MITES Manual (2002). Unfortunately, technologies changed, and new ones appeared in the past fifteen years, making the MITES Manual outdated and not as useful as it originally was. For this reason, I decided to create a new manual focused on interactive new media, and to make it in an easy-to-access online form that will allow me to update and grow it. In this way, creating a valuable tool for curators and exhibition designers, particularly those not specialised in new media.

Every year, more and more artists are engaging with new media and bringing it into their practice. While the idea of integrating robotics, computers, electronics, and other new technologies into art is natural to art practice, new media art demands more from both practitioners and those dedicated to presenting the works. Curators and exhibition designers are now faced with a field that changes not over decades but sometimes over months. The consequences of such accelerated technological progress have resulted in an artform that has been neglected within institutional contexts. Few museums integrate new media art into their collections, or as Beryl Graham and Sarah Cook tell us in Rethinking Curating (2010): "time still moves slowly within the museum structures; many curators are art historians, and so anything new struggles for admittance through the gates." This has resulted in a circular argument due to the lack of presence in the art world, they are little understood and thus engaged with less, resulting in few works making it into collections because there is no understanding of their workings. Put simply: as curators are not familiar with new media art, the artform is

not present in collections and knowledge on how to curate it is too scarce; this means that curators are not familiar and thus avoid these works.

Further complicating things, we have INTERACTIVE new media art. If new media art sans interaction is already a complicated issue for unfamiliar curators, interactive new media art ads a further layer of complexity. For art historians, conservators, and other museum professionals, touch and, by extension, interaction have been anathema for a long time. And while interactivity has existed in artworks for a long time, this interaction is often rendered inert once the artwork has been inducted into an institution. Duchamp's Bicycle Wheel (1913) was meant to be spun by visitors yet, once enshrined into art history, it is now presented as a static sculpture to the point where MoMA showed the highly interactive work in an exhibition entitled To Be Looked At (2002-2004), fossilizing the work further by presenting it as a static sculpture. Examples of other interactive works rendered immobile abound, from Hélio Oiticica's Bólides (1963-1964) to George Maciunas' Fluxkits and boxes (1962-1978) to Pippin Barr's The Artist is Present (2011) — which the artist once was asked to turn into a video instead of a video game (G. Cepeda and Barr 2019). Museums have constantly removed interaction and meaning from artworks, leading to misinterpretations and misunderstandings in those not familiar with the history of the works. Often times, this is done in the name of conservation; however, in the case of interactive new media art, this argument loses strength. Not only that, many of these works cease to exist if interaction is removed from them and become a collection of computer parts.

Figure 1: Oiticica, Helio, 1964*, B11 Box Bólide 09*. Wood, glass and pigment. TATE Liverpool, Image: © Projeto Hélio Oiticica

Figure 2: Maciunas, George,1964*, Fluxkit.* Vinyl-covered attaché case containing objects in various media. Image: © George Maciunas

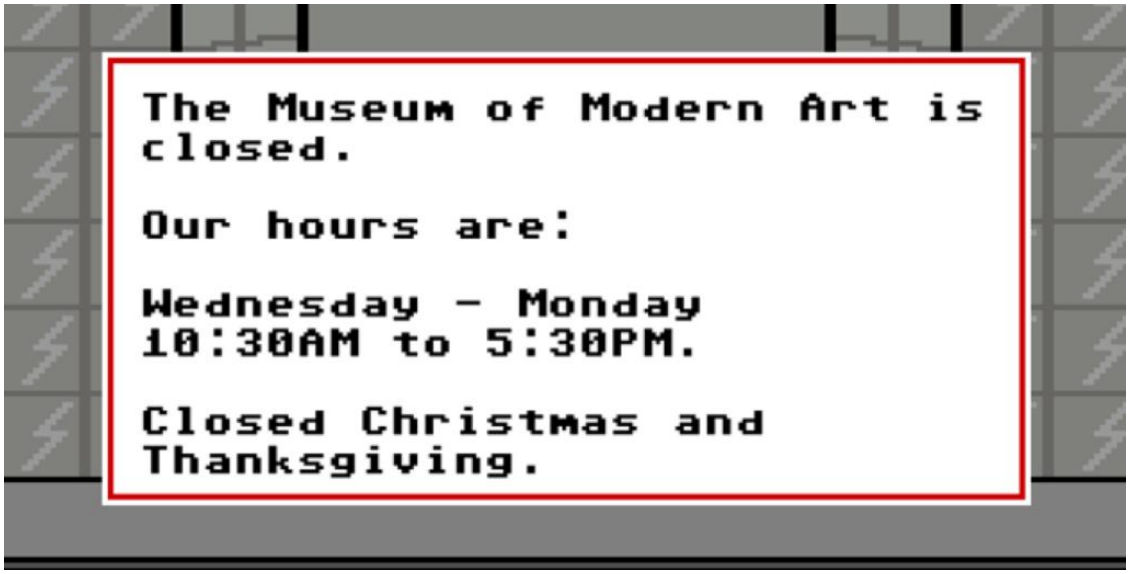

Figure 3: Barr, Pippin , 2011, *The Artist is Present*. Video game. Screenshot © Pippin Barr

Curator Pau Waelder in his Node Center course *Curating New Media Art: Process, Interaction, Virtuality* (2019) offers a way out of this curatorial dead end: The emergence of the Geek Curator. A geek curator is a concept originated by Russian artist Olia Lialina (2009) and defines it as a curator who is not only fluent in the theories and workings of art world and museums, but also in technology, programming, and exhibition design. Geek curators often have multidisciplinary backgrounds and are computer literate, as well as have an understanding of the display challenges of an artform that usually has no aesthetic component or whose aesthetic component comes from within the framing of a computer screen or projector. It is within this context that this manual comes to be, created with the intention of explaining what interactive new media art is and how it differs from other media, and offering methodologies, answering questions, and presenting

solutions to the most common issues curators and exhibition designers may face. Unfortunately, due to regional and cultural differences, in America the use of geek curator may not be adequate.

Geek – An enthusiast of a particular topic or field. Geeks are “collection” oriented, gathering facts and mementos related to their subject of interest. They are obsessed with the newest, coolest, trendiest things that their subject has to offer.

Nerd – A studious intellectual, although again of a particular topic or field. Nerds are “achievement” oriented and focus their efforts on acquiring knowledge and skill over trivia and memorabilia (Vazquez 2013).

For this reason, the term “Nerd Curator” is a more fitting term for someone that matches the description given by Lialina in her text when working in Canada and the US.

1.1 The Structure of the Manual

In the first section, you will find information aimed at making the theoretical approaches to curation clearer and simpler. By drawing from existing new media literature, my professional practice, and the experiences and knowledge of a variety of curators and artists, as well as the approaches of the Laboratorio Arte Alameda in Mexico City and the Foundation for Art and Creative Technology in Liverpool, United Kingdom, the manual attempts to aid curators to engage with interactive new media art by explaining its peculiar relationship to neomateriality, location, interactivity, and time, as well as the necessary multidisciplinary work involved in it.

The second part of the manual deals with the practical concerns of the aforementioned concepts. Then, I offer specific recommendations for engaging with media rights, marketing, and education departments, as well as a basic methodological template. This section concludes with an analysis of specific artforms and how to design exhibitions that exploit their specific qualities in the best way possible. The media discussed include: net art, interactive live streaming, interactive video, interactive performances, video games, virtual reality, augmented reality, robotics, and artificial intelligence.

The third section, Memory, concerns itself with the preservation of the knowledge generated during the exhibition design process both as a way to preserve the

memory of the exhibition and practical lessons learnt during the process. This final section gives curators a series of recommendations for how to document Interactive new media artworks so interaction is not ignored in the documentation process.

While the manual does not deal with collecting, conservation, or preservation issues, there is a small section at the end of the manual with resources for those who wish to delve deeper into these areas.

This manual is intended to be a living document, growing and changing as I mature as a professional and as others contribute to it through the comments sections and other forums. Ideally, this work will continue to grow and expand as the field continues to change and become a guide useful for artists and curators wishing to engage with interactive new media art but lack the expertise.

1.2 Why Engage with New Media Art?

While new media art in itself is not new, the first accepted example being Wolf Vostell's *The Black Room Cycle* (1958), recent developments in computer technology have led to more artists having access to new media technologies which can be implemented at a relatively low cost and with lesser technical know-how than ever before. Alongside, new generations of artists now breaking into the scene have lived their entire lives connected to the internet, consuming video and audio and playing through computers. For these new artists, new media is not new at all and are using it as a means of artistic expression without distinction between new media art and more traditional means of expression. As of 2019, this new generation of artists is starting to make its way through the artworld, and we will see more and more new media artworks.

For this reason, if museums, art labs, and other cultural institutions are to remain relevant, it is necessary for them to be knowledgeable of the artform and its challenges, both in curation and display, or risk sinking into irrelevance as other more flexible institutions become the home for this form of digital culture.

2 Curation

2.1 Understanding Interactive New Media Art

Interactive new media art is a subdivision of the more general new media art group. As an artform, it has existed since the 1960s, when computers began a process of becoming more and more accessible, and had a brief moment of popularity in the 90s, before acquiring negative connotations, due to its association to the institutions that made it even possible for artists to have access to such technologies. It is at this time that terms such as ZKM art and SGI art, which stand for Zentrum für Kunst und Medien and Silicon Graphics Incorporated, respectively (oración incompleta). These labels came negatively associated with a certain control by the institution and the over reliance on technical aspects of the work (Kwastek 2013 p.2).

However, a new generation of artists, for whom new media art is not a novelty or a new development in human technological progress but a fact of life, have come of age and are bringing their new media literacy to the forefront. This attitude towards new media and the accessibility of incredibly powerful technology have brought new media to relevance again. Next, we have to make a distinction between new media art and digital art. In Aesthetics of Interaction in Digital Art, Katja Kwastek (2013 p.1-9) tells us that computer art is art that refers mostly to computer generated graphics; digital art, on the other hand, can refer to both immaterial works, such as code, software, or data, and installations and performative works of art. Furthermore, she tells us that it is also applied to “works that use digital technology as part of their method of production and to projects in which the processual qualities of digital technology are an elementary feature of the work”. As can be seen, these definitions become nested within one another. If I were to attempt my own definition, I would argue that new media art is art that involves the use of non-traditional media, whose original purpose was technological rather than artistic (e.g. the internet, DNA, robots, etc.), and that does not simply emulate other media.

Interactive new media art is therefore a form of new media that exploits the computational and technological potential of its medium to generate artworks which could not be achieved without digital means and that respond in one way or

another to stimuli issued to them, and, in some cases, are capable of generating their own stimuli to feed to the human component of the equation.

Curator and academic Steve Dietz argues that new media art is like other contemporary art, but it also has particular characteristics that distinguish it from contemporary art and, by extension, from the systems involved in the production, exhibition, interpretation, and dissemination of contemporary art (Graham and Cook 2010). These characteristics he speaks of are interactivity, connectivity, and computability, and they exist in various degrees and combinations in each new media work. Each one of these three taxonomic divisions is a good starting point for the understanding of new media art; however, they are not the only characteristics of new media art that make it a unique and complex subject. These include neomateriality, location/space, time, instability, and reproducibility. It is important for curators to understand these characteristics of new media art if a successful curation is to take place, as each category has direct effect and consequence on various aspects of the curatorial process.

With all that said, it is important to note that this manual will only focus on those works in which the Interactive facet of a work is present. For this reason, non-interactive new media, such as digital painting or algorithmic art and others, will not be mentioned.

2.2 Crucial Concepts for Curating Interactive New Media Art

2.2.1 Connectivity

Another of Dietz' categories, connectivity, can be quite broad, as these works utilise the internet or other networks to increase their reach or to access other forms of data from which to generate themselves. Others connect themselves to secondary technologies in order to exert physical force on the real world. As such, the requirements for a work to be considered connected are very easily met.

Through connectivity, artworks become richer and more dynamic, responding to events in real-time or allowing distant operators to behave as if they were sharing the same space. An artist can connect to audiences across the world or interact in real-time with an artist down the street or all the way across the world. They can also gain access to web cameras in other countries or to data being generated

online, such as tweets or information on the traffic conditions or the tides. In a way, connectivity renders physical distance inconsequential, even if the work itself exploits this distance in a metaphorical way.

One way to classify all the possibilities open by connectivity is by what they enable us to do instead of what they transmit, as that can be summed up as facilitating the movement of data from one point to another. Instead, we can say connectivity can enable the following:

Communicate: Works that allow communication enable the artist to connect to their audience or for different audiences to connect with each other to transfer ideas.

Operate: Through connectivity, works can take control of objects, computers, and software. This control may be in its entirety planned or be subversive in some way.

Observe: This is a passive mode in which connected works provide windows into other parts of the world.

Send and Receive: This mode allows for the transmission of concrete files, documents, and instructions that can then be used independently of the connection.

Interact: Linked in a way to communicate, interaction does not require the transmission of verbal or textual data. Interaction instead uses other methods, such as player avatars or abstract concepts. For example, in a work like Genova Chen's Journey, the player avatars cannot talk or type to each other, but instead can help each other move through the game world.

Measure: This method is one of the most abstract ones but many works utilise it before creating visualisations; a work may measure the incidence of a word on twitter and use it to alter graphs or colours it displays. It may detect movement and activate aspects of itself. While not the most obvious and easy to observe, measurement is one of the strongest tools in the connected work.

Another peculiarity of connected works is the fact that what they connect to tends to not be something of the artist's creation and, as such, depends on others to be maintained and kept online. This is both a boon and a curse, as it expands the artist's reach while at the same time putting them in a position where the work may

stop functioning at any moment in time. Websites may be deleted, online platforms become abandoned (for example Google Plus is no longer accessible), hardware is replaced or no longer made, and network protocols and standards becoming deprecated are a few of the risks connected works face. Examples of this can be seen in one of the most notable examples of net art to date, *wwwwwwwww.jodi.org (*1995) (Figure 4), which no longer functions as designed because some of the file images are no longer displayed, thus rendering the experience incomplete.

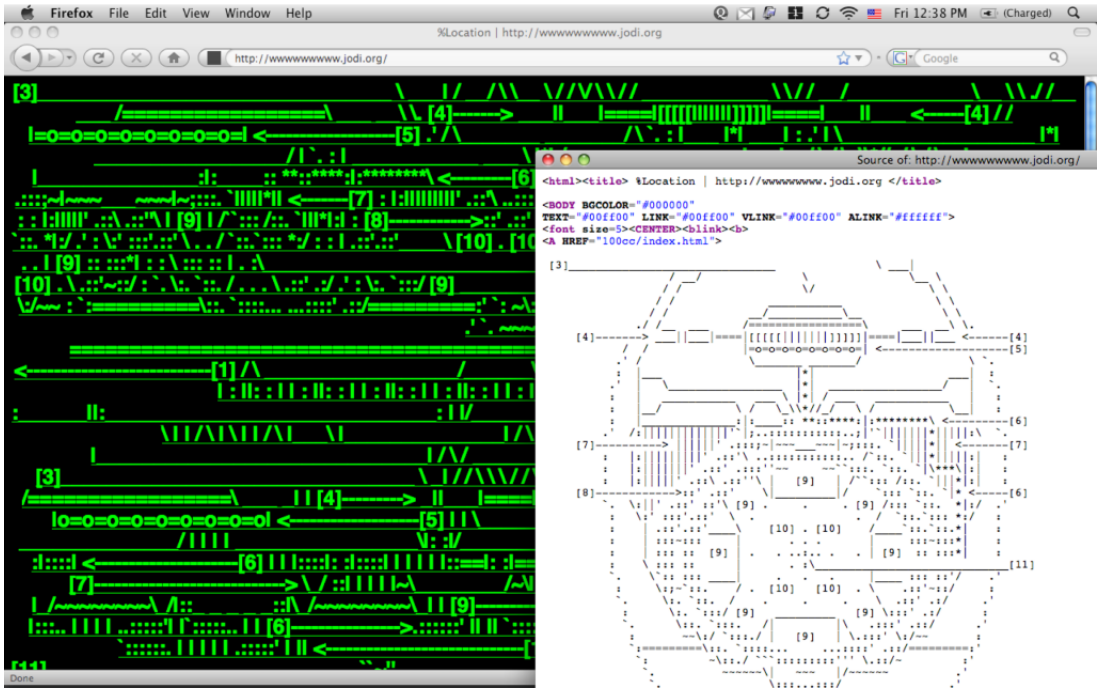

Figure 4: Jodi, 1995, wwwwwwwww.Jodi.org. Website and HTML, Screenshot source code.

Connectivity can be achieved through various means, not only through the internet, some of the most common include: physical connections, such as USB cables, thunderbolt, and optic fiber, to name a few, and wireless connections, like Bluetooth, local networks, and the internet. The reasons to choose one over the other depend on the inversely proportional factors of distance, bandwidth, and reliability. Physical connections, such as those offered by USB and Thunderbolt, are limited by the lengths of the cables; however, they offer high transfer speeds for large amounts of data. On the other end of the spectrum, we have the internet, which offers connections over vast distances, yet the bandwidth and speeds involved are limited in comparison to connections by cable. Finally, reliability also should be considered; wired connections have fewer points of failure, as cable technology is much simpler. This results in easier troubleshooting and repairs. As we move to more complex technologies, this unreliability increases. Wireless

Internet connections are notorious for their tendency to drop or be interrupted by high energy devices such as microwave ovens.

2.2.2 Interactivity

Interaction can be very roughly defined as the ability of two or more actors to have a reciprocal action or influence on each other; not all interactions are equal. In this context, interactivity refers to an actual communication with the work instead of the act of activating a work which proceeds to function on its own. While human-like interaction is probably impossible, other degrees of interaction are possible, from mono-directional led interaction, where either machine or human takes the lead and the opposite responds to the stimuli provided by the originator, to more bi-directional interactions, where both machine and human modify the outputs of the other through their own stimuli and their own reaction to the other's stimuli. It should be noted that this interaction is not boundless and occurs within the limits programmed by the artist and technological limits.

Figure 5 explains the actors involved in interactive works and the types of interaction they engage in. First, we have the interactive artwork, which for all effects and purposes is a computer (C), then we have the artist who, until we have fully self-aware artificial intelligences who self deterministically choose to be artists, will be a human (H), and the participant who, again, will remain a human (H) for the foreseeable future.

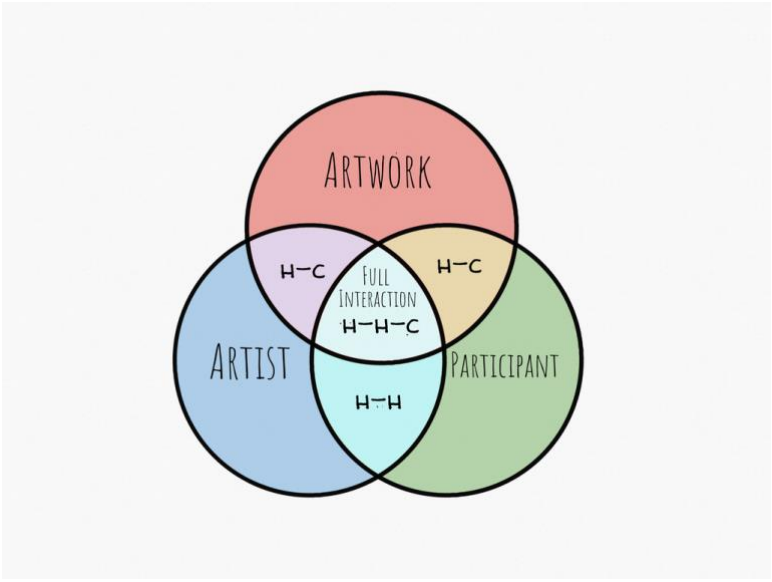

Figure 5: Here we see the possible combinations of interactions between all actors involved. Rene G. Cepeda

Therefore, we have 4 types of interaction depending on who the actors involved are. When the artwork interacts solely with the artist, we have human-computer interaction (H-C); the same is true when the artwork interacts with the participant (H-C). Then, we have interactions where the artist and the participants interact with each other(H-H), and finally we have interaction in which all agents are involved, full interaction (H-H-C).

Interactive new media art can occur on all four modes. In H-C cases, the artwork responds to the human actor in one way or another. Examples of Participant H-C cases include Rafael Lozano-Hemmer's *Body Movies* (2001)(Figure 6) or Kelly Dobson's *Blendie* (2003-2004) (Figure 7). In these works, the artist does not have to be present in any way for the work to function. For Artist H-C, the works respond to the artist and their actions and no non-artist participant is involved in the interaction. For example, in *Stickman* (2017, Figure 8), Stelarc allows an autonomous exoskeleton he wears to control his movements. In this case, there is no non-artist participant; the public, who is usually the participant as well, simply becomes witness to the interaction between Stelarc and the Machine. In H-H interaction, the technology often, but not always, works as an intermediary between humans.

In *Help Poppy Build The Computer* (2017)(Figure 9), performance artist / musician Poppy uses Facebook live to livestream herself awaiting in front of a variety of computer parts for viewers (participants) to choose through Facebook reactions which part she should connect to her computer next. In this case, the technology served as a facilitator to connect Poppy to a large number of participants and aggregate their real-time choices, which she then used to perform an action.

The last mode, H-H-C, is the most complex of all the interactions, as it requires all three actors to actively engage. Cecilia Suhr's *I, You, W*e (Figure 10) is a work where the participant stepping in front of the work initiates a process where music is generated by their appearance, which in turn causes Suhr to react to it and improvise new music, which in turn changes the music generated by the work. As more people step in front of the work, the music changes, creating an interactive performance where all involved have a part in creating a unique unrepeatable performance.

Figure 6: Lozano-Hemmer, Rafael, 2001, *Body Movies*. Four 7kW Xenon projectors with robotic rollers, 1,200 Duraclear transparencies, a computerised tracking system, a plasma screen, and mirrors. Museum of Art, HK Arts Development Council, Hong Kong, China. Image: Rafael Lozano Hemmer

Figure 7: Dobson, Kelly, 2003-2004, *Blendie*. 1950's Osterizer blender altered with custom made hardware and software for sound analysis and motor control. Image: Kelly Dobson

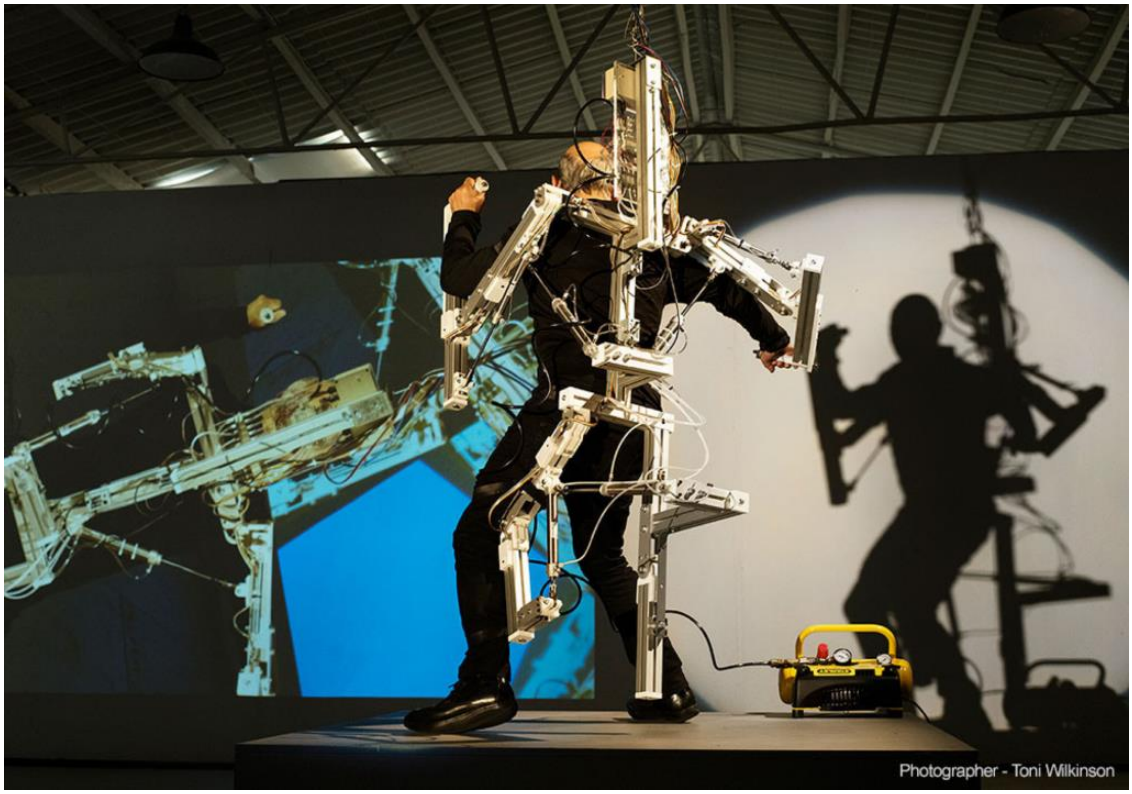

Figure 8: Stelarc, 2017, *Stickman*. Full-body exoskeleton, speakers, and sensors. Fringe World 2017, Perth. Image: Toni Wilkinson

Figure 9: Poppy, 2017, *Help Poppy Build the Computer*. Interactive Livestream. Screenshot.

Figure 10: Suhr, Cecilia, 2019, *I, You, We.* Interactive Performance. Bronx ArtsSpace, NY. Image: Cecilia Suhr.

There is one more form of interaction that does not depend on humans to occur, which is computer-computer (C-C) interaction, where one or more systems interact with each other. This form of interaction has the same characteristics of H-C; however, it often occurs at an accelerated pace due to the fact that both agents are computers that can function at speeds much faster than those that a human can achieve, both in calculation and physical speeds, if not intellectual complexity. As this form of interaction functions at the artefact level (something conservation departments do not object to unless the interaction is physically violent), it presents fewer challenges to curation and display.

2.2.2.1 Degrees of Human/Computer Interaction

Depending on the degree of reciprocity between the human component and the computational component (Loop of information), interaction can be measured through its reciprocity and involvement. For the purpose of this text, this interaction refers to a direct communication with the work and not to the operation of exhibition displays. The following taxonomy operates from the point of view of the public/participant.

Mostly input: In this case, the user provides an instruction to the artwork, which it then proceeds to execute on its own. E.g. press start to begin a flyby through a virtual space.

Mostly output: The exact opposite of “mostly input”. In this case, the computer feeds instructions to the user, who then proceeds to execute them. E.g. move in front of the camera and smile, and an augmented reality version of you as a viking is displayed.

Full interaction/Feedback loop: In this case, both human and computer feed each other instructions, which in effect activate the artistic experience. E.g. a video game where the user’s actions influence the computer’s actions, which in turn require a new response, over and over again.

Of all interactive new media art, the newest and the ones most often associated with interactivity are Virtual Reality and Augmented Reality. Contrary to what one may think, Virtual Reality and Augmented Reality works do not always involve full interaction. In VR, the user dons a special pair of goggles that use screens to simulate a stereoscopic experience which, when combined with audio, creates an immersive experience. However, this does not mean the experience is interactive; many VR experiences often are videos or virtual walks through landscapes in one manner or another. Augmented Reality through mobile phone screens or other devices overlays computer graphics on top of live video, in effect enhancing reality through a digital layer. As with VR, AR can be a passive experience where the participant is merely an observer. On the other hand, when VR and AR’s interactive possibilities are exploited, it is possible to attain a form of interaction with abstract concepts that is impossible to replicate in other artistic media. Meanwhile, other media that may be considered passive can, through the appropriate artistic vision, be more interactive than the aforementioned examples.

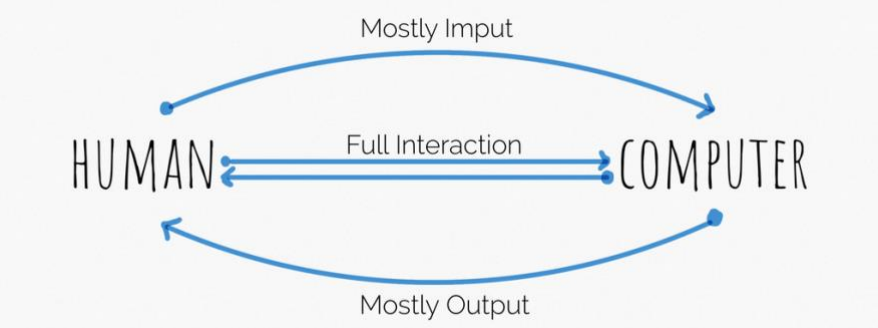

Figure 11: Diagram explaining the flow of various forms of interaction, with arrowheads indicating the recipient of the interaction. Rene G. Cepeda

Of course, not every visitor wishes or is able to interact with every artwork, either for lack of interest or digital literacys or disability. For these cases, vicarious interaction may offer a solution. Vicarious interaction is a situation where the viewer limits their activity to observing others interacting with a project, thereby taking a distanced position relative to the work (Kwastek 2015 p.95). Thus, while the viewer may not have the same experience as the participant, they may be able to understand the interactions and what is happening in response.

Helen Stuckey, a curator for several video game exhibitions, has this to say on vicarious interaction:

> Non-player content such as game-capture, projected play and didactic text to ensure that those visitors reluctant to engage with the games themselves were presented with alternative ways to engage with the exhibition's themes and ideas. This provision carried with it the possibility that they would be engaged enough by what they saw to be tempted to play. Games Lab took advantage of the museum's capacity to offer audiences experiential opportunities outside their normal contexts.
>
> (Stuckey, 2010 p.68)

This recommendation can apply not only to video games but other forms of interactive content, as the relationships between the participant and the artwork are similar if not identical.

2.2.3 Computability

Of all of Dietz' categories, computability is the most complex, as, in theory, it enables the other two categories. However, when Dietz refers to computability, he does so in a very specific way. He does this by asking a couple of questions: Was the work created through a series of programmed instructions or can it be modified programmatically? Computability, then, makes its appearance in works where the computer is an active agent in the creation of the work. For example, in basic live streaming art, the computer is simply facilitating the connection between artist and human. A video game, however, depends on the computer, in a way, to generate the work either by controlling the interactions or generating the game world.

Finally, a work that takes data and manipulates it and then through programmed behaviours by the artist presents the public with a completed work is an artwork where computability is at the forefront. Keep in mind these are quick examples and each work has to be studied in depth to determine how prominent computability is.

For example, photoshopping a digital photograph does not qualify it as a new media art, as its computability can be duplicated through analog means. On the other hand, a print that was generated through the analysis and manipulation of demographic data is new media art, if not interactive.

2.2.4 Neomateriality

More often than not, when we hear the words new media and digital, the basic assumption is that the work will be immaterial and that data has no physical presence. Christiane Paul argues this is not accurate and that, in fact, data can take presence in it (Paul 2015a). This can manifest itself in several ways, some more obvious and apparent than others. Some ways in which code and information become material can be seen in interpretations of how the digital perceives the world or in how intrinsically alien our reality is to a computer's perception of the world. Artists have been able to transform this immateriality into reality by a variety of methods, including 3D printing, visualisations of what the machine sees, and overlaying machine readable code representations of an artefact over real artefacts. In addition to Paul's examples, there is a different way in which the immaterial can be translated into the real: by applying force. When some code orders a robot to move in a certain direction and pick something, it is applying force in the real world through a body, effectively becoming material.

2.2.5 Location

In new media art, location can be a complex situation, as it can be argued that the actual work happens in the communication occurring between the visitor and the software, and not with the physical manifestations it may present. Furthermore, location in this context encompasses both physical and immaterial spaces. Physical spaces or sites are geographically determinate, while immaterial spaces in new media art exist as digital metaphors, such as the website, the virtual world, or the network, amongst others.

From this distinction, works can be classified based on which kind of space they exist in and their dependence on such space:

Site-agnostic: These works can be shown in any space, as they do not present any characteristics that may depend on the location they are in. This includes video games, most work that occurs on screens, portable CAVE

system displays, and others. In curatorial and design terms, these works are the most commonly encountered.

Site-specific: These are works that were created with a specific site in mind and are almost impossible to show in a different space without massive modifications, if at all. Often times, the barriers to relocating a site-specific exhibition stem from the work depending on the site's historical context, spatial configuration, presence of certain individuals, or other non-reproducible factors. Examples of this include projection mapping works or works that depend on the historical context of a space to work.

Virtual sites: These works, while not dependent on a physical site, are still specific to a virtual location. Virtual sites can be spatial metaphors, such as a virtual world, or entirely abstract concepts in the case of databases and websites. Regardless of the immateriality of these concepts, it is possible to treat and engage with them in the same way real-space
sites are engaged with. In effect, artworks that are virtual site-specific have similar requirements to those in site-specific artworks. For example, they may only exist in a specific server, since the information they require resides within, or they require a specific virtual world and its internal workings and/or community to function. Should those spaces cease to be accessible, the artwork itself cannot be shown. In effect, these works are some of the most fragile forms of new media art, as they depend on external factors outside of their creator's control.

2.2.6 Authorship and Conservation Within Interactivity

Interactivity in art has traditionally been shunned; philosophers, from Plato to Hegel, fail to discuss it or subsume it to a broader discussion of the senses. Aristotle considered it inferior due to his perception that touch was related to the sensual body, while Greenberg banished tactility from readings of "the modern sensibility" (G. Cepeda 2015). As Platonic ideas of the inferiority of the flesh to the mind have permeated western civilisation for centuries, tactile works thus seem to have been largely ignored. While Dada briefly flirts with it, as in Duchamp's *Rotary Glass Plates* (1920) (Figure 12), it is fully embraced in the 60's, starting with Roy Ascott's "change-paintings" (Figure 13). In new media art, interactivity appears in full force in the 1990's, when technological advances and access to computers made it easier

for artists and the public to engage with it. As interactivity is a fairly new concept in art history, it creates tensions both in terms of authorship and conservation.

Figure 12: Duchamp, Marcel,1920, *Rotary Glass*. Plates Painted glass, iron, electric motor, and mixed media. Yale, Connecticut Image: Yale University Art Gallery.

Figure 13: Ascott, Roy, 1961, *Change Painting.* Plexiglass, wood, and oil painting. Ipercubo.eu. Image:Syncretica Archive.

In authorship terms, interactivity poses a crucial question, if a work cannot be completed or experienced in full without the intervention of a non-artist third party, is authorship still exclusively the artist's or is everyone that intervenes an author?

Answers to this question vary, but as a general rule, it is a good idea to take into consideration how far the interaction goes and if the interaction adds to the work.

It could be argued that in a work in which the interaction simply sets in motion a series of interactions that regardless of how varied and emergent they are do not result in permanent modifications of the work, the authorship still remains squarely with the artist and their team. Cases where the artwork requires the input of others to be fully created are complicated, as traditional curation still privileges the process of ideation. For example, in Dries Verhoeven's 2010 interactive performance *Life Streaming*, the work depends on the video conference between two other people, neither of which is the artist. Even in citing this work, the attribution goes to Dries Verhoeven instead of the people in front of the camera. At most, in cases such as Rirkrit Tiravanija's *Untitled (Free)* (1992), people are listed as the materials. While curatorial texts do acknowledge the extended authorship, there is a division between these texts and what the public sees, which tends to be the limited information presented in the labels. An effort should thus be made to explain to the public how their actions are collaborating to the completion of the work. For further discussion on labelling go here.

The other issue with interactivity comes from the fact that these artworks by their nature have to be manipulated and risk damage. This creates a conflict with conservation departments whose function is to reduce object deterioration. This phenomenon does not affect new media art in the same way it does more traditional artworks. Some works are comprised of a combination of software and hardware, and this hardware is often treated as any other artwork. This means that the entire piece is treated as an irreplaceable singular object. Such treatment of works results in the deactivation of the work, presenting it as a static object that once had life. Examples of such deactivation abound, particularly from the time of Fluxus, such as Hélio Oiticica's *Bolides (*1964- 1965) and Georges Maciunas' *Fluxus Boxes* (1963-1977). The case of the *Bolides*, while not new media, exemplifies how such an object is deactivated. From the Tate website, we can find the following mention: "It was originally intended that these three elements could be manipulated by spectators, but this is now prohibited..." (TATE n.d -a). In a way, the object will never be as it was; the original meaning behind it will only be communicated through secondary sources. For contemporary pieces and pieces held by the artist, this is not a problem. Nevertheless, for works in private collections or situations where the artist is not available to authorise changes, the

preservation of the artefact takes precedence. However, there may be a way out of this impasse. If we accept that new media art is as much about the software as it is about the physical object, we can make a case for the creation of duplicate artefacts that can be presented to the public while the original (as much as that is possible in new media art) can remain untouched and unaltered. Of course, the public has to be made aware of this situation. This action has precedent in works such as *In Advance of a Broken Arm* (1964) and Sol LeWitt's instructions. In the former, the artefact has been replaced multiple times, proving the artwork is not tied to the artefact in all cases; meanwhile, the latter, shows us how the artist's instructions can be used to generate the works. Granted, LeWitt probably intended for the varying results from following his instructions to be part of the artistic process of the work. In new media, the instructions (source code, flow diagrams, etc.) can be used to recreate the work while maintaining its essence.

For works that lack specific hardware, the process becomes much easier, as they lack uniqueness and a physical form to be damaged. Given that there is no physical form to purely digital works, concerns over damage to the work become irrelevant from a conceptual angle. Of course, damage to computers, tablets, controllers, and other hardware is always of concern, but since they are not linked to an artwork, the loss is significantly less than if a work was damaged.

This lack of a physical object can be hard to come to terms with, as for most of art history, each artwork has had a "body" it has been attached to. However, one needs only look at other media to find alternate ways to engage with immaterial works. Music and theatrical performance are artforms that have always been separate from the medium they exist in. Just as sheet music or a script are not the artwork, the same can be said of source code or even executable files. The true artwork resides in the actions and outputs of the result from performing said code. It is important for curators to keep this in mind, as object fetishism can at times overtake practitioners and make the proper display of the work suffer, since priority is given to the objects associated with the work. One such example can be seen in the V&A's *Videogames: Design/Play/Disrupt* (2018-2019) exhibition, where the work *Bush Bash* by SK Games had its control interface (a car cut in half that was meant to be driven) encased in acrylic, rendering the game unplayable (Figure 14).

Figure 14: Detail of the deactivated control interface and accompanying signage. V&A Dundee. Images: Rene G. Cepeda

2.2.7 Time

Time in new media art is very flexible in some ways, as is in film, while also being incredibly rigid to the point where some works are best suited for multi- session extended interaction. To grapple with time in new media art, and particularly with its interactive variant, parallels can be found with film. While the comparison has been criticised for not being an exact parallel, it can still be useful. In both media, time passed within the work can be flexible, move forward and backward, stop for a while, show events concurrently, both sharing the same timeline or a completely different one, or they may even not involve the passage of time at all.

Where the comparison breaks down is on how this time is spent. In film, save for the most avant-garde of artworks, the experience is meant to have a clearly marked play time, after which, the film ends and the spectator may move on. And while a film may benefit from extra viewings, in effect, the work remains unchanged. In new media, each subsequent viewing may be entirely different or new options may become available. A work may become longer or shorter, depending on other participants and their actions, or the viewer could manipulate the work and, in effect, make its play time different. For others, the experience may have no determined conclusion, instead being an open-ended world open to exploration, or it may even present extremely long play times meant to make a point through sheer absurdity. Some works may even be intended to be experienced through various non-consecutive sessions at the leisure of the audience/participants.

Conceptually, unlike static works of art where the passage of time is either frozen in a moment or suggested, in interactive new media art, time takes a new dimension. Through interactivity, time can be slowed down, sped up, frozen, or reordered in ways that even film cannot do. Of course, this does not preclude new media art from also utilising the same time manipulation we can see in film, pictorial, and sculptural work; in a way, interactive new media art builds on top of those other temporal manipulations and gives control of them to the participant, not the artist.

A curator needs to be aware of these peculiarities, as they will dictate the path that the exhibition will take. Some of these works openly resist the institutional time as well as the average time spent by visitors on each work of art. While most new media art is created within institutions or with display in mind, certain forms inherit their relationship with time from technologies originally meant for private spaces. Internet art, video art, and video games are technologies that benefit from intimate interaction from the comfort of one's home.

Researchers Smith, Smith, and Tinio, in their article *Time Spent Viewing Art and Reading Labels* (2017), discovered that museum visitors spent a mean time of 28.63 seconds looking at each artwork. This means that artworks that require long experience times may be at a disadvantage, and the more works of this kind there are in a space, the higher the chance a work will be overlooked. Therefore, it is necessary for curators to account for time in the curatorial process and avoid including too many artworks that require extended interaction times.

There are several ways to deal with Time in the exhibition space that may reduce visitor uncertainty. Artworks that have specific performance times are the simplest to deal with, as a booking system or a notification stating the time is more than enough. For variable-time works, the solutions are slightly more complicated, but digital booking systems, such as Waitwhile, allow for dynamic modification of queue times, making bookings for such situations more flexible. In any case, setting a time limit for such experiences may be ideal if said artwork is either very extensive or popular. Finally, for those works that have a set time, the best solution is a real-time timeline. One of the best examples of such a solution can be found at the V&A's *Videogames: Design/Play/Disrupt* (2019) exhibition. Upon arriving at a space where several videos are played on a loop detailing certain aspects of gamer culture, one finds a screen that visually shows which of the 4

chapters is currently being played, how far into said video the spectator walked in, and the duration of each segment as well as the whole video. As the video plays, this screen's sections fill up, indicating how long until it is over. This solution gives visitors a wealth of information regarding the films being shown. First of all, it gives visitors an idea of how long they have to stay in the space if they wish to see the video. Next, it provides viewers an idea of how far into a specific section they came in and when it is safe to leave the space.

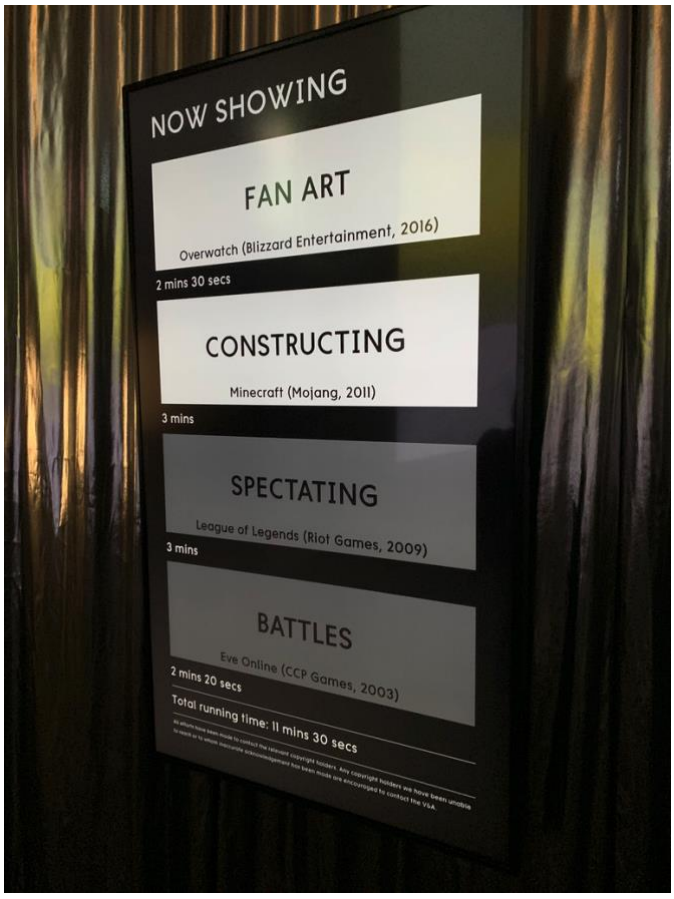

Figure 15: This interactive billboard shows us how far into the video we are. In this case, Spectating is about to begin. Image: Rene G. Cepeda

Figure 16: As time passes, the current space lights up, giving visitors an indication of how much time is left in the section. Image: Rene G. Cepeda

2.2.8 Instability

Interactive new media art, and in fact all new media art, is unstable in a variety of ways. The most obvious is the changes that occur to the work as interaction takes effect on it. In some works, the change is temporary. For example, in Daniel Rozin's Mechanical Mirrors (1999-2019), the mirrors' surface changes as the participant moves in front of them; however, this change will revert itself as soon as the person moves away from the artwork. Other works will be modified permanently through the actions of both the artist and/or the public. One such example can be seen in Harrell Fletcher's Learning to Love You More (2002), where the website would grow and be added to as more participants submitted their responses to various prompts appearing on the website. In effect, the artwork was being formed as time passed, and by the end of the project, the artwork had changed in its entirety.

Figure 17: Rozin, Daniel, 2007, *Weave Mirror*. 768 C shaped prints, 768 motors, video camera, control electronics. Bitforms gallery NYC. Image:Daniel Rozin.

There is, however, another type of instability that affects new media art, interactive and non-interactive alike: versioning. According to the consulting firm TechTarget, "Versioning is the creation and management of multiple releases of a product, all of which have the same general function but are improved, upgraded or customized." New media artworks are also subject to this and there are a variety of reasons versioning may take place. The simplest reason being adaptations made to a work in order to display it in an exhibition. These modifications may be

simple or may involve a total change in technologies or structures. In other cases, the artist may continue to work on the work, changing it based on prior exhibitions or simply as the artist wishes to improve on their work.

Versioning is a very effective way to keep track of these changes during research. It allows curators to know which specific manifestation of the work is being engaged with as well as track its genealogy through time. John Ippolito, in his text Death by Wall Label (2008), illustrates the importance of curation and research of a properly designed labelling system that is responsive to new media's needs. For more information on labelling, please go to the exhibition design chapter here.

2.2.9 Reproducibility

For artworks that have no physical form or site dependence, reproducibility is one of the most exciting features of new media art. In the digital world, it is very hard, if not impossible, to have an original something. The simple act of creating a backup immediately creates an identical copy of the work; keeping several versions of the same file creates countless originals, each different from the others, yet all are the same work. Back in the age of mechanical reproduction, we could argue the master, a document from which copies would be made for mass distribution, was the original of something and was considered invaluable to the right people. In the digital age, however, the original has lost a lot of its meaning. With perfect 1:1 reproduction, each copy becomes an original and loses its arbitrarily assigned value.

For curatorial work, this has some interesting implications regarding authenticity, accessibility to the work, distribution, and even preservation. Authenticity in works without an original can be problematic but can also be liberating. Historians and curators may find this uncomfortable and may even attempt to engage with digital works in the same way they have worked with more static and unique art forms, such as painting. Curators may feel reluctant to create multiple copies of the digital files in their collections or to even use them within the exhibition. They may equate the storage method with the artwork and protect the physical object while neglecting the information held within until it is lost. As curators, we need to understand that what we are studying, caring for, and presenting is not an artefact but an immaterial object without physical form and that this object behaves differently from "real" ones. This means we would do well to create as many copies as possible of the work (properly identified) to ensure its survivability, as

digital media is extremely volatile. It also means it is very possible to present multiple copies to the public when designing exhibitions, which would allow more people to experience the work. There may be some semiotic implications in doing this, as the public may interpret the presence of multiple copies of the work as the work lacking importance in comparison to more “exclusive” works. One of the only known examples of this effort at duplication of artworks was for the exhibition *Seeing Double: Emulation in Theory and Practice* held at the Guggenheim museum in New York in 2004. This exhibition would place original artworks alongside its emulated doubles, or even triples, with the objective of gauging public reactions to said duplication (Reinhart and Ippolito 2014). Their findings seem to indicate that more technologically literate audiences seem to be more accepting of duplication than those who are not. However, this varied by work and even by display method. Overall, audiences seem to have positive reactions to this approach (Rinehart and Ippolito 2014 pp. 131-135)

In terms of preservation, reproducibility can be both a positive and a negative thing. On the positive end, creating backup copies of works and migrating them to newer technologies is relatively simple from a technical perspective. On the other hand, due to this 1:1 reproduction, should bit rot or data corruption happen, all subsequent copies of the work will inherit those flaws. As an aside, bit rot is a little-known phenomenon where background cosmic radiation, heat, contaminants, or wear will in rare cases cause the data to become damaged. A similar risk comes from media decay, that is, the period of time during which storage media remains in working condition. As a general rule, magnetic storage media and cassettes will last 10 to 20 years at most with moderate use, Floppy disks will last 10 years at most due to unreliable manufacture, CD’s and DVD’s will last between 5 and 10 years, Blu-ray will last a bit longer but there is no concrete data to prove they last longer than CD’s and DVD’s, and M-discs will theoretically last up to 1000 years but, again, there is no proof. Hard-drives will last 5 years while flash storage will last 10, but depends on how much it is used for. To prevent losing data to bit rot or storage media decay, it is important to continually check all stored files for damage or corruption and periodically replace them.

Media	Estimated Lifespan
Magnetic data (tapes)	Up to 10 years
Nintendo cartridge	10-20 years
Floppy disk	10-20 years
CDs and DVDs	5-10 unrecorded, 2-5 recorded
Blu-Ray	Not certain, probably over 2-5 recorded
M-Disc	1,000 years (theoretically)
Hard disk	3-5 years
Flash storage	5-10 years or more (depends on write cycles)

Figure 18: Average life of various storage media. Image: Storagecraft.

2.3 Labelling

Creating a label for a new media artwork is a far more demanding proposition than it is for a more traditional artwork. Alongside the difficulties present in creating any label, we are now presented with works that, as has been mentioned above, are immaterial, unstable, reproducible, and with far more complicated attribution than any other artwork before. How we deal with this can seem daunting. However, Jon Ippolito, in his 2008 text *Death by Wall Label,* proposes a system that attempts to counter the inadequacies of the traditional wall label. First, it recognises the variability in authorship, titles, dates, media, and dimensions, and then presents an improved variable label.

The traditional label features a single artist, title, date, medium, dimension, and collection (Ippolito 2008). However, for the highly volatile new media work, it is necessary to account for its constant evolution. Thus, if we were to use Shezad Dawood's *Leviathan* (2017) as an example, a traditional label would look something like this:

Shezad Dawood (1974)

Leviathan (2017)
Mixed media

This, however, ignores the incredible scope of Dawood's work: Leviathan, as the name indicates, is a massive undertaking involving 10 films, a VR experience, neon, text, websites, textiles, and sculptures, and is actively being worked on with a planned conclusion at the end of 2021. A large number of individuals were involved in its creation, including web developers, extras, film crew, and many more, making this a work in which several individuals are ignored by the labeling system, effectively erasing them and leaving Dawood as a monolithic presence by crediting him as the sole creator. This should be evidently insufficient both for art historians and for the public, who gets a distorted idea of what the work is, its scope, and the individuals involved in it.

How to fix this? Going in order, we must first tackle attribution, where we should find ways to attribute every participant by name or alias instead of by a group or collective which usually devolve into, again, assigning authorship to one particular individual (Ippolito 2008). How do we do this then when we have a project such as *Leviathan*? The ideal option is to exploit the fact that this is new media art and to create digital labels that allow those interested to access a credit roll through the press of a button. If printed labels are the only option, then attribution to the artist and teams involved is the best compromise; however, this can be further enhanced through QR codes or web addresses that lead to an online expanded label.

Variable titles are the second challenge to our new media label. Variable titles are not uncommon in the artworld and, as an artist or collective change their minds or decide to fork a project into a new one, titles can and often do change. For this reason, our label must be flexible and allow for a genealogy of the work. The best way to address this is to introduce a variation system that accounts not only for naming changes but also for changes in the artwork. Again, in our digital label, this could link to earlier versions of the work or expand on the changes that led to the creation of a new variation. What constitutes a new variation? This could be something as simple as the addition of new parts to the work, a migration to a new operating system, or any other factor that modifies an artwork in a way that makes it patently obvious that it is a new

iteration of itself. In the cases of a print version, the label would mention the name, followed by a variation number and an explanation of the major changes to the work as well as where it was first shown. This could be further enhanced through the use of a decimal number indicating subsequent hangings of the same work. Thus, variation 1.1 is the first showing of the first iteration of the work, while version 3.5 is the fifth showing of the third iteration of the same work.

Regarding variable media, Ippolito has a complex taxonomy that distinguishes between materials that are definite versions of themselves and those that can be considered interchangeable. It also accounts for performance, networking, encoding, and more. However, these are granular distinctions that would confuse the average visitor more than they would help. Instead, Ippolito suggests a listing of the pertinent media involved in the work (Ippolito 2008). In such a way, this becomes a simple list, such as software, monitors, screens, performers, and whichever other elements are involved in the work. In the ideal label, we would have a generic version of all the parts under the general identification of the work and a more specific version under the variation. In practical terms, in the general identification of *Leviathan*, we use the term media source, while under the more specific version, we mention the specific form this media source takes, in this case, film. A similar substitution occurs with media display and the five projectors, and so on. Notice, however, how “acrylic on canvas” remains, as this refers to a painting that is an integral part of the piece and never changes.

Next, we have dimensions, where Ippolito has faced a surprising amount of pushback, since standardisation in cataloguing practices often consists of definite measures which, while seemingly innocuous, may have consequences in retagings of the work, as future curators may feel constrained by definite measurements where these were not intended by the artist. Therefore, it is important to accept and fight for “variable dimensions” as an acceptable entry both in catalogues and labelling, when such a factor is important.

Having taken all this into account, we can present a hypothetical label (as Dawood does not follow this system publically and it is impossible to be certain as to how the work has evolved) for *Leviathan* as shown in The Bluecoat in 2019.

Shezad Dawood, OK-RM London, Inês Geraldes Cardoso, Miranda Sharp, Laurie Storey

Leviathan (2017)

Neon, sculpture, acrylic on canvas, media source, media display, VR, Computer, Software

Variant 3.1 (2019)

(The Bluecoat Liverpool 2019, first five films of ten being shown and first presentation of VR experience in Oculus Rift)

Neon, acrylic on canvas, film, five projectors, Cculus Rift, computer, software More info at: notarealurl.com*

* this URL would take you to an interactive extended label with more detailed information on the artwork (stakeholders, variants, media, etc.).

Of course, in the case of a digital labelling system, the attributions would expand and present an extended credits sequence with all the participants' positions as well as the detailed composition of OK-RM members who participated in the project.

2.4 Technological Fetishism

Technological fetishism is a phenomenon very common in new media art exhibitions and can be observed in a variety of ways. This fetishism can be technophilic or technophobic. The former presents technology as a panacea, a way to solve all problems, while the latter is the exact opposite, exposing technology as a negative influence in humanity. While I will not take a stance on either end of the spectrum, it is important to realise that by focusing on the technology behind works, the implied message is that what makes these works important is not the artistic work behind it but the technological novelty. An example of this over-reliance on technological novelty can be seen in the use of the term "ZKM art", which is often used in a mocking manner to refer to artworks that rely on technological advances (Kwastek 2013 p.2).

This criticism does not imply that exhibitions that emphasise the technologies used are de facto bad. However, it is meant to reveal a curatorial cliche that has pigeonholed exhibition design and the art discourse for the last three decades.

2.5 Marketing/Commercial Concerns

When marketing exhibitions, a decision has to be made regarding how they are to be promoted. One option is to embrace the technological and interactive nature of the works. The other option is to treat the exhibition as a traditional art exhibition and promote the themes behind the exhibition.

Exalting the technology over the art is the standard operating procedure of most new media art exhibitions; take, for example, #*TheSocialGraph* (2010), an exhibition that takes pains to avoid saying what the exhibition is about and instead focuses on the technological novelty of new media:

> #TheSocialGraph is an evolving exploration of the burgeoning field of social media art and the relation of contemporary art with this populist tool as a medium, facilitator, and subject for art.
>
> (Hyperallergic 2020)

Doing this may attract novelty seekers and cultural insiders; however, it is extremely alienating to any individual not steeped in both the jargon of International Art English and social media literacy. As an added layer, we are presented with a highly technophobic prose predisposing the visitor to assume the technologies here presented as something inherently negative. Rarely does the adjective “populist” appear as a desirable descriptor. Of course, this would depend on the approach the artists involved take. However, from what is presented, it is hard to determine if this is the case or not. In this particular example, I use #*TheSocialGraph* not to criticise the exhibition, which went on to receive good reviews, instead, I use it to illustrate a trend in new media art promotion.

Writings like these exist for a reason: they resonate within the art world and look particularly well in grant applications. However, we have an obligation as curators to balance this with the public interest, since as new generations, beginning with the much wrongly maligned millennials, take over as the baseline public to our institutions, the discourse must shift. For generations born in the 1980’s and later, digital technologies, such as social media, streaming, and whatever comes next, will not be a novelty. Unlike generations born in the pre-digital age, there is no paradigm shift for them, therefore, texts as those presented in *#TheSocialGraph’s* marketing come across as either outdated, patronising, or worse, self-important.

A less extreme example of the prior can be found in *Tag Ties & Affective Spies* (2009), an exhibition about the connections generated through social media and the emotional links created through it as well as how content is created and consumed. The press release for which reads:

> The online works included, highlight the controversies of the web 2.0, commenting on the constant balancing between order and chaos, democracy and adhocracy, exposure and exploitation that it presents.
>
> (Dragona 2009)

In this case, we still witness techno fetishism, both positive and negative. However, in this case, it is clear the artists themselves share this relationship with the medium. It is still curious to find oneself discussing the political and social implications of a medium. It is rare to find an exhibition which focuses solely on the constant balancing between order and chaos, democracy and adhocracy, exposure and exploitation presented by oil on canvas (although, perhaps there should be), but that seems to be the current trend in new media art making.

This is not to say that new media has to be about itself. Artists such as Pippin Barr, Porpentine, and others are using new media as a way to comment on aesthetics, gender identity, and more, and yet, all their work is often subsumed into the technological discourse. One example of an exhibition comprised in its entirety of new media art was FACT's *Space Invaders* (2010), an exhibition dedicated to video games and which is described as such:

> Space Invaders: Art in the Computer Game Environment is a group exhibition exploring the increasingly blurred boundaries between videogame spaces and real spaces. From the detailed, complex worlds of Grand Theft Auto to zen gaming and augmented reality, the exhibition brings together world renowned new media artists and innovative games designers who are pushing the limits of the medium.
>
> (FACT 2009)

Here we see a description more in line with what we would find in a more traditional exhibition. The emphasis is placed on the works and the themes behind them, and there is no mention of exciting technologies or references to new media as a tool. FACT treats a video game exhibition as an art exhibition first and foremost. This sends the message that new media is art and not a novelty. By doing this, we integrate new media further into the art canon.

Semantics are not the only important marketing concern in new media art; at times, the exhibition has bled into the marketing face of the institution. According

to Fiona Mclean, in her book *Marketing the Museum* (2012), Marketing's obligations within cultural institutions have been grossly misunderstood. Value for money, profit making, and audience building have become the metrics by which museums live and die. This has created marketing departments that have become overzealous in the protection of the institution's "brand". On the other hand, we have new media art, an artform that exists in open defiance to the capitalistic goals of this commodified vision of the world. By its very nature, new media art rejects commodification, censorship, and authoritarianism. While a lot of art has historically been contentious and confrontational in the same way, what has changed is that non-new media art was easier to contain and, in most cases, could be divorced from the institution's "image".

An example of this bleeding could be seen in TATE's commission *Uncomfortable Proximity* (2000) by Graham Harwood. In this work, TATE's website was hacked by Harwood and made to present an alternate version of the website that displayed grotesque image composites of body parts and modified texts that exposed the hidden and often censured histories of TATE. In its original form, it was intended that every third visitor to the official site would instead be redirected to the modified one (Harwood 2003). In its final form, when someone visits TATE's website, a second window opens in the background presenting Harwood's version. This, along with a contentious request that a modified TATE logo (Mongrel TATE) replace every mention of the TATE on the website, highlights the kinds of compromises the artist had to make. Not only that, but these decisions demonstrate the conflicts that probably arose between curatorial and marketing departments and their conflicting interests (Noort 2000). On the one hand, curatorial has an obligation to preserve artistic integrity while marketing is in charge of preserving institutional integrity and informing the public about the institution and its programme.

Obviously, the final form *Uncomfortable Proximity* took was the result of countless negotiations and compromises. While not ideal, it serves as a lesson on the intricacies of new media art and its inherent cross-disciplinary nature. It also bears mentioning that, while artists have always questioned the institution, Harwood's work was controversial within the institution due to the perceived purity of the web page. When we visit a web page, we expect a certain "truthful" information to be given to us, and any deviation is assumed to be nefarious (i.e. hacking). As such, subverting the web page not only questions the institution but our belief structures

as consumers of web content. It is natural for the marketing team to be more aware of this than the curatorial team.

2.6 Planning Process

2.6.1 Pre-planning

In order to successfully create an interactive new media art exhibition, it is necessary for you to make some alterations to your methodology. While this is not the only way to go about it, this method may be a good starting point from where to create your own.

As soon as it is decided to include new media artworks in an exhibition, a list must be made of the different platforms required. This list will help determine which works can actually be shown in the exhibition space. Factors such as space between kiosks, internet coverage, length of experience, outlet availability, and even hardware available within the institution, will limit the number of works that can be shown in the space. Often times, it is not possible to select works in person. In those cases, it is very important to get a live demonstration using platforms such as Skype, where the artists, or whomever is in possession of the work, can demonstrate both the general dimensions and workings of the artwork and the interactions it is capable of. Sometimes, catalogues and photographs are not enough with interactive works. In some cases, like in VR and AR, it may be possible to use institutional hardware to at least get a close approximation of the complete work. For example, Ed Fornieles' *Truth Table* (2016-2017) (Figure 19) requires several accompanying artworks as well as a bed. However, the VR experience can be had simply by downloading the software and using a VR headset.

While many artists may provide their own hardware, this in itself may cause issues when the gear is coming from abroad, as it may be hard to convince customs officers that the objects in question are parts of an artwork instead of merchandise (Graham 2004). To prevent this, it may be convenient to hire a solicitor specialised in international trade. In the UK, the National Import Relief will allow institutions to move electronics and other hardware into the country as art objects if they leave the country at the end of the exhibition; see section Community System of Duty Reliefs. If this is not possible, it may help make your case to custom officials if you can demonstrate that the hardware is used in an artwork. Present photographs and videos as well as

exhibition catalogues as proof. It is not enough to know which technologies the artworks will be using; thus, specifics for each artwork are necessary to prevent unexpected expenses further into the exhibition design process.

Figure 19: Fornieles, Ed, 2016-2017, *Truth Table*, VR. Basement Roma Italy. The complete setup requires a bed and a dedicated space to hang the other related artworks. As Truth Table simulates a series of sexual encounters, the artist used a bed both as a way to keep the participant comfortable and to give greater immersion into the sexual encounters by simulating the intimacy of a bedroom. Image Roberto Apa

List of specifics:

- Physical dimensions
- Operating system version (e.g. Windows 98, OsX Maverick, Linux)
- Power sources required
- Power converters required
- Plug types
- Types of connections
- Minimum internet speed required
- Servers required
- Control interfaces
- Furniture
- Miscellaneous software

- Number of cameras, sensors, and projectors
- Light level requirements
- Any other equipment the artwork may require to be provided by the institution
- For VR: type of headset and manufacturer

Keep in mind compatibility issues; your IT department is qualified to help you determine which artworks work with your existing equipment or if new gear is required. In cases where the artists or another institution will provide the hardware, the question of compatibility is no longer an issue. However, space, internet coverage, time, and power issues still remain.

In terms of length of experience, if any experience takes any longer than five minutes, a decision must be made as to how it will be handled. For further reference, see Time in the exhibition space under the Curation subheader. As for media rights, go here.

While this is happening, layout planning should begin. With new media art, it is important to be very aware of the space's peculiarities. Floor plans and 3D models are ideal for this; make sure they are accurate and mark power outlets, windows, skylights, and internet coverage. 3D models are best for this, as outlet height and light sources can be simulated within them. Some recommended software for this include Sketchup and Ikonospace. These are easy-to-use programs that can be mastered in a few days. A handy tool for determining the space required with projections is Projector Central; this website allows curators or designers to input the make and model of a projector and the website will let them know how much space that projector requires, how dark the space must be, and many other important factors for determining where a projector should be placed or if it is suitable for the space at all.

The Raspberry Pi mini computer is a good alternative to full size computers for the purpose of media centres. These low-cost computers can be modified to function as simple media players, and their small size allows them to be placed behind or next to any display technology. This reduces confusion and provides easy access when attempting to troubleshoot issues, and also reduces the length of cables required, both saving money and minimising interference from various sources. Their simplicity means there are no complex interfaces or software that can crash or create conflicts, thus reducing upkeep. Of course, a certain degree of computer literacy is required,

but a basic setup can be done by almost anyone following the provided instructions. For more information visit the Raspberry Pi website.

2.6.2 Porting and Demos

If the artworks require porting or the creation of demonstration versions, it is necessary to discuss this with the artist. Porting is the process of adapting a work to function in newer technology. It is often done when the technology used is no longer being supported, made, or is simply incompatible with current technology. Porting is a complicated and, at times, costly process, but depending on the work, it may be worth the expense. In fact, at times, the request to port an artwork is enough for an artist to decide to do the porting themselves.

Demonstrations or demos of artworks is a concept not yet explored in the arts; however, it is very common in the field of commercial video games. A demo is an abridged version of a work, often used in stores and tradeshows, to give consumers a feel for the complete product. For interactive works with extremely long play times, it may be worth exploring this possibility with the artist. When asked about it, academic and video game artist Pippin Barr had the following to say:

> **Rene Garcia:** When I began my PhD thesis, I believed that it could be possible to create demo versions of artworks that had extremely long play times, such as your game "The Artist is Present". As of late, I feel like that unless the artist themselves decided to create a demo or abridged version, to create one would just create problems. What do you think? Is it possible to create these demos? Is it better to negotiate it with the artist (if they are still around)? Or simply decide on how long we allow each visitor to play and after this time tell them: well, this is it, if you want to complete this experience you can find it in such and such a place?
>
> **Pippin Barr:** Huh, what a weird and interesting idea.
>
> Definitely strikes me as something you'd want to discuss with/collaborate with the original artist (though in terms of artwork you could probably argue you could create the demos themselves as artworks!). Personally, thinking about an experience like The Artist Is Present, I don't think I'd agree to a "demo" version except as a completely new art project – I wouldn't see it as actually representative of the original game/work. I've declined opportunities to exhibited [sic] as a "trailer" for instance. This would probably be true of any game that's leaning on the idea of duration in a serious way – if you remove it, it kind of cripples the project? I suspect the "if you want to play more, find it here" is probably the right/easiest option.
>
> Such an interesting idea!
>
> (G. Cepeda and Barr 2019)

Other possibilities opened by this conversation with Barr is the idea of presenting the full work, and after a length of time has passed, stop the interaction and present to the participant the option to continue the experience in its original form. Of course, this would require the work to be available either on the exhibition's website, the artist's website, an app store, or a physical copy that can be taken home and installed.

Recreation and reinterpretation are other possible options to preserve an artwork. In the case of recreation, we accept that associated artefacts are not crucial parts of the artwork and that the software or immaterial aspect is more important. In this case, the artwork can be remade with newer technologies. Gilbertto Prado's *Desertesejo*(2000/2014/2018) was completely recreated using the video game engine Unity (Prado and Cuzziol). Another example would be to recreate Jodi.org in contemporary web code, ensuring it looks and functions exactly as it used to back when the coding employed worked properly.

Reinterpretation, on the other hand, allows for the creation of alternative works derived from the original source code. A precursor of this idea would be the artistic practice of Sol deWitt, whose works are in fact the instructions left behind to create a new artwork, and which allow for the re-creator's own sensibilities to come through. In this case, the original artwork is not touched and the reinterpretations may derive vastly from the original, making this the least ideal option for preserving specific artworks.

2.6.3 System Compatibility

The next step should occur when the curation team has all the works on site, where they should be tested for compatibility with networks and the local hardware, and notes should be made of any adaptations made to either the space or the supporting technologies required for the artworks. If possible, works should be left working constantly in a similar schedule to that of normal opening hours in order to determine if any technology crashes after a certain period of time or if it overheats. Should this happen, IT can take steps to remedy the situation or give recommendations. If the artist is available, an effort should be made to contact them, both to inform them of possible errors in the software and to receive recommendations on proper operation. In case of new works, this is valuable

information for future hangings or curators, as it will save time and resources in the future, simplifying the curatorial and exhibition design process.

In cases where video or audio recordings will be used, try to have multiple copies of the media in question at hand, as flash drives tend to fail at random times. This will ensure downtime is kept to a minimum. In the case of streaming video, there may be moments where the connection to the server is lost for a variety of reasons; in that case, try to have archive video or some other form of related media that can be presented while the connection is restored.

One way to combat overheating is through the use of fans inside furniture or lowering the temperature of the space through air conditioning (this step is not optional in cases where there are many heat sources within the space as well as works that require temperature control). In the case of computers, water cooling kits can be implemented as a last resort. These kits range between $20 USD and several hundred dollars. Of course, these have to be thoroughly tested before they are installed. Reviews from trusted sources, such as Tom's Hardware, should be used to determine the best kit to purchase.

For devices that cannot be cooled in the aforementioned ways, putting the devices into standby or having two or more devices to cycle through could reduce risks. In the case of mobile phones in VR, keep the headsets on standby until they are required; otherwise, the battery will run out or the device will heat up in a short span of time.

Document every setup, including adaptations, modifications, and challenges faced during the installation, and include this in the exhibition binder as part of its permanent record. In the future, these images, alongside the other collected experiences in the exhibition notes, will simplify future installations.

2.6.4 Length of the Experience and Usability

What a significant segment of an artwork is, is one of the toughest questions for curators to answer. Ideally, an artist would like for the entirety of the work to be experienced; however, this is not always possible. In a way, the easiest answer would be to create a demo or abridged version of the work. However, talks with artists and curators show that this approach is not recommended and would require extensive work, if it is even approved to begin with.

As the demo option is not ideal, we must work around the artwork as is. For works with no clear beginning, the experience can start and end at any point, and the only thing to be decided is how long should the experience last. In a properly documented work, the artist probably has prior exhibition experiences as well as their own recommended play times. For works that have no prior exhibitions or where documentation fails to mention this, user observation may hold the answer. To do this, the best option is to have non-expert individuals engage with the work and determine how long it takes them to either get bored or grasp the core ideas behind a work. While probably not feasible in all exhibitions, even a post-opening test is suggested, if only to detect possible issues that can be addressed in future exhibitions.

The proposed methodology consists of the following steps:

- Make sure your exhibition space is almost finished and at least the wall texts and the works you wish to test are fully functioning and their display design almost finished.
- Create a list of artworks you wish for the test group to visit and emphasise that there is no order in which they should be visited. Tell the test subjects that they do not have to visit them all if they find them uninteresting and that they can walk away at any time from a display.
- Allow the test group to engage with the works on their own and try not to sit or stand too close to them. Individuals change their behaviour when they feel they are being closely monitored.
- Monitor their reactions, comments, and actions, as well as the time spent with each work.
    - Once a test subject is done with the visit, ask them the following:
    - Were there any works that kept your attention longer? Why?
    - Were there any works that frustrated you? Which and Why?
    - Did you find any of the artworks hard to operate? Which and why?
    - Were the instructions provided clear enough?
    - Did prior familiarity with certain technologies help you?
    - Did you understand what each work was trying to say? Which ones were hard to understand?
- Finally, show them how you intended them to work, their meaning, and their proper operation. Record their comments.

- Take your test subjects through each work they had difficulties with and show them how you intended them to work, their meaning, and their proper operation. Record their comments.

Ideally, this study should be carried out with a variety of individuals, but even just a couple of individuals will help you identify ambiguities, mistakes, and vulnerabilities in your design. The next obvious step is to address whichever issues seemed to be mentioned the most. The more feedback you get on something, the clearer it is that something is an issue; do not go changing something that was only mentioned once. Naturally, all changes derived from this test should be documented in the exhibition binder.

Examples of common complaints and their solutions include:

- Inability to navigate an artwork due to lack of technical knowledge: This is best solved by having staff ready to provide assistance in the operation. Simple text instructions may be insufficient or confusing.
- Convoluted instructions: Similar to the previous issue; however, the difficulty stems not from technological illiteracy but because interactions and objectives are not clearly explained. Rewriting texts can fix this.
- Color blindness: For works that have no inherent color blindness filters, software such as Visolve can apply a filter to any computer screen that makes color differentiation easier. While the software should not be on at all times, make sure it is obvious that this feature is available by approaching a staff member.
- Game controllers are too complicated: In some cases, modifying game controllers to only have the required buttons could solve the issue. In other cases, someone may need to take over controlling the gameplay while obeying the instructions of the visitor.

Do keep in mind that the recommendations given here will need to be combined with those given in other sections of this guide as well as the sections dedicated to every technology used in the exhibition.

Some works may require the participation of the public to begin working, and until this happens, the work remains inert. According to Pau Waelder in his course Curating New Media Art: Process, Interaction, Virtuality (2019), visitors either tend to ignore an artwork or assume that it is broken or that it is a

“sculpture” if nothing appears to be happening. For this reason, it may be necessary to generate some content ahead of the opening so works have a starting point for the public to feel like engaging with the works is expected. Front-of-house staff could also invite people to engage with works, or even use the works when no one else is using them. This last option requires the staff to encourage public participation or it may give the impression that only the staff is authorised to use the work in question.

2.6.5 Booking

Another important consideration when it comes to very popular artworks or those with long play times is queue management. Three possibilities present themselves, each of which has to be evaluated based on the requirements of the institution.

For very small spaces, first come, first served may be the best solution; however, if a queue begins to naturally form, it may be ideal to set up a queue. In most museums, this is the way most art is consumed. However, the interaction factor makes it necessary to create a system that allows for fairer access. Queues add some organisation and facilitate fair access. However, depending on the popularity of the artwork, it may lead to unwieldy “conga lines” that slowly consume all available free space. Finally, booking both online and offline allows visitors to have more control as to how to use their time as well as have peace of mind knowing they will get to experience the artwork in question. Visitors should be given the option to book online, through the phone, and within the institution, both ahead of time and on the same day.

There are many apps that allow the creation of waitlists/bookings; one of the best ones is Waitwhile. This app not only allows for users to use the app to book and manage their booking but also sends SMS notifications to the visitor, so they do not miss their appointments. What is interesting about this app, is that it also handles a suite of analytics, allowing you to see daily visitor stats, cancellations, average waiting times, days with the most traffic, and other statistics. Its pricing varies depending on the number of daily visitors and is available for most mobile phones.

Method	Pros	Cons
Online and Offline Booking	• Easiest system for visitors to guarantee a spot • No waiting in line • Visitors can use their time better • Suitable for large to medium crowds • Appointments make it easy to know when things start. • Ideal for visitors with disabilities	• No spontaneous participation • Logistically complex • Drop ins may be possible but depends on availability • Requires effective bookkeeping. •
In situ Queue (with physical barriers)	• Easy to set up • Suitable for small to medium crowds. • Allows for spontaneous participation	• Long wait times may discourage visitors • Not friendly for visitors with disabilities. • Time spent in line means less time in the galleries. • No clear way to know how long it will take to get to the activity • May require large spaces for the queue to stretch in
First come first served	• Ideal for small crowds • Self organizing • No setup required • Allows for spontaneous participation	• Lack of order will lead to chaos in medium to large crowds • Allows visitors to skip other visitors

During the exhibition itself, works should be constantly monitored in several ways. One reason is to ensure the desired software is indeed running on the hardware, and if not, this should be corrected. For VR, battery powered headsets have to be checked every hour to ensure there is enough charge in the headset for operation or that the battery is replaced with a charged one. Also, do integrity checks on the hardware, making sure lenses, straps, and controllers are in working condition. Invigilators should also be ready to assist visitors who may suffer from motion sickness or severe disorientation. For AR, loaner devices should be checked for battery charge. Networked works need constant supervision to make sure the internet connection remains strong as well as to check if outside resources are functioning properly. In the case this is not true, artists often create offline content to at least maintain the work functioning in a limited manner. If this content is not available, it should be brought up to the artist as a potential plan B. In the meantime, all network malfunctions must be reported to IT as soon as possible, giving as many details of what could have caused the issue. Robotics may require a combination of all the recommendations given here, depending on their workings. But as a baseline, their servers should be monitored for overheating as well as the workings of their mechanical parts.

The public's behaviour within the exhibition space should be observed and documented through photography, video, and interviews in order to determine points of friction, such as artworks without clear instructions, ignored displays, popular ones, number of users, length of experimentation with each artwork, and time reading labels.

All notes, photographs, and other information gathered from proposals to take down should be included in the exhibition notes. One method for ordering this binder would be to use dividers separating each artwork and attaching all the notes related to it. Specifically, modifications, alterations, issues with the space, furniture design, operating instructions, and artist's notes should all be present for each work. Furthermore, a divider dedicated to the exhibition design should also be created. This divider will deal with installation issues, modifications done to the space, visitor numbers and other statistics, installation shots, and observations by the staff. Finally, a divider for known issues should also be included, both ones that were known and could not be solved for whichever reason and ones that may have arisen in the course of the exhibition.

2.6.6 Workflow

The following Gantt chart will outline the basic structure of the technical planning process. It is meant to illustrate the differences between traditional curation and new media art curation. Therefore, not all the curatorial process will be highlighted, such as marketing, education, etc. It assumes a one-year time span and should only be considered a starting guideline you will adapt to your own workflow.

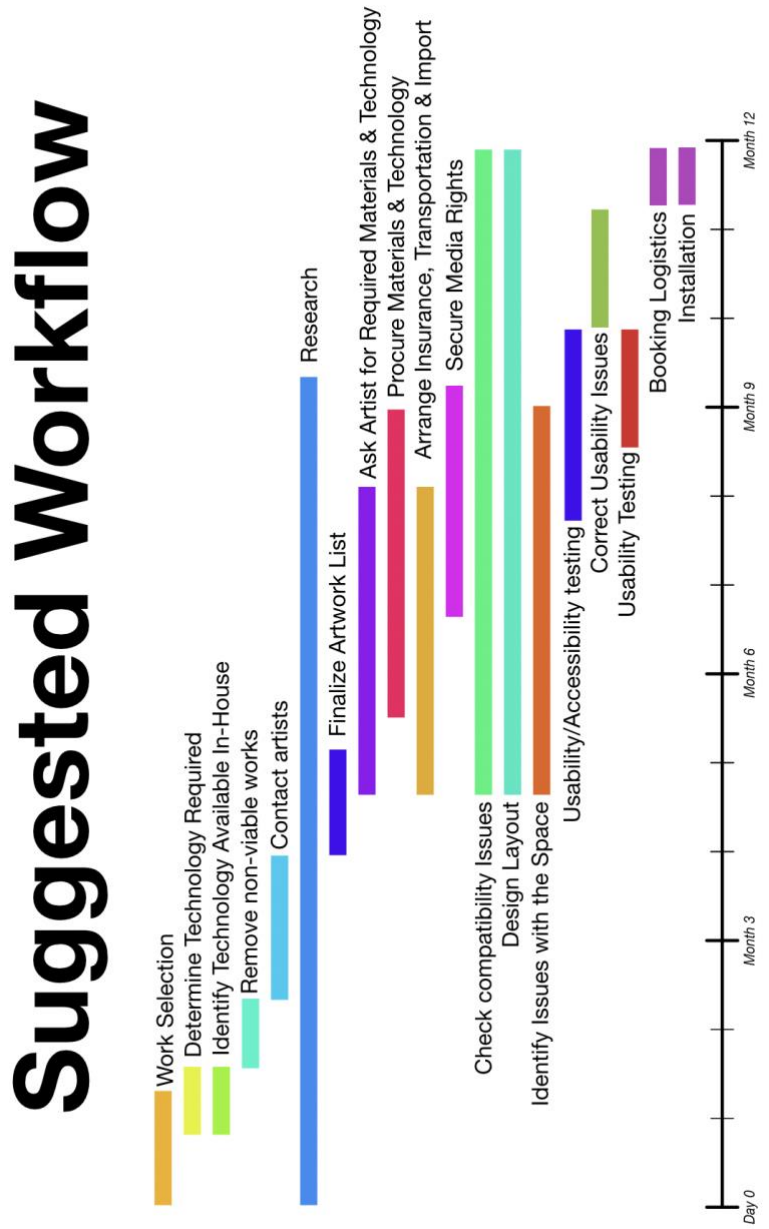

Figure 20: Visualization of the recommended workflow for a one-year project. Image: Rene G. Cepeda

3 Exhibition Design

3.1 Curator-Designer Collaboration

Historically speaking, exhibition design —as an independent field comprised not of curators but designers and architects and other professionals— is a new development. From the cabinets of curiosities of the XV Century up to the museums of the first two decades of the XX Century, the task of deciding how to arrange and display a collection fell on either the amateur collector or the specialised curator in charge of a specific collection. This changed in 1924, when Frederick Kiesler, influenced by the Bauhaus design principles of form following function and treating the wall as a plane, came up with the free- standing, demountable display system the Leger und Träger, or L&T system, to display pictures at the Konzerthaus in Vienna (Huges 2010 p. 14-15). The system effectively separated the artwork from the walls, changing the relationship between art and decoration. This marks the beginning of a new way of thinking about exhibitions, where multiple disciplines are involved in the process of mounting an exhibition (Staniszewski 2001).

Meanwhile, El Lissitzky was already integrating interactive techniques into his *Abstract Cabinet* (1927-1928), in which panels holding the artworks could be moved by the visitors and four-sided drums could be rotated to display different works (Staniszewski 2001). This innovative display technique would go on to influence other curators, such as Alfred Barr and Philip Johnson (Ibid). It is important to note that Lissitzky saw exhibition design as an extension of artistic practice and not as a secondary profession for him (Ibid).

On a different approach, we have *Film und Foto* (1929), a photographic exhibition that presented the work of various artists of the era, including Lazlo Moholy-Nagy, Edward Weston, Marcel Duchamp, Man Ray, and many more. While not much is known of the exhibition design process, what is known is that the main hall was designed by Moholy-Nagy. This is interesting because, at the time, the artist was heavily involved in set design and participated in the curation of this exhibition as an artist, a curator, and a designer. This resulted in a hanging where the works were laid out salon style, but also as an imitation of a book. Each photography was placed in a double page alongside a photograph of objects from science and industry that served as inspiration, encouraging a dialogue between the two

(Zervigon 2014). Although the exhibition had an interesting concept, it nevertheless adheres strictly to the aesthetics of the white cube (Zervigon 2014).

In contraposition to this exhibition, we have the Soviet Pavilion at the 1928 Pressa exhibition in Cologne, Germany. This space, designed by El Lissitzky, is monumental, dramatic, and experimental, and reflected the emotions and general optimism of the early Soviet regime prior to Stalinism. As such, the exhibition was a propaganda tool; a fact reflected in its theatricality and massive scale of the works. Lissitzky as an artist curator presents us with some of the first interactive exhibitions. The influence these exhibitions have had is undeniable and can be seen in everything, from the exhibition design at the Museum of Economy (MIDE) in Mexico city to the grand pavilions seen in festivals such as the Venice Biennale. Furthermore, we can see in these exhibitions the first examples of artist curators who take over the design of all aspects of the curatorial and design processes.

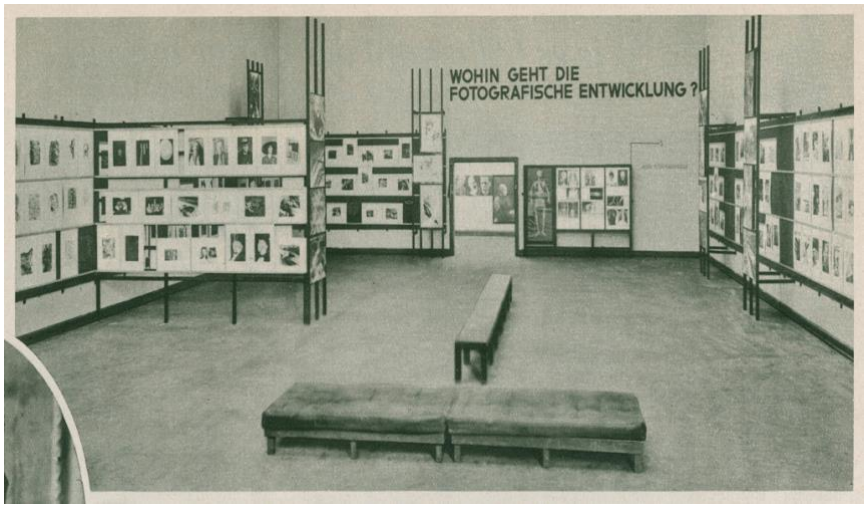

Figure 21: Film und Foto, Stuttgart, 1929. Installation view of Room 1. Exhibition design by László Moholy-Nagy. Images by Arthur Ohler.

Figure 22: Pressa, Cologne, 1928. Installation shots. Images by Sophie Lissitzky- Küppers

However, these grand exhibition designs that melded architectural and artistic ideals would not become the standard. Instead, Alfred Barr's installation method would go on to become the most common way to display art in contemporary art spaces. Barr would create exhibitions that laid the foundations for what we now call the white cube. Gallery spaces devoid of decorations in neutral colored walls (ironically, Barr considered white walls as too intrusive and instead preferred beige linen as the cover for his walls) with artworks displayed in complete independence from the space, demanding attention as aesthetic objects. This method, while seemingly neutral, recontextualises any object placed within. It tells the viewer that the object is worthy of admiration for itself, not its historical context or its location, and is elevated by its very placement into the æther. Not only that, this method presumes a standard viewer of a certain height and a certain level of education. It is minimalism made manifest. It also resulted in the complete sidelining of the exhibition designer as an aesthetic contributor.

With no more need for complex architectural designs and the L&T system replaced with the pedestal, artworks required no complex arrangement, both due to the ideological bend of minimalism and the removal of superfluous design elements, including color; thus, the design of the exhibition could be done by the curators themselves. All that was required was a lighting system, white paint, and high ceilings. The works would speak for themselves, and if the artist wished for color or to intervene the space with architecture, that was their prerogative; the exhibition designer's job was to ensure proper spacing, hanging, placement of wall texts, and the occasional graphic. This tendency for extremely minimalist space would continue to this day, although there has been a definite trend towards more experimental display by the late XX Century and early XXI Century.

While in smaller institutions the curator still functions as the head exhibition designer, in larger places, specialisation has led to the creation of design departments, where specialists in graphic design, architecture, print media, exhibition design, and other related fields work to fulfill the needs of both the marketing and curatorial departments. This has created a division in the design process, where the two departments will only meet during predetermined meetings and collaboration tends to diminish just by the mere fact that the departments may exist in different areas of a building or even different buildings. The degree of cooperation between these two groups can be either very limited or the exact opposite and involve close cooperation between designer and curator.

Inarguably, the more involved both teams are in the process, the better an exhibition will be, as it will allow for exhibitions where the design is not only functional and aesthetic but will also support and complement the exhibition's objects. In new media, this involvement is even more important, since, in a curious twist of fate, in some cases designers are more familiar with the objects of an exhibition because they work with its supporting technologies in an involved and constant manner. Being immersed in new media on a daily basis makes them especially sensitive to the peculiarities of the medium than someone not deeply versed in the workings of web design, streaming, and social media, amongst other technologies. As curators, we are traditionally trained to exist within the world of museums, painting, sculpture, and performance. The world of new media remains vastly unexplored by non-specialised curators, especially from older generations.

While focused on heritage, the text Do it together: The effect of curators, designers, and technologists sharing the making of new interactive visitors' experiences (2016 Petrelli, Dulake, Marshall, Kockelkorn & Pisetti) makes an excellent case for collaboration between designers and curators and how this collaboration can yield new ways to interpret a collection. Petrelli et al. present a case where curators and designers were involved in a workshop where both teams were involved in the entire process. This resulted in the heritage professionals understanding how technology was utilised in ways they had not considered; at the same time, this process allowed the design teams to understand the thought process of the heritage staff as well as their concerns and needs. In the end, this translated into a better working relationship where both teams were able to speak the same language and create exhibitions that truly exploited the capabilities of new media instead of being limited to more traditional implementations.

In the specific case of new media art, designers may be able to educate curators on certain subtleties presented by specific artworks. For example, a designer well versed in web design may be able to provide creative solutions to present web art beside a projection on a screen or a large scale tv. They may be able to explain why a certain artwork functions the way it does or why a certain alteration has significance. Certainly, it is impossible to explain all creative and technical possibilities of this cooperation in a document. What is important is to keep an open mind and be receptive to all recommendations made by the design team. Designers are versed in human computer interaction and user experience; this means that they are ideally suited to address some of the thornier issues that arise

in interactive new media art. One example would be generating operation instructions for artworks, simplifying interfaces (in cases where they are allowed to), and designing user friendly input devices when works such as web pages have no predetermined controls.

However, it is also important to know that this cooperation is not unilateral and that curators can also have innovative approaches as to how to both design and present work, both from prior experience and also because they are not bound by the implicit laws of design and how technologies “should” be presented. Curators can also help on the design process by giving the design teams a deeper understanding of the works being shown, the artist’s intentions, and other important details of each work displayed.

In order to foster this cooperation, teams need to be willing to cross institutional barriers, such as geographical separation, as well as preconceived notions of expertise. Some of the most common barriers to cooperation include differences in language use and jargon, which can often become barriers when used as a way to conceal information or by accident, when the same term has slightly different meanings. To combat this, it is important for all teams to familiarise each other with their specific jargon as well as to agree on common terms.

Examples of design jargon:

Body copy: the main body of text.

Display type: Typefaces (fonts) designed for large scale signage, not suitable for body copy.

Kerning: The space between two characters; can be adjusted to achieve a more pleasing display.

Ledding: The space between two lines of text.

Tracking: It is the separation between characters in a whole word.

Orphans and widows: words and short lines of text that appear at the end of a paragraph all on their own.

Lorem ipsum: placeholder text.

Usability: how efficient, simple, and pleasurable it is to use something.

Examples of curatorial jargon:

Commercial: referring to work that is commercially available.

Courier: a person tasked with traveling with an artwork and ensure its integrity.

Information system: labels, signage, and wall texts.

Distributed: art that is accessible through a variety of ways. Currently, digital networks are the main method of distribution of artworks outside of traditional channels.

Variable: artworks that change through the actions of the audience or other phenomena.

Methodologies can also cause conflict, since different disciplines move at different paces and treat the information they receive in different ways. While the working speed of curators is mainly dependent on their own performance, design teams are bound to multiple factors outside their control, including suppliers, printers, drying times, assembly, and much more. As for information, while often expected of them, designers are not people who generate slogans or any kind of copy (text), and within the discipline, it is often seen as a nuisance.

Communication is another important factor; teams should be in constant contact through meetings, workshops, and feedback sessions. Lack of communication can lead to misunderstandings or the feeling that one team is not doing anything. Due to differing methodologies, design and curatorial may appear to each other like they are doing nothing while, in fact, both are involved in highly demanding tasks. For this reason, progress reports are crucial for a smooth working team, as they help delineate responsibilities and tasks that need to be done and who is responsible for them. Do keep in mind it is important to keep these meetings and feedback sessions short and contained; there is nothing worse for a workplace than constant meetings that get in the way of the work.

Finally, identify points of friction between teams; small complaints can quickly snowball if not addressed. If one team feels like they are being ignored, collaboration will suffer. Keep an eye out for signs of trouble, like uncooperative team members or a lack of communication during meetings.

3.2 Cross-Departmental Collaboration

When designing an interactive new media art exhibition —in fact any new media art— interdisciplinary collaboration becomes crucial if one desires to create an effective exhibition. As interactive new media art is, by its nature, interdisciplinary, this peculiarity will naturally seep into the exhibition and require the involvement of various departments in ways not traditional to them. Next, we will analyse the ways in which these departments may be involved directly in the setup of an exhibition. This is in no way a new methodology and in fact has been implemented in a variety of shows, including the

SFMOMA's 010101: Art in Technological Times, where curators from the departments of Media Arts, Painting and Sculpture, Architecture and Design, and Education and Public Programs worked together in order to bring the project to fruition (Graham 2005). In the same text, Graham tells us that "The need for excellent relationships with installation, technical and archiving staff is an obvious factor for digital media" and highlights the importance of the horizontalisation of institutional hierarchies when working with new media art (Graham 2005). While Annet Dekker highlights the importance of cross-departmental work "with experts from outside the museum (artists, programmers and other specialists), bringing technical expertise and conceptual thinking together."(Dekker 2018, p. 7) in the creation of exhibition memories and conservation of new media art, her argument is just as valid for the exact same reasons in all other stages of curatorial work.

3.2.1 Education Department

Of all departments involved in an exhibition, the education department has one of the most difficult tasks. Usually, the education department has to go through each work and their meanings and create a series of plans that will help audiences further understand and learn from the exhibition.

According to the ACT Project, older audiences (ages 60 and up) report lower engagement with digital media, and what they do use is often limited to email, SMS texting, gaming, and light social media use. While the report, which can be found here, makes no mention about which types of games are being played, we can infer from the other interactions reported that said games will be games with

simpler controls and often digital versions of card games, chess, and dominoes, as opposed to more mainstream fare, like first person shooters or art games.

Taking this information into consideration, it is possible to create action plans that combat this technological illiteracy and foster a more positive relationship with new media. Such approaches through new media exhibitions could have a positive impact both in the enjoyment of exhibitions and in a positive relationship with technology for seniors who may have been hesitant to engage. It is also important to note that research on the elderly and their use of technology has shown that:

> ... negative stereotypes of older people being avoidant of technology and incapable of its use are outdated. With proper encouragement, clear explanations of the personal benefits and an appropriate time schedule, older people certainly have the potential to become equally effective inusing technology and computers as younger age groups.
>
> (Broady, Chan and Caputi 2010)

As was mentioned before, the other often ignored way education departments may engage with new media art is explaining to visitors how certain behaviours in artworks function counter to normal operation of the medium being used. While this may seem obvious to some of the public, for others, this pulling back of the curtain can help teach visitors about the risks and benefits of new media's more subtle peculiarities, such a privacy concerns, potential for connectivity, racial bias in algorithms, or gaslighting. As new media breaks conventions, it makes more obvious the hidden features of itself.

Since 2006, TATE digital has developed an online platform used to connect with younger audiences and generate reports and research, which is publicly available and has helped drive their online exhibition strategy. Although it is not mentioned in their reports, it is very possible that curatorial and marketing have made use of this information to shape exhibitions and other functions of the museum. In fact, all types of data regarding visitors, both online and offline, should be openly shared and explicitly brought up in meetings. Never forget that the education department has the most contact with the audiences (second only to invigilators) and is more attuned to the needs and wants of the community. In fact, if any department will notice challenges and opportunities in the gallery space, it will probably be the education department. As most education departments already have a working relationship with the local community, it is important to listen to what education has to say regarding future exhibitions and changing curatorial approaches so they

align more with the local needs and wants. This in turn will result in exhibitions that are visited by a wider variety of audiences and even generate positive changes. In many cases, there is a wealth of information that is available but underutilised. One way to increase synergy between departments is to encourage sharing this information (Tate 2015).

For example, perhaps the education department has realised there is a greater need for computer literacy amongst the elderly, particularly to avoid fraud and scams. Curatorial then could perhaps tailor a show about social issues to include this often ignored demographic and create a series of workshops on how to use a computer and on the most common types of scams and how to avoid them. This could in turn be implemented into the exhibition, perhaps with real life cases from within the community. The result being a program that has roots in the community and offers a solution and links it to the lives of people the visitors may actually know, thus creating a stronger emotional link that may result in actual action to correct this situation.

3.2.2 Invigilators

Invigilators, volunteers, and other gallery staff are often approached by visitors and asked about the works. In some cases, they have been prepared, in others, they train themselves, and in some cases, they either give erroneous information or avoid engagement with the public except in terms of damage and loss prevention.

When new media art is involved, this task becomes even more complex, as the task of educating technologically illiterate audiences falls onto them. This may include educating users on how social media works and on the operation of video game controllers and other devices, as well as on how the natural or intended use of these technologies relates to the uses these works are being given by the artist.

While some may look at this as something the user has to figure out by themselves, it is important to keep in mind that with an average view time of 28 seconds per traditional artwork, the possibility that an interactive work will be used diminishes greatly if the setup is intimidating and complex-looking and no help is being offered to the visitor.

When properly trained, invigilators become invaluable to their institutions. In the case of interactive new media exhibitions, they can be trained by

curatorial, IT, and education to be the first point of contact between the public and the works on display.

- Introduction and overall information
- Artist Information
- Information on each specific work and its participants
- Useful Information for Visitors
- Further Information for Volunteers
    - Artist websites
    - Extra videos, images, etc.
    - Relevant news articles
    - Charities relating to the social issues of the works
    - Top tips for getting survey responses
    - FAQ's

While crafting this pack may seem as superfluous or labor-intensive, according to FACT's Visitor Services Manager, Joan Burnett, the results are quite noticeable in visitor's satisfaction benchmarks.

As was shown in the *SFMoMA 010101* report by Beryl Graham (2002), front-of-house staff had to be trained in the operation of all works in question and as to which artworks are to be touched and which should not be touched. As invigilators are often the first to notice issues, it is important to brief them in the operation of the hardware present in the exhibition and how to solve common issues, as well as giving them access to keys to cabinets or other important spaces and the relevant passwords.

Finally, their feedback at the end of the show should be documented through interviews and integrated into the exhibition memory, so future shows can benefit from the knowledge acquired this way. This feedback includes issues with artworks failing or crashing, difficulties the public presented in operating displays, and even general attitudes to both the exhibition and specific examples.

3.2.3 Information Technologies

The relationship between curators, exhibition designers, and information technologies is far closer when interactive new media art is involved. In most exhibitions, IT's job is to ensure that the institution's networks work, ensure

multimedia kiosks are working correctly, and setting up projectors and other supporting technologies for an exhibition. However, when it comes to interactive new media art, IT's obligations are expanded to solving curatorial challenges, such as providing in-depth knowledge on the technologies involved, solving display challenges, creating custom solutions for outdated devices and software, and setting up servers, secondary domains, websites, and moderation systems, alongside its usual obligations.

While specialised curators may not need constant support on the subtleties of new media art, curators who are not as familiar with the artform will do well to lean on the IT department's knowledge. As time passes and primary sources become scarcer, this relationship may become more important. The following is a breakdown of several ways an IT department may be able to assist in each of the forms of new media art explored in this manual. For specific information on each technology, refer to the relevant section in the manual.

Net Art: This medium consists of a variety of technologies, all working together to collect and distribute information in a variety of ways. IT can help explain how different technologies exploit connections, protocols, and other technologies in order to create art and how this differs from standard operating procedure. Besides this, they can help find an ideal display method that makes the best use of Net art's characteristics.

Interactive Live streaming: This relatively new technology may not be the most complicated to understand and in fact is very similar to other more familiar media, like traditional telematics. However, as it depends on open access for the public, it requires a strong knowledge of internet slang and memes in order to better control the conversation lest it turns into a platform for harmful ideologies, such as racism, white supremacy, homophobia, and others. IT will also be required to keep a close eye on the stream to ensure it is up and working correctly for the entirety of the experience.

Interactive Video: This particular medium may seem to require minimal theoretical assistance from IT, and most of the support will come from the interactive angle and its relationship to video games, an area which is still in its infancy within art history.

Interactive Performances: For this artform, IT will mostly be expected to cover technological issues, such as connectivity, troubleshooting, and the like.

Video Games: While a lot of progress has been made on the engagement between art history and video games by a variety of authors, such as Bourgonjon, Vandermeersche, and Rutten (2017), Parker (2013), and G. Cepeda (2013), amongst others, non-specialised curators, especially those who do not play games, may struggle with video games and their idiosyncrasies. These include the always online nature of recent video games, video games as ever evolving software that may never be truly complete, re-editions, and remakes. Other ways in which IT may assist is in the emulation of software and hardware for games as well as procuring alternatives to original consoles and control interfaces. It is also probable that members of the IT staff play video games with some frequency and may be able to help curators understand how art games differ from more traditional fare.

Virtual Reality: Virtual Reality shares a lot of similarities with video games, both in the ways they are controlled and the language that surrounds them. Areas where IT will be able to lend expertise include the choosing of appropriate hardware for the VR experiences involved as well as assisting with setup and event support.

Augmented Reality: Except for very dedicated setups, most AR applications will require little to no care. However, the more complex works will require complex setups as well as involve interactions with networks and data from multiple sources. It is in this area where IT may become helpful to a curator's work. By explaining the interactions between technologies, IT can give context to certain aspects of a work that otherwise may be considered irrelevant or altogether overlooked.

Robotics and AI: Robotics, alongside with AI, are one of the few areas where IT's involvement will be limited, as these media depend on specialised knowledge. Regardless, IT will be able to lend support in the installation and upkeep of the work.

One of the most common functions of IT is the administration of servers within the institution. A server is a powerful computer that holds data that can be accessed by multiple computers (clients) at any time. Web pages and databases containing anything from text files to financial data to multimedia are contained in these

servers. Depending on the artworks, artists may require servers to be set up to contain their data. This can be done either by renting a server from a provider, such as amazon web services, or through local machines within the institution. In both cases, IT personnel will be required to configure access, keep intruders out, and ensure that the servers are accessible to whomever they should be accessible to (Tanenbaum and Wetherall 2014).

For some technologies such as VR Igloos, a media server can be set up by the company who rented or sold the device, and it will contain all the data required. This cuts down on slowdowns and remains available even in cases when the internet is down. Once again, IT will be able to maintain such devices working properly.

3.2.4 Installation

Installation teams often acquire practical knowledge through each show they help set up, yet their advice and experience are often not reflected in documentation. Installation teams may not be able to assist in the curation process but their intimate knowledge of the space and its peculiarities can make exhibition design a smoother process. While an internal exhibition design team should be familiar with the space they are working with, when an external design firm is hired, this is not possible. Integrating members of the installation team into the process will result in fewer issues in the design process. These are things such as faulty power outlets, light leaking into the space at certain hours, uncooperative hardware, and other details that may catch a design team unaware and force redesigns or adaptations at inopportune times. By reducing surprises at the ground level, unforeseen costs can be reduced.

3.2.5 Conclusion

In the end, it is impossible to account for all the ways cross-departmental cooperation may occur. Nevertheless, it is important to keep an open mind about how each department can collaborate and bring their own expertise to the table. Ideally, at least one member of each team should be present at all stages and meetings and willing to speak up and share knowledge. With a team that is able to create a rapport and truly cooperate, any exhibition will be a more complete and successful one.

Finally, remember to credit everyone who was involved in the project: IT, legal, marketing, design, education, invigilators, engineers, and anyone who had a hand in helping a show take shape should be credited or future collaborations may be compromised due to this oversight, as their knowledge may be required in the future for maintenance and preservation.

3.3 Time in the Exhibition Space

Interactive New Media Art, like film and performance (which it integrates into itself), depends on time as an inherent part of its functioning. However, unlike "live" or "time-based" new media, art happens in "real time". The difference is subtle but crucial in the design process of an exhibition. For example, as Katja Kwastek explains in *Aesthetics of Interaction in Digital Art* (2015), performance is tied to a temporarily fixed beginning and end (a fixed duration); however, new media is not. Particularly, fixed durations are not a given in interactive new media art. This happens either through the ability to repeat the experience with different outcomes or a work that requires interaction outside of the structured operating time of the institution or that operates continuously. Kwastek, however, mentions a universality in the way interactive new media art works in relationship to opening hours. Developments in artistic practice, however, have come to challenge this.

One such example is Pippin Barr's The Artist is Present (2011) (Figure 3), a web-based video game which, under Kwastek's examples, would be accessible anywhere at any time, places a time-based challenge, as the work is only truly operable during MoMA's real world operating times. While this poses little challenge for institutions geographically located in the Americas, for institutions in other time zones, this becomes a challenge. Beijing is twelve hours ahead of New York, making the experience available mostly at night. In this particular case, the work would either require modification by the artist (or whoever has permission once Barr is not able to do so), fooling the work through a VPN (a VPN is a technology that can fool software connected to it to believe it is physically located somewhere else) to make it believe the institution is located in New York, or simply present the work as is and make visitors aware that the artwork is available on the internet between certain times.

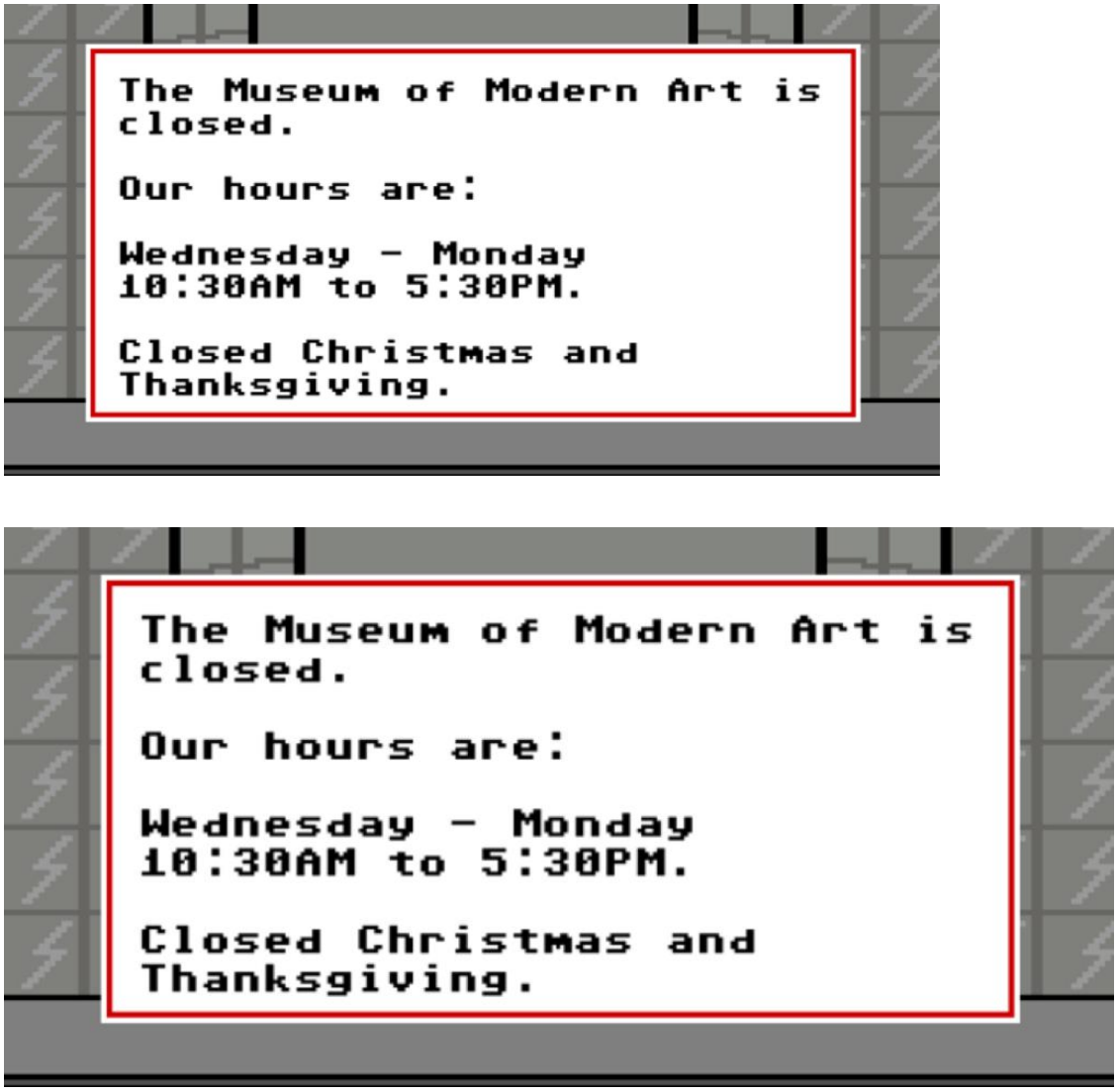

Figure 3: Barr, Pippin , 2011, The Artist is Present. Video game. Screenshot © Pippin Barr

As can be seen from the prior example, time in new media can be complex not only in curatorial terms but in display terms. The ways in which time can affect display include, but are not limited to:

Physically tied to another geographical time: Geographical time refers to the local time at a geographically distinct place, for example, New York Time. Works like these may need to be fooled into working during institutional operating hours, modify operating hours to accommodate the work, or left to function as is.

Extremely long play times within the gallery space: As Beryl Graham and Sarah Cook note in Rethinking Curating (2010), institutions are not usually set up to display new media art with long durations. This issue between the white space and the dark box becomes even more problematic once interactivity is added to the mix. Expecting visitors to stand for longer than 10 minutes in one space creates logistic issues, both in foot traffic and in the accessibility of the works. On the audience's

end, the variability in duration times, compulsory presence once the presentation has begun, and even interest and time spent watching art (27 seconds according to Smith; Smith and Tinio 2017), conspire against exhibition designers. One solution is the creation of a media lounge where comfortable seating and internet access is provided; this space sends a message to visitors that experiences within it are meant to be taken at a leisure (Graham and Cook 2010).

One of the most interesting media lounges is the Huddersfield Media Centre's Medialounge, which not only created an inviting space resembling a living room but also created tiers of engagement by dividing artworks into three separate lounges, each one housing works of progressively longer play times. The first area had more immediate works, often with no interactivity involved; a second area was the 10-minute zone, for works that had play times of 10 minutes or less; and a final sit-down zone, where experiences lasting up to 30 minutes were located (Graham and Cook 2010 p. 103).

Extremely long play times untethered to the gallery space: Video games, interactive video, net art, and other works which do not require the institution or specific artefacts can be untethered from the institution and be made available remotely. In this case, the institution serves as a demonstration hall which invites the public to continue their engagement at their leisure at home.

Journey (2012) by Genova Chen (Figure 23), is an example of an artwork that has a very long play time but can be accessed outside of the gallery space. The game can last between two and seven hours to complete, depending on how dedicated the player is to exploring all the game's secrets. The objective of this networked game is to traverse a vast desert and reach the top of the mountain. The game functions as a metaphor for life (the journey to the mountain's summit) as well as the way relationships appear and disappear as one moves through life. As this is a commercially available game, the player could potentially acquire a copy of the game, either at the institution or online, and continue playing at their leisure.

Figure 23: Genova Chen, thatgamecompany, 2012, *Journey*, video game. Screenshot. While Journey can be completed in the course of 2 hours of play time, players can extend this time by exploring the world more thoroughly, making its play time highly varied.

Performance and one-time events: Except for very particular cases, these works can be presented very easily by creating specific time slots for them. Even if it seems like the presentation is not going to be heavily visited, it may be a good idea to set up a booking system, both to get an accurate measure of public interest and as a way to prevent overcrowding and occupancy limits.

Proximity Cinema (2013 Figure 24) by Tiffany Trenda is one such work. Without Trenda and her suit, nothing will happen; only through the interaction between Trenda, the suit, and the people that approach her, does the work, whose intention is to illustrate how the relationship between persons, words, and touch have changed by the addition of mobile devices, work.

Figure 24: Trenda, Tiffany, 2013, *Proximity Cinema.* Mobile phones, sensors, and latex bodysuit. Venice Biennale. As people approach Trenda, the sensors activate the mobile phones, inviting the participant to approach and touch Trenda; when they do, the phones show pictures of that body part. Image: Xarene Eskandar.

3.3.1 The Audience

Time also challenges the physical space simply by the fact that the audience is required to occupy a space within it. While this may not be an issue with shorter experiences, the larger the span of time an artwork demands of the visitor, the longer the artwork remains inaccessible for others. Another factor that makes space a critical necessity is the existence of vicarious participants and queued participants.

For popular works, this crowd can quickly create issues for visitors not interested in the work as well as become a health and safety risk. While the media lounge option can alleviate some of the issues in displaying works with long play times, for certain artworks, such as long-play VR experiences or video games, a booking system allows for the creation of time slots that have the right duration for a visitor to experience a significant section of the work. For further details on the logistics of such systems, please refer to the Planning Process section here. For particularly long play times, the best solution may be to facilitate remote access to artworks as a secondary alternative. This is particularly easy with net art, live streaming, interactive video, some interactive performances, and augmented reality. Others,

such as virtual reality and video games, become more difficult to provide remote access to, as they may require specialised hardware, such as specific headsets, video game consoles, or powerful computers. Finally, works that require a specific geographical space, physical contact, elaborate constructions, or hardware unobtainable by individuals, such as VR domes and robotics, are impossible to access remotely in a significant way.

3.4 Space in the Exhibition Space

Regardless of how immaterial interactive new media art can be, it requires physical interfaces to exert force in the real world and to receive our inputs. Thus, all works have physicality through the computers within the space, the controllers, keyboards, mice, and other input devices, monitors, speakers, robots, and other mechanisms through which they provide feedback. Not only that, but many of these artworks require dedicated spaces, scenography, and furniture, all of which can have very peculiar and specific requirements. However, the physical space taken by the artwork is not the only factor to take into consideration, there is also the issue of location. That is, how the artwork is situated in the world.

3.4.1 Location

It can be argued that the actual work happens in the communication occurring between the visitor and the software and not with the physical manifestations it may present. Thus, location in this context encompasses both physical and immaterial spaces. Physical spaces or sites are geographically determinate; meanwhile, immaterial spaces in new media art exist as digital metaphors, such as the website, the virtual world, the server, or the network, amongst others. From this distinction, works can be classified based on which kind of space they exist in and their dependence on such space:

Site-agnostic: These works can be shown in any space, as they do not present any characteristics that may depend on the location they are in. This includes video games, most work that occurs on screens, portable CAVE system displays, and others. In curatorial and design terms, these works are the most commonly encountered.

Figure 25: Interactive Sonic Systems, *ReacTable*, 2006, FILE Brazil. As the name implies, this is an interactive table and, as such, can be located in any space as long as it has internet access and a power outlet. No modifications are necessary when displaying th this work in different gallery spaces. Image: Interactive Sonic System

Site-specific: These works were created with a specific site in mind and are almost impossible to show in a different space without massive modifications, if at all. Often times, the barriers to relocating a site-specific exhibition stem from the work depending on the site's historical context, spatial configuration, presence of certain individuals, or other non-reproducible factors. Examples of this include projection mapping works or works that depend on the historical context of a space to work.

Les Liens Invisibles and Simona Lodi's *The Invisible Pavillion* (2011) is an example of a site-specific artwork. It is an augmented reality exhibition overlaid on top of the Venice Biennale and, as such, cannot be adapted to other sites. The whole experience is an intervention of the Biennale's exhibition space, where artists overlay their own works on top of the existing exhibitions. Some replace artworks while others exist independent of them, and some add to the works presented.

Figure 26: Les Liens Invisibles and Lodi, Simona , 2011, *The Invisible Pavilion*, VR app. Venice Biennale. Example of an artwork overlaid on top of the Biennale.

Virtual sites: These works, while not dependent on a physical site, are nevertheless still specific to a virtual location. Virtual sites can be spatial metaphors, such as a virtual world, or entirely abstract concepts in the case of databases and websites. Regardless of the immateriality of these concepts, it is possible to treat and engage with them in the same way real space sites are engaged with. In effect, artworks that are virtual site-specific have similar requirements to those of site-specific artworks. For example, they may only exist within a specific server, as the information they require resides within, or they require a specific virtual world and its internal workings and/or community to function. Should those spaces cease to be accessible, the artwork itself cannot be shown. In effect, these works are some of the most fragile forms of new media art, since they depend on external factors outside of their creator's control.

While the space is virtual, the participant is actually located within a physical space and, depending on how the experience is handled, the participant may be able to move. This can result in injuries or accidents should the participant walk beyond the limits of the physical space (the real room is smaller than the virtual one) or may attempt to use or avoid objects that do not exist. To avoid this, the best option is to tether the user as in Figure 28; this kind of setup can keep the participant from wandering into walls or other situations. Of course, if the site requires no physical objects, it is best to clear any and all obstructions as well as ensure there is a flat floor, as even the slightest bumps can be interpreted as something bigger

by someone in a VR headset. If movement is not required, it is best to sit the participant on a stable and comfortable couch or chair.

Figure 27: Rafman, Jon, 2014, *Rosenquist Jeopardy,* Virtual Reality space. Rafman's rooms are virtual spaces that can be inhabited by humans through the use of VR technology. The space does not actually exist, but through immersion, it takes physicality. In effect, what Rafman does is recreate real life locations in a 3d modeling software and covers it in a texture inspired by a prominent artist's artwork. Participants can then move around the space. Image: Jon Rafman

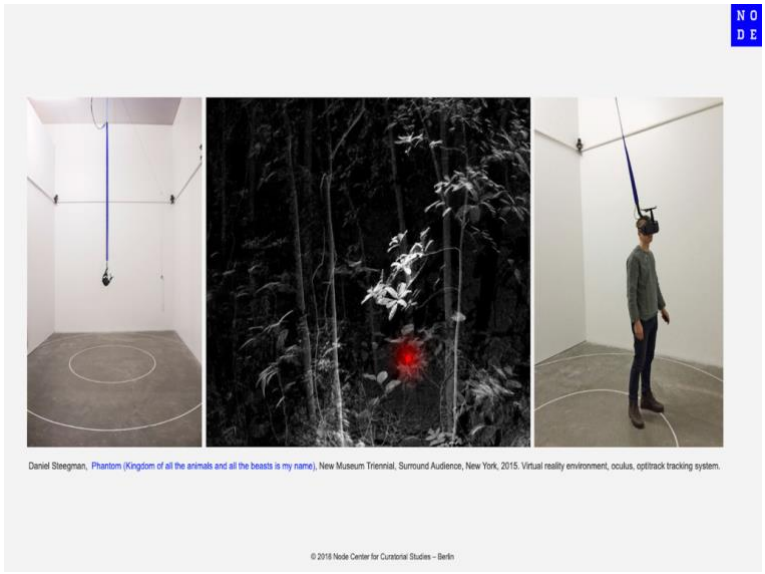

Figure 28: Steegman, Daniel 2015, *Phantom*, New Museum, NYC. Here, the VR headset is attached to a tether attached to the roof; this way, the participant cannot walk into a wall or other spectators. The lines on the floor indicate the visitor's range of motion. Image: Node Center for Curatorial Studies

Another approach, taken by The Bluecoat in Liverpool, involves the visitor approaching reception and requesting assistance with the artwork. Upon request, two members of staff will accompany the visitor up to the artwork and function as witness and assistant. The witness' job is to bear witness in the case an accident of any form was to happen during the visitor's use of the artwork. Alongside this

function, the witness will also assist the visitor through voice commands, giving instructions on how to operate the work as well as provide hints when the visitor seems lost or confused. The assistant will attempt to keep the visitor physically safe by directing them to the designated safe zone as well as function as a catcher in case the visitor suffers some discomfort.

Figure 29: Dawood, Shezad, 2018, *Leviathan Legacy Part 1*, Software, Computer, Oculus Rift. Bluecoat Liverpool. In this case, the visitor must go back to the front desk (the work is almost at the end of the gallery) and ask for assistance. Following this, they will walk back to the artwork accompanied by two members of staff: the witness and the assistant. Their titles have no relation to the artwork. Image: Rene G. Cepeda.

While the second option seems to be the most effective in terms of solving issues around health and safety as well as interaction issues, it is resource-intensive, as it requires members of staff to be dedicated to these functions or requires the visitor to take a detour in their visit to request assistance. This last version of the system should be avoided at all costs, as it adds further steps to the already precarious viewing process.

3.4.2 Practical Concerns

The theoretical aspects of a work can shape how the work is displayed and the physical space of the gallery, and also influence how the work is shown as well as how many works can be shown, not only by virtue of the area available but

because each work requires different conditions which modify the space through lighting, audio, temperature, and cabling.

3.4.3 Hanging and Maintenance

Curators are very familiar with arranging objects within a space and, indeed, new media artworks can be handled as sculpture or canvas. However, several factors complicate this. The first issue to keep in mind is the necessity to have access to the work in order to be able to give maintenance to it. New media works can be really unstable, as most of them are hacked together or utilise technology in experimental manners. This translates into works that may work one day and not the next. For some works, physical access can be complicated due to how they are presented. For example, Martin John Callanan's Departures of All (2013) (Figure 30) is hung up high, and should it require physical maintenance, this becomes complicated, as access will require a ladder and either for the work to be completely unmounted or to work on it at odd angles.

Figure 30: Callanan, Martin John, 2013, *Departures of All.* Nowshowspace 2013.The work attempts to emulate a flight board in an airport and, as such, requires to be hung up high, complicating access to it.

For non-physical maintenance, the process can be simpler if remote access software is installed and kept running in the background. Software such as TeamViewer or LogMeIn can be used by the artist or the IT team to perform upkeep on the work. For this to work, a series of requirements need to be met. First, an internet connection is required independently of whether the artwork itself requires it or not. Next, a copy of either TeamViewer or LogMeIn is required. Technically, you could use the software as a private user, but the legality of such a

move is questionable. One possible loophole is for each artist to install the software for their personal use (i.e. the upkeep of their own work) and allow a friend (staff member) to use the software. Finally, a wireless mouse to allow gallery staff to return the artwork to its intended location, as logging out of the software often returns the user to the desktop. Also, remember to disable screensavers, as these could also cause distractions.

Keep in mind many new media configurations will utilise familiar objects in unconventional manners, and this will require adaptability on the part of the exhibition design and installation teams. Projectors may be hung aiming straight down or up, televisions may require to be rotated or used as tables, in fact, the possibilities are limited only by the artist's imagination.

Figure 31: In this 360° tent, the projectors point inwards in what would seem an unconventional arrangement. Anything hanging in front of them would cause it to cast a shadow on the surrounding screens. At the same time, maintenance in this case is easier, as the back of the projector is easy to access. Image Rene G. Cepeda

Finally, it is said that a good exhibition design is invisible to the visitor; while it is a basic design principle, keeping exhibition design as invisible as possible is even more important when interactive new media is present. This is because any ornamental design can create confusion between artwork and decoration, as well as create sensory overload in the visitors. This does not mean all spaces must be sterile white cubes or black boxes, but that care should be taken to not create an overwhelming ambience that will stress the public out and lead to reduced visit times.

3.4.4 Power

As was mentioned above, new media artworks are very unstable and many do not take kindly to being turned off and rebooted constantly. Other works cannot be stopped, as they are supposed to be ongoing processes and stopping the computer's work would damage the process. For these reasons, it is suggested that computers running processes or that require many configurations are kept running for the duration of the exhibition. For works that do not require constant operation, artists can set up the artworks to start on their own at certain times and later turn themselves off.

For Apple computers this is done in the following way:

1. Go to system preferences
2. Click on Energy Saver
3. Deactivate automatic graphics switching
4. Move the display slider all the way to the left
5. Deactivate the option 'Put hard disks to sleep when possible'
6. If you wish for the computer to turn on and off on its own, click on Schedule...
7. On the Pop-up click the start-up and sleep boxes and choose the times at which the computer should turn on and go to sleep (sleep is suggested as it does not reset configurations or other functions, check with the artist before using this option nevertheless)

For Windows computers, do the following:

- Press the windows key and type 'settings', then press enter
- Click on System
- Click on Power and Sleep
- Set the two highlighted options to never
- To set up automatic start-up and turning off in Windows requires going into the BIOS configuration and, as such, should only be done by the IT department. Contact them to activate the feature.

One issue that is often ignored is the frequency of the power grid in a determinate country. This frequency is how many times the polarisation of a charge changes from positive to negative in a second. The most common ones are 50 Hz and 60

Hz (KSB n.d.). Motors of all kinds are highly susceptible to this variation in frequency, with consequences ranging from decreased performance to permanent damage to the equipment. For this reason, it is very important to check the operational frequency of your country's power output and that of the device. If these do not match, you must install a variable frequency drive (KSB n.d.). Of course, this is not a simple procedure for a non-expert and, as such, an electrician should do the setup as well as determine if a VFD is required. One thing that can be done before any equipment arrives at your door is to compare the frequencies used by the object's country of origin with those used where you are.

It is also important to make sure all devices pass at least a basic inspection to ensure they are safe to use. While some countries like the UK and Australia have the Portable Appliance Test (PAT), others like Mexico and the USA do not, which makes giving adequate recommendations difficult, as standards vary so much. At the very least, check for frayed cables, loose connectors, blown out fuses, and burn marks. If any of these signals are found, discontinue use of the device immediately and find a replacement.

3.4.5 The Space as a Black Box

Especially when projectors are being used, but also when certain visual effects designed by the artist require it, the entire space will become a black box. In exhibition design terms, a black box is a space dedicated to displaying film or video in a space similar to a movie theatre. In Figure 32, we see a space isolated from the rest of the galleries, which serves as a way to keep the rest of the gallery space properly illuminated while ensuring the projections shown are not washed out by ambient lighting. The risk, however, is that too many projections and objects that require low light levels to properly display will result in a gallery space that is in effect a giant black box. While not always a bad thing, and in fact darkness can allow for a far more dramatic use of light, as noted by Philip Huges (2010), low light levels can lead to visitors feeling oppressed, exhausted, or sleepy, and thus are not ideal. One way to fix this situation is to present 'islands' of light and transitional areas where the lighting is brighter in order to combat these feelings. Even so, keep in mind sudden dramatic changes in lighting can be very annoying and a gradual transition from dark to light is ideal.

If you opt for utilising the entire gallery space as a black box, make sure you do not get light contamination from one display to another. At the very least, barriers can be used to segregate these spaces and ensure minimal interference between works. This is particularly important with artworks such as projection mapping, where even the slightest amount of undesired lighting can destroy the illusion completely.

Figure 32: Wodiczko, Krzysztof, 2009, *Guests*. Installation view at FACT. This space was notably difficult, as the resulting space could be very dark at moments, necessitating the invigilators to be alert at all times. Image: Jon Barraclough.

Of course, most artists would love to have an absolutely dark space with no glowing signs or other lit indicators. However, this is often an untenable proposition, as health and safety standards have to be respected. Ideally, this should be negotiated with the artist to achieve a good compromise between any legislation regarding dark spaces and what the artist desires.

3.4.6 The Space as a White Cube

The white cube is currently the more traditional configuration for a gallery space and is how most exhibition spaces are prepared before any curatorial decisions are taken. These spaces tend to have very even ambient lighting and lack the potential for dramatic illumination of specific works. In a way, this configuration communicates the idea that all artworks on display are equal in one manner or another.

While it may seem that, as long as no light dependent artworks are present, the space will present no challenges, this is not entirely accurate. Glare can turn an impressive and well-designed exhibition space into a frustrating experience in no time. Artworks presented on any type of screen need to avoid glare or they

become unusable. This includes spotlights, ambient lights, and even sunlight from nearby windows, doors, or skylights.

Figure 33: This plastic hood will minimise glare coming from the top or sides. However, it is not as reliable as glare reduction film. Image: Posturite.co.uk

One way to identify problematic areas is to first identify external light sources, like windows, doorways, and skylights, and then identify the locations of all works and accompanying lights. Then, go through where every display will be located with a tablet (any tablet will work: iPad, Galaxy, etc; although, the bigger the better) and place it at the planned height and angle that the work's screen will be placed. This will allow you to identify places where glare will cause problems. Repeat this process at different times of the day to ensure you account for the sun's movement. Armed with this information, you can make decisions on the positioning of the works or if barriers will be necessary. Two options that can be used when displays cannot be moved are anti-glare films, which are clear plastic covers that are affixed to screens and reduce the glare, and screen hoods, which are plastic attachments to monitors that act like localised physical barriers. Of course, of the two options, anti-glare film is the most aesthetically pleasing one, although it may not eliminate all glare. As always, it is a balancing act between aesthetics vs functionality. In the end, the decision has to be made by curatorial, the artists, and the exhibition team together.

3.4.7 Environment Control

Conservation experts tend to be very cautious about temperature and humidity control, and tend to be very well versed in controlling it. However, one area they may not be familiar with is when the artwork itself overheats and may even damage itself. Fortunately, design departments are very familiar with heat management and may be able to assist.

As a baseline, keep in mind that projectors can get very hot very fast and should have proper ventilation or fires may occur. While in traditional displays projectors and computers will not cause many problems, when they are presented in unconventional ways, heat may become an issue. For this reason, it is important to ensure all furniture has slits or an open back for the heat to go out. Other options include fans and water cooling setups; the latter, however, should never be implemented in computers not owned by the institution. Water cooling kits can be purchased online through online retailers. However, while not expensive by themselves, they can be costly if they are not installed by someone knowledgeable in computers and, as such, should only be considered in cases of extreme overheating and if IT approves and installs them or hires someone to do so.

VR headsets, particularly the ones that use mobile phones, are also susceptible to overheating. Unlike computers and projectors, there are not many solutions to cooling these phones. At best, they should be rotated and kept on standby while waiting to be used; otherwise, it is probable the mobile phone will turn itself off at an inconvenient time. Additionally, keeping a fan blowing cool air at them may extend the time they can be operational before being turned off to cool down.

As for ambient temperature, it may become necessary to adjust air conditioning settings to account for the extra heat generated by the hardware in the space. This adjustment is better done on a case-by-case basis and depending on the actual temperature in the space once the exhibition is open. This may be easier or harder depending on the specific needs of different objects and the recommendations of the conservation department.

3.4.8 Cabling

The natural instinct of an exhibition designer not familiar with new media art is to hide all cables as to present a neater appearance to the exhibition space. In new media art, that is not always the case. For some artists, the act of showing the innards of the system and expose the digital or “artificial” nature of the work is essential. The solution to this question is as simple as contacting the artist and asking them what their wishes are. For works where the artist is not present, this is one of the moments where thorough documentation of prior exhibitions is very helpful. Conversely, it is important to document how the cables were presented in the present exhibition as well as the reasoning behind it.

3.4.9 Sound

According to Philip Hughes (2010), sound is often neglected in exhibition design and one of the main reasons for this is the difficulty of isolating soundscapes between works. This is due to the way exhibition spaces are designed: with high ceilings and multiple hard surfaces that bounce sound around the space, creating a melding of all sounds present within.

There are ways to mitigate this, such as utilising soft materials, like foam, padded walls, carpeting, curtains, and sound absorbing panels. These solutions can be costly and require much more effort from the exhibition designer. Parabolic speakers are a viable solution; they work by redirecting sound through a parabolic dish in order to focus sound waves in a specific area. Keep in mind sound leakage will occur, although at a lesser degree. Depending on the area you wish to cover, these speakers may cost up to several thousands of dollars. They are best used when there are few artworks far apart from each other that require audio to be heard by a small group of people. It is also important to mention that the sound quality they provide is not ideal and are mostly suited for voice and not music or other aural content.

Other more cost-effective options include the infamous black box, which allows galleries to isolate multiple works from each other, reducing the interference they may exert upon each other. The final solution is to provide headphones to isolate the participant from other sounds in the space. This last option is the most financially feasible but may not be viable for every artwork. One way to do this and still have audio in the space is to have the main piece's audio to be on speakers while secondary or less important works have headsets (

Figure 34).

Figure 34: For this setup at the Bluecoat for the exhibition *Shezad Dawood: Leviathan* (2019), the video on the right (red) had its sound played in the gallery space, while the rest of the videos played their audio through headphones built into the furniture (left).

3.5 Media Rights

In theory, by the time a work reaches an institution, it most certainly is protected by fair use doctrines as long as the artist does not simply copy the object in question. However, due to the confusing and often arbitrary way fair use can be interpreted, a few concepts can be elaborated on.

When artists are commissioned to create works, they should be coached on how they may implement copyrighted works into their practice. The following are a few basic recommendations.

- Artists may implement media from other creators as long as the use is transformative or provides new meaning.
- They may also do so if the use implies criticism or review of the media taken.
- If the artist can explain why the work was used and how it furthers artistic objectives, they may use existing copyrighted material.
- The artist must credit the original sources regardless of modifications made.

(Collegeart.org, 2019)

Museums and other cultural institutions have been granted exceptional powers as to when they can ignore copyright and other media rights. The most important of these is the ability to preserve and display works for the future. For this reason, the permissions given to them may even overrule the artist's own copyrights.

- When copyrighted works are used in connection with physical or virtual exhibitions, the use should be justified by the curatorial objective, and the user should be prepared to articulate that justification.
- The amount of a work used in museum publications, the size and resolution of published reproductions, and the level of fidelity of those reproductions should be appropriate to the analytic or educational purpose.
- Downloadable images made available online should be suitable in size for full-screen projection or display on a personal computer or mobile device, but generally not larger.
- When image details and support for "close looking" are offered online through large or high-resolution images, downloading should not be facilitated unless a special justification is present.
- Images provided to the public should be accompanied by attribution of the original work as is customary in the field, to the extent possible.
- Images and other documentation of museum collections should be associated with all appropriate and reasonably available metadata.
- Images and documentation of museum collections should honor institutional policies designed to protect noncopyright (sic) interests of third parties, including the privacy of individuals and the cultural sensitivities of communities.
- Material made available online should be redacted to protect the privacy and other noncopyright (sic) interests of third parties, in accordance with prevailing professional standards.
- Visitors to the site should be informed that the materials they access are provided for their personal and/or scholarly use, and that they are responsible for obtaining any copyright permissions that may be required for their own further uses of that material.
- Institutions should prominently offer such users a point of contact for further information and correspondence and they should respond promptly to user complaints, corrections, and questions.
- When provided, downloadable images provided online should be suitable in size and resolution for full-screen projection or display on a personal computer or mobile device, but generally not larger.
- Materials made available should be accompanied by attribution as is customary in the field, to the extent possible.
- Items should be augmented with all appropriate and reasonably available metadata.

(Collegeart.org, 2019)

One important distinction in copyright and media rights between America and the United Kingdom is the protection afforded to anyone making a recording or any kind where other copyrights are accidentally included, such as music or images. This is termed incidental inclusion, and according to the UK's copyright service, it is not an infringement (Copyrightservice.co.uk, 2019).

The following resources can be consulted for further reference:

USA

http://www.collegeart.org/programs/caa-fair-use/best-practices

https://fairuse.stanford.edu/overview/

UK

https://www.bl.uk/business-and-ip-centre/articles/fair-use-copyright-explained

https://www.copyrightservice.co.uk/copyright/p27_work_of_others

As art video games generally lean towards independent production, media rights are often not complicated. However, games by big corporations will require direct contact with publishing companies to negotiate these rights.

3.6 Working with Specific Media

3.6.1 Connectivity

3.6.1.1 Net Art

Net Art has often been a charged term with a fluid definition, often used as a catch-all for anything digital by some authors, like Rachel Greene, and by others, such as Julian Stallabrass, it has been used to specify a very small practice. Tilman Baumgärtel further refines the definition in the following way:

Net art addresses its own medium; it deals with the specific conditions the Internet offers. It explores the possibilities that arise from its taking place within the electronic network and is therefore 'Net specific'. Net art plays with the protocols of the Internet, with its technical peculiarities. It puts known or as yet undiscovered errors within the system to its own use. It deals creatively with software and with the rules software follows in order to work. It only has meaning at all within its medium. (Baumgärtel 1999, as cited in Dekker, 2018)

Even as new media continues to exploit the web, such as through social media performances, live-streaming, and even video games, which may exist within web pages, these examples in themselves are not net art. They do not exploit errors in the system or play with its rules. In the case of net art, the web page, its html, css, and its hyperlinks are a medium and the object of artistic expression, both tool and its message.

Net art is an incredibly peculiar art form. It is democratic in its distribution; as long as one has access to an internet connection, it is accessible. It, however, requires a specific literacy, particularly if one is to fully engage with the form. One of the most notable cases of this phenomenon is the groundbreaking wwwwwwww.jodi.org by the Belgian duo Joan Heemskerk and Dirk Paesmans (Figure 35 and Figure 36). When the visitor accesses the web address above, it appears as a jumble of green text over a black background. However, if the visitor was to open the web page's source code, the diagram of a nuclear bomb in ASCII art becomes visible. This action, i.e. choosing to see the source code, requires a very specific knowledge of web design and coding not usually available to most, therefore placing a barrier to entry to visitors.

Another peculiarity of net art is its volatility; as the discipline of web design has evolved, certain instructions, software, and methods have become deprecated or abandoned in an effort to create a more secure and efficient web or have simply ceased to exist. As net art often exploits errors in code or uses older software and links to other web resources, when these become obsolete or disappear from the web, the artwork begins to decay.

The final peculiarity of net art is its relationship with location or, more exactly, its lack of physical location. As was mentioned before, access to an internet browser is all that is required to access any form of Net Art. Ironically, this location agnosticism makes the display of net art in the physical space of the gallery an interesting challenge. Often, the time period required to explore these works can stretch indefinitely, as artists expected them to be experienced at home or some other private space. However, Net Art can also be location-specific, that is, it exists or operates on a specific website or server, and should these stop to exist or change, the work loses context and or functionality, often both.

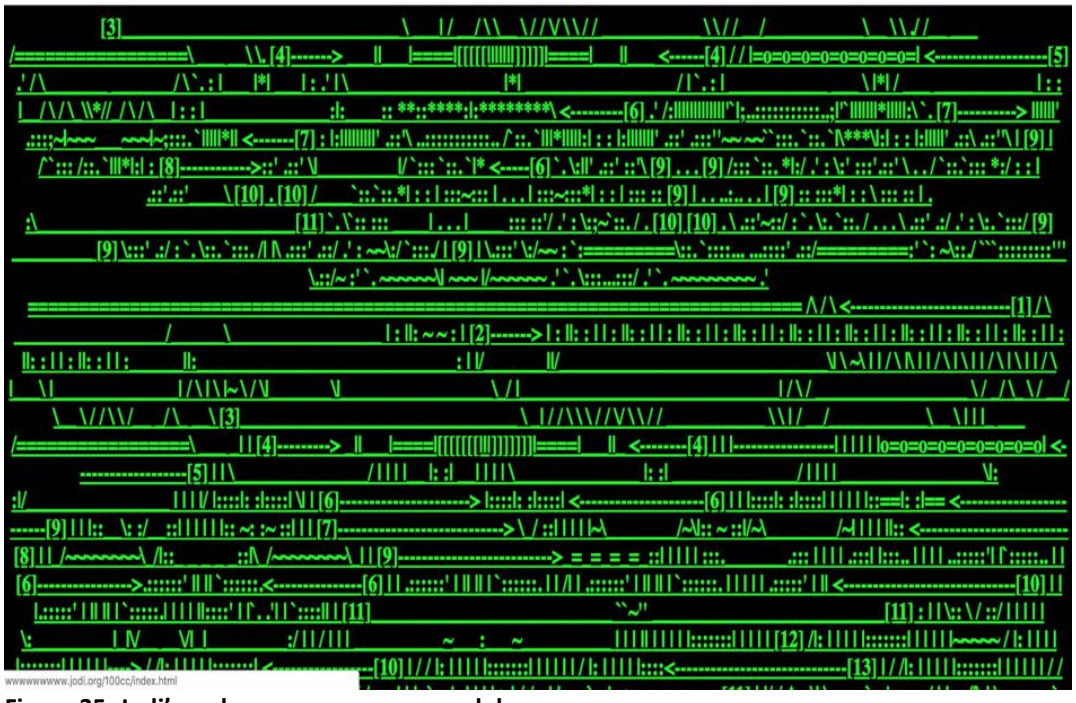

Figure 35: Jodi's web page as seen on a web browser.

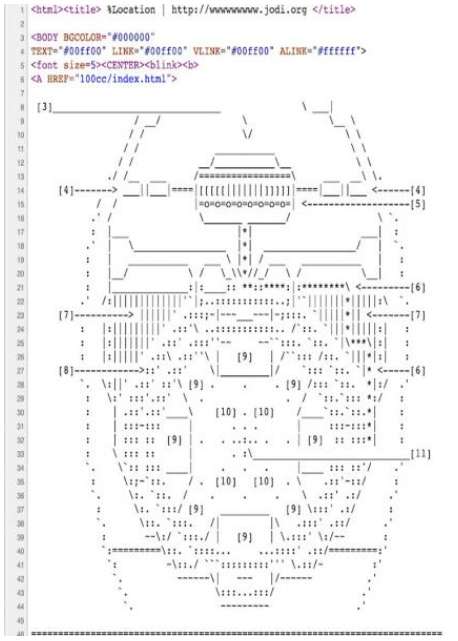

Figure 36: Source code for the same web page as in Figure 35

Time And Space In Net Art

While the peculiarities of time and space have been touched upon in the introduction, in this section, these characteristics will be explored further. As time and space are some of the most critical considerations when designing an exhibition, it is necessary to thoroughly understand how Net Art subverts traditional understandings of both concepts. The artform can be incredibly varied, with some works requiring minimal time to activate, while others may benefit from longer visits where the user can take their time and browse the artwork in order to discover the many layers it may have.

A clear example of the latter would be the aforementioned *wwwwwwww.jodi.org,* where the visitor must switch between the source code and more traditional navigation while exploring every object in search of hidden hyperlinks that take the visitor deeper into the web page and sometimes return them to previously visited pages. In this type of exploratory work, time becomes extremely flexible and depends on the visitor's engagement and desire to explore. This time factor complicates exhibition in the gallery space, as computers or tablets will be occupied for random periods of time. One solution to this issue, which is not often seen in the gallery space but is very popular in other exhibition spaces, like video game trade shows and children's museums, is the creation of kiosks that allow multiple users to experience the same work and compensate for users that take a more leisurely pace (Figure 37). This solution also creates a more social

experience, allowing visitors to comment on their experiences and engagement with the work, and thus enhancing the exhibition.

Figure 37: In this example, two users can experience the video game in question independently and at the same time. Photo by: Nick Statt/CNET

Location in net art can also be a challenge, since, strictly speaking, there is no need for a website to be accessed from a specific physical location. The exception to this concept often comes not from artistic reasons but political or financial ones. China, for example, limits what web pages and online platforms are accessible to its visitors, often by blocking content critical to its policies or social rules. On the other end of the spectrum, media companies are often motivated to limit access to their content from certain markets. For example, the BBC iPlayer blocks people outside the UK from accessing their content. While, at first glance, these limits may not seem relevant to the institutional context, they do in fact affect artworks in the gallery space.

Certain works, such as Stephanie Rothenberg and Jeff Crouse's *Laborers of Love* (2013) (Figure 38), will probably be blocked in the future under the Digital Economy Act 2017, which requires yet undefined methods to prove every viewer is of legal age to access content of a sexual nature. This will prove complicated in a museum setting and will probably require legal counsel or the outright removal of the work. As for digital rights, works that were not designed to be accessed from the institutions geographical location will also face challenges. One way to circumvent all these roadblocks is the use of a Virtual

Private Network (VPN). VPN's function by fooling blocking and tracking services into believing the user is in a different location. Depending on where the exhibition is held, these may be illegal as well.

Figure 38: Rothenberg and Crouse, Jeff, 2013*, Laborers of Love*, Digital Video. FACT Liverpool. Still frame of a Laborers of love user video.

However, not all location issues in Net Art derive from the physical location of the user, others stem from the need of certain works for specific virtual sites. These virtual sites can be traditional websites over which the artist has intervened, while others require access to databases and media stored in servers independent of the project. Works that depend on these locations require uninterrupted access to these resources or they cease to exist in their complete form. Some merely lose certain visual assets while others are rendered inoperable. It is for this reason that it is important to ensure that all, if not most, systems required for their functioning are available or can be replaced in some way.

The best way to ensure these kinds of works continue to exist is to record them using Rhizome's Conifer; a web page archiving system created with the intention to preserve net art and all its assets as accurately as possible, even emulating older ecosystems. This emulation is crucial to the preservation of net art, as it circumvents issues of deprecation and unavailability of software or media codecs.

Conifer is a very easy to operate resource; all that is required is to create an account and then simply paste the web address one desires to record, choose a version of a web browser, and click start. Once the page loads, all that is needed is for the operator to go through every interaction possible. In the case of sites with secret interactions, it is important to contact the artist or their estate and attempt to get a list of all steps to be taken. Once the recording is done, it can be accessed at any time, even if the website or other resources cease to exist. The system even works with social media platforms like Facebook and Instagram, amongst others.

Best Practice

Net Art, in theory, includes some of the most simple forms of interactive new media to display, as its requirements are reduced to an internet connection, a computer, a screen, speakers (not always required), and some input devices. Even these requirements have been reduced a great amount by the introduction of affordable tablets, negating the need for computer mice and keyboards while at the same time making them much more accessible to users with disabilities.

Hardware

- For Net Art, display options are simple and, in general, require no special considerations. Having said that, display can be optimised by the following recommendations.
- Ensure your computers have been updated to have the latest patches available and antivirus software to ensure your network is safe from hackers and other malicious software.
- If at all possible, have a dedicated network exclusively for the public facing computers.
- Make sure your network can handle the amount of traffic that will be generated; otherwise, pages will slow down and damage the experience. Use estimated visitor numbers and consult with your IT department.
- When using computer mice, avoid using ball mice, as these require constant upkeep. Likewise, provide an appropriate surface for the mice. Rugged, textured surfaces are better than glossy ones. Rough finish laminate or wood are ideal materials.
- Keyboards and computer mice present an entry barrier to people with disabilities. A way to circumvent this issue is to avoid using traditional computers and instead use tablets. The university of Birmingham has made

studies regarding the accessibility of tablets and concluded tablets can facilitate access to users with disabilities (University of Birmingham 2014).

- Avoid hanging tablets in right angles, placing them at an angle makes for easier operation.
- Tablets should always be plugged into power; do not depend on batteries.
- Tablets will also require regular cleaning in order to maintain hygiene and tracking accuracy. A simple moist microfibre cloth is enough.
- Ideally, use tablets larger than nine inches and enlarge fonts to make it easier for users to read the screen. Search for the accessibility option under settings.
- Software such as the open source and free Openkiosk can be used as a way to secure a computer for use as a public terminal. Software like these are purpose-built internet browsers which lock the computer's other functions and keep focus on the artwork.
- As an anti-theft measure, all kiosks should have locks to limit access to the devices.

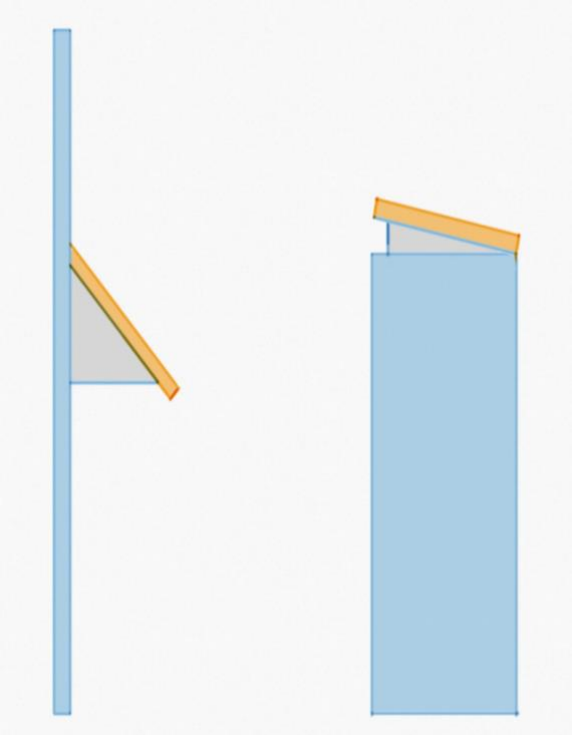

Figure 39: Two possible tablet placements. Left: on walls. Right: on tables or pedestals. The angle of each display varies depending on the height of the tablet. Make sure you avoid glare and that typing is comfortable. Image Rene G. Cepeda.

Porting Net Art

In general, Net Art does not require porting, instead, it is easier and cheaper to emulate the original ecosystem. This can be achieved either by using the aforementioned Conifer or through the use of software emulation on a PC computer.

Online services like Browserling.com and oldweb.today can be used to emulate older browsers and in this way have a way of accessing older browsers and the peculiarities that Net Art originally exploited. This opens another way to rescue Net Art that is no longer on the internet. If the institution has access to the source code and other associated files, this exact copy of the website can be hosted by the institution's own servers and then accessed through these services. Unfortunately, these web-based solutions can often be too slow or fail; in these cases, in-site emulation is recommended.

For this, a contemporary computer, a copy of a compatible operating system, and a web browser are required as well as a copy of the software DOSBox. Your IT department should be able to set up DOSBox to run the copy of the older operating system and the browser, effectively recreating an older computer within the newer one. Once this is done, the browser is ready to open the older web pages and display them.

If a Net Art work uses Adobe Flash, for now you do not require any emulation, but keep in mind this may change in the future. The software used to create these works has been abandoned and, as it belongs to Adobe, obtaining the source code in order to fully port it to new technologies will prove difficult if not impossible.

Basic Questions

Do I need to emulate browsers for all Net Art?

No, it all depends on how the artist exploited web protocols. Many works still function without the need for any emulation.

Can Net Art be accessible to everyone?

In most cases, it is possible for Net Art to be just as accessible as a regular web page; however, certain works may not, depending on how they were

created. For example, Jodi.org's work may be difficult to use for certain users, as the coding is also manipulated to achieve certain effects which may in fact interrupt assistive technologies.

If a work is meant to work over an existing web page (e.g. the institution's web page) who needs to be involved?

In most cases where the artwork overlaps with other departments, like with IT and Marketing in this case, the best course of action is to negotiate with all players concurrently and to highlight the fact that the institution will benefit from the effort. These kinds of negotiations can be difficult and require compromise on both ends. This compromise, however, should not be allowed to diminish the works, in which case, it is better not to implement it. It is not unheard of to have web pages intrude into others as marketing tactics. Examples of this are ilovebees.com or the marketing campaign for the movie The Day The World Stood Still (2008). These examples of marketing takeovers will facilitate your negotiation efforts with departments focused on public retention, page views, etc.

Can net art be presented offline?

As long as the work does not require access to external services (e.g. video hosting and twitter feeds), it is possible, and in most cases, it is a very simple process. In some cases, a custom offline version will have to be made depending on how the site was coded. If this is necessary, a web coder can make the alterations easily after authorisation for an offline version is given.

Case Study

Including Net Art into an exhibition, from an exhibition design perspective, presents curators with fewer challenges than other forms of interactive new media art. The form has been present since the 1990's and shares a common ground with other art forms, such as video art.

Once the selection is made, determine which works will require special treatment. This includes using legacy browsers, recreating networks and databases, or other assets. Afterwards, hardware must be chosen; as mentioned, with the latest developments in tablet technology, it may be a good idea to implement tablets instead of traditional computers, both for their ease of

use and accessibility and for the simpler installation and upkeep. Even kiosking is simpler on tablets, as both iOS and Android operating systems implement features to configure devices into kiosk mode.

Kiosk design should follow after deciding between single and multi-user kiosks. As a general rule, if the piece is central to the exhibition or if high turnover is expected, it is recommended to implement a multi-user kiosk. Remember to test all technology on-site to make sure networks reach all the works and are functioning correctly with the network's security measures. Finally, all adaptations, changes, and challenges and related solutions must be thoroughly documented and appended to the exhibition binder. Interactions should also be documented, both visually and through written descriptions of the processes, especially when the interactions involve complex procedures, such as social interactions.

For example, in Figure 40, *Hashhush* (2014) by Hilde Krohn Huse live streams data from Twitter, which is accessed by an app and visualised through infographics and statistics. The way it is presented is through a hanging LED screen that surrounds the space. In this way, it was possible to allow as many people as possible to experience the work without blocking view to anyone. Given that the piece is located in the Museum of London's cafeteria, this also solves the question of how people will interact with the work. As visitors are either sitting, eating, or waiting in line for their food, participating with the work by tweeting at it is basically unobstructive and almost a natural action for most twitter users. The piece also plays no sounds (in fact this would be impossible in a cafeteria, as it would disrupt visitors). Unfortunately, the memory of this work is difficult to access, since there are no videos of it available and just a few photographs available on the web. Even the artist's web page barely mentions the piece. As a way to avert this, a transcript of the twitter feed and the users can be generated, and recordings of the fully functional artwork could have been made. As of today, the work is partially functional, but with some coding work, it could be revived and documentation could be made.

Figure 40: Krohn Huse, Hilde, 2014, *Hashhush*, Twitter/LED screen. Museum of London. Image: Museum of London

3.6.1.2 Live streaming

Streaming is a technology where media (most usually audio and audiovisual) is being transmitted as it is consumed; it is not stored at the recipient's end before its consumed. It is the difference between a transmission of a television programme (streaming) and owning a copy of said programme on DVD (download). Examples of streaming media include Spotify, pre-recorded YouTube videos, and Netflix.

Live streaming shares the same characteristics with streaming and adds two more variables. As the name implies, in live streaming, media is being recorded and transmitted at the same time. While this may sound like traditional live broadcasts, the digital nature of live streaming enables the second variable: interactivity. Live streaming operates through dedicated platforms, such as periscope, YouTube live, twitch, and Facebook watch, which enable communications between the caster and the audience and between audience members themselves. Unlike previous telecommunication methods (performance art done through video conferencing), live streaming is decidedly much more democratic, with the barrier to access being close to negligible (Topic 2002 p.192).

Traditionally, these communications are text- and image-based and allow the casters to respond to the audience, either in conversation or action. However, there have been cases where the interaction occurred between the audience and the software, creating a crowd-sourced audience-led performance. *Twitch Plays Pokemon* (2014) allowed viewers to send commands to the video game, effectively creating a collective remote experience. To date, this has been one of the most sophisticated uses of live streaming technology.

In the artworld, the closest examples include performance artist Poppy's *Help Poppy Build a Computer* (2017), where the artist sits by a table that holds random computer parts and tallies votes for which pieces to pick up and connect, effectively giving up control to the audience over her actions. Unfortunately, due to how Facebook Watch works, a large part of the audience participation process was lost, as the chat stream was not archived. While Facebook archives both the video and the chat stream, it is not possible to remove this memory from Facebook and retain the chat stream, effectively removing an important part of the performance. While some streaming software can save the comments, this depends on the choices of software by the artist.

For post-facto conservation, it would be necessary to either create a special software or manually transcribe all chats to be saved.

Curatorial challenges include the difference between live streaming and interactive performance, concepts of networked participation, censorship, and time. Mostly, curators will not face huge challenges when working with live streaming, as it shares so many similarities with traditional performance. However, there is a slight difference between live streaming and interactive new media art performances. The distinction revolves mostly around how the interaction is done. In live streaming, the interaction generally revolves between a distant audience and whatever is being streamed, be it an actor, performer, or device, and is usually social in nature. The audience tends to directly talk to the streamer and the streamer responds to these comments or instructions often directly. Interactive performance, meanwhile, does not require remote access; it is entirely possible for an interactive new media art performance to not require the internet or any network at all.

Also important to curators is to accept the possibility that censorship will be required in these types of work; not of the work itself but of the public's interactions with it. How far will the institution allow participants to go? Is racially charged commentary allowed? Maybe in cases where the work is looking for these reactions, this is a valuable contribution; however, in a work that focuses on aesthetics? Definitely not. Therefore, each institution and their curators have to really look at the work and determine where the line is drawn. Unfortunately, even the most innocuous of works can be targeted by trolls and people wishing to hijack the conversation, and thus actions must be taken. Stephanie Dinkins' *Not The Only Ones* (2019) and *Project al-Khwarizmi* (2016) are counter examples of this process. Dinkins recognises the inherent biases that machines may draw from the data they are fed and instead creates positive representations of persons of colour in AI by curating the information fed to AIs.

Finally, time itself is a minor concern, as the interaction can continue with the same degree of fidelity in any other space, and curatorial teams should not be afraid to suggest extended visits outside of the institution. In some cases, the work will be enhanced by such approaches.

Time And Space In Live Streaming

As a live media, time is crucial in working with live streaming. As with traditional performance art, live streaming requires the audience to be present at the moment the work is happening, at least in order to experience the performance in its entirety. After the act has happened, all that is left is a memory of the event. This memory will never be able to fully recreate the performance in a meaningful way. The act of audience participation in certain performances makes this doubly important, as it adds a sense of meaning and belonging to the proceedings. While one may be able to watch a video of Marina Abramoviç's Rhythm 0 (1974) and realise the importance of her work as well as understand the general meaning, it is impossible to recreate what the audience physically present experienced.

When presenting live streaming video, two different approaches become evident: if the performance is live or if what is being shown is the memory of the experience. For live performances, the main concern is to enable the interaction of art and audience through the inclusion of input devices required. Given that most streaming platforms are mobile-phone-compatible, the actual process involves providing public internet access as well as informing the public about which App is required and how to find the stream. Ideally, marketing materials should inform visitors ahead of time about the required software and, if required, that an account should be created ahead of the performance.

When what is shown is a memory of the performance, the process becomes much simpler, as it can be treated as a traditional piece of video art and all that is required is a screen or projector and a means of reproduction. While most live streaming memories are stored online, it is a good idea to generate a copy that can function offline, which makes the copy itself more accessible, as it can be played without an internet connection. Keep in mind that live streaming happens not only through the video feed, but also through the chat, and as such, this parallel channel should be included in order to preserve the full experience as closely as possible.

Time in live streaming video can be handled in traditional ways, such as allowing the experience to play on its own and simply allowing visitors to drop in and drop out at their leisure. Of course, for live performances, time can vary from a brief

moment up to a constantly on experience that lasts days, months, or even years. A good example of long running live streams (if not an interactive one) is *#ALLMYMOVIES* (2015) by actor/performance artist Shia LeBeouf, which ran for 72 hours straight as the actor sat in a theatre and watched every movie he has been in in reverse chronological order. While presenting this live stream in its entirety to an audience is technically possible, it is better to understand that the way to experience this live stream is doing so as the original audience did: log in for a few minutes and leave and maybe come back later.

Another possibility for these types of performances is allowing and encouraging access through the internet instead of through the institution. In a way, the institution informs visitors of the existence of the artwork, allows visitors a taste of the whole experience, and the visitor can afterwards continue the experience from their own house at their own pace.

Best Practice

Hardware

From a presentation standpoint, the hardware required is often minimal and depends on whether it is a live performance or a recording of said live stream. While most artists interested in in-situ streaming would probably have their own hardware setups, it is important to understand the basic requirements for live streaming. The most basic setup requires a mobile phone with a high-quality camera (iPhones and top of the line Samsung Galaxy phones fit this bill), a specialised mobile phone microphone, a lens, and a lighting setup. Of course, for more professional streams, a high-quality video camera with HDMI live output, a broadcasting hub, lighting, streaming software, and a laptop are required. These setups allow for the video captured to be manipulated or modified through the software as it is streamed, opening more interactivity possibilities. For institutions interested in live streaming, it may be a good idea to have a mid-range setup, both for internal purposes and as a backup for artists who desire access to the artform.

If artists bring their own equipment, ensure voltage converters are available. The best resource for determining voltage and plug compatibility is the International Electrotechnical Commission’s Plugs List. Simply compare your country’s voltage and plug type with the hardware’s country of origin, if they do not match, adapters

can be bought at any electronics store. In live performances, two scenarios become evident: *ex-situ* and *in-situ*.

For Ex-situ Performances

- The curatorial team may choose to perform a large-scale presentation in a theatre-like space, in which case, a media device can display the video feed while visitors can connect through mobile devices and participate this way.
- It is important to have a few devices for loan for those cases where visitors for one reason or another cannot use their own.
- These devices should have the application preloaded and secured to keep the public from accessing other functions of the device.
- Kiosks with these devices can be placed out of the main area, since those using these devices can see the stream in them (Figure 41).
- This setup allows for both active and vicarious participation, making it much more accessible to those without mobile phones or who do not wish to participate.

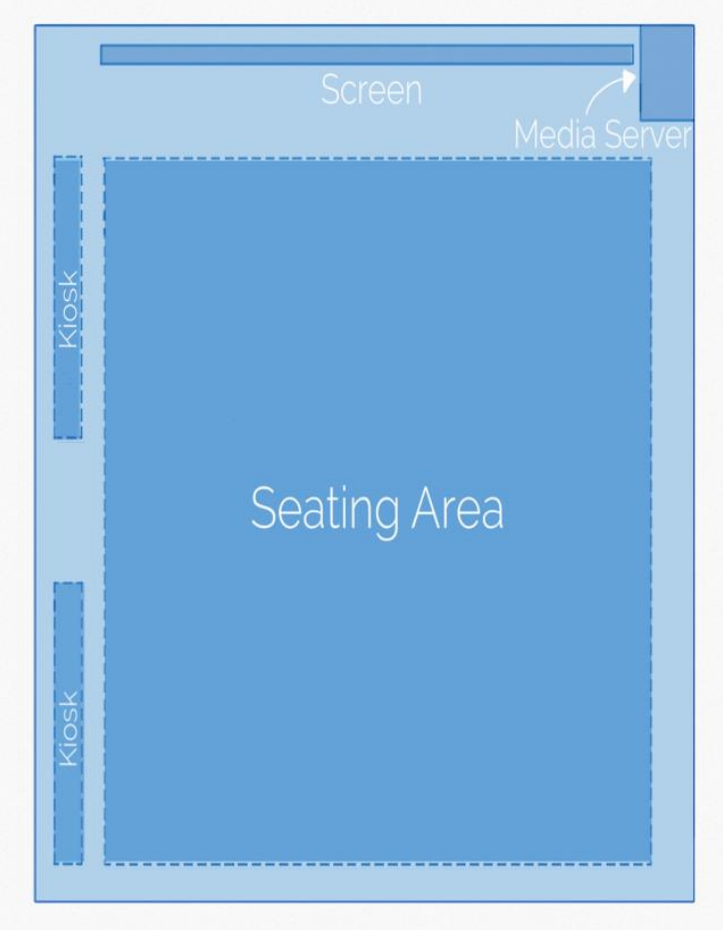

Figure 41: Layout with kiosks for ex-situ performances. Image Rene G. Cepeda.

For In-situ Performances

Display possibilities expand even more and may depend entirely on the artist's wishes, as they may choose to receive all interaction through the streaming platform or in combination with person-on-person interaction Figure 42.

1. Make sure wiring is laid out around the outside of the performance area and away from the public, both for the safety of all involved and to prevent anything being disconnected.
2. Use gaffer tape to keep all cabling in place and protected.
3. A secondary screen may be set up to show what the performance looks like through the internet but is not necessary.
4. The public can be invited to use digital devices, both their own and the institution's, to interact with the performance.
5. As for the space, this will depend entirely on the collaboration between the artist and the curatorial team and has no basic requirements besides a high speed wired internet connection to ensure the stream is as high quality as possible.

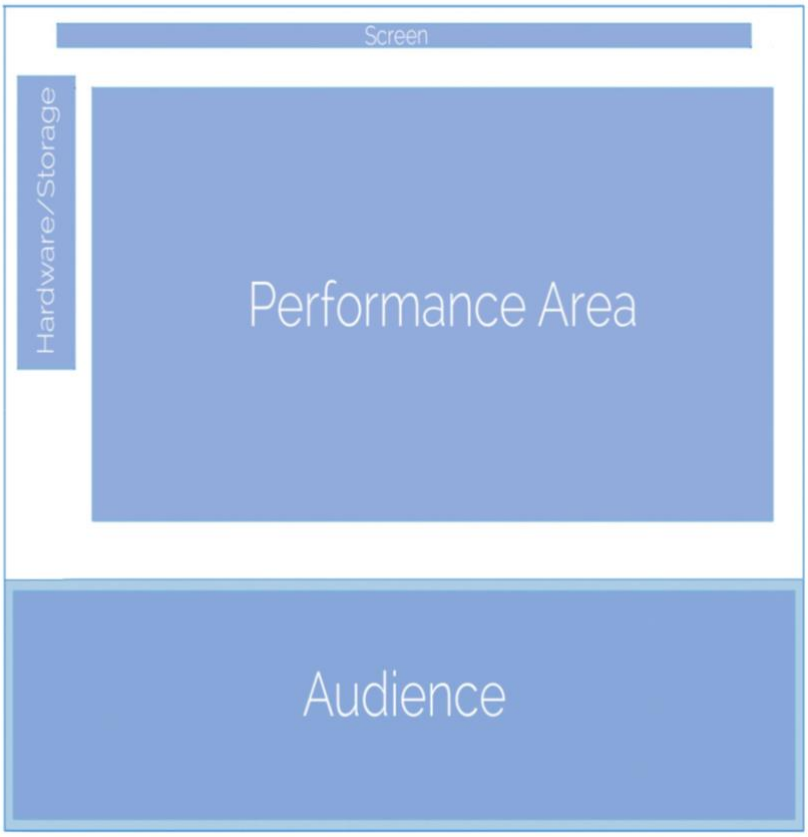

Figure 42: Sample layout for an in-situ performance with both remote and local access. Image: Rene G. Cepeda

For Both In-situ and Ex-situ

- In both cases, visitors should be made aware of the requirements to participate in the performance as well as how to download and use the required software.
- Step-by-step guides can be included in both the exhibition handouts and the institution's website.
- It is of the utmost importance to have a moderation team ready to block and delete offensive content. As has become painfully evident, certain individuals enjoy disrupting any unmoderated content by posting racist images and comments.
- Ensure your moderation team is up to date with current internet trends in order to block things that may appear innocent to those not in the know. This includes innocuous looking things, such as the number 1488 which is linked to neo-Nazi groups, amongst many other things.
- QR codes can be used to facilitate the download process. (Figure 43)
- Assistants must know how to fluidly operate the streaming apps on all four main platforms: iOS, Android, Windows (PC's), and macOS (Mac).
- In cases where video memory of the live stream is to be shown, the process becomes much simpler, since a large-scale presentation is not required (it may be desired, depending on the aims of the exhibition). For this situation, handle this as any other video, with a few caveats.

Figure 43: Example of a QR code; this code leads to https://www.qr-code- generator.com/. Image Rene G. Cepeda

- If the video is being hosted online (for example, YouTube makes it hard, if not impossible, to download streamed video), attempt to make an offline copy. This copy should be done by recording the screen as the video streams in order to capture the chat stream as well. Otherwise, a large part of the performance will be lost.

- Free software like VLC allows for screen recording that is suitable for preserving live streaming.
- Make sure you capture in full-screen.
- As chat streams have a tendency to scroll incredibly fast, it may be a good idea to allow visitors to manipulate the rewind, forward, and pause buttons.
- Kiosk software, such as SiteKiosk, should be used to ensure the integrity of any computers accessible to the public.
- A simpler, less interactive option would involve creating a DVD of the video and presenting this video on a traditional television-DVD-player setup.

For both situations, the options for arranging viewings of the performance should be a matter of determining viewing times. In live performances, this time is decided by both institution and artist. At this point, it is important to discuss whether it is possible for the performance to occur multiple times. For memory of a performance, it is simply a matter of deciding how many showings a day are to happen and then designate a space and set the recording on a loop. For live performances, we can then decide on whether the viewing will be booked or open to anyone. The former option allows for more orderly attendance but requires visitors to book an appointment and the institution to implement some sort of ticketing system. On the other hand, an open space with no booking allows visitors to drop in and out. Of course, occupancy may become an issue if the experience becomes really popular. As always, keep your spaces within occupancy limits and any extra visitors should be invited to connect through their mobile devices.

Basic Questions

Is live streaming synonymous with performance?

While performance IS a central aspect of live streaming, live streaming is a subcategory of the whole that is performance. Live streaming requires the internet, it can be accessed remotely, and has a social aspect most commonly manifested through chat streams between the audience and the artist and between audience members. For the purpose of this manual, live streaming is a performance being streamed live through a streaming platform and involves a degree of social interaction.

Is interactivity intrinsic to live streaming?

Yes. However, the degree of interactivity varies from artwork to artwork; some, like Poppy's performance pieces, engage with the public in a more involved way than Shia LaBeouf's works, in which the stream lacks any form of communication but visitors in the physical space could interact with him. If there is no participation, then what is being watched is streaming, not live streaming.

Can I present live streaming like a traditional film?

From the audience's point of view, this is absolutely possible; the setup can resemble a movie theatre. However, in live streaming, the use of integrated interactions should be encouraged; otherwise, the works become deactivated and lose a part of themselves.

Is live streaming always visual?

No. While most live streaming is visual, audio is another popular option. Finally, data can also be streamed and interpreted in a variety of ways. Regardless, most recommendations issued here can be adapted and modified to fit these specific cases.

Can live streaming be accessible only from within the institution?

While possible, this goes against the entire purpose of live streaming. We do not refute the possibility of an artist generating a form of private live streaming and, in fact, such avenues should be explored. In general, most live streaming is meant to be accessible by the largest group of people possible.

Is there a recommended livecasting software I can use?

There are many options of livecasting, both paid and free, and depending on your needs, a free option can be OBS. Unfortunately, OBS lacks formal tech support and requires a certain degree of computer know-how to fix issues. There are other free options; however, they tend to be neutered versions of paid software. If you wish to have a more professional option with tech support, Wirecast is the best solution. A license goes for 250 USD, but is being actively supported and has dedicated tech support.

Case study

Stelarc's Re-Wired / Re-Mixed: Event for *Dismembered Body* (2015) (Figure 44) is a robotic performance work where the artist had his senses telematically translated to different geographical locations. Thus, he saw images from London while the sounds he heard came from New York; meanwhile, one of his arms was encased in a robotic exoskeleton that could be controlled remotely by anyone connected to an online interface or from a touchscreen in the gallery. The performance lasted six hours for five days, after which, the arm alone was displayed while activated; meaning anyone could still operate it remotely. Alongside the arm, a video of the performance serves as a means to illustrate the actual work performed.

In this case, the live streaming functioned differently from more traditional live streaming, as the receptor of the streams was the artist, not the public. Nevertheless, the social aspect remained, since the audience could interact with the performer through the manipulation of the arm. As performances are very limited as to how long they can go on, Stelarc's solution of leaving the arm working while a video presented a memory of the performance is an ingenious approach to the problem of time in performance. It expanded the audience of the object, and while a big part of the performance is missing, the interactive factor remains.

This performance is a good example of how to preserve certain forms of live streaming. By preserving the memory of the work while allowing the public to experience a part of the full experience, the work remains somewhat active. Future curators are being given a full understanding of the work and it is an artefact that will be functional for a long time, allowing for reenactments or interactive display. Apart from this, the artist has a thorough photographic registry of the work, including schematics on the intended functioning of the exoskeleton arm, which can be used in the future as reference for repairs or recreation. This registry is publicly available on Stelarc's website and on the project coordinators' website. Ideally, all this information is saved on solid state media for the future, as websites are notoriously volatile.

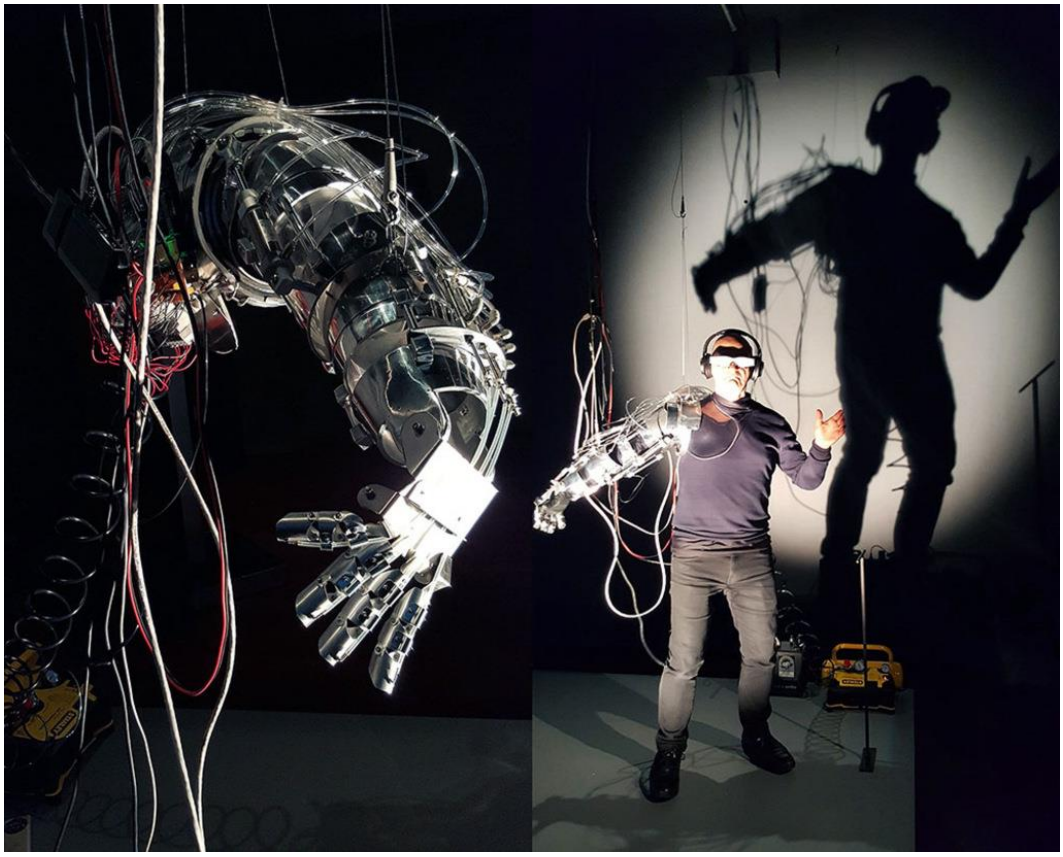

Figure 44: Re-Wired / Re-Mixed Event for *Dismembered Body*, Stelarc 2015, live streaming exoskeleton. PICA, Perth. Detail of Stelarc's exoskeleton arm and headgear. Stelarc is effectively isolated from the physical space he is situated in by the headphones which live stream audio from a streamer in New York while the goggles stream video from a streamer in London. Meanwhile, the audience can remotely control the arm through a web interface. Image Stelarc.

3.6.2 Interactivity

3.6.2.1 Interactive Video Art

Starting in the 1960's, video art has undergone a variety of transformations, starting with the work of Nam June Paik, which were experimental works exploiting the peculiarities of video technology and the combination of video with other disciplines, such as theatre, painting, and sculpture. Video art often questioned the existing power structures and, due to its accessibility, allowed the voices of "the Other" (women, minorities, etc.) to question how television and film presented them. After the initial exploratory 1960's and 70's, the 80's and 90's introduced a new stage in video art, bringing with it a merging of high art and popular culture. In this era, video art's veracity began to be questioned and artists began to use parody as a means of grappling with this denial. The 90's were also the birth of interactive video art. This interaction was very limited yet marked a switch in the power relationship between artist and spectator. In Jeffrey Shaw's *Legible City* (1988–91) (Figure 45), we see the beginnings of interactive video, with the visitor choosing both the speed and different directions to take, as well as a proto-VR experience, where the cyclist moves through a virtual world, just not in a fully immersive way.

Figure 45: Shaw, Jeffrey,1988-1991, *Legible City*. Video and Bicycle. Karlsruhe. Image © ZKM | Center for Art and Media

As video technologies allowed for higher resolution, as well as becoming much more accessible, artists began to explore with interactivity in video. One of the

best examples of this exploration of viewer-controlled video is *First We Feel Then We Fall* (2017) by Jakub Wróblewski and Katarzyna Bazarnik. In this adaptation of James Joyce's *Finnegans Wake* (1939), the viewer can move between different scenes, each one containing at least 3 different tracks. Each scene has its own soundtrack that is based on the same text but enriched with unique sound effects (Bazarnik and Wróblewski 2017, p ii131). By freely switching between scenes and the tracks in them, every viewer creates their own individual experience, either by design or free association.

First We Feel Then We Fall exemplifies a free form of interactive video; however, linear experiences are also possible. One such example could be seen in the recently released Netflix film *Bandersnatch* (2018), a more structured narrative where binary choices are presented to the viewer at key points of the narrative. However, *Bandersnatch* exploits the computational powers of Netflix's servers to track certain choices, enabling new narrative paths dependent on certain prior choices or blocking others. Tracking changes and modifying upcoming ones is what distinguishes *Bandersnatch* and *Legible City*. Unlike the former, *Legible City's* interaction has limited consequences: either something is seen or not, and each choice within the branches does not affect future choices. In a way, the more interactive video art becomes, the closer it edges to becoming a video game. For us, we will define Interactive video art as a form of video art where interaction never achieves a constant full feedback loop.

With all that in mind, curators can already see some of the challenges facing them. The most important of these is the intimacy of the experience. As these works depend on creating individualised experiences, collective viewing (although possible and has been done) is not ideal. As such, it is important to account for the individuality of the experiences during both research and planning. Another challenge posed by individualised experiences relates to the meaning extracted from the work, since different participants may access discrete parts of the work and they will derive completely different meanings and interpretations. This factor, however, does not deny authorship, as any and all options have been decided upon and chosen by artist beforehand. While the final experience changes from person to person, it is a permutation of the creative work of the artist.

Another challenge is to correctly identify the proper mechanics of the interaction with the work. Some artworks may exploit the hyperlinking capabilities of Blu-ray

players, others use the ability to change chapters or audio tracks seen in DVD players, some use the flexibility of tablet apps to manipulate the video while some may use the accessibility functions of web browsers (some of which do not work on tablets), and, finally, some may use completely custom control interfaces. Such a varied approach to interactive video requires an extra level of engagement from curators, as each one poses its own practical challenges. Namely, the more specialised and customised software and hardware used by the artwork, the harder it is to adapt in case one aspect of it is missing as well as the more specific the display solution has to be.

Time And Space In Interactive Video Art

Unlike traditional video art, which can be observed by an unlimited number of spectators and each and every one of them will leave with roughly the same impression, in interactive video art, for the most part, it is an intimate relationship between the viewer/participant and the artwork. In practical terms, an interactive video will require a variable amount of time, as different users will engage with it at their own pace and as long as it captures their interest.

In terms of space, the exhibition need not be situated within a theatre context, instead, smaller, more intimate setups can be explored. These setups mirror in many ways those for traditional video art, except they include control interfaces. These controls may vary widely in size and complexity. *Legible City* requires a large installation that must accommodate a large screen for the video to be projected on, a projector, and a stationary bicycle. On the opposite end of the spectrum, we have *First We Feel Then We Fall,* which can be shown on a computer screen and using a keyboard as a control interface. While these works may not be ideal for large scale viewing, vicarious participation should not be discouraged.

Best Practice

Hardware

As has been mentioned, working with interactive video art is, in most ways, similar to small-scale video art. However, due to its interactive nature, most of these works require computers and some may depend on remote connections to properly function.

- If the artwork requires an internet connection, it is of the utmost importance that the connection be as reliable as possible to ensure the ideal viewing experience. Wired internet connections (i.e. a cable connects to the device being used) are to be preferred over wireless ones. If this is not possible, avoid locations with low signal strength, since low signal power results in long loading times, stuttering, and stopping at random points of the experience.
- Explore the work in its entirety while connected to the desired network and test all options possible to make sure all relevant permissions are enabled on the computers and the experience works adequately. Document any modifications to the network.
- Isolate connected works from the public networks so visitor connections do not degrade the experience. Your IT department can do this upon request.
- Ensure a high-quality anti-virus and firewall are installed. This will keep the computer and network safe from intrusions and malicious software.
- If the video feed is not dependent on the internet, ensure the computer is capable of reproducing the content. If the content fails to play, ask the artist or their estate for the relevant codecs. These can be installed by your IT staff. Make sure you add a hard copy of the codecs and any other required software to the exhibition binder.
- For non-local artists, if the work requires specialised hardware, check with the artist on which hardware can be acquired locally. This will save money on insurance, transportation, and import fees.
- When artists bring their own equipment, ensure voltage converters are available. The best resource for determining voltage and plug compatibility is the International Electrotechnical Commission's Plugs List. Simply compare your country's voltage and plug type with the hardware's country of origin, if they do not match, adapters can be bought at any electronics store.
- Complex installations may require specialised personnel, although, most commonly, these tasks can be done by the artist or their assistants. When this is not the case, the artist should provide detailed assembly instructions. Make sure these instructions are integrated into the exhibition binder for future use.
- Not all works have a visual/aesthetic component (i.e. a kiosk or an artist dictated mode of display). However, before designing any kiosks, make sure the artist or their estate agrees with these modifications. In such cases

where the adaptations are approved, it must be made explicit that such modification is not part of the original work, at least in the exhibition binder.

- In cases where artefacts related to the work are no longer functioning, emulation or replacement may be the only option. As long as the artist is living, it is possible to negotiate on how these adaptations may take place. One suggestion would be to modify the system to preserve the interactivity of the work with new technology and display the artefacts next to it as any other museum object, explaining the relationship between the work and the artefacts.
- For works in the stewardship of the institution, a decision can be made to continue the use of the work's original components or whether a duplicate artefact would preserve the work both in its original form and in function. In my opinion, the creation of interactive duplicates preserves the works and their nature much better than freezing the object in time by rendering it inert.
- For works unattached to specific artefacts, ensure that whichever platform you choose will be compatible with the artwork. Some interactive video art that is web-based runs on custom web pages that may or may not have full functionality on tablets. Some may require the touch capabilities of a tablet while others may require the mouse pointer or specific key presses.
- When designing displays, allow for at least a family of four to comfortably stand around the display and have a clear view of what is being done.

Basic Questions

Is interactive video art the same as live streaming?

No, while both involve video, interactive video art tends to not be live, which is the most basic characteristic of live streaming. Furthermore, interactive video tends to be more flexible as to how interaction may happen. Finally, while live streaming is a social experience, interactive video art leans more towards an intimate, individual one.

Is interactive video art the same as VR video?

In a way, VR is the direct descendant of interactive video art and, at their core, both are very similar experiences, with the difference being one of immersion. In VR, the visitor is enveloped by the video, effectively placed within the scene, while interactive video is still framed within the television or computer screen.

Can interactive video be presented as a predetermined linear video experience?

While it is possible to create a recording of one performance of the video and present this in a non-interactive way, this process neuters the work and effectively removes the most important facet of it, altering the meanings and artistic expression of the artwork. For these reasons it is not recommended to do so.

Case Study

Figure 45, *Legible City,* is a good example of an unorthodox display; while it is still an intimate interaction, since only the cyclist has control, the viewing experience is collective and could in theory be directed by the crowd. Interaction is controlled by the pedaling and steering of the bicycle, making it an integral part of the work, and were it to stop functioning or go missing, the artwork would be incomplete. In such a case, the ideal solution would be to create a new bicycle that can control the experience. The label for the work in such a case would be required to mention the substitution. There is historical reference for this action, with the most famous example being Marcel Duchamp's *In Advance of a Broken Arm* (1964), which has been replaced multiple times.

In terms of installation, the computer, projector, and screen needed for the work can be locally sourced. The bicycle, however, would have to be shipped and insured. As can be seen, this work requires a sizable space and, while the experience time is potentially unlimited, it is very probable that most visitors will only drive for a few minutes. Queueing for this experience may be recommended, although depending on the popularity of the work, this may be left as a first come, first serve experience.

Finally, documentation of the work would include photographs of the work as well as detailed notes on installation in cases where the bicycle or the software have been altered. If visitors had problems operating the work or understanding it, these would be documented as well.

Figure 45: Shaw, Jeffrey,1988-1991, *Legible City*. Video and Bicycle. Karlsruhe. Image © ZKM | Center for Art and Media

3.6.2.2 Interactive New Media Art Performances

While the Idea of incorporating technology to theatre dates back to at least ancient Greece and the “Deus Ex Machina”, where an actor representing a god was literally lowered into the scene with a machine, for a long time, performance remained unchanged. The next big change in performance came from Richard Wagner’s idea that theatre should be a host for other arts; this concept opened the door to further possibilities. The next paradigm change to performance happened when cinema was integrated into theatre scenery. This integration of technology into performance continued through modernism and later into the 1960s avant-garde, where artists like Nam June Paik integrated film and television more and more into their performances. As digital technologies, robotics, and telecommunications became more accessible and powerful, performance artists began experimenting with the many possibilities presented to them (Dixon and Smith 2007).

As it becomes clear, new media has a long history in performance and has continued to evolve. Interaction, for example, has changed in performance by the inclusion of interactive new media. While interaction has been part of what we traditionally call performance art (1960s onward), works like Abramoviç’s *Rhythm 0* (1974) required the audience to interact with the artist; however, this interaction required no technology to happen.

Rhythm 0 consisted of a table on which participants could find several objects, including a rose, makeup, scissors, nails, grapes, wine, and even a gun and bullets. Abramoviç stood by this table for six hours allowing the public to interact with her by freely using the objects on the table. The spectators cut her clothes, pricked her with the rose’s thorns, and one person loaded and aimed the gun at her. After six hours, Abramoviç left the stage as the audience dissipated. To this day, it is considered one of the most important works of art ever made. In Rhythm 0, we see one of the first truly interactive works of art, where the work would not exist at all without the audience’s participation. New media art continues Abramoviç’s legacy both in substance and interactivity.

For this manual, we will concern ourselves with art where new media is integral to the interaction. An example of this kind of performance is Cecilia Suhr’s *I, You, We* (2018), a work where the software responds to both Suhr’s and the audience’s

actions: as the audience steps into the camera, the software changes the visuals and audio in response to certain characteristics of the person and, at the same time, Suhr improvises music based on the music generated by the software, which in turn reacts to Suhr's music, further modifying its output. This interactive performance would be impossible without new media and it is what we are concerned with.

There is an overlap between live streaming and interactive performance that bears mentioning. At the base level, both interactive performance and live streaming are performances; the difference lies in the networked characteristic of live streaming. Interactive performances do not require an internet connection and the interaction is often more intimate, involving participants present in a location. In a sense, all performances are site-specific, while most live streaming works are site-agnostic, at least from the point of view of the public. As curators engage with interactive new media art performances, several curatorial concerns have to be kept in mind. Interactivity, connectivity, presence, and authorship can pose unconventional challenges.

While interactivity in performance is very well understood, the added technological layer requires a more nuanced approach. If direct contact with the artist can be problematic at times, *Rhythm 0* being a prime example of this, an added layer of technology can create a troublesome situation. As was determined in the Stanford Prison Experiment and the Milgram Experiment, if an authority figure hands power to individuals, these individuals will often perform violent actions without a feeling of guilt, and in the case of the Milgram experiment, the distance created by technology only made it worse. *Rhythm 0* is a clear example of this phenomenon: since participants were given authorisation by figures of power, (i.e. the gallerist and the artist), the performance became more and more violent as inhibitions faded, until Abramoviç was held at gunpoint. As technologies erect a second barrier between humans, the possibility of transgression increases. Curators must be aware of the possibility that any given work may end crossing a line and must prepare accordingly. Regardless of the artist's intention, certain hard limits must be set and enforced and should aim to protect the health and safety of both the artist and the audience as well as protect the institution from ethics claims.

Another question raised by interactivity in performance is the authorship dilemma, that is, who is responsible for the work? Is it the artist who creates and delineates the experience or is it the audience and the artist together who share authorship? Answers to this question are as varied as there are curators and artists. One opinion

argues for total shared authorship, as no work would exist without the participation of the public, while the opposite position argues for total control by the artist, as all interactions are predetermined or allowed by the artist themselves. While the concept of the public as co-author is not a new one, as the role of the audience in the artwork has been recognised since the sixties, this is not reflected in the actual curation and memory making of the works. *Rhythm 0* remains firmly under Abramoviç's authorship and the same happens with Stelarc's *Rewired/Remixed* (2015). No labelling system, to my knowledge, officially recognises this relationship, instead, it is mentioned in the label text where it may be overlooked.

If on top of this authorship through participation we layer the question of who was involved in the creation of an artwork, we have an overly complex situation. One of the most famous examples of this attribution paradox can be seen in Damien Hirst's famous spot paintings, which have been painted both by the artist and a series of assistants. Who then is the author? In Hirst's case, it is important for collectors, as owning a Hirst Spot Painting is a large part of its perceived value. Another example is Rembrandt's *Man with the Golden Helmet (1650),* which is now believed to have been painted by someone in his studio. This has resulted in the work being expunged from Rembrandt's oeuvre and effectively reducing its importance regardless of the fact that the work is on par with Rembrandt's own work. However, attribution is not only problematic when the work is done under a "master" and their assistants, it also arises under equals who operate in different fields. New media is often faced with this dilemma. Programmers, musical composers, and engineers share as much authorship in the creative input that leads to an artwork as the artist. Ideally, recognition to all involved would be the best. One way to achieve this would be with credits similar to those seen in film, where everyone's contribution is recognised. In screen-based arts, this is very simple, as a page with all the credits or rolling credits in video are good options. For non-screen-based forms, it is possible to create a credits sheet that could be placed near the work's label. It is not an ideal solution and not everyone may read it, but if treated with the same importance as the rest of the information system, it will live on in catalogues and the memory of the work. The labelling section offers other possible solutions.

The second factor, Connectivity, does not imply the internet and its various elements, since other types of connectivity exist, and connectivity between devices is fairly common in interactive new media art performances. This does not imply

internet connectivity is not possible or has not happened. An example of a connected artwork is Stelarc's Rewired/Remixed (2015), in which a variety of technologies, including projectors, sensors, tracking software, and robotics, are connected to each other in order to control the robotic exoskeleton that moves Stelarc at the whim of a remote audience. It is only when all these elements work in unison that the piece activates. What is interesting about this is that, while the particular elements are non-essential for the experience (they can be replaced with newer elements or elements made by another company), the way they interact with the work is unique. Therefore, what is essential to the experience is the way the connection works and not the artefacts themselves, and thus these can be replaced without damaging the work. This will become evident as works age and original components cease to exist or newer technologies replace them.

Presence is also an interesting concept in interactive new media art performances, as experiences in this category do not always require the physical presence of any of the individuals involved. The artist may be in a remote location being controlled by individuals all over the world, or the artist and participants may be located in different specific locations, or, more traditionally, both groups are located in the same space. This flexible approach to presence makes dealing with performances an interesting challenge, since, in remote artworks, every aspect of the connection has to work or the entire performance will fail.

Time And Space In Interactive New Media Art Performances

Time in Interactive New Media Art Performances is an interesting concept. While most performances have a predetermined duration, this duration is highly variable and, depending on the nature of the artwork, it may or may not pose a challenge to host institutions. Any performance whose duration is shorter than the opening hours of the host poses little to few challenges. Those that extend beyond opening hours can be much more problematic.

Artworks whose duration is longer than standard opening hours will have to depend on recordings, photographs, and other methods of memory making, such as live reproduction over the internet. When displaying these works, we must accept that the entire experience is not meant to be experienced in its entirety. Of course, this is a rare occurrence, as the interactivity factor demands an active audience.

Space requirements for interactive new media art performances depend on where the artist or artefact will be present and where the public/participants will be located. The more traditional performances simply require a space as big as the artist requires, plus the audience. For those where the artist or artefacts being interacted with by the public are in a remote location, the space needs to only accommodate the expected or allowed number of visitors. Finally, when the audience is the one accessing the performance remotely, space should be treated as in the prior case.

Best Practice

Hardware

- Working with Interactive new media art performances requires a great degree of flexibility, as the forms it may take are unlimited. These experiences may require a minimum of technology or complicated multimedia setups and artefacts. No matter what, the following suggestions are a good starting point.
- Regardless of complexity, be prepared to document both the public and the performance. This includes video, audio, photography, and visitor interviews if possible.
- Attempt to gauge public interest in order to determine how much space you will require. Booking makes this easier, as you have concrete numbers of participants at predetermined times.
- As most new media runs on digital devices, make sure both the public and the artist have access to electrical outlets. If not enough are available, prioritise the artwork.
- In cases where the internet is required, ensure signal strength is adequate.
- Internet access for the public should be separate from internal networks for security and should have firewalls set up.
- Ensure works that require internet work properly before making them accessible to the public.
- Clearly delineate areas visitors are allowed to enter and those that are reserved for the artist. As visitors are expected to enter the space and interact, it may be difficult to distinguish what is ok to touch and what is not.
- All delicate hardware required should be kept in glass cases or opaque boxes to keep it away from curious visitors. Glass or acrylic is to be used on

anything meant to be seen, while opaque boxes (wood is a cheap and effective material) or other enclosures are to be used for equipment that is not part of the aesthetic experience and not meant to be touched.

- When working with international artists, unless the artist has customised or hard-to-find equipment, it is often cheaper to acquire any hardware (projectors, sensors, etc.) locally. This will cut on insurance and transportation costs and taxes.

Basic Questions

Does interaction make every work performative?

In a way, yes. As soon as a live element is introduced to the work, it acquires a performative aspect; however, for the purpose of this manual, performance has to be the core of the experience. To further elaborate, up to a certain point, the act of standing in front of an artwork is interaction and, as such, a performative action. However, this is a low bar to cross in new media. This benchmark would make all interactive new media artworks into performances. For this reason, I propose to raise the bar: for interaction to be significant, it has to go beyond the activation of a process; it has to create a series of reciprocal actions between individuals and the work.

Is every new media art performance interactive?

No, interaction has to be explicitly integrated into the experience in a significant way. However, the degree of interaction need not be that of a full feedback loop, even a simple action can have significance in a performance.

Are interactive new media art performances the same as live streaming?

No, while most live streams are performance, not all performance meets the characteristics required to become a live stream. These requirements include for the work to be transmitted through the internet and involve a social chat aspect that links the audience to each other and to the artist. In fact, performances of the type mentioned here may not even incorporate networked elements at all or require communication between audiences separated by geographical distance.

Case Study

Tiffany Trenda's Proximity Cinéma (Trenda 2013a) is an interactive new media performance where [The artist] is completely covered in a synthetic suit with forty small 2.6" LCD cell phone screens. The images on these devices relay the words most spoken between men and women. They include: "Go Ahead", "It's OK", and "Don't Worry About It". The image on these devices changes depending on how far away the viewer is from the artist. When the audience touches the screen, it reveals a photo of the artist's body (Trenda 2013a). The work, therefore, only works while the suit is being worn and Trenda is actively engaging with the audience. As with traditional performances, once the artist stops performing, the work dissipates and only memory remains. In this case, the public memories preserved by the artist consist of the artefact (the suit), the photographic and video recordings of the events where the show has existed, a basic description of the project, and a list of times the work was performed and where.

While schematics of the suit and documentation of how it works are probably kept by the artist, the public record is sparse, and it is not clear what happened to the work and its artefacts past 2015. Furthermore, a simple Google search shows the artist has continued to show the work up to February 2019 yet has not continued to document the development of the work on her own website. This oversight puts the future research of the work at risk, as it leaves further documentation up to other organisations and scatters it all over the internet.

Figure 46: Trenda, Tiffany, 2013, *Proximity Cinema*, mobile phones, sensors, and latex bodysuit. Venice Biennale. Archival image of the bodysuit at work. This is one of the few images on the artist's website. Trenda has stopped updating her record of the project since 2015. The project, however, continues to be performed. Image: Tiffany Trenda.

3.6.2.3 Video Games

The video game industry is one of the most, if not the most, successful entertainment industries in the world, expected to be worth over 90 billion dollars by 2020. With an audience of 2.5 billion and an average of 45% of all players globally being female, we can deduce that video games are one of the most prominent and highly influential cultural practices in the world. However, cultural institutions seem hesitant to recognise their cultural and artistic significance. In part, video games are a victim of their own success, often seen as entertainment rather than art or culture. Yet, even as far back as the late 1980s, video games were being included in exhibitions in a very limited form. The exhibition *Hot Circuits: A Video Arcade* (1989), at the Museum of the Moving Image, presented one of the first exhibitions of video games under the premise that the curatorial action of choosing and displaying video games within an institutional context elevated these games to aesthetically artistic works. However, none of the works (obsolete even then) were created with artistic intention.

To find video games explicitly made with the intention of creating art, one may look first at artists that treated video games as ready-made objects to be reinterpreted or intervened, such as Jodi.org, in which they alter the code for the popular video game Doom and turn it into an abstract experience called *Untitled Game* (1996-2001). See Figure 47.

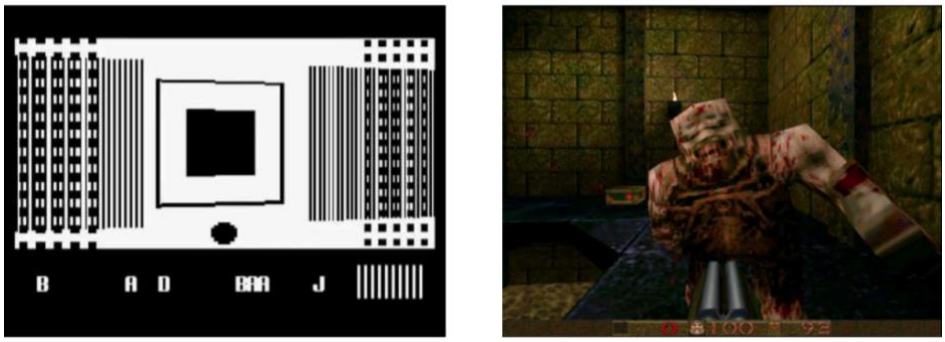

Figure 47: Jodi 1996-2001, *Untitled Game*, Video Game modification. Screenshots. Left: original game. RIght: Jodi's modification.

Works such as these are intervened objects and not born as artworks. Instead, they are the equivalent of how Man Ray would take a non-art object, such as an Iron, and turn it into an art object by modifying it. In order to find a true art game, we have to look at the early 2000's, when independent developers not bound to financial reports and marketing teams began to develop non-traditional, often

experimental games. One of the earliest examples of this is the Italian collective Molleindustria and their multitude of anti-capitalist games. Molleindustria's games are small, free browser games meant to satirise capitalist institutions as well as meditate on labor and alienation. While their goals are laudable, they have not been highly visible and remain entrenched in the periphery.

However, it was not until the late 2000's that Jonathan Blow and his game *Braid* (2008) brought art games to the foreground. Blow had been a vocal critic of video games and their apparent inability to become art, as they attempted to imitate film while their interactivity sabotaged any attempt at a meaningful story. Blow changed this by creating one of the first games to actively be recognised as an art game. He achieved this by using game mechanics as a vehicle of narration instead of delivering meaning through cutscenes doled out as rewards for proficient gameplay. After Blow's games, other creators began to embrace the label of art games and have continued creating video games that embrace experimentation, satire, medium introspection, meaning, and aesthetics over recreation. Amongst these creators, we can find Genova Chen, Joseph Fares, and Pippin Barr, to cite a few.

In an interesting development, video game history has mirrored art history on a different time scale. Games like *Pong* (1972) and *Space Invaders* (1978) functioned as the Neolithic era, the early nineties operated as a form of renaissance, and the early 2000s as modernism, with games becoming experimental and abstract, often looking at the early years of the artform. Then, finally moving into a form of postmodernism, where the tropes and structures of formal game making are questioned and subverted, often with an ironic self-conscious glee.

Authorship

Video games can be complicated for curators to engage with, as authorship questions can become quite complex. Other issues include space, time, obsolescence, and the complicated media rights required, since some works are owned by huge corporations who may or may not be interested in future preservation or display of the works they own or may implement music from other artists, which may require independent authorisation. One last issue is the possibility of a game changing from initial release to the version on display.

Authorship may not seem like a complicated issue in video games, as the game is created and the players are allowed to interact within the rules of the system as set by the author/auteur/game designer. However, some games have become mediums themselves, where people with enough creativity and ingenuity can create their own artwork. The most popular game that enables this form of artistic creation is *Minecraft* (2011), a game world where the player mines and refines raw materials from the game world to create construction materials which can be used to create almost anything they wish. These creations can go from simple houses and sculptures to in-game computers that can run *Minecraft* within it. In these cases, while *Minecraft* is a game where the original intention was to create an open-ended world where players could explore and survive in a vast world, players eventually saw other possibilities and began creating things that its creator never expected. One of the best examples of this being Blockworks, a collective that creates art installations in *Minecraft*. To attribute authorship in these cases, two approaches are apparent: in one, a double attribution could be suggested. This double attribution would credit game creators and artists separately, implying that the game is more than a simple medium. The second approach is to treat the game as a medium (just like canvas or marble) and simply recognise the resulting work.

Double Attribution example:

Exeter

Artist: Blockworks

Game Designers: Markus Persson, Jens Bergensten, Stephen McManus

Minecraft world

Simple attribution example:

Exeter

Blockworks

Minecraft

The first form of labelling allows for the public to recognise the importance of the video game in the creative process. However, this is not always the desired implication, as the video game can sometimes be more akin to a physical space upon which the artist performs. The game/online world *Second Life* (2003) has captured artists' interest since its inception for the creative possibilities that became possible in a virtual world that has a geography of its own. As such, performance artists have found the platform as a new space ripe for

experimentation. In such cases, the Simple attribution example may be much more adequate; this, however, varies between works. As a recommendation, one must decide if the video game itself qualifies as an artwork upon which the artist enacts a second creative work or if the video game functions as a platform or medium. While the former has, to my knowledge, not been done, the Minecraft and Second Life examples benefit from the simple attribution format.

As for video games where they themselves are the artwork, the attribution is still contentious, as these works may have anything from one up to hundreds of people working on it. These people do not all participate to the same degree in the creative process; some are technical workers while some are involved in creative choices that may affect the aesthetics or functioning of the work. In a way, video games share a workflow similar to that of film. However, game studios and game designers (the equivalent of a director) develop reputations unlike those of film studios. For this reason, it may be important to recognise both the studio and the game designer independently.

Sample attribution for video games:

> Journey (2012)
> Game Designer: Jenova Chen
> Studio: thatgamecompany
> Video Game

Obsolescence

Obsolescence is an interesting phenomenon that afflicts video games more than other new media, as video games are designed to function with specific hardware in mind or utilise technologies that may have been abandoned in lieu of better, newer ones. For example, games made for the DOS era often need to be artificially slowed down because newer computers are so fast, these games over-perform and become unplayable. Console video games often only work with the console they were designed for, and should those machines cease to function, the games are unplayable unless they are ported or emulated. Even more worrying are the trends in digital rights management currently implemented. In order to combat piracy, game makers have begun to implement a variety of measures that may cause the complete disappearance of their games in the future. Always-online games depend on connections directly to

company servers, which authorise and sometimes provide the content present in the game, and once these servers are closed, the game becomes unusable and is effectively gone. Even games that do not require a constant connection may be using specific digital rights management software that issues a certificate, allowing the game to be executed in the authorised hardware, and, again, should this service stop working, the game becomes unplayable.

While most art games do not need to worry about these systems, some, like Journey (2012), a game already in the Victoria and Albert Museum's collection, will have to contend with this situation. In these cases, working closely with the companies who run these systems and negotiating permissions to alter the DRM and networking functionalities of the games in question may be the best approach.

Even web browser-based games run this risk, as the software used to make them may be deprecated, either due to security reasons or to better technology being invented. Flash games are a prime example of this. Currently, Adobe, the makers of Flash, are planning to stop support and distribution of the software and its player in 2020. The famous website Newgrounds, which became a popular outlet for artists specialising in Flash video games, has begun a migration process that will allow it to be free of Flash in the coming years.

The final issue with video games is versioning. Versioning is a consequence of video games being modified through patches by their developers after release. One of the most popular examples is Hello Games' No Man's Sky(2016), a game that lacked multiple features when released and has been changed by Hello Games significantly in its life time, making it an essentially different game from what was offered in release. For this reason, keeping track of game versions is crucial in the curation, as what visitors and curators may see today may not match what the game will be in the future. For an even more extreme example, see Final Fantasy XIV (2010), where the game was remade in its entirety and does not resemble the original game, as seen on release, at all.

Time And Space In Video Games

Video games have a peculiar relationship with space, which refers not to geographical space but to the platform they are available on. Some games are playable on windows computers, others on Mac computers, some do not require a

specific platform, and so on. As most video games are meant to be consumed privately, this information is crucial for visitors to be able to procure their own copies. Therefore, a finalised attribution for a game could look like this:

> Journey (2012)
> Game Designer: Jenova Chen
> Studio: thatgamecompany
> Video Game (Playstation 3 / Playstation 4 / Windows Computer)

Time also has practical implications in video games, as they are usually created with use in private in mind. As such, some games may have extremely long play times while others may never finish. Curators then may have to accept they may never finish exploring the game before documenting or presenting it, and when displaying it, decisions have to be made as to how long is the minimum time necessary for a visitor to begin to grasp the significance of the work. Art Games tend to be less prone to extended play time. However, examples such as Pippin Barr's *The Artist is Present* (2011) would require five uninterrupted hours of gameplay should one wish to get to the end of the experience.

For shorter experiences, setups do not need to be complicated: usually a console / computer or multi-user kiosk should suffice. For longer experiences, a booking system and a vicarious participation setup could allow for longer play sessions. A final option is to allow visitors to drop in and out at their pleasure with a set maximum time of 10 minutes. Of course, this last suggestion only applies to less complex experiences where the learning curve is minimal; the more complex the experience, the better it is to set a booking system which allows time to instruct players on how to operate the experience.

Types Of Video Games By Hardware And By Genre

Video games have slowly developed their own taxonomies, which would be important to cover, and which allow for a better understanding of the medium. The first taxonomy presented covers the different types of hardware games may utilise, and while some may function in one or various systems, some are exclusive to one or another due to technological or marketing reasons. The second taxonomy analyses different genres of video games. Understanding these categories will allow curators to more easily predict the philosophical and practical direction a gaming experience will take, even before experiencing the work.

By Platform

The following gaming devices are listed by popularity according to the Entertainment Software Association's 2018 report:

- Personal Computers
- Smartphone
- Dedicated Gaming Console
- Wireless Device
- Dedicated Handheld System
- Virtual Reality Devices

By Genre

The following genres typify the most common genres available. Most video games will implement one or more of these genres, creating things such as action-adventure or Puzzle Platformer.

Action: These games prioritise physical dexterity and reflexes; some of the earliest games fall under this category. Examples of games in this category include: Pong, Kosmosis, and Braid.

Adventure: Adventure games focus on puzzle solving and exploration over action. Examples of adventure games include: Myst, Journey, Firewatch, and most interactive fiction.

Fighting: This type of games focuses on martial arts competitions and relies heavily on the physical skills of the player. Examples include: Street Fighter, Tekken, and Mortal Kombat (sic).

Platformer: Platform games emphasise traversing the game world and exploration. Jumping is prevalent. Examples include: Super Mario Bros., Braid, and Fez.

Puzzle: These games put emphasis on intellectual challenges and have a low barrier of entry. Examples include: Myst, The Witness, and Return of the Obra Dinn.

Role-playing: Role-playing games involve inhabiting the life of a character, often choosing skills and dialogue responses, creating thus a living world. Examples include: World of Warcraft, The Witcher 3, and Final Fantasy.

Sandbox: These games allow creative freedom for the player to explore and create within them, often within a themed game world. Examples include: Minecraft, Terraria, and No Man's Sky.

Shooter: Shooter games emphasise armed combat and challenge players through dexterity and spatial awareness. Examples include: Doom, Wolfenstein, and Super Hot.

Simulation: Simulation games attempt to recreate a facet of life as accurately as possible. The challenges posed are usually intellectual. Examples include: The Sims, Papers Please, and This War of Mine.

Sports: Sports games focus on sporting competitions of all kinds. The challenges are often physical. Examples include: FIFA, Madden, and Forza Horizon.

Strategy: These games require planning, problem solving, and devising strategies to overcome gameplay challenges. These are often military in nature. Examples include: Age of Empires, Starcraft, and Civilization.

Best Practice

Before engaging in any form of curation in video games, due to their interactive nature, it is necessary to at least observe the game being played, although playing the game in person is the preferred option. This will allow curators to understand the relationship between player and game. For this purpose, it is not necessary to be proficient in the game but simply to understand its mechanics and functions. Should you not be able to play the game to completion, it is recommended to find play throughs of the game; two of the best options for this are YouTube and Twitch.tv. It may be useful to add the words "no commentary" to the search so you find videos free of extraneous commentary.

For other issues of curation, it is worth looking at Helen Stuckey's masters dissertation of her experiences curating video games not just as objects of entertainment but as culturally important objects:

> To promote reflection on gameplay mechanics themselves, curators may consider presenting works that feature similar gameplay for contemplation. Juxtaposing two video games such as *Robotron 2084* (Eugene Jarvis & Larry Demar, 1982) and *Smash TV* (Eugene Jarvis & Mark Turmell, 1990), both of which feature gameplay that is dependent on a variation of a swarm mechanic, is one means of highlighting a particular Artificial Intelligence and its resulting gameplay (Stuckey 2010 p.66-68).

To represent video games in the twenty-first century, it is becoming increasingly apparent that the curator must look beyond the designed object and address the cultural production that surrounds games. The role of the curator now extends beyond the idea of an 'art of video games' as framed exclusively through traditional ideas of the design object, which characterised *Game On* at its inception. In seeking a fuller understanding of video games as cultural objects, the curator must embrace the broader cultural activities of the communities of players of video games. This territory offers the curator possibilities for representing elements of the played game and acts of re-mediation of the playing with the game that is characteristic of contemporary media practice (Stuckey 2010 p.72-73).

Hardware

Ideally, all video games in an exhibition should be playable in one way or another. In the gaming industry, it is common to consolidate all games into workstations, allowing visitors to choose whichever game interests them most. This arrangement may work in cases where space is limited and all the games in question share the same platform. For most situations, however, it is best to give each game its own kiosk. This will communicate the importance of each game as an individual artwork.

Depending on the platform, display will vary and a choice must be made as to whether any games merit vicarious participation or if individual participation is enough. For individual participation, simple kiosks or workstations will suffice. For games where vicarious participation is desired, more complex solutions will be required. Finally, as a rule of thumb, short simple experiences will be best suited for individual participation, while longer and more complex works will benefit from vicarious participation.

General Recommendations

- If a game is available in a variety of platforms, prioritise the PC version over the console version for ease of use.
- For PC, determine how powerful the computer required will be. For most art games, this will not be an issue and almost any computer made in the last 5 years will suffice. Certain games will require more powerful setups, and in most cases, a living artist will be able to offer suggestions and minimum requirements. If the artist is not available, the IT department should be able to assist you.

- Make sure your computers have dedicated graphics cards and always aim for the highest possible option, as this will give you better performance as well as somewhat reduce the need to upgrade the video card too soon.
- If the games are older than six years, you must check for compatibility. Six years is the average lifecycle of a game console, which may mean your software will require sourcing of older hardware.
- For PC games, the easiest way to check for compatibility is to google the phrase “will X video game run on Y operating system”, where x is the name of the game in question and Y the operating system your current computers operate in. Again, IT should be able to assist.
- Most DOS games and some windows 95 and earlier games will require either emulation or to find updated versions. Keep in mind updated versions often offer improvements such as enhanced graphics. Consider this before taking this option, as it may alter the meaning of the works in the context of the exhibition.
- In the case of older consoles, currently the best approach is to find older systems being sold in websites such as Ebay. Make sure these systems include controllers and all required cables or you may be stuck with an unusable system.
- If finding a console is a problem, ROMs may be your best option. ROMs in the gaming context are copies of games made into files that can be played on personal computers without the necessity of the specific console. For cultural institutions, the best approach is to own both the original console and a legitimate copy of the game, even if it is unusable, and either make your own ROM or download one from the internet. These can be downloaded from various sites from the internet such as Vimm’s Lair.
- If you are using ROMs, you will require the appropriate emulator to make the copy work as well as an appropriate controller. Remember to virus scan anything that is downloaded from the internet. RetroArch is a popular choice with plenty of options for running a variety of games from different console generations. The following link has a step-by-step guide on how to set up RetroArch.
- In the same way traditional video art requires specific hardware in order for the work to display correctly, all pre-2000’s video game consoles were designed to work with CRT televisions and will be distorted in wide screen televisions. The solution can be to use CRT televisions for these kinds of

games or to use a console upscaler such as the Framemeister XRGB-mini. Both solutions will resolve the resolution issue.

- When adjusting the upscaler, make sure you preserve both aspect ratio and pixel size. Not doing so may result in severe graphics issues.
- Try not to go into resolutions above 720p for emulated games.
- For PC games, it is less of a problem, and in some cases, a non-issue. If the image becomes distorted, the best option is to run the game in windowed mode.
- A good resource for retro gaming is the YouTube channel My Life in Gaming. For overall troubleshooting, PC Gaming Wiki is a good resource.
- Other hardware that may be required for video games are controllers, mice, keyboards, and other peripherals. If at all possible, try to use controllers made by the console manufacturer. If this is not possible, aftermarket solutions can be used but may lack functionality or be more fragile.
- On PCs, the best controller available is the standard microsoft xbox controller.
- Make sure you use a wired version to reduce battery issues, theft risks, and connectivity problems.
- Keyboards and mice should be no problem, and for the purposes of gaming in an exhibition context, all that matters is that the movement is smooth enough.
- Other peripherals may limit the flexibility you may have in resolving issues. One example are light guns, which will not work in modern displays and require a CRT TV.
- For art games, the artist may have created unconventional control interfaces. In order to not damage the originals, it may be wise to recreate these controls and keep the originals in storage. This recreation will require the support of the maker community or gaming enthusiasts whom should be contacted as soon as possible.
- In modern consoles, it may be necessary to modify controls and disable the Home button. This will effectively lock users out of the system's configuration and prevent them from accidentally leaving the game. To disable the home button, the only option is to open the controller and physically remove the button or glue it in place.
- For keyboards, a good technique for disabling keys is to open the controller and use tape to stop the membrane from closing the circuit. This disables as many keys as you wish without damaging the keyboard permanently.

- One final option is to 3D print custom controller bodies that have had the superfluous buttons removed.
- As video games can be intimidating to some, and only when experimenting with the controls is not part of the experience, a simple graphic explaining what each input does can be very helpful for visitors. See Figure 48.

Figure 48: Simple controller layout diagram. Make sure not to label unused buttons to avoid information overload. Image: Xbox.com

- Disable rumble technologies unless the game requires them, as these can be very confusing to those not used to such features in games.
- Keep a second fully working controller aside to allow staff to control the systems if the need arises. Ideally, this controller should be connected with a physical cable to expedite the process.
- Have at least a few spare controllers to replace broken or missing ones.
- For modern video games, enable color blind friendly options or indicate that these features can be enabled upon request.
- Avoid salon hangings of video games, as the sensory overload can become overwhelming. It is better to treat video games the same way as video art and present works independently.
- In order to avoid noise from becoming obtrusive (in cases where multiple games are present), provide headphones for each individual experience.
- When designing display furniture, make sure air holes are cut on the back and the sides. These vents will prevent overheating. As a general rule, allow for at least 10 cm above, behind, and to the sides of every device. Fans in the enclosure can also help reduce heat accumulation.

- To test for overheating, turn on the console and play the game for the same length of time as your opening times. It is important that the game is being run all the time, as devices on standby will not generate the same amount of heat.
- When working with older computers, you may come across a few ports you may need to familiarise yourself with. These ports have now been replaced with USB devices; however, if you require to connect a legacy device to a modern computer, in most cases, it is possible to do so with an X to USB converter, where x is the old port. Figure 49
- In some cases, PS2 ports may have issues with adapters; for this reason, the recommended adapter should be an ACTIVE PS2 to USB adapter.
- Determine what type of signal your devices require; PAL, C-Cam, and NTSC are the three standards. Televisions are often compatible with one and not the others; thus, ensure you have the correct device for your region. In cases where you cannot get the correct device, you can buy PAL to NTSC, NTSC to PAL, C-Cam to PAL, and C-Cam to NTSC converters. Modern televisions tend to be able to handle both; however, this has to be tested prior to the exhibition.
- If at all possible, devices should be wired, as this will make network issues easier to solve given that, by nature, wired connections are more reliable.
- Peak suppressors and enough power outlets should be available for each individual kiosk. At the very least, you will require two outlets per device, one for the display device and one for the gaming unit.
- Ideally, designate support staff to be at hand to explain operation as well as solve tech support issues related to the video games. In cases where this is not possible, invigilators should have some basic understanding of the operation and notify relevant staff of any issues.
- Motion sickness, while not as prevalent as in VR, is still an issue and staff should always be at hand ready to provide assistance. Keep in mind this can happen very suddenly and be ready to react.

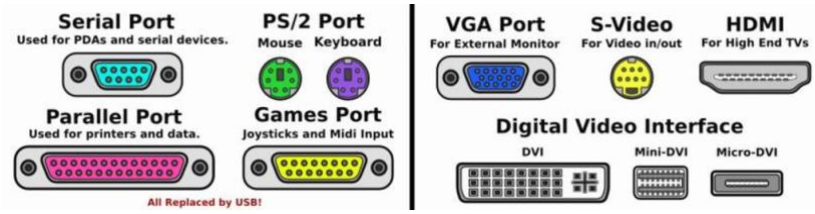

Figure 49: These are some of the most common ports you may come across with in older systems. Most can be replaced with X to USB adapters. Image: techyv.com

Individual Participation

- Kiosks for this mode of participation can be very simple. In the case of a PC or a game console, all the visitor needs is access to the controls (either a game pad, joystick, or mouse and keyboard) and a screen. All other technology should be kept away from the visitor's reach and kept under key.
- If you foresee a certain game being extremely popular, a space-saving option is to create multi-user kiosks. For more information on multiuser kiosks, please go here.

Vicarious Participation Displays

These setups are to be used in cases where either the hardware used is unique and/or very complex, where the artwork requires long play times, but more importantly, where it would be interesting for others to see someone else play, either because they lack the confidence to engage with the work, cannot play it, or simply have no interest in the interaction facet of a work.

Vicarious participation does not necessarily need to be massive in scale; at times, a simple side room with space for a player and a small audience may be enough.

- Determine if the participant playing has a performative and significant function or if they are simply controlling a video game. In some cases, the person's action of playing holds important meaning or may be visually interesting. In other cases, it is simply a person standing in front of a screen.
- If there is a performative aspect, you may wish to integrate this into the display. If this is the case, you will need to allocate enough space to the player as to not impede their motions and keep spectators at a safe distance.
- Players should always have their own screen, this will allow the participant to have the intended experience and not have to adjust to suit the spectators, as they are effectively engaged in what is usually an intimate personal experience.
- By using a video splitter box, it is possible to have a smaller screen for the participant and a projector or video wall for the rest of the public. In this manner you can generate a better viewing experience for everyone without compromising gameplay or visibility for all involved.
- When choosing video splitters, first you have to determine which video outputs and inputs you require. It is possible to find splitters that may allow

you to switch from one input to a different output. An example of this is going from composite video to HDMI. The nomenclature for such devices indicates the input (i.e. the device where the video comes from) to the output (the type of connector your monitor or screen uses). (Figure 50).

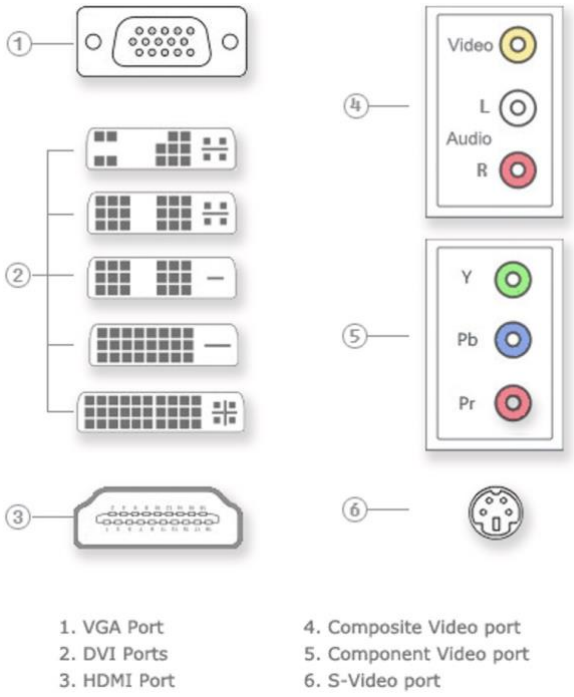

Figure 50: List of the most common video ports. Image: optishotgolf.com

Basic Questions

Are all video games commercial action spectacles?

While this may be the general perception by the public at large, video games have expressive and aesthetic potential, which has been exploited by artists in a variety of ways.

What are some examples of art video games?

Examples of art video games include: Pippin Barr's *The Artist is Present* (2011), Molleindustria's *To Build a Better Mousetrap* (2013), and Porpentine's *With Those We Love Alive* (2014)

Are there artistic commercial games?

While scarce, not all commercial games are devoid of artistic merit, some examples include *Spec Ops: The Line (2012), This War of Mine (2014), Flower (2009), The Last of Us (2013), and Hellblade: Senua's Sacrifice (2017)*.

Do all video games have to be playable?

While vicarious participation is encouraged, it is also important to remember these artworks were meant to be played, and while commercial shooters may require very complex controls, most art games tend to be simple in their control schemes. Making video games non playable negates the very reason they were made as games and turns them into film yet, due to the lack of choice and interaction, lose all meaning.

Can CRT games be played in modern widescreen TVs?

For the most part yes; however, you can expect distortion and unresponsive gameplay. To fix this, you may want to use a console upscaler to retain image fidelity as much as possible.

Case Study

For an example of a vicarious participation setup, we can look at FACT's Time and Motion exhibition, where they showcased Molleindustria's To Build a Better Mousetrap (2013). Participants could approach the workstation on the left (Figure 51). The actual CPU is hidden within the plinth while the visitors have access to a 23-inch monitor and a computer mouse. This allows players to have control of the game without blocking the secondary projection, which is meant for those that wish to only observe. For this project, FACT decided that a simple computer monitor would be insufficient to attract visitors to the game and instead utilised the bright colors and cartoonish graphics of the video game as a means to attract attention to the game as well as to share the gameplay with other visitors in the space. This would in effect allow those intimidated by the concept of playing a video game to still experience the game in a limited way, and if the player was a friend or relative, it would allow them the opportunity to play by proxy by issuing recommendations to the player.

In order to avoid user confusion, the screen used for the individual display was a touchscreen. This solution effectively stops visitors from exiting the game and makes the game simpler to control. As for memory making, photographs, floor plans, and technical specifications, they remain in the archive while the game itself can be found in Molleindustria's own web page.

Figure 51: Molleindustria, 2013, *To Build a Better Mousetrap,* installation shot, Time and Motion: Redefining Working Life, FACT Liverpool. Image FACT.

3.6.3 Computability

3.6.3.1 Virtual Reality

Virtual Reality, or VR, can have different meanings depending on the professional and academic backgrounds. However, for the context of this project, I will use Michael Heim's definition:

> Virtual Reality is an immersive, interactive system based on computable information (1998). Heim then proceeds to present the three "I's" of VR, which are immersion, interactivity, and information intensity. Heim defines immersion as the ability of the system to shut out the external world in order to make the person believe they are in a different space. Interaction refers to the computer's lightning-fast ability to change the scene's point-of-view as fast as the human body can alter its physical position and perspective. Finally, he defines information intensity as the notion that a virtual world can offer special qualities like telepresence and artificial entities that show a certain degree of intelligent behaviour
>
> (Heim, 1998, p.7).

While Heim provides an adequate definition of what a VR system is, his definition is now lacking, particularly in the interactivity addendum. As Heim's book was published in 1998, he was obviously working with older technology, which no longer reflects the current status of VR. When Heim describes interactivity, in layman terms, he is referring to the ability of the VR system to track head movements and maintain the appearance that the person is in fact looking around a virtual space. As can be seen in Virtual Realism (1998), the technologies Heim worked with include the CAVE system, where the spectator is located in a room where the walls function as the screens and the visitor moves around this space, and rudimentary uncomfortable VR headsets with body tracking technologies, which allowed for limited interactions, both powered by what he describes as incredibly powerful computers.

Nowadays, VR headsets as light as a small cardboard box can be bought for less than 5 pounds, while the more advanced versions, like the Oculus Rift with its high-resolution screens and motion controls, sell for around 400 pounds. These new versions of VR (the cave system has been almost abandoned by now outside of certain niche applications) offer a greater degree of interactivity, allowing the user to interact with other individuals and artificial intelligences in a variety of ways, including the manipulation of both virtual and real world objects, the creation of new objects within these spaces, and even the modification of said spaces. This

progress has led to a point where the mere action of head-tracking is no longer considered interactive anymore. In order to refine the interactivity clause by Heim, I propose the following: Interactivity is the ability of the system to respond and present new interactions to the person or persons in the system, often allowing the application of force in the virtual world.

As an important distinction, virtual reality spaces like the CAVE system would be better defined as either a form of augmented reality or even extended reality (XR), in which VR and AR (augmented reality happens when real world objects are integrated into the virtual world) are utilised to potentially create an even more immersive experience. At this point, its implementation has been limited and has been achieved with various degrees of success.

When working with VR, curators have a variety of conceptual challenges to deal with. Interactivity, the immateriality of an artwork and the absence of a physical artefact, a potential lack of clear authorship, and the mutability of the experience through time are the main concerns.

Interactivity relates to the misconception that just because something involves a computer it must be interactive. In fact, not all VR experiences require interaction in a significant way and are mostly limited to tracking where the spectator is looking. It is important for curators to understand this distinction, as it changes the possible interpretations of a work. Currently, most VR art has tended towards passive film-like experiences instead of interactive experiences. However, more and more artists, such as Marina Abramoviç, have begun to experiment with interaction in the digital space.

Physical immateriality can be a complex problem to grasp for curators used to engaging with artefacts in one way or another. However, a simple metaphor may help clarify the concept: Just like music is not the sheet music, the record player, or the recording itself, VR is not the headset or even the screen it is displayed on. Instead, the artistic VR experience occurs in the connection between the participant and the artist through the software. Practically, this means that when working with VR, the importance of the work lies in presenting the experience as closely as possible to its original form. It also means that presenting VR in a way that does not respect this concept is, in essence, diminishing the work. To continue the previous metaphor, presenting the sheet music for a piece is not the

way the music is meant to be experienced and is in fact an unsuitable substitute. It also highlights the importance of preserving software over hardware.

Authorship in most new media art can be a complex and delicate subject, as it usually involves different individuals working on the guiding ideas of another creator. Even when a collective group is involved, there are hierarchies that we need to be aware of in curation. There may be software engineers, robotics experts, networking specialists, and other individuals, often not considered "creative", involved in the creation of new media works, and curators need to be aware of this relationship. Further discussions on authorship can be found under the curation section.

Mutability is the final characteristic that a curator must be prepared to engage with. As digital works, VR artworks can be refined from exhibition to exhibition. As resources become available, graphics may change, the quality of motion tracking may improve, or the entire work may be moved to better hardware. Each of these versions builds on the others and, thus, modifies the work. In software development, this is called versioning and is tracked with incremental numbers. Decimals are used for small improvements and full numbers for significant changes. In presenting art worlds, it is useful to document which version of the software is being presented, as this allows future curators to more easily track changes to the artwork.

One final consideration is to be able to separate VR art from VR that enables looking at art. The former involves works where an artist utilises VR as a medium of artistic expression. The latter involves experiences such as walking into a van Gogh painting or moving around a virtual museum. While the recommendations set forth here are focused on VR art, most can be applied to other VR experiences.

Time And Space In VR

One final consideration before approaching VR in an exhibition context is to take into account the length of the experience. VR experiences may take a few minutes to fully explore while others may require multiple small viewings or an extended period of time to fully experience them. This will shape the form your exhibition space will take, since you may want to limit the time users spend with a particular work or allow them free rein.

Limiting experience time, while good for exhibition turnover, may lead to negative feelings in the visitors. It also has the potential to limit understanding of the work. Alternatives to limiting experience time may include the addition of more kiosks, sharing the experience through a projection of what the participant is seeing, creating a sign-up sheet with time slots for visitors to have a predetermined bracket of time, or offering off-site access options if possible. While short experiences offer no such issues, the longer the experience lasts, the more important it is to offer at-distance options to visitors, in which case, the experience may be considered a demo or teaser for the full experience.

Of course, in VR, space exists as two different concepts. One is the metaphorical space the visitor enters once the headset is on and the other is the real world space. A deeper discussion of metaphorical space can be found under the curation section of this manual.

Physical space in VR depends on the degree of interaction required by the user. The more limited ones, including those that could be defined as movies or guided tours, can be experienced while seated and require the least amount of space. Other VR artworks require people to have freedom of movement. In these cases, it is necessary to ensure the visitor cannot hurt themselves by hitting walls or pedestals or get entangled with any cables. Below you will find more detailed recommendations.

Types Of VR

Tethered VR

These setups depend on a high-powered computer to handle all the computation of the simulation as well as its graphics. By extension, these headsets tend to offer the best graphics as well as the more responsive and interactive experiences. As a trade-off, these headsets must be tethered to the computer and, while adapters exist to turn them into wireless headsets, some trade-offs must be made. These include latency (a delay between the user's actions and the computer responding and displaying the results of such action), the need to charge batteries every five hours or less, and connectivity issues due to interference or other external factors.

These are some of the most flexible setups for VR, as they offer the widest range of control options and compatibility. It is also necessary to make sure the software to be

used is compatible with the specific hardware, as each manufacturer has its own apps and supported experiences. Should it ever be released, Acer's OJO 500 is an ideal headset for institutions, since its design allows for easier cleaning between uses and offers compatibility with Steam VR and the Microsoft Store (Lily 2018).

Figure 52: Oculus Rift S with controllers and sensors. Image: Oculus

Figure 53: HTC Vive being worn. The tether to the computer can be seen coming from the back of the headset. Image: Vive.com

Standalone VR

These headsets contain a small computer in charge of running the software. As a consequence of their small size, their computational power is lower, thus lowering fidelity in all areas. Battery life is also a concern. As with tethered VR setups, one needs to make sure that the software to be used is compatible with the chosen headset. Some may allow the use of motion sensing controllers or video game controllers to control the experience.

Figure 54: Oculus Quest. Example of an untethered headset. Image: Oculus

Smartphone Head-mounted VR

These headsets use mobile phones as their display and computational hardware and use simple head mounts to hold the phone as the screen. The quality of the experience depends on the power of the phone used, with more recent models giving a better experience. As mobile phones are not dedicated VR devices, battery life and overheating can be very limited. These headsets are very flexible, as programming for mobile phones tends to be much more accessible to artists and institutions. One of the issues with this approach is the fact that certain phones may be priced above 1000 USD and the head mount itself adds between 50 to 150 USD on top of that.

Figure 55: Samsung Gear VR is an example of a mobile phone solution. Pictured: headset and controller with limited motion tracking. Image: Samsung.com

Cardboard VR

Cardboard is the most affordable head mount available, as they are often made out of cardboard or cheap plastics, and prices go between 5 USD and 15 USD for the more expensive ones. These VR headsets offer the most limited interactivity, often limiting it to looking at an object for a length of time to activate it. These headsets also use smartphones for their operation. However, since the interactivity is so limited, they are mostly used for VR films where there is no interaction at all, thus allowing for the use of cheaper phones.

Figure 56: Google Cardboard. This is the simplest VR option available. It is affordable and simple to use at the cost of interaction and better motion tracking. Image: Google.com

Playstation VR

While technically a low-cost version of a tethered VR headset, this is a gaming headset and operates under the Playstation Store, making it useless for artists and museums. The experiences it provides are limited to what Sony allows and the entry costs to publish in the platform are prohibitive (Sony PlayStation VR Analysis 2017).

Figure 57: The PSVR is a dedicated gaming headset. Its use for artworks is highly limited. Image: Playstation.com

VR Immersive environments

These are large scale VR experiences that allow for a more social experience, as their capacity fluctuates between 5 and 700 people. Of course, the level of interaction is lower than that of tethered headsets but can respond to multiple individuals at the same time. They can respond to motion tracking sensors, treadmills, tablets, and other modes of input except touch. Their biggest downside is the distortion that may occur in cases where the user is at the edge of the walls. As with all other types of VR, their degree of interaction and the size of the space depends on the artist and what they envision the piece to be. Finally, it should be noted that unlike other forms of VR, the experience is limited to one collective scene from one point of view and from where multiple users experience the same visuals, although they may move and interact within that scene freely.

There are two main styles of VR Immersive environments: the ones based on the Cave automatic virtual environment (C.A.V.E.), which is enclosed by 4 walls where the virtual world is projected on and supported with 3D glasses that allow for the illusion of objects floating in front of the user. The other implementation are 360° projection domes where the projection is done in a hemisphere, thus allowing for a more seamless experience, as there are no corners to break the illusion. Depending on the structure, projection screens can be cylindrical or partial hemispheres. The closer to a sphere the structure is, the more immersive the experience can be.

Figure 58: Igloo Vision's system; provides 360° of vision and its design allows for a variety of content to be presented within, including interactive content. Image: igloovision.com

C.A.V.E. is an older system and is much more limited than projection domes due to the size of the space, the lack of flexibility in terms of the experiences available, as well as the loss of immersion due to the existence of corners.

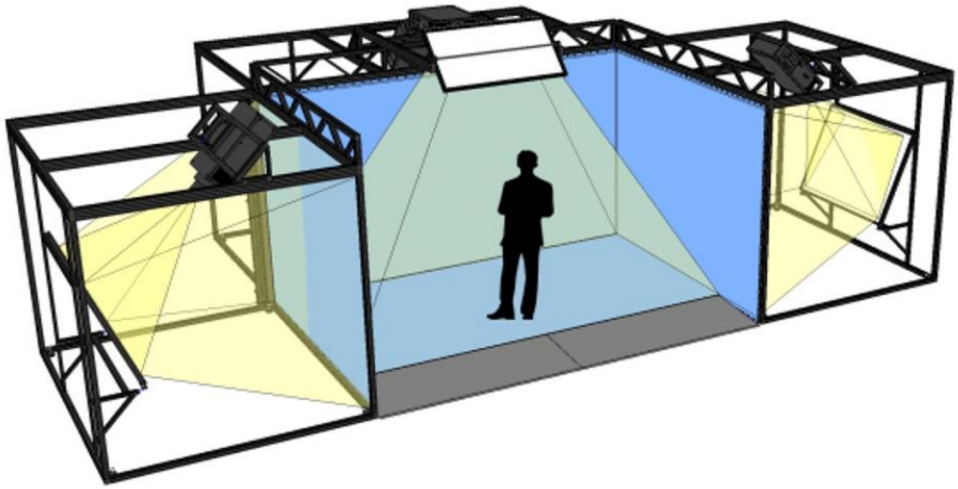

Figure 59: The C.A.V.E. system is a predecessor of the Igloo. As can be seen, the setup is much more cumbersome. Image:visbox.com

Best Practice

When working with VR, prior to any planning, it is important to arrange a meeting with all the artists or, in case the artist is not available or living, documentation must be sought to determine their particular needs. It is therefore important for curators to ask the following questions:

- Is there previous documentation on installation that can be used as a reference?
- Is the institution in possession of the required media rights?
- Which hardware will the work be using?
- Which are the space requirements? Is this a standing/free-moving experience or is this a seating experience?
- Will the artist provide their own hardware? If not, which equipment does the institution require?
- Is an internet connection required?
- Are the hardware and software usable as they are or is there a need to convert the experience into new software?

Armed with these answers, it is important to include these responses in the exhibition binder and permanently include them in its documentation. Throughout the project this information must be amended and extended as a way to create a history of the work's evolution and the challenges encountered.

Hardware

Technical Considerations for All VR Headsets

- First, consider the Inter-pupilar distance of a headset. IPD is the distance between a user's pupils and is crucial for the proper alignment of a headset's lenses; otherwise, users may suffer discomfort and have a lower quality experience. Some headsets like the Oculus Rift S do not allow for such adjustments to be done on the fly. While not crucial, having the ability to adjust IPD may reduce problems with users being uncomfortable and even tired after using a headset.
- When artists bring their own equipment, ensure voltage converters are available. The best resource for determining voltage and plug compatibility is the International Electrotechnical Commission's Plugs List. Simply compare

your country's voltage and plug type with the hardware's country of origin. If they do not match, adapters can be bought at any electronics store.

- For experiences where the participant has to be standing up, a minimum of 2 meters by 1.5 meters (6.5ft x 5ft) of free space is recommended, and a maximum distance between the CPU and the headset of 5 meters (16ft) (SteamVR FAQ).
- Make sure there is space to set up the motion sensors for the VR hardware. Each manufacturer has different requirements regarding height and positioning, and it is recommended that you refer to the documentation included with the hardware. As a recommendation, attaching sensors to walls or other stable hard-to-move supports is recommended, although tripods are also an option. Nowadays, not all VR headsets require sensors and this step may be skipped.
- If the experience does not require network functionality, this function should be disabled to avoid unauthorised usage of web browsers and app stores.
- If the experience requires network functionality, parental controls and strong passwords should be used to avoid usage of the web browser and app stores.

For example, Nicola Plant's Sentient Flux (2013) (Figure 61) is a VR work that uses a tethered headset and requires space for the user to not bump into objects or people. This is important, as the experience requires the visitor to play with floating "particles" and move them around by waving their hands around. If there is not enough space, users may injure their hands or hit others.

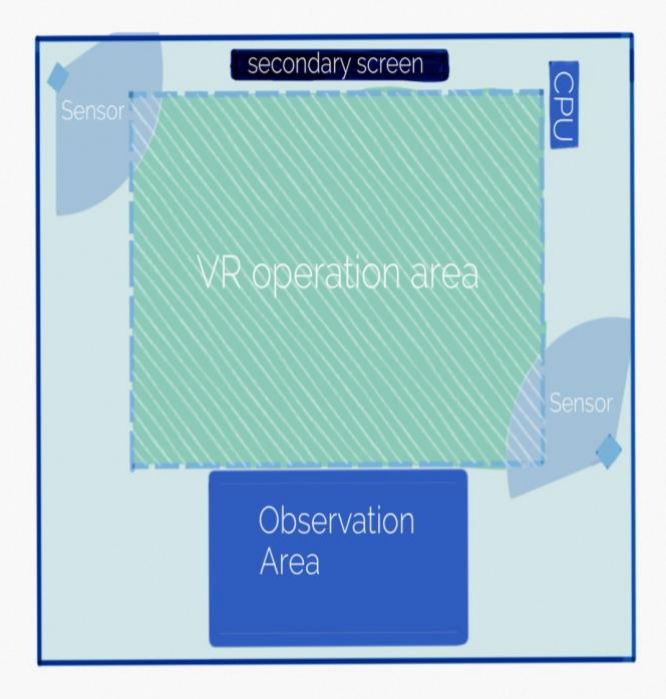

Figure 60: Example layout of a VR setup. Based on the SteamVR recommendation layout.

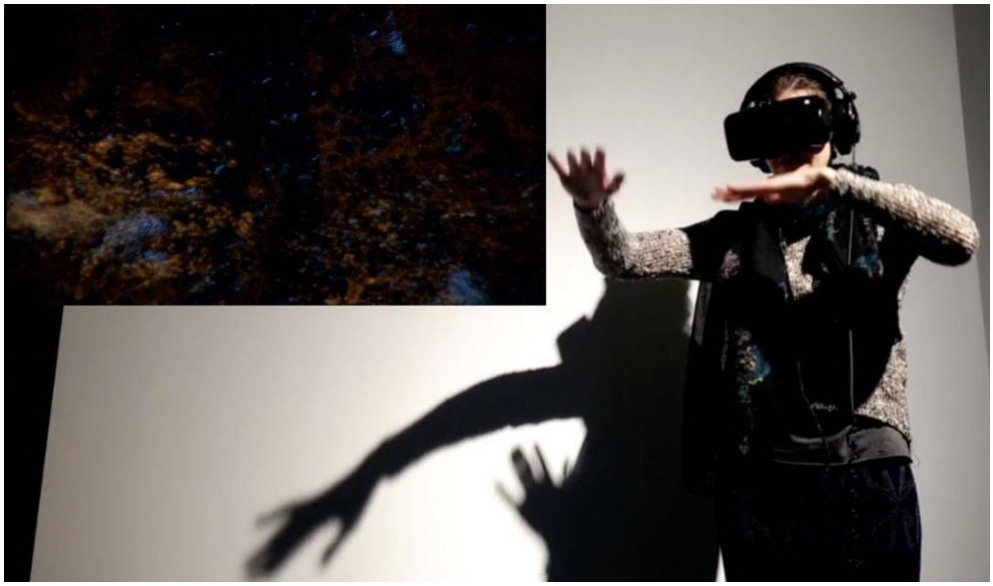

Figure 61: Plant, Nicola, 2013, *Sentient Flux*, VR. The participant requires space to make hand gestures and look around the virtual space she is in. While she sees an infinite virtual space, in fact, she is limited to the physical space.

Figure 62: Man with headset tethers, sensors, and camera. Image: Nicola Plant

Figure 63: Modigliani VR at TATE. Due to the many headsets, vicarious participation was not considered necessary. Unfortunately, this makes the experience impossible to use by those who suffer from motion sickness. Image: Tate

Health Considerations

- As the effects of VR use on children's health have not been thoroughly explored, it is recommended that no person under the age of 12 should be allowed to use these devices.
- If possible, replace any foam facial interfaces with pleather ones for easier cleaning.
- For hygiene reasons, disinfectant wipes are to be provided as well as hypoallergenic wipes to remove any leftover cleaning products in order to reduce the risk of allergic reactions.
- Another option worth exploring is the use of Disposable Virtual Reality Hygiene White Masks. These masks are used as a physical barrier between the user and the headset and are disposed of after use.
- As motion sickness is a known side effect of VR in susceptible individuals and since it is impossible to determine a priori whether a certain participant will present symptoms, motion sickness bags and seating arrangements for those affected are recommended.
- Signage informing visitors of the risks involved in the use of VR should be placed as close to the device as possible.
- Ideally, in any space where VR is involved, invigilators should be ready to provide assistance to visitors who feel ill or disoriented. Special care should be taken to prevent users to wander outside the designated area.
- Do not leave visitors unsupervised, as they are not aware of their surroundings and are very vulnerable.

- Do not allow people to enter the interaction area while somebody else is using it. Allowing this to happen will result in people getting hit or tripped.
- Keep a close eye on the tethers; as visitors spin around, they may become entangled and injure themselves or damage the hardware.

Technical Considerations for Tethered VR

- In order to work with VR within the museum context, there are certain technical considerations that need to be met.
- Grounded electrical outlets must be provided as well as a surge protector with at least 3 outlets (CPU, monitor, and VR headset).
- In the case of tethered VR, a computer that meets the minimum technical requirements is necessary. As software and hardware continually evolve, it is hard to recommend a baseline system. The best option is to contact the IT departments who should be able to recommend a suitable system. In some cases, a custom-built computer would be a better investment over pre-made computers purchased through traditional channels.
- Avoid laptops, since even gaming laptops may have conflicts with VR technology and are harder to troubleshoot and upgrade.

Technical Considerations for Smartphone Head-Mounted VR

- In the case that computers not built or purchased for the project are to be used, SteamVR's benchmark utility should be used to test the suitability of the device. Link: https://goo.gl/V5vJHL
- Devices and software should be updated to the latest stable build as soon as you know they are needed. Further updating should be delayed until after the show has finished in case the latest updates are unstable in any way. Unfortunately, for connected works, this may not be possible at all, as the software may update itself automatically or refuse to work until upgraded.
- Only upgrade during a show if there is a high security risk.

Technical Considerations for Standalone VR

- Battery life is always a concern and, thus, standalone headsets must be kept charging while not being used, or if the batteries can be removed, then two spare batteries should be kept nearby and the depleted battery charging meanwhile.

- To prevent theft of the unit, an anti-theft tether is recommended; various commercial solutions are available. Another viable option is to design your kiosks in a way where the cables feeding into the computer cannot be pulled through the cable opening. In this way, the cable connecting the headset to the machine becomes its own security tether.

Figure 64: Anti-theft tether for VR headsets. The small black box attaches to vital cables in the headset and is then connected to an alarm system.

Technical Considerations for Smartphone Head-Mounted VR

- An effort should be made to limit access to the smartphone held within the visor, both for security reasons and to block access to the telephone's interface and configuration.
- Between uses, the visor should be checked for battery life as well as to make sure the proper experience is loaded and not something else.

Technical Considerations for Cardboard VR

- It is mostly recommended only for situations where budgetary reasons prohibit the use of more dedicated headsets and should ideally be either sold to the visitor or given away for free.
- These headsets often lack the ability to keep the headset enclosed, thus making security an issue unless each visitor uses their own mobile phone.
- If visitors are providing their own phones, a QR code or shortened hyperlink should be provided for the visitor to download the required software.
- As these headsets are most commonly made of cardboard, they should be considered disposable.
- May be justified as a marketing expense, as the headset becomes a souvenir for the exhibition and provides a conversation starter even outside of the museum.

Technical Considerations for Immersive Environments

- In the case of the C.A.V.E. and similar large-scale setups, the requirements vary depending on factors such as size and degree of interaction.
- In general terms, it is best to avoid C.A.V.E. setups for their cost and lack of flexibility.
- Certain domes can be set up outdoors, freeing up gallery space.
- Various companies, such as Igloo Vision, offer complete packages where the client provides the content and the space, and they will design, install, and operate the experience, thus freeing resources and upkeep.
- Keep in mind these projection technologies cannot render the ceiling or the floor of the experience and so the content must accommodate these limitations.
- Ensure you have an adequate space for the setup. The smallest of these domes require at least 5 m^2 in area and 5 m in height.
- Make sure that at least three 13 Amp sockets are available or account for an electrician to perform the necessary installation.
- While generally not required for the operation of the domes, wired internet access is required for maintenance and tech support to be undertaken by the company remotely.

Internet Access

- While most institutions now offer free internet access to their visitors, it may be a better idea to keep the work in an independent network as to avoid the experience being slowed down by other internet traffic. It is of the utmost importance, however, that this network is not the main internet network for the museum for security reasons. The IT department should be involved through the whole process even if internet access is not required, as their staff may be able to advise on the particulars of the institution.
- When giving internet access to an artwork, it is important to test its performance at least a week before installation is finalised, as different spaces may have dead spots where wireless internet is unreachable, thus forcing the work to be relocated or a wired alternative to be provided. Furthermore, these tests will also reveal any problems with the networking setup and allow IT to set the relevant network permissions for the work.

Basic Questions

What is Mixed Reality?

Mixed reality is an emerging field that combines VR and AR and the real world to create new immersive experiences. For example, a Mixed Reality or MR experience could involve objects that exist in both the real and virtual world and share the exact same location, which a visitor could then manipulate by reaching out and holding them physically but seeing a virtual object through VR goggles. Another example could be a projection mapped space that overlays a digital world over a room and objects changing its appearance.

Is there a difference between headsets for museums?

Yes and no. With the most popular tethered headsets like the Oculus Rift and the HTC Vive it is possible to run any kind of VR experience designed for Windows, Linux, and Apple computers. However, mobile apps, like those designed for Cardboard and mobile phone VR, will most probably not work with one of these headsets. The reverse situation is also true: a Cardboard or mobile phone VR headset is not compatible with Oculus Rift and HTC Vive software. Even more problematic are the standalone headsets, as these headsets depend on the dedicated app stores for each specific platform. In the end, the decision as to which headset to use depends on the artist's choice of platform.

Is VR expensive?

Not particularly. If the artist provides their own equipment, the costs to the institution are minimal in comparison with the preservation work and other curatorial tasks performed in conventional artworks. In cases when the institution has to provide the equipment itself, it is important to keep in mind that VR headsets are a platform and not the artwork themselves. That means that, as long as the institution continues to exhibit VR art or uses the headsets for other purposes (education for example), the ROI is significantly high even taking into account the high-performance hardware required. Keep in mind these computers can also be used for other high-performance tasks, such as architectural renders or video games in the appropriate exhibition.

Can I present a VR experience as a video if I do not have access to headsets?

One of the most distinctive characteristics of VR is the ability to immerse the user into a different world. Video offers different connotations and may in fact eradicate the meanings of the work entirely. Of course, you may discuss the possibility of this compromise with the artist. However, not all artists are ok with this. Other artists may be ok with porting the experience to a cardboard headset (not all artworks allow for this). As always, it is best to approach this in a case-by-case basis.

I want other visitors to see what the person using the VR headset is doing, is this possible?

Yes, it is possible to present a feed of what the person wearing the headset is experiencing through a monitor or projector. Most tethered headsets offer this option by default and require nothing more than the aforementioned output device. All other VR platforms (save for 360° immersive environments) lack this functionality. However, due to the low costs of entry, the option of providing multiple headsets becomes much more feasible.

This setup also offers the additional benefit of allowing people with extreme motion sickness or certain disabilities to vicariously experience artworks they would not be able to otherwise. Of course, the ideal set up is an immersive environment such as the C.A.V.E. or a 360° projection dome. However, the decision to implement these solutions depends on budget, compatibility of the work, as well as the artist's wishes for the work.

Case Study

Osmose (1995) is a VR experience that implements interactivity, motion tracking, computer graphics, and 3D sound in an effort to create an immersive space where the immersant can explore their relationship between themselves and the world. It achieves this by tracking the position , breathing, and balance of the immersant through a variety of sensors. It was these sensors that introduced particular challenges to the space, as the technology used in this artwork is as large as a refrigerator and generates great amounts of heat. Thus, ventilation became a great challenge and required the support of a technical team to solve these problems (Graham 2008).

As can be seen in Figure 65, *Osmose* also makes use of a theatre setup to allow for vicarious participation. In this case, the immersant is located in a private space with a semi-translucent backlit wall allowing the viewers to see what the immersant is physically doing while a screen on the opposite side presents a stereoscopic (3D) real-time video and audio from the point of view of the participant. The vicarious participants are handed 3D glasses, so the video acquires a greater sense of depth and immersion. Such setup required bookings to be made in advance to become an active participant, which was something the curators noted was not well received by everyone. However, the complexity of the setup as well as the time required to experience the work demanded such arrangements. Other considerations for this display include the removal of most light from the theatre space, as this can interfere with the video projection, reducing image quality and making the 3D effect harder to experience. Documentation for this work includes images of the setup, the hardware and installation, as well as a series of published reports by the curator Dr. Beryl Graham.

For another example of how varied VR experiences can be, we can look at Ed Fornieles' *Truth Table* (2016-2017) (Figure 19). For this work, Fornieles required a space that simulated a bedroom, as his work aims to simulate the intimacy of sexual acts through a variety of bodies. For this reason, it was important for the space to feel private to visitors; placing the artwork in an open space would have led to visitors feeling uncomfortable or self-conscious. As an added benefit, this separation from the main space keeps younger visitors from witnessing the sexual content of the work unless they have permission from their guardians.

Figure 65: *Osmose* theatre setup. Real-time video is on the left and the immersant is on the left in a separate space. Seating arrangements in the middle allow for easy observation of both the immersant and what they see.

Figure 19: Fornieles, Ed, 2016-2017, *Truth Table*, VR. Basement Roma Italy. The complete setup requires a bed and a dedicated space to hang the other related artworks. As Truth Table simulates a series of sexual encounters, the artist used a bed both as a way to keep the participant comfortable and to give greater immersion into the sexual encounters by simulating the intimacy of a bedroom. Image Roberto Apa

3.6.3.2 Augmented Reality

In his book, Understanding Augmented Reality, Alan B Craig (2013) defines AR as a medium in which information is added to the physical world in registration with the world (p15), and further expands on it by combining it with Ronald T. Azuma's three defining characteristics of augmented reality as follows:

- The physical world is augmented by digital information superimposed on a view of the physical world.
- The information is displayed in registration with the physical world.
- The information displayed is dependent on the location of the real world and the physical perspective of the person in the physical world.
- The augmented reality experience is interactive, that is, a person can sense the information and make changes to that information if desired. The level of interactivity can range from simply changing the physical perspective (e.g., seeing it from a different point of view) to manipulating and even creating new information.

In layman's terms, augmented reality presents us with images and text overlaid into the real world in a way that responds to the physical space that is being looked at through a device and this information corresponds to both the point of view from where it is seen and the specific location of the user. Furthermore, this information must be interactive, allowing the user to, at the very least, allow for changes in perspective and up to the creation of new information.

In Figure 66 and Figure 67 we can see how the 3D sculpture can be observed from different perspectives depending on the physical location of the user and the simulated position of the sculpture. This enhancement, in turn, is not simply overlaid on the world but appears to physically exist in the room. This model has a location within the physical space and, as such, retains its position in the world even if the spectator moves around it. Not only that, but the sculpture's position does not shift as the user moves and, instead, we see its backside in agreement with how an object would appear in the real world.

Figure 66: Baker Cahill, Nancy, 2017, *Hollow Point 102*, AR, 4th Wall app video capture. Image Nancy Baker Cahill.

Figure 67: Baker Cahill, Nancy, 2017, *Hollow Point 102*, AR, 4th Wall app video capture. Image Nancy Baker Cahill.

Unlike VR, AR requires the physical world for it to exist on top. While VR performs some of the same functions as AR, it is completely self-contained and, in fact, this is its very draw: the ability to leave the real and to exist within an alternate, often fantastic, world. While VR thrives in the virtual, AR revels in the existence of a world to augment and even expand. AR presents various challenges, these include: interactivity, immateriality, hybrid digital-physical artefacts, collective authorship of non-traditional creators, and the evolution of the artwork.

As in VR, interactivity, immateriality, and hybrid artefacts are heavily intertwined and must be addressed in conjunction. In a way, there are no passive AR experiences, since, at the very least, the act of holding up a digital device and choosing to activate the experience can be considered input-only interaction. However, in more involved experiences, the immateriality of digital artefacts can change through manipulation. For example, in *Hollow Point 102* (Figure 67), the object can be moved and rotated by the user in order to place it in the "ideal" position, and afterwards the very neomateriality of the object comes into play, as the visitor is able to move around the virtual object in physical space to get a proper view of the object. Meanwhile, any time AR reacts to a physical object (marker) and modifies it (Markers will be explained in-depth under the Types of AR section), the object is effectively a hybrid object. A hybrid object requires the AR layer to be complete; otherwise, it is effectively damaged in the same way a broken sculpture missing pieces is damaged. Cecilia Suhr's *Flame Paintings* are effectively incomplete until AR overlays animation and sound over them. If these are missing, the artwork is missing a key component. Inversely, AR software lacking the physical object is also denied its completion and is just as broken. How the hybrid object is linked to interactivity can be seen as the trigger to the entire experience, even when the bulk of the AR experience may be passive. As mentioned, the act of using the app on the object is an interactive action.

As for collective authorship of non-traditional creators, AR artworks require the collaboration of creators that are not artists in a traditional sense. Software developers and engineers involved in the project have to creatively solve problems posed by the creative vision of the "traditional" artist and have as much hand in creating the artwork as the artist. Curatorial teams must then make decisions on crediting creators and other individuals in a way more familiar to film or software development rather than traditional art.

Finally, as problems in the software are found and fixed and the experience is refined or adapted, the AR work will keep evolving, effectively creating a living work of art. One consequence of this life is the concept that the artwork shown in today's exhibition is not the same artwork as the one seen prior or afterwards. In software engineering, this phenomenon is called versioning. This is done through a numerical system where decimals imply smaller changes while whole numbers imply large changes that may be considered different from those before and those after. Versioning is important for curatorial work, as it allows researchers to track the lineage of a work and how it has evolved through time, providing thus a richer history of the work. In a way, versioning could be seen as the digital equivalent of pentimenti, letting us see how the artist changed the work over time.

Time and Space In AR

Time for AR applications is highly variable and ranges from a few seconds to multi-hour experiences. However, on average, AR artworks lean towards shorter times, making them easier to engage with in an institutional context. While any artwork benefits from extended observation and interaction, for the most part, experiences in AR tend to be relatively short and pose no issues.

While time is not often a concern, AR presents us with a paradoxical dichotomy. Despite AR depending on a geographical location, not all AR art is location-specific. For example, *Hollow Point 101* (2018) by Nancy Baker Hill (Figure 68) presents digital sculptures created by her on any space. Meanwhile, Cecilia Suhr's Flame series (n.d.) (Figure 69) requires physical artworks of the artist creation to be present. Finally, Debra Scacco's *The President Wilson* 1928 (2018) (Figure 70) requires the user to be present in a specific set of GPS coordinates (close to the Statue of Liberty) to be activated. As can be seen, this makes certain AR experiences impossible to translate into other contexts while others require specific objects or nothing at all. For this reason, it is important for the curatorial team to be aware of the spatial and physical requirements of the artworks they wish to include.

As always, for site-specific works, alternatives such as prerecorded video or photographs are an option. However, this strips interactivity from the work and, at times, may distort the meanings of the work. For this reason, alternative display methods are highly discouraged.

Figure 68: Baker Cahill, Nancy, 2017, *Hollow Point 101*, AR, 4th Wall app. Photo by Rian Brown Oslo.

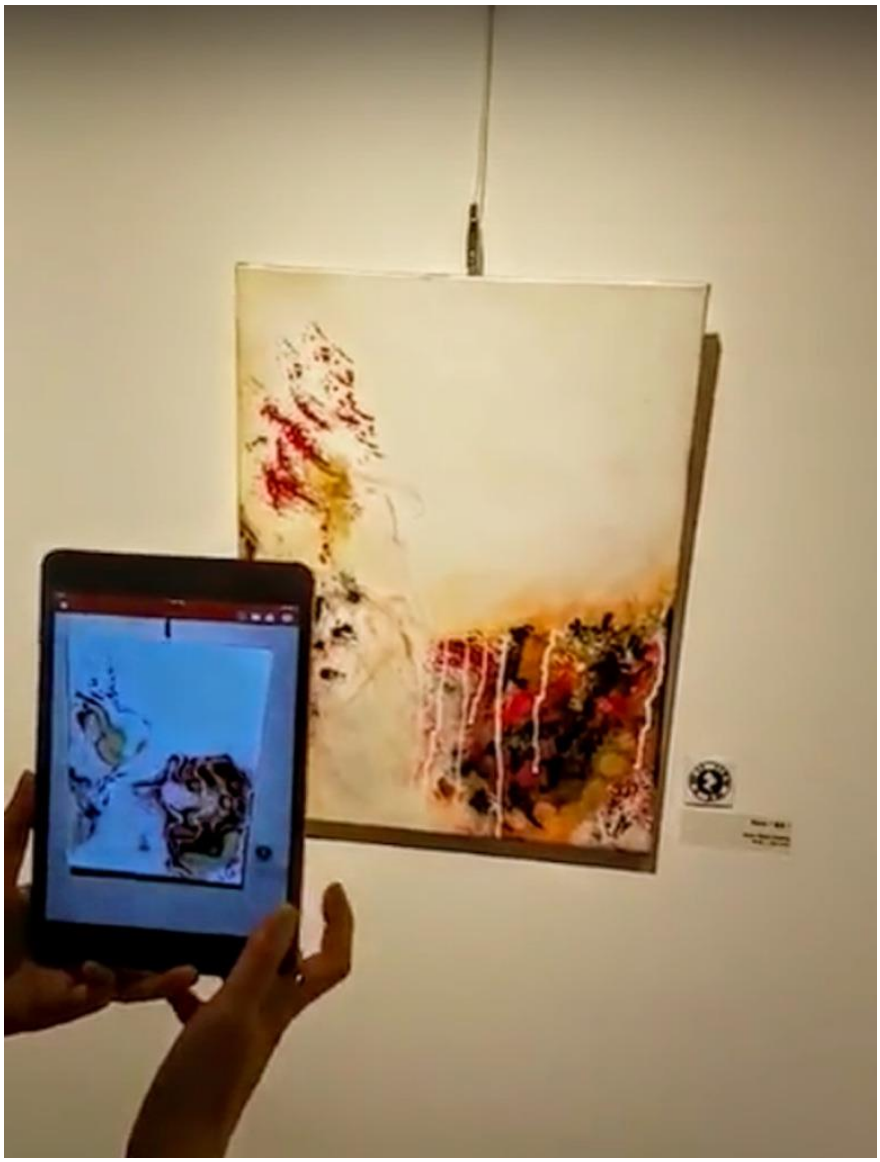

Figure 69: Suhr, Cecilia, (n.d.), *Flame 7*. Photo by Cecilia Suhr.

Figure 70: Scacco, Debra, 2018, *The President Wilson*, 1928. Photo by Debra Scacco.

Types of AR

VR can be categorised under six different types that can fall into two categories: trigger-based and view-based (Edwards-Steward, Hoyt, and Reger 2016). Triggered VR, as its name implies, requires a stimulus of some sort. This includes object and paper markers, GPS markers, QR codes, and location or object recognition. View-based augmentations, on the other hand, simply display their augmentations without the need of any markers. Citing the prior examples, Suhr's Flame Series is a form of triggered AR, where the application recognises the work that is being looked at and applies the corresponding augmentation. Another example of marker use would be Scacco's The President Wilson, where GPS coordinates activate the work and it displays the AR augmentations on the required location. Finally, for an example of view-based AR, we have Nancy Baker Cahill's Hollow point 101, in which any space can be augmented by her work, as it does not depend on a marker of any kind.

Within the trigger-based category, we can find four types of AR. The first type is Marker-based AR, where a marker, be it an object or a paper image, can serve as the focus of the augmentation or simply a way to access digital content (Edwards-Steward, Hoyt, and Reger 2016). Digital artists David Lobser and Damjanski created an AR application that recognised Jackson Pollock's paintings (the marker) and overlaid new images and animations on top of the paintings, creating reinterpretations or replacements of the works in the MoMA galleries (Loux, 2018, Figure 71).

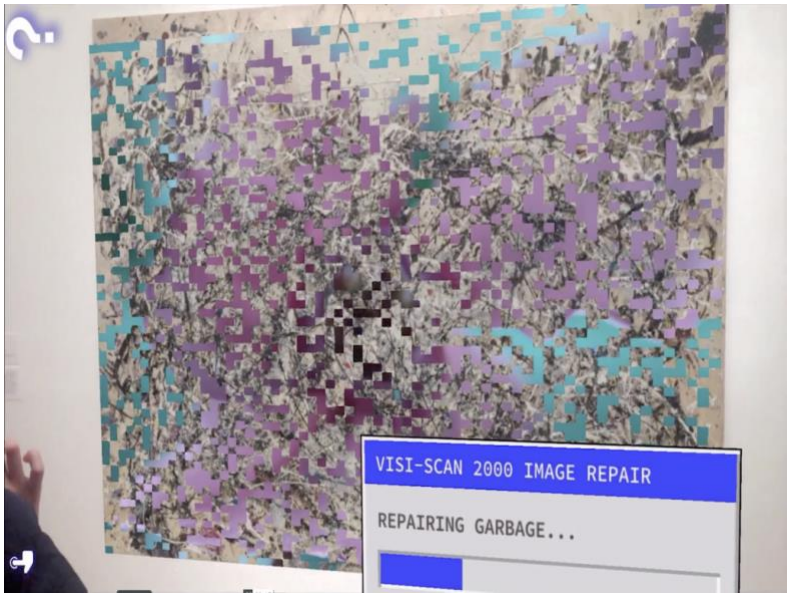

Figure 71: Lobser, David and Damjanski, 2018 *MoMAR*, AR.

The President Wilson (Figure 70) is a good example of the second type of trigger-based AR: Location. In this instance, GPS data is used as the marker, which triggers location-relevant augmentations on what is being observed. In this case, if the user is not in the correct location, the App displays nothing.

Dynamic Augmentation is similar to marker-type augmentation, with the difference that the AR experience responds to changes in the object in real-time. Rafael Lozano-Hemmer's People on People (2010) is an example of this augmented reality, where a recording of earlier visitors is projected in real-time over the shadows of current visitors.

The last type of trigger-based AR is complex augmentation, which can be defined as a combination of marker/location and dynamic augmentation, resulting in a form of VR where the overlaid information responds to specific locations and objects within this location but also responds to changes in them (Edwards-Steward, Hoyt, and Reger 2016). Unlike simple location-based AR, where the overlay happens on the coordinates specified, complex augmentation will respond to specific objects within the location.

View-based AR, meanwhile, can be divided into indirect augmentation and non-specific digital augmentation. The first augments a static view of the world. One such example would be an app that captures an image of a painting, identifies some aspect of it, such as the sky, and allows the user to change the color of the sky. Non-specific digital augmentation digitises a dynamic view of the world without reference to what is being viewed. An

example of this is Hollow Point 102 by Nancy Baker Cahill, where the digital sculpture is placed within the space but, in truth, there is no interaction between the space itself and the digital augmentation.

While technological distinctions have been avoided in categorising AR in this text so far, there is a relevant technological division in the types of AR experiences. So far, most of the discussion has focused on experiences mediated through a screen of some kind, be it a mobile device or augmented reality glasses, to cite a few. However, there is a second type of AR in which the augmentations are projected onto surfaces in the real world and, in the future, possibly through holograms. Projected AR requires no technology mediation on the user's end, that is, no special glasses or devices; the user is simply free to interact with the projections they encounter.

Best Practice

Usually, AR requires a much simpler setup than VR and other technologies. In fact, most of the time, all an institution must do is provide an internet connection (this will be touched upon further down) and a QR code so the visitor may download the software themselves. However, not all AR experiences are mobile only with software downloadable from the more common app stores.

Hardware

When artists bring their own equipment, ensure voltage converters are available. The best resource for determining voltage and plug compatibility is the International Electrotechnical Commission's Plugs List. Simply compare your country's voltage and plug type with the hardware's country of origin. If they do not match, adapters can be bought at any electronics store.

- Talk with the artist regarding the requirements of the work.
- Can the audience use their own devices? If so, where can they get the required software and its minimum requirements?
- If the audience can get the app on their own, the following methods can be used to facilitate this action:
- QR codes are the most common. To generate a QR code, one may use services such as www.qr-code-generator.com; all that is required is the link for the respective app stores required and the service will generate a

code that can be integrated into the exhibition's information system. Keep in mind you need to generate two different QR codes, one for Android and one for iOS.

- Alternatives to QR codes. While QR codes are the easiest most user-friendly option, not all mobile phones have the software required to read a QR code. In that case, a shortened URL or even the name of the app may be enough to help the user access the app. In most cases, all three options may be used.
- Keep this information visible and available before the visitor enters the exhibition space. This will reduce the amount of people blocking paths or the display itself while they download the app and get it running.
- Provide some degree of tech support by training an invigilator or dedicated staff in the basics of downloading, installing, and use of the experience in both iOS and Android. This person should offer help to any person who requests it as well as have their own unit (not their personal mobile phone) to assist those who do not own a mobile phone or whose phone is incompatible with the software.
- If the application is only available for one ecosystem, it is then recommended that you make this known to visitors and for you to offer devices compatible with the application.
- If devices are provided by the institution, make sure the proper security precautions have been taken to limit unauthorised access to the device.
- Even if the visitors can use their own devices, have a few devices ready for loan in the case a visitor cannot provide their own or are facing difficulties.
- Make sure the area where the augmentation takes place is free of delicate objects and low obstacles. As visitors will be occupied with the digital image, it is possible for people to walk into objects and low barriers.
- For mobile AR, provide enough lighting to ensure the proper recognition of markers. What constitutes adequate lighting varies with the quality of the mobile device's camera being used. At the very least, institution-provided devices should be able to recognise the markers in the gallery.
- Inversely, in the case of projection AR, make sure the space is dark enough for the projectors to display a clear and bright enough image.
- Should the AR experience require GPS or Internet access, ensure an adequate signal strength is available.

- In the case of GPS signals, currently there are no accessible commercial solutions to this problem and it may be necessary to either move the specific work to another area or find a compromise with the artist.
- If sound is an important part of the experience, the public should be advised to use headphones. If at all possible, complimentary headphones can also be offered.

Basic Questions

What is the difference between AR and VR?

Virtual Reality replaces the real world with a completely fictitious one by creating a feeling of immersion and isolating the user from what surrounds them. Augmented reality, instead, seeks to enhance reality by overlaying information on top of the real world.

Are all AR experiences based around mobile device apps?

While it may seem all AR experiences depend on mobile devices, this is not entirely accurate; projection mapping, smart glasses, and other technologies and creative approaches to established technologies have allowed artists to create AR experiences independent of mobile devices as the main point of interaction.

Case Study

Hollow Point 101 (2017) by Nancy Baker Cahill is one of several AR sculptures created by the artist meant to exist nowhere and everywhere. As there is no physical or geographic requirement for the artwork, it can be “shown” in any space. This proves challenging for exhibition spaces, as the presentation of the work would involve an empty room and instructions on where to download the app or a series of mobile phones on a table to experience the work. Not only that, but depending on how each participant is placed in the exhibition space, their experience varies from the experience the person next to them is having. Of course, this asynchronous individualised experience offers exciting possibilities for institutions. Conversations can be had on the implications behind an artwork that does not physically exist or how even the positioning of the work in a physical exhibition space changes the artwork.

Unfortunately, Nancy Baker Cahill maintains a very spartan website that consists simply of pictures of her artworks. Proper documentation for a project like this is hard to come by and contains no public record. This may be as part of a way to protect the way the app itself works; however, this seems unlikely. Also missing is the actual justification for the artworks themselves, the artist's intentions, the process, collaborators, and other details, and while some of this data can be found through internet searches, this is not an ideal way to preserve such an ephemeral artwork that can disappear when the app ceases to function, either through obsolescence or removal of the app.

A way to solve this is to put a copy of the source code for both the app and the artwork in the care of a cultural institution and place it under a creative commons license as to facilitate its continued existence.

Figure 72: Baker Cahill, Nancy, 2017, *Hollow Point 101*, AR, 4th Wall app. Photo by Rian Brown Oslo.

3.6.3.3 Robotics

Robotics have a long history in art, from references in Chinese texts of human-like automa (Needham 1956) and ancient Greek mechanical water clocks to Da Vinci's Automa Cavaliere (ca. 1495) and to today's autonomous machines. True robotics in art began to appear in the 1960s alongside computers and programming languages as a direct consequence of kinetic art, liberating sculpture from its inert form. One of the first of these robotic artworks is the appropriately named Robot K-456 (1964) by Nam June Paik and Shuya Abe, followed by Tom Shannon's Squat (1966) and Edward Ihnatowicz' The Senster (1969-1970). Each of these works explores a different facet of the complicated relationship between human and machine; a concern that has become more poignant (and will continue to be so) in the last few years.

Classification of robotics can prove complicated, as often the robot itself is a means to an end. For example, Van Arman's Cloudpainter's (2018) robot is the means through which an artificial intelligence (Cloudpainter) exerts a force on the world. In this case, the robotics are more akin to a body for the AI than being the central piece of the work. In other cases, robotics begin to merge with cybernetics, as in the case of Eric Siu's Touchy (2012). This work is a camera system worn by the artist which behaves independently of the artist and will only restore vision after the artist is touched; if this contact continues for 10 seconds, Touchy will take a photograph. This also exposes another peculiarity of robotics in art: their function as facilitators or agents in performance. For this reason, it is recommended for curators to approach robotics with an open mind and consider all the possible ways robotics and interaction shape each other. For example, while Touchy is a facilitator in Siu's practice, Ihnatowicz' The Senster and Mari Velonaki's Diamandini (2011) are in themselves autonomous performers and, in fact, behave with an autonomy not commonly seen in other artwork. Both Diamandini and Senster use programmed instructions to create their own emergent behaviour, developing affinities and dislikes as well as what can be interpreted as feelings of boredom and interest in response to their environment and the public and acting upon them. While not truly intelligent actors, their behaviours are self-directed and result in interesting feedback loops in terms of interaction.

For the purpose of this text, robotics will refer to autonomous machines (mechanical, digital, or both) that interact with a human in one form or another. This will exclude robots that make art, such as Pindar Van Arman's Cloudpainter, for their lack of interactivity, as well as machines that have no autonomous workings. This includes remote puppetry, direct manipulation, or human direction.

Curators working with robotics should be aware of the following challenges: complex often hacked together technology, preservation vs interaction, autonomous devices, and authorship. When artists engage in robotics, it is very rare for them to work with pre-established technologies. This means these robots consist of cobbled up electronics, servos, displays, and other hardware which they have put together to create what they desire. While artists who have a full engineering team are not unheard of, it is still rare. This will translate into builds that may work sporadically or suddenly stop working. As their creators will probably not be available for the duration of an exhibition, curators should be ready to source replacement parts as well as individuals who can help maintain the works functioning during the exhibition.

This ties directly with the second issue of preservation vs interaction, which means that these often delicate objects may have to be handled by the general public. For this reason, one should expect damage to objects and for things to randomly stop working. While preservation departments may be uncomfortable with works being damaged, while not a certainty, damage is a natural consequence of constant manipulation. Ways to reduce this potential damage include vigilant staff supervising the interactions or limiting interaction to supervised one-on-one sessions. Another option, but one not endorsed by the author, is to leave the work inert and present it as a static deactivated object. This option, however, robs the work of its meaning and purpose.

Time And Space in Robotics

Generally, time is not an issue in robotics, as interaction tends to happen in real-time and has a definitive duration. In cases where robots are intended to continue their functioning outside of standard operating times, it is still recommended that robots be supervised from time to time. This supervision has less to do with a robot uprising and more with the possibility that the autonomous machines may become stuck or damage themselves or their surroundings.

Works that are required to continue running even after closing times may require to do so in order to develop more complex behaviours or because the task they have been assigned with requires extended production times. At best, if these processes are predictable, it could be arranged so the output occurs within operating times or is recorded; otherwise, not many options are available. It is worth repeating that this is a very rare occurrence and most robotics experiences do not require extended run times.

Space in robotics is simple in conceptual terms yet can be one of the most demanding ones when it comes to actually placing objects in a gallery space. As robots can range in size, from palm-sized up to room-sized constructs, and some are not stationary, finding the appropriate space for them can be a challenge. Of these, roaming robots are the most problematic, as the probability of them becoming damaged is higher than that of stationary robots. Mari Velonaki's *Diamandini* (Figure 73) is a perfect example of this. In its free-roaming configuration, the robot will approach visitors from a variety of angles, which may surprise some visitors and may result in the robot being bumped or knocked over. Other robots which may cause issues include those that autonomously reach out to visitors as well as those that are below eye level, which may sneak up on someone and trip them.

Even when the robot is not free-roaming, the sheer scale of some robots, such as Robotlab's *juke-bots* (2001), can be complicated to display, as they require high ceilings and a space large enough to fit both the robots and an audience, as can be seen in Figure 74.

Figure 73: Velonaki, Mari, 2011, *Diamandini*, robot, software, articulated sculpture. Diamandini will move around a space and approach certain people or objects of its own free will. Image Mari Velonaki.

Figure 74: Robotlab, 2001, *juke_bots*, Robotic dj's. As can be seen, the space needed for this work is significant. Furthermore, health and safety requires even more empty space as a buffer zone.

Best Practice

Interactive robots come in a variety of sizes and shapes: some are stationary and some are free-roaming. As such, this guide will address size and mobility under separate sections. Additionally, a general section will deal with factors that apply to all robots.

Hardware

General Recommendations

- Determine how the robot will be powered. Battery powered robots will require different setups from those powered by the electrical grid or those using alternative power options such as solar power.
- For battery powered robots, consult with the artist or the person responsible for them as to what arrangements are required. The most common solutions include a place to charge and store spare batteries or a dedicated space within the exhibition space to set up a charge station.
- If possible, have multiple batteries at hand so no robot is left powerless during operating hours. Of course, this depends on how long each battery will last under constant use.
- At least have three batteries: one in use, one fully charged and ready to be replaced, and one being charged (Three battery protocol).
- As soon as the replacement battery starts being used, the original one should be set to charge. Ideally, the third battery has a full charge by now.
- For alternative power sources, you will need to consult with the artist or person in charge as to what the best way to power the robots will be.
- For solar power, it is possible to use a lightbulb to charge the robot if solar light is not available. This will, however, be less environmentally friendly and, as such, should be the last option explored.
- For works that need to be plugged in, ensure voltage converters are available. The best resource for determining voltage and plug compatibility is the International Electrotechnical Commission's Plugs List. Simply compare your country's voltage and plug type with the hardware's country of origin. If they do not match, adapters can be bought at any electronics store.
- A few robots will use the internet; for these cases, it is ideal to create a network exclusively for them. This will keep your internal network safe from intrusions as well as guarantee that the work has enough bandwidth to

properly function. Your IT department should be able to configure a secondary network.

- As robots require specialised knowledge in electronics, robotics, and other engineering areas, if a work ceases working correctly, immediately power it off and contact the relevant people. Whom to contact should be noted in the documentation for the work
- While an artwork is out of order, inform visitors why it is out of order and provide a video of the robot operating so visitors at least have an idea of what it does.
- Keep in mind that including robots from international artists will probably be a costly proposition, as most robots made by artists are one of a kind and very hard to replace.
- Some may not even be allowed into certain countries depending on the technologies they implement.
- Transportation and insurance will be considerably higher than those of most new media art.
- While it is possible for an artist to create the robot with local parts, this is not usual except for commissions.

Small-scale Installations

- Robots in this category have no minimum size; however, anything bigger than a human will be considered large-scale.
- These are the easier robots to work with, as they do not require large spaces and, in general, pose limited health and safety risks.
- Small robots will usually require protection from humans, as their parts may be delicate or could be stolen easily.
- Many of these robots can be battery-operated and will not require large sources of power.
- Conversely, these robots are more likely to utilise unconventional means of powering themselves.
- Invigilators should keep an eye for robots becoming stuck on objects, general malfunctions, and theft prevention.
- Invigilators should also be trained in the operation of the robots so they can provide support to visitors that may be struggling with the artworks.
- If the work is to be worn, invigilators should always be there to help visitors put on the object; this should never be left to visitors alone.

- These robots are bigger than a human and may be dangerous if precautions are not taken.
- Unless the interaction is direct with the human, create a wide perimeter that allows for the robot to move freely without coming into contact with the general public.
- In cases of real physical risk, hard barriers are to be used; a cordon will not be enough to stop a child or a determined visitor.
- When a visitor is meant to interact and approach a large-scale robot, determine if it is possible to power it off or arrange for it to be as inert as possible while the visitor approaches.
- Have a trained assistant escort the participant to where they are supposed to be and then activate the robot.
- Not all large-scale robots can cause bodily damage. For this reason, it is important to do a full risk assessment with the artist, curators, conservation department, and health and safety officer to ensure the safety of visitors as well as to preserve the artistic integrity of the work.
- While robots may have a determinate height and width on standby, these dimensions may change when the work is functioning. Keep this in mind when choosing an exhibition space and make sure the required space is clear of all hanging cables or other objects.
- According to OSHA research, the time when most accidents occur is during setup and testing. Make sure everyone involved is aware of the risks and danger areas (also known as envelopes). Each robot has its own envelopes which can be identified through conversation with the artist or operators. Keep in mind anything or anyone within the maximum envelope is at risk and should be ready to get out of the way. See Figure 75 for an example of the maximum, restricted, and operating envelopes.

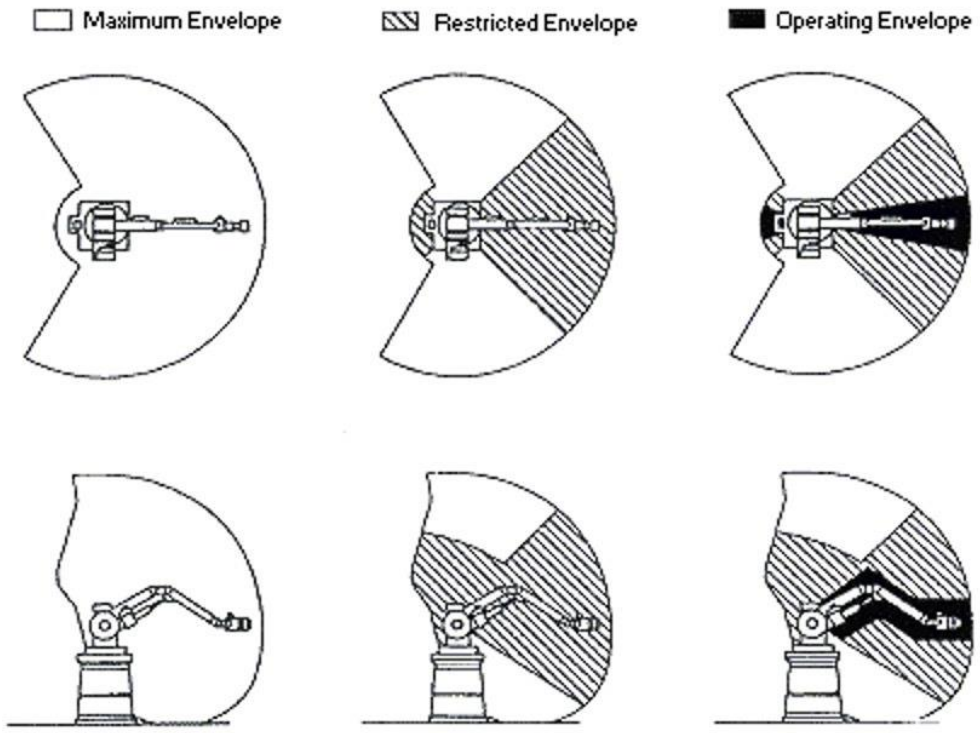

Figure 75: Here we can see the different envelopes for a robotic arm. The maximum envelope determines the area within which the robot may move, the restricted envelope determines the area where the robot will be moving, and the operating envelope is the area of the robot that will be in operation. The darker the area, the riskier it is for someone to be within that area. Image: OSHA.gov

The following recommendations are copied verbatim from the OSHA Industrial Robots and Robot System Safety:

Risk Assessment: At each stage of development of the robot and robot system, a risk assessment should be performed. There are different system and personnel safeguarding requirements at each stage. The appropriate level of safeguarding determined by the risk assessment should be applied. In addition, the risk assessments for each stage of development should be documented for future reference.

Safeguarding Devices: Personnel should be safeguarded from hazards associated with the restricted envelope (space) through the use of one or more safeguarding devices:

- Mechanical limiting devices;
- Nonmechanical limiting devices;
- Presence-sensing safeguarding devices;
- Fixed barriers (which prevent contact with moving parts); and
- Interlocked barrier guards.

- Awareness Devices. Typical awareness devices include chain or rope barriers with supporting stanchions or flashing lights, signs, whistles, and horns. They are usually used in conjunction with other safeguarding devices.
- Safeguarding the Teacher. Special consideration must be given to the teacher or person who is programming the robot. During the teach mode of operation, the person performing the teaching has control of the robot and associated equipment and should be familiar with the operations to be programmed, system interfacing, and control functions of the robot and other equipment. When systems are large and complex, it can be easy to activate improper functions or sequence functions improperly. Since the person doing the training can be within the robot's restricted envelope, such mistakes can result in accidents. Mistakes in programming can result in unintended movement or actions with similar results. For this reason, a restricted speed of 250 mm/ß or 10 in/ß should be placed on any part of the robot during training to minimize potential injuries to teaching personnel.
- Several other safeguards are suggested in the ANSI/RIA R15.06-1992 standard to reduce the hazards associated with teaching a robotic system.

Operator Safeguards. The system operator should be protected from all hazards during operations performed by the robot. When the robot is operating automatically, all safeguarding devices should be activated, and at no time should any part of the operator's body be within the robot's safeguarded area.

- For additional operator safeguarding suggestions, see the ANSI/RIA R15.06-1992 standard, Section 6.6.
- Attended Continuous Operation. When a person is permitted to be in or near the robot's restricted envelope to evaluate or check the robot's motion or other operations, all continuous operation safeguards must be in force. During this operation, the robot should be at slow speed, and the operator would have the robot in the teach mode and be fully in control of all operations.
- Other safeguarding requirements are suggested in the ANSI/RIA R15.06-1992 standard, Section 6.7.
- Maintenance and Repair Personnel. Safeguarding maintenance and repair personnel is very difficult because their job functions are so varied. Troubleshooting faults or problems with the robot, controller, tooling, or other associated equipment is just part of their job. Program touchup is

another of their jobs as is scheduled maintenance, and adjustments of tooling, gages, recalibration, and many other types of functions.

- While maintenance and repair is being performed, the robot should be placed in the manual or teach mode, and the maintenance personnel should perform their work within the safeguarded area and within the robot's restricted envelope. Additional hazards are present during this mode of operation because the robot system safeguards are not operative.
- To protect maintenance and repair personnel, safeguarding techniques and procedures as stated in the ANSI/RIA R15.06-1992 standard, Section 6.8, are recommended.

Maintenance. Maintenance should occur during the regular and periodic inspection program for a robot or robot system. An inspection program should include, but not be limited to, the recommendations of the robot manufacturer and manufacturer of other associated robot system equipment such as conveyor mechanisms, parts feeders, tooling, gages, sensors, and the like.

- These recommended inspection and maintenance programs are essential for minimizing the hazards from component malfunction, breakage, and unpredicted movements or actions by the robot or other system equipment. To ensure proper maintenance, it is recommended that periodic maintenance and inspections be documented along with the identity of personnel performing these tasks.

Safety Training. Personnel who program, operate, maintain, or repair robots or robot systems should receive adequate safety training, and they should be able to demonstrate their competence to perform their jobs safely. Employers can refer to OSHA's publication 2254 (Revised), "Training Requirements in OSHA Standards and Training Guidelines."

General Requirements. To ensure minimum safe operating practices and safeguards for robots and robot systems covered by this instruction, the following sections of the ANSI/RIA R15.06-1992 must also be considered:

- Section 6 – Safeguarding Personnel;
- Section 7 – Maintenance of Robots and Robot Systems;
- Section 8 – Testing and Start-up of Robots and Robot Systems; and
- Section 9 – Safety Training of Personnel.

- Robots or robotic systems must comply with the following regulations: Occupational Safety and Health Administration, OSHA 29 CFR 1910.333, Selection and Use of Work Practices, and OSHA 29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout).

Free Roaming

- Free-roaming robots may seem to be able to go anywhere they wish. However, in one way or another, they are confined to certain spaces.
- In theory, free-roaming robots that move around the public are not particularly strong or dangerous.
- Tethers can be physical and include power cords or any type of cable that the robot requires to obtain information or fluids necessary for their functioning or they can be safety measures.
- Physical tethers can be tripping hazards or cause the robot to become snagged. As such, they should not be used in spaces where people can walk amongst them.
- Physical barriers are another option that can keep a robot within a designated space. These fences should be proportional to the robot's size and, ideally, should not interrupt observation and interaction with the robots.
- Other robots may map the area they are supposed to stay in and, once they have this map, will only stay within it.
- One final option to keep robots within a space are virtual walls. These "walls" are basically digital signals being sent out from a small station and which the robot senses and will not cross, effectively creating a virtual wall around the designated space. This option is often the best; however, not all robots can use it, as their cost is often higher than a simple wall.
- For robots that move around a space but are separated from the public, the fence may be a low plywood wall, while in some other cases, plexiglass walls, cyclonic fencing, or other barriers may be required to keep the public safe.
- If a robot will be moving through the public, it is a good idea to notify the public beforehand. This will stop visitors from being unpleasantly surprised should the robot sneak up on them as well as make them more aware of their movement around the space.
- Very small roaming robots should not be set free in a gallery space, instead, designate an area for them. This way visitors make a conscious decision to interact with them and will not step on them by accident.

- Free-roaming robots also include human locomotion. Examples of this include Eric Siu's Touchy (2012) and Stelarc's Re-Wired / Re-Mixed (2015), where both robots are actually attached to the artist or participant and, while they lack control of the robot, they carry it around on their bodies.

Stationary

- These robots require less attention than free-roaming ones; however, they still may have free-moving parts that may cause accidental harm.
- First, determine if the robot needs to physically contact visitors; if not, it may be a good idea to set a minimum allowed distance as with any uncovered sculpture. Of course, this distance may be larger than in traditional sculpture due to the robot potentially being able to reach out farther than its base.
- If the public is to come into direct contact with the robot, make sure it is firmly attached to its base and that said base is heavy enough to not topple when the robot moves or is touched.
- If the robot is located in a 360° display and requires to be plugged in, make sure cables are either covered so they do not become a tripping hazard or get unplugged by accident. Ideally, run all wiring internally, both on the plinth and through the floor.
- If you fear the robot is too delicate, plexiglass cases are a good compromise as long as they do not impede interaction.

Basic Questions

Are machines that are controlled by humans robots?

The line between robot and machine is a very thin one and, depending on who is being asked, a machine operated by a human can be a robot. However, the Enciclopædia Britannica defines it as: "Robot, any automatically operated machine that replaces human effort". This is the functional definition used in this text and, as such, precludes human operated machines from this classification.

Are all robots interactive?

No, robots can simply be programmed to follow a very rigid set of instructions without responding to their environment in a way that creates interaction.

Do I need specialised staff to host robots in my institution?

While not imperative, it would be ideal to have someone at hand that could at least troubleshoot basic issues with the software and hardware. However, depending on the reliability of the robot in question, this may not be necessary.

Case Study

Kelly Dobson's *Blendie* (2003-2004) is an interesting robot, as it defies the traditional perception of a robot, either as a humanoid or some purpose-built machine. Instead, *Blendie* is a vintage Osterizer blender that has been modified to become autonomous and interactive, making it into a robot. Participants can make the blender spin by imitating the noises the blender itself would make, thus speaking the "language" of the blender. Besides this response to external stimuli, *Blendie* may initiate a conversation on its own, completing the full interaction loop.

One of the peculiarities of *Blendie* arises from the nature of its "body", as technically there is nothing special about the repurposed 1950's blender. In theory, should something happen to it, it could be replaced with another blender of the same model. However, if we embrace the idea that the true interaction occurs between software and participant, then the very blender becomes irrelevant as far as it can be replaced with an entirely different blender. Again, conservation departments may not be keen on this approach, although it may be worth considering in an extreme case.

A work like *Blendie* is easy to present in a gallery space; however, it does pose one considerable challenge. *Blendie* is not a quiet artwork and, as both it and whoever interacts with it must be constantly making noise, it may not be ideal for places where other audio works may exist. For this reason, one way to display *Blendie* is to assign it its own cabin or audio isolated space. This space could be similar to a phone booth both in its construction and sound dampening qualities. Another option is to situate it in a space where it is the only work with an audio component.

Due to the interactive qualities of the work, ideal documentation should be done through video, as photography is not enough to capture the work in full. Dobson has documented her work in her website through text, explaining her intentions,

video showcasing her tests of the work, and a diagram that, while not technical, successfully explains the intended workings of the work, allowing for future repairs and recreations of the work.

Figure 7: Dobson, Kelly, 2003-2004, *Blendie*. 1950's Osterizer blender altered with custom made hardware and software for sound analysis and motor control. Image: Kelly Dobson

3.6.3.4 Artificial Intelligence

Artificial Intelligence is an often misunderstood term in popular culture. The most common interpretation can be found in countless television shows, films, and literature, which is that of an often bodied digital intelligence that exhibits autonomy, problem solving skills, and self-awareness. From Galatea to Shodan, from the Master Control Program to C3-P0, humanity has always imagined artificial beings that are our intellectual equals. The reality is much more mundane yet so much more significant. AI is hard to define, as what we think of as intelligence is itself not very clearly defined. However, a definition of AI could be: "a computer program able to change its behaviour based on prior experiences and exhibits problem solving capabilities without pre-programmed responses."

Of Dietz' categories, the most appropriate for AI is Computability. By definition, AIs have to process information both to understand it itself and to generate outputs that humans can understand. No information fed to an AI goes through the AI's software without it being analysed and transformed in some way. In fact, even if the other two of Dietz' categories are present, both do so as a consequence of the computational tasks performed by AI.

However, understanding that, as Sarah Cook says, computability is the ability of computers to use logarithmic functions to respond to a series of commands (2004 p.45) does not help us distinguish between AI and non-AI software. And so, the difference between what we would call normal software, like Microsoft Word, and an AI comes from the fact that AIs are autonomous to a certain degree; they draw conclusions from the data they are fed and create behaviours that were not programmed by their creator. Meanwhile, traditional software remains inert unless given concrete instructions by an operator. They require an external will to activate them and will not change the way their tasks are programmed to be done unless these instructions are modified by an outside force.

Having said that, there are limits to an AI's autonomy. Unlike the AIs seen in science fiction, fully sentient and autonomous artificial intelligences are to this day not possible. In a broad sense, AI can be subdivided into two categories:

> **Weak AI or Narrow AI**: It is focused on one narrow task, the phenomenon that machines which are not too intelligent to do their own work can be built in such a way that they seem smart. The most popular example of this type of intelligence is Deep Blue, the chess playing AI famous for beating Chess Grand Masters.

> **Strong AI:** The machines that can actually think and perform tasks on their own just like a human being. There are no proper existing examples for this but some industry leaders are very keen on getting close to build a strong AI which has resulted in rapid progress.
>
> (Kumar 2018)

Designating AIs as weak does not imply they are inferior or deficient. In fact, these AIs are able to draw conclusions from the data they obtain and implement it into later attempts (machine learning), often in what at times can be described as mirroring biological processes (genetic algorithms) and create their own solutions to the problems they are fed based on the knowledge they have acquired (generative). As technology and computer sciences continue to advance, weak AI will help in the creation of strong AI.

Machine learning is programming computers to optimise a performance criterion using example data or past experience (Alpaydin 2004). It is the core idea behind AI, as it allows machines to be able to solve problems for which there is no clear way to generate an algorithm (a series of instructions to be followed in order to obtain a result). Incidentally, one of the ways to allow machines to solve this quandary is to emulate biological processes. In this case, evolution through natural selection. Multiple instances of the AI are created, each of which attempts to solve the same problem in slightly different ways. This is measured by assigning progressive goals.

Each time an instance (also named agent) reaches the goal or failed but got closer to success, all other agents are eliminated and the successful agent is reproduced and the process is started all over again. Over a series of generations, the AI will have evolved until it can solve the problem in its entirety successfully. The problem with this method is that we have created a black box. A black box in computer science terms is a system where we can see the inputs and outputs of the system but not how the machine reached the latter from the former. This creates a problem when detecting bias in the outputs of an AI, which can have terrible repercussions depending on the use of the AI. Finally, the AI can then use all the “experience” it has acquired to generate solutions to newer problems given to it based on what it has learned. This is what is called a generative AI.

Apple’s Siri, self-driving cars, and Google Search are examples of weak AI. While incredibly useful and capable of learning, they are limited in their tasks and are not self-aware or completely autonomous. Given that AIs are computer programs, they

tend to be mostly invisible to humans and may even exist in products where they may not be expected at all. They can also be a component of something else.

The simplest example of AI existing within another software is non-human opponents in video games. However, not all AIs are without a body. While some robots are basically machines that repeat a series of instructions, others act as bodies for AIs. These kinds of robots are now beginning to appear in a variety of ways, including artificial pets, like Sony's AIBO (Figure 76), or caretakers for the elderly. It is important to keep in mind that for the AI, its body is replaceable, modifiable, and, to a degree, irrelevant, as the AI can exist without a body to the point where it can be given a simulated body within a computer and continue to operate with no changes to its behaviour due to it existing virtually as opposed to physically. In curatorial terms, this will allow us to separate robotics from the intelligence that controls it.

Figure 76: Sony's Aibo is an AI-powered robotic pet. Image Sony

Human processes such as facial recognition, behaviour prediction, language analysis, traffic control, purchasing stocks, and personal assistants are but a few of the areas of action taken over by AI. This has fascinated artists both for the ethical questions, such as how much of human life is controlled by computers, and worries regarding privacy, security, and the philosophical implications arising from the rise of these "intelligent" agents.

For curators, AI can be hard to explain to the public, as it can be both the result of an artistic practice, such as a chatbot that converses with the public about their "britishness" as in Libby Heaney's Britbot (2018) (Figure 77), or it can be the artist itself, as in Pindar Van Arman's Cloudpainter (Figure 78), where the painting is done by an AI with Van Arman's contribution being in the creation of the AI itself and teaching it how to paint.

Figure 77: Heaney, Libby, 2018, *Britbot,* AI chatbot web page. Screenshot. Britbot is a chatbot web page that questions visitors on their perceptions about britishness. Its responses are dynamically tailored from the responses given by the human.

Figure 78: Van Arman, Pindar, 2018, *Cloudpainter*. The robotic artist interprets Van Arman's teachings to create its own artworks. Image Pindar Van Arman

Another challenge in AI is attribution. While Britbot is easily attributable to Heaney, Cloudpainter forces curators to reconsider the relationship between man and machine. Would we attribute Cloudpainter to Van Arman and the resulting artworks to Cloudpainter itself or would we attribute them to the human by the transitive property? Is this a collaboration? And if so, is creating Cloudpainter and teaching it a contribution to the work? This question has been asked before in cases such as those of Congo the Chimp, whose works have been sold for $25,000.00 USD at auctions.

While Cloudpainter is a notable example for being a bodied and named AI artist, the more prominent AI artist would be minmaxV(D,G) = Ex~pdata(x) [logD(x)]+Ez~pz(z) [log(1−D(G(z)))], an AI designed by the art collective Obvious and which is to date the most expensive AI generated work, selling for $432,500 USD at a Christie's auction. I would argue attribution belongs squarely to the artist, as, unlike art made by animals, the works resulting from a generative AI were the result of an artist creating a piece of software with that very intention in mind, that is, they are the authors of all the resulting work. Furthermore, as weak AIs, they lack the real creative drive of a living organism. Of course, as AI technology is refined, all of the above may change and AI may become much more powerful and its applications much more wide ranging.

Finally, a word of caution regarding AI and how they derive knowledge. As was mentioned before, AIs need information in order to learn, and in cases where the AIs receive information directly from the public, they can be perniciously manipulated. If this data is skewed in any way, the AI will derive all its actions from this tainted data. This can result in AIs adopting certain human failures, such as racism, classism, or cognitive bias. For this reason, institutions should be watchful in their moderation of the data fed to artificial intelligences available to the public. Techniques to address this will be mentioned in the best practice section.

Time and Space In AI

AIs deal with time in a similar way to how humans deal with time. They need to wait for information to become available and they require time to process that information and to generate a response. The difference between AI and humans is the speed at which they can go through information once they have acquired it.

In the institutional context, interactive AIs can be treated in the same way as video games. Some will require short interaction times while others may be more involved. *Britbot,* for example, requires participants to engage with it for 10 minutes in order to complete the interaction. Unlike video games, interactive AIs are generally designed with short experience times.

Space for AIs is highly variable and depends on whether the AI has a body or not. For AIs with no physical body, space requirements are generally minimal, with the most common requirements being a screen and some input devices. However, bodied AIs can be much more complicated. As with robotics, they may be stationary or free-roaming, big or small. For more information on how to work with bodied AIs, please refer to the robotics section by clicking here.

Basic Questions

Do I need to watch all data being fed to an AI?

No, this is mostly important in cases where the AI generates its own responses and communicates directly with the visitor.

Are all robots controlled by AI?

No, some are controlled through strict pre-programmed routines. Robots that are controlled by AI are more spontaneous, present problem solving capabilities, or perform activities in ways that cannot be pre-programmed.

How can I tell if something is using AI?

The easiest way is to ask the artist. However, some telltale signs include: the software is capable of responding to natural language (i.e. speaking or writing in a casual form without specialised commands), it is capable of analysing media in a manner similar to a human, or the words neural network, deep learning, Turing test, and natural language processing are mentioned in relation to the artwork.

What can be done with AI?

AI has found uses in a wide variety of areas, all of which can be explored by artists in one way or another. Some examples of AI include crop growth prediction, facial recognition technology, deepfakes (generating realistic looking

videos from a still image), algorithmic trading, video analysis, musical composition, designing solutions to industrial design problems, and much more. It is impossible to predict where AI will work and how fast it will get there.

Case Study

Britbot (2018) by Libby Heaney (Figure 79) is an artificial intelligence residing on a web page where participants engage in a conversation with the AI around the concept of britishness. As more individuals chat with the AI, it learns more and more about both conversation and the concepts of what being British is. In terms of functionality, *Britbot* is one of the simplest AIs to interact with, as it functions as a messaging app like Whatsapp or Facebook Messenger.

This project is interesting to study, as Libby Heaney's project is incredibly open about how data is utilised. Although not openly stated, due to the delicate nature of the dialogues generated, the data Britbot is allowed to use in conversation must be carefully watched and certain words or concepts must be removed periodically.

Documentation for the project is hard to find and makes understanding the algorithms used almost impossible. This poses questions as to how the AI develops conclusions and builds its knowledge. Ideally, such a project would allow us to see what goes into the black box to better attempt to understand the outputs. To potentially enhance the memory of this work, we would require links to the whitepapers (in-depth exploration of the issues and solutions involved in the creation of the AI) for Britbot, as well as source codes for both the website and the AI itself.

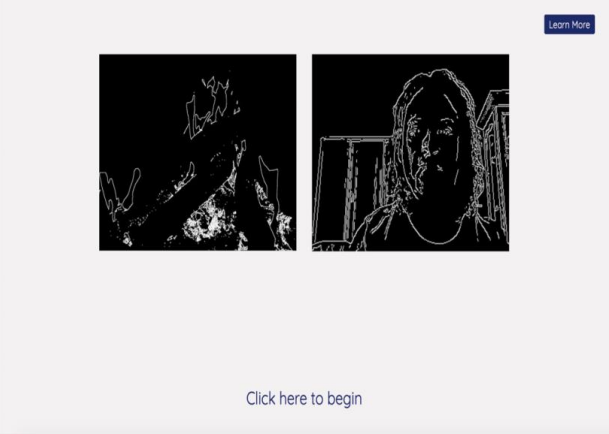

Figure 79: Heaney, Libby, 2018, *Britbot,* AI chatbot web page. Screenshot.

3.6.4 Kiosking Interactive New Media Art

Furniture design for interactive new media art may be different from traditional furniture for more traditional art exhibitions, as it introduces new challenges including usability, accessibility, and the upkeep of artworks which will be in constant interaction. While this may seem intimidating, in fact there is a wealth of knowledge and information on the subject coming from exhibition design in the field of interactive science museums and commercial exhibition design, particularly from the video game industry.

I do not wish to imply that within the field there is no valid knowledge, as art curators and exhibition designers have certainly met works of art that integrate technology such as video art and other audiovisual works. What is different within interactive new media art is the fact that while the aforementioned works integrate technology into them, none of it is meant to be touched and withstand hundreds, if not thousands, of interactions within the timeframe of the exhibition. Interaction demands that special attention be paid to it, as a broken work, an inoperable one, or an artwork that simply cannot be understood effectively becomes dead.

To clarify, the purpose of this chapter is to help exhibition designers and, most importantly, curators to understand the needs of kiosk design within the context of interaction, computability, connectivity, accessibility, usability, and aesthetics.

3.6.4.1 Accessibility

As the museum going public is not a homogeneous group and interactive works require to be usable ideally by everyone, accessibility is crucial. The following recommendations should not be taken as the sole answer to these issues; however, they function as a bare minimum any interactive work requires to be accessible. Keep in mind some artworks and their creators may resist your efforts to enhance accessibility. While this may be an issue, it is important to remember that even with more traditional works, not all of them are accessible to all and may never be so. Nevertheless, it should be a goal of any institution to make artworks accessible to as many people as possible. In fact, all designs within the institution should follow the seven principles of universal design (Chicone and Kissel 2013):

Equitable use

Flexibility in use

Simple and intuitive use

Perceptible information

Tolerance for error

Low physical effort

Size and space for approach of use

Many of these recommendations come from Dinosaurs and Dioramas: Creating Natural History Exhibitions by Sarah J. Chicone and Richard A. Kissel (2013)

- Make sure all surfaces have a maximum height of 77 cm from floor to underside and a reach depth of 25.5 cm. This will guarantee wheelchair users and children will be able to reach anything placed on them. This applies to plinths and other surfaces as well.
- Reading materials, such as labels, signs, and the like, should have a 20° angle from the horizontal to facilitate reading for seated and standing individuals.
- Keep your type readable by avoiding sharp contrasts such as white paper and 100%-black letters or green on red. At the same time, avoid having no contrast at all. A light off-white shade is better to enhance readability.
- Avoid using typefaces with small ascendants and descendants as well as with very small inner spaces. Some types designed to help with dyslexia include Lexia Readable, Open-Dyslexic, and Dyslexie.
- As many screens will be involved, reduce glare as much as possible, either by moving light sources or using physical barriers or anti-glare filters.
- Ensure your printed materials are color-blind friendly. While software like Color Oracle may help you identify issues, it is best to contact people that present deuteranopia, protanopia, and tritanopia to better inform you.
- Freestanding table legs should be more than 30.5 cm apart; however, you also need to include a barrier easily detected by cane at no more than 70 cm above the floor.
- Keep a minimum distance of 152 cm between displays to allow for comfortable movement.
- Any object mounted to the wall, including artefacts, specimens, and cases, must not extend outward from the wall more than 4 inches, unless its

bottom edge is lower than 27 inches above the floor or higher than 80 inches above the floor.

- Similar to free standing display cases, the base in a wall-mounted case should also be no more than 36 inches from the floor.
- Game controllers, mice, keyboards, and other input devices should be extendable so they can be adjusted to the person using them. Avoid rigid solutions that only accommodate one-hand positions.
- When using computer mice, avoid using ball mice, as these require constant upkeep. Likewise, provide an appropriate surface for the mice. Rugged, textured surfaces are better than glossy ones. Rough finish laminate or wood are ideal materials.
- Avoid hanging tablets in right angles, placing them at an angle makes for easier operation.
- Tablets should always be plugged into power, do not depend on batteries.
- Tablets will also require regular cleaning in order to maintain hygiene and tracking accuracy. A simple moist microfibre cloth is enough.
- Ideally, use tablets larger than nine inches and enlarge fonts to make it easier for users to read the screen. Search for the accessibility option under settings.
- Software such as the free open source and free Openkiosk can be used as a way to secure a computer for use as a public terminal. This software is a purpose-built internet browser which locks the computer's other functions and keeps focus on the artwork.
- As an anti-theft measure, all kiosks should have locks to limit access to the devices.
- Ensure no physical control interfaces require too much physical strength.
- Avoid knobs or implement a way for these to be operated in an alternate way.
- Have children and people in wheelchairs and with vision impairments to move around the space and interact with the works before the opening. This will allow you to identify issues that may have been overlooked and fix them.
- If finding willing individuals is not possible, go through all spaces and artworks on your knees and on a wheelchair to at least get a feel for the space and any adaptations that may be needed. This is a last resort option.
- Remember to always create large font printouts of all exhibition texts on beige paper for hard-of-sight visitors.
- For works that may be deemed inappropriate for minors or others, physical barriers can be implemented around the work. See Figure 80 and Figure 81.

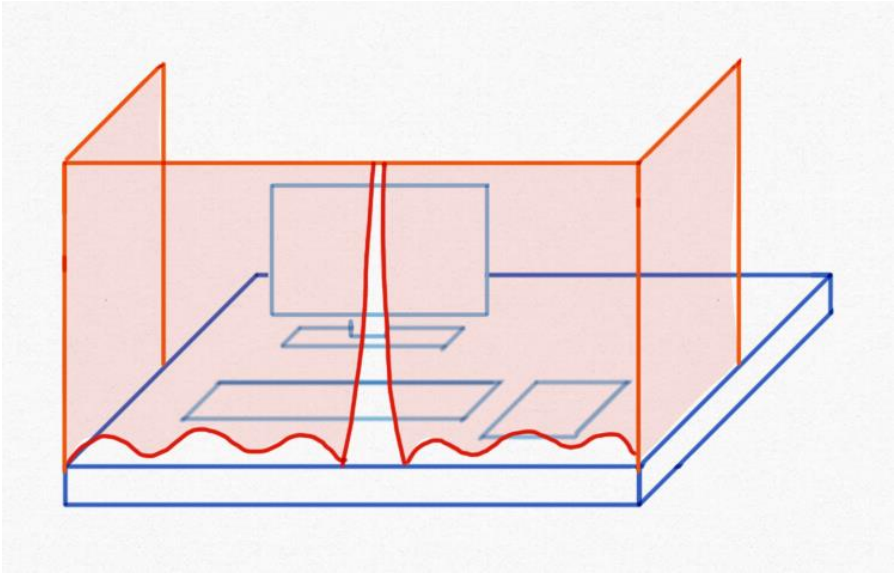

Figure 80: In this example, the display is hidden by a small curtain which blocks the screen from view. When in use, the curtain is opened and the visitor's own body blocks access. Image: Rene G. Cepeda.

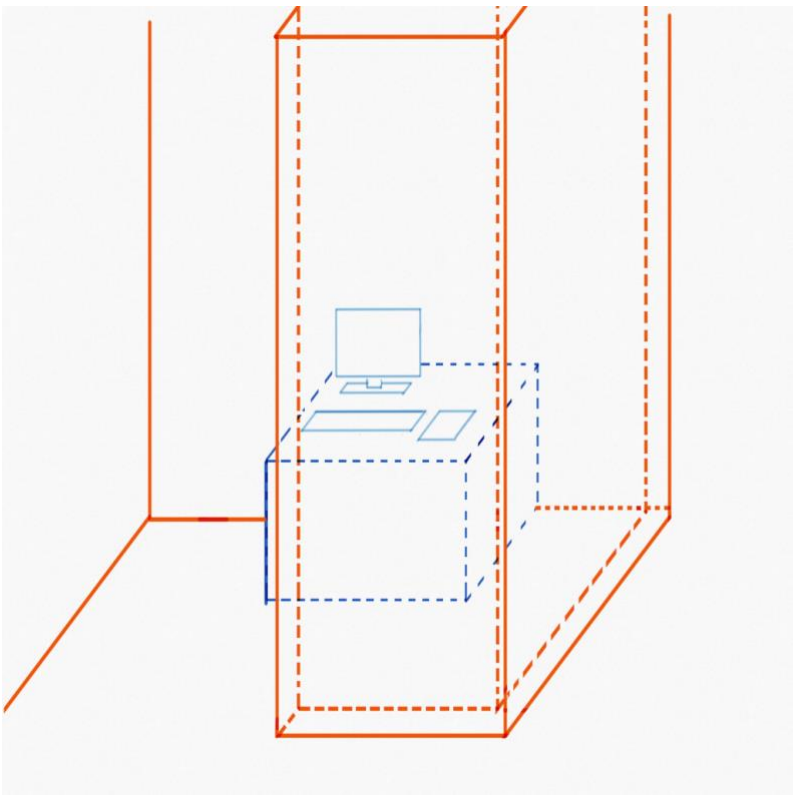

Figure 81: In this configuration, the display is placed in an isolated space. This space can be further separated by including a curtain to function as a door. Image: Rene G. Cepeda.

3.6.4.2 Usability

Kiosks should not only allow users to engage them regardless of any disabilities, they must also be usable. While accessibility refers to whether something can be approached and operated by individuals both able and disabled, usability refers to how effective, efficient, and pleasurable it is to use something.

- Interfaces and instructions should be clear, using simple language and short sentences.
- Ensure there is enough lighting for all texts to be read.
- For displays that were built in the institution, make sure control functions retain a consistent iconography throughout the entire institution. This will reduce confusion.
- Provide feedback to indicate works are functioning. Clicks, beeps, and vibrations can be easily implemented into devices. Lack of feedback can lead to the perception that artworks are not functioning correctly.
- Keep spare control interfaces. Video game controllers break, keyboards lose keys, and mice cables can get snapped. Replace these as soon as possible.

3.6.4.3 Multiuser Kiosks

Multiuser kiosks are displays that allow for multiple users to engage with one experience at the same time. These experiences can or cannot be networked to allow interaction between users. This networking is dependent on the work and may require that users are not able to look at each other's play areas. If the experience is not networked and users do not interact with each other, this "privacy" is not necessary.

Multiuser kiosks offer certain benefits, such as encouraging social interaction, greater availability of popular works within a space, reduced footprint, and increased engagement. As such, they should be considered in cases where a work may involve interaction between users through networking or when an experience may prove to be popular and waiting times should be reduced.

In Figure 37 we can see an example of a multiuser kiosk for a video game. In this case, both users are playing the same game and are competing against each other. This means the consoles are networked and that both users require their own screen to ensure visibility is clear in such a small monitor. These types of setups allow for better engagement and enjoyment of the experience as there is no competition for resources. It also doubles the amount of people able to engage with the work without requiring much more space. In fact, this particular setup can accommodate up to 4 players, two on one side and two others on the opposite side. Other configurations, like the one in

Figure 82, allow for up to 8 people on an even smaller area and privacy can be had due to the shape of the design.

Figure 37: In this example, two users can experience the video game in question independently and at the same time. Photo by: Nick Statt/CNET

Figure 82: In this example, up to 8 players can experience the same video game independently of each other. Image: Kiosks4business.

These are not the only configurations possible, others include circular tables in cases where mice and keyboard are required, booths with seating arrangements, and many more. In the end, the shape the multiuser kiosk takes depends on both the creativity of the design team and the artwork. Do keep in mind that while the examples here provided reference video games, in fact, multiuser kiosks can be used for other new media artworks, such as web pages, interactive video, and interactive live streaming.

3.6.4.4 Kiosk Designs

Sometimes kiosks will be designed by the artist. One such example is the custom arcade cabinet for Lu Yang's *Uterus Man* (2013 Figure 83), which was made to resemble arcade games from the 80s and 90s and features images of the eponymous character. While its construction resembles traditional arcade games, this cabinet had to be modified from an existing one and retrofitted with contemporary technology able to run the game.

In other cases, the institution can decide to create their own cabinets as a form of immersive design or to make controlling certain experiences more approachable. For an example of an accessible and usable kiosk, we can look at the V&A's *Videogames: Design/Play/Disrupt* (2018-2019) furniture designs, particularly the ones for Tale of Tales' *The Graveyard* (2008;

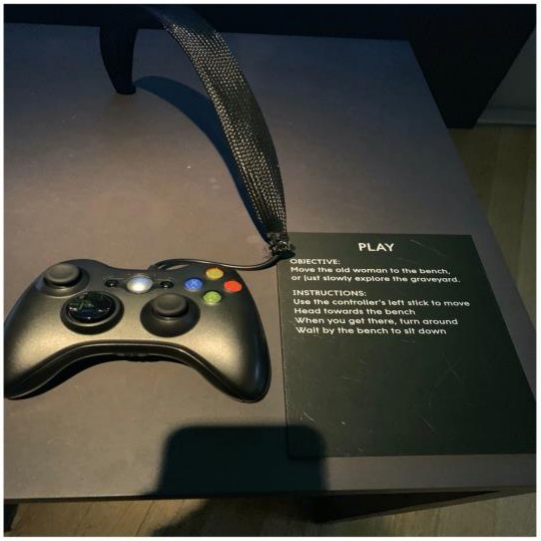

Figure 84). The kiosk in question features a desk with enough leg space for a wheelchair user to sit comfortably close to the controller. The controller is tethered to the "desk" by its USB cable but has enough slack to be held in a comfortable

position both sitting or standing. The Kiosk also features a simple label explaining the objective of the game as well as how to operate the controls. Clearly, a lot of thought was put into making this display approachable regardless of any physical conditions. Furthermore, explaining the goals and controls makes using the display effectively simple and approachable to both experts and novices alike.

Figure 83: Bespoke cabinet for Uterus Man. Photo: Lu Yang.

Figure 84: The kiosk has been designed to look like a desk. This skeuomorphic design communicates to the visitor what is the expected approach. The label to the right explains in simple terms what the player should do and how to do it. Notice the spotlight drawing attention to both the display itself and the instructions. Image: Rene G. Cepeda.

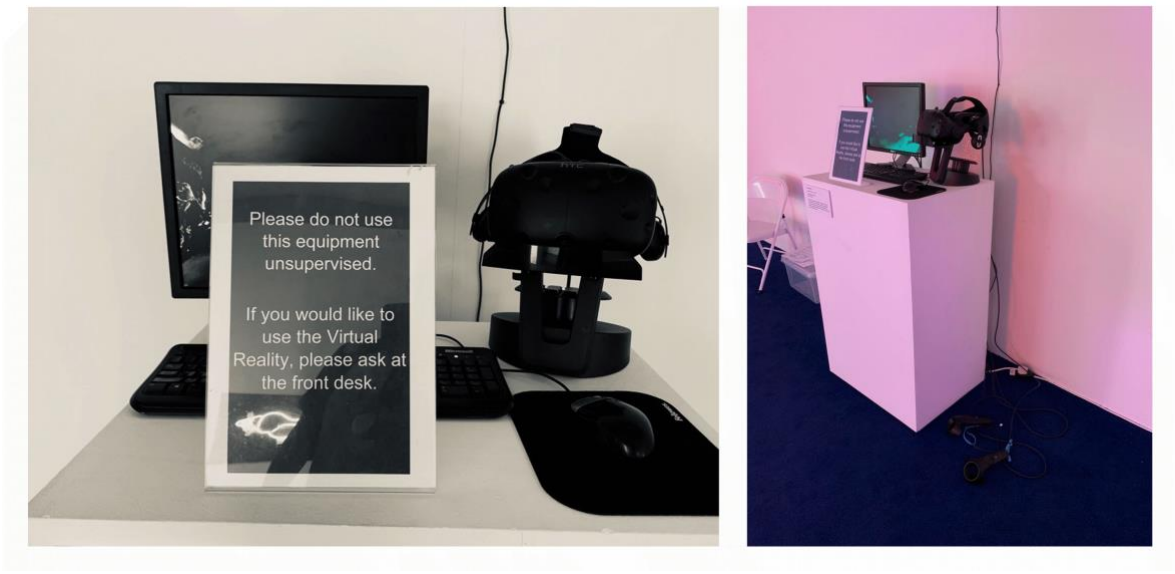

Figure 85: This simple setup hides the CPU within the pedestal but lacks cable management, which means the controllers lie on the floor. Also interesting is the manner in which one gets access to the device. Image: Rene G. Cepeda.

Figure 86: In this case, a kiosk is not needed; however, a creative solution still had to be built. The mobile phones are tethered to the ceiling through their charging cables and said cables are protected with a mesh. To prevent removal of the phone, the silicone covers are glued to the mesh, making removal harder. Image: Rene G. Cepeda.

3.6.4.5 Technical Considerations

Interactive new media art kiosks have certain requirements that other types of displays do not. Heat generation being the most important of all. Works that utilise projectors, screens, and computers are susceptible to overheating if kept within small unventilated spaces. These can cause irreparable damage to the work or even cause fires. When designing furniture meant to conceal these parts of the artwork, ensure there are at least 10 cm between the devices and the containing structure. Vents should be cut into the furniture to allow for airflow. These should have an input and an output; otherwise, hot air will remain trapped in the structure.

For high performance machines, like those needed for VR experiences, extra fans should be placed in the furniture as well as vents on the opposite face of the furniture. If this is meant to be a long term setup, air filters should be put on the

input air holes so the computer remains dust free. In setups without fans, filters can be placed on all air holes (

Figure 87). As an added precaution, keep a fire extinguisher at hand in every space that has such setups.

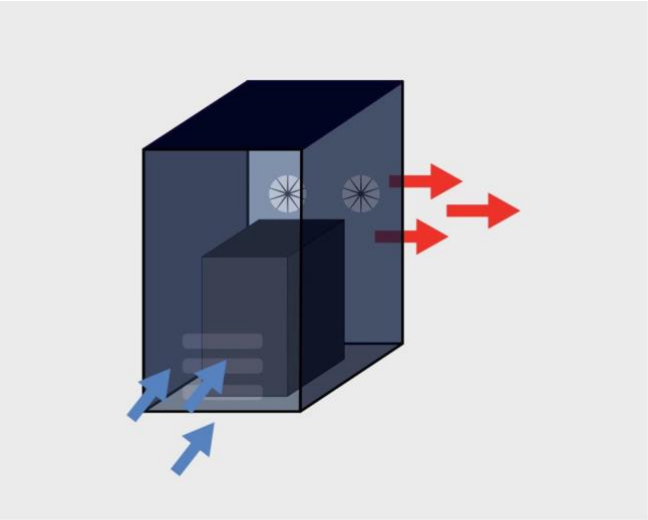

Figure 87: Cool air enters through the front of the furniture and hot air is expelled out the back. Image: Rene G. Cepeda

Some interactive new media artworks revolve around exposing the workings behind our day-to-day technology. For these artworks, hiding cables, CPUs, and other technological trappings would be a contradiction. Nevertheless, these works with exposed components may still require presentation and protection. If the artist requires it or the exhibiting context allows for it, it may be possible to simply present the work as is by simply securing the cables and hardware by bolting them to the display surfaces. In cases where this is not enough, plexiglass cases can also be used to protect the artworks. For this solution to work, the case should be tested for overheating and extra air holes should be drilled. Recommended locations for this extra ventilation include the back and top of the case.

While the curatorial implications of hiding cabling have already been discussed, there are other practical concerns such as choice of cables and cable management. To choose cables, it is important to understand the technologies being used in an artwork. For older technologies, this requires a certain degree of knowledge in electronics. Fortunately, in the early 2000's, technological advances have led to a much simpler connection ecosystem. The introduction of HDMI technology and wireless streaming have simplified multimedia connectivity.

For older technology, however, cable choice is much more important. The first factor in cable technology relates to whether the signal to be transmitted will be analogue or digital. Analogue signals are continuous waves that relay data through variations in their shapes. Digital signals, on the other hand, use binary signals (on or off) to transmit data. Most older technologies are analogue while more recent ones are digital. The main difference between both technologies is in quality and susceptibility to interference. As analogue technologies depend on slight variations in the wave, any unwanted changes to this wave (interference) will degrade the signal. On the other hand, digital signals will either work or not, meaning there is no degradation of the signal.

In practical terms, analogue signals may not work due to cheap cables with poor shielding, too many cables in close proximity interfering with each other, damage to the connectors or the cable itself, or other electronics in close proximity. Digital signals fail either because the cable is broken, the connectors are faulty, or there is a failure in the hardware itself. Therefore, troubleshooting an analogue connection requires IT to get involved and test a variety of factors. Meanwhile, for digital, it is possible to replace the connectors, change the cable, or proceed to troubleshoot the hardware.

When buying replacement cables, the quality of the cables is most important when dealing with analogue signals, as plated gold connectors do have an effect on the quality of the signal. The quality of the shielding is also important as well as the maximum length of the cable, since all can affect the system. Meanwhile, for digital cables, there is no such variation in quality except for HDMI and USB versions. For example, using a USB 2 cable between two USB 3 devices will limit the devices to the feature set of the USB 2 protocol. In other words, digital devices will be limited by the device or cable with the lower version of the protocol. The final limitation for both types of signals is the maximum cable length permitted by each technology. These maximum lengths vary greatly and should never be exceeded.

Having mentioned this, the most common cables are those seen in

USB This is the most common connection used nowadays. There are 3 distinct generations with USB-C being the latest implementation. Unfortunately, there are a plethora of connectors which makes finding the correct cable a complicated endeavour. USB C is attempting to fix this and is finding wide acceptance in modern electronics. It can be used to transfer almost any kind of data. Maximum length: 5 m	
HDMI Alongside Displayport this is the current standard for transmitting audio and video to display devices, it supports ultra high resolutions such as 4K and in the future 8k. It can also transmit uncompressed digital audio. It is very convenient as it combines two high quality signals into one cable. Maximum Length: 5 m with a standard cable, Up to 15m with a high quality cable	
Displayport A competing technology to HDMI, it has a few technological differences but for most purposes these are negligible. In most cases the decision to use either connection depends on the hardware being used. Maximum Length: 3m.	

Figure 88 (All maximum lengths come from Sewell Direct).

BNC This connector can be attached to a variety of cables including audio and video cables. It was used in older computing devices. Maximum Length: 500m.	
Twin Core Cable with PHONO connectors (RCA) Used to transmit stereo audio and video. They are color coded, White for left audio or mono sound channel, white for right audio channel and yellow for the video signal. Can not transmit above standard resolution: 480i or 576i. Maximum Length: Depending on quality up to 91.5m.	
Component (YPbPr) An extension of the RCA cables, these cables can go up to 1080i resolution which is better than standard resolution but not as good as true high definition such as 1080p. They break down the video signal into three signals one each for Red, Green and Blue. Maximum Length: At standard definition up to 30.5m (depending on cable quality), at high definition up to about 5 m.	
S-Video Standar resolution cable (480i or 576i) better than RCA and coaxial but not as good as composite video. Maximum Length: 45.7m.	
XLR Most commonly used for high quality audio devices. Sometimes used for stage lighting. Maximum Length: 30.5m.	
MIDI MIDI is a standard for electronic musical instruments. Its associated connector the 5 pin DIN connector is used to connect MIDI devices. Maximum Length: 15m.	
Phone Jack Originally invented for telephone switchboards, it is now used for musical instruments such as guitars, and other consumer audio devices such as headphones, stereos and more. Several sizes exist.	

CAT 5 Colloquially known as an ethernet cable, it is used to network computer devices such as internet routers, computers and servers. Can transmit a variety of data reliably for long distances. Maximum Length: 100m.	
SPIDF Optical Cable Commonly used to transmit high definition audio as a digital signal. It has now been substituted by HDMI which has the capacity to transmit higher fidelity audio. They can not be bent tightly or they will break. Maximum length: Up to 5 m.	
VGA VGA cables are used to transmit analog signals usually from computers to monitors and other display devices. This standard co-existed with DVI until they both were replaced by HDMI and Displayport Maximum length: No maximum length	
DVI The DVI standard was created to replace VGA and unlike VGA transmits digital signals. It is backwards compatible with VGA. Maximum Length: Up to 4.5m at high resolutions (above 1280x1024), or up to 15m at lower resolutions (1280x1024 and below)	
Firewire Usually used to transmit data between devices, it is not widely used anymore but remains a popular connection with audio and video professionals. Maximum Length: 4.5m.	
Thunderbolt Like Firewire, this standard is used to connect devices of all kinds. It can be thought of as a combination of Displayport and USB. This standard simplifies connections as the port can be used to transmit video, audio or raw data depending on the software without specialized input and output outlets. Maximum Length: Theoretically 10m, most cables max out at 3m.	

USB This is the most common connection used nowadays. There are 3 distinct generations with USB-C being the latest implementation. Unfortunately, there are a plethora of connectors which makes finding the correct cable a complicated endeavour. USB C is attempting to fix this and is finding wide acceptance in modern electronics. It can be used to transfer almost any kind of data. Maximum length: 5 m	
HDMI Alongside Displayport this is the current standard for transmitting audio and video to display devices, it supports ultra high resolutions such as 4K and in the future 8k. It can also transmit uncompressed digital audio. It is very convenient as it combines two high quality signals into one cable. Maximum Length: 5 m with a standard cable, Up to 15m with a high quality cable	
Displayport A competing technology to HDMI, it has a few technological differences but for most purposes these are negligible. In most cases the decision to use either connection depends on the hardware being used. Maximum Length: 3m.	

Figure 88: List of plugs for media connectivity. Image: Rene G. Cepeda.

As many of these setups use a variety of devices combined in unorthodox manners, wires can become an issue. Use gaffer tape to manage all cables and avoid tangles and potential tripping risks.

Tape hanging cables together unless instructed not to do so. Remember to give enough slack to cables attached to moving parts. Adjustable monitors, computer mice, and keyboards should be movable and allow visitors the possibility to reposition them for better comfort. Any cables running along the floor should be taped to the floor or covered with floor cord covers. See

Figure 89.

As a final note on cables, make sure you label which cable connects to which port. This can be done with simple masking tape and a naming system. Simply label each device with a name and a number and then, on each cable end, label it “To device X”. This will simplify both installation and upkeep by reducing uncertainty.

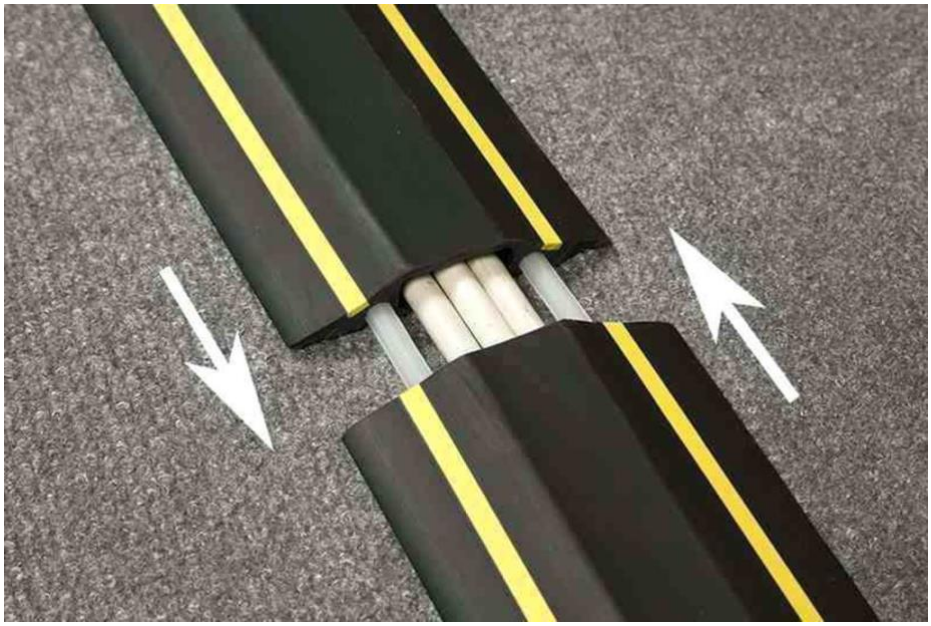

Figure 89: Cable protection. Image: Startatoz.com.

3.6.4.6 Input Devices

Input devices include a variety of systems, from the physical to the immaterial. Physical input devices include mice, keyboards, joysticks, touch screens, and other devices that can be held, touched, or come into direct physical contact with. Immaterial input devices include motion detection sensors like Kinect, infrared cameras, eye tracking cameras, and other devices that detect movement and interpret it as an input.

For physical devices, the most important concern is durability, as these devices will be put under an incredible amount of stress. Depending on how the artist handles these input devices, solutions can range from repairing or replacing parts of the controller or even the entire device to recreating the controller. This solely depends on whether the controller is considered part of the artefact. One unfortunate example of the latter is the game Bush Bash (2014) by SK Games when it was shown at the V&A. As can be seen in Figure 90, the car used to control the experience was deemed too delicate and a decision was made to encase it in acrylic and render it inert. This decision has effectively erased the entire artwork and turned it into a gameplay video. The better solution would have been to leave the artefact to the side and recreate the control interface. It did not even have to be another sawed-half car, it could have been a particle board recreation of a car with working controls, thus actually preserving the artwork and not just a shadow of itself.

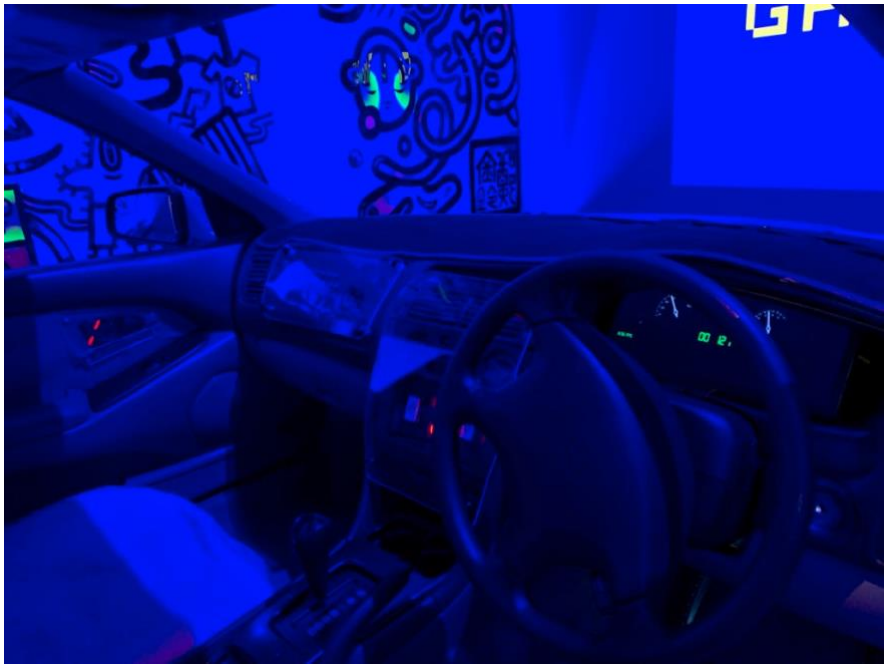

Figure 90: Detail of the deactivated control interface and accompanying signage. V&A Dundee. Bush Bash is a video game where two players sit in a sawn-half car and control the game by using the car's control interfaces. Unfortunately, at the V&A, conservation concerns have rendered the game unusable. Image: Rene G. Cepeda.

For objects where the artwork has no specific control artefacts, considerations are much more mundane; although high durability options, such as metallic keyboards, can be used if the costs of buying new keyboards from time to time is deemed too high.

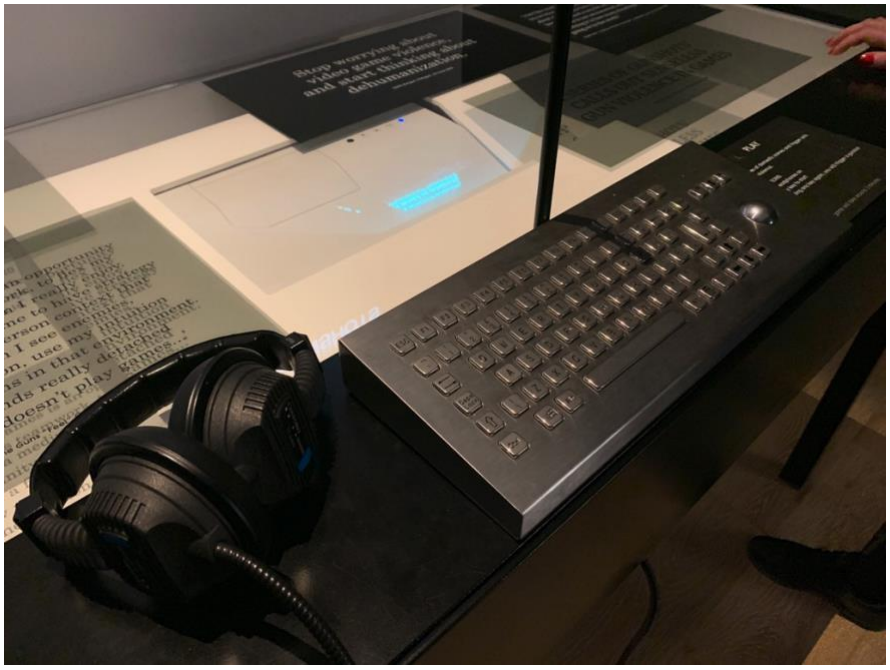

Figure 91: In many cases, these metallic keyboards/mice may be considered overkill. However, in permanent displays, they significantly reduce the need to replace input devices. Image: Rene G. Cepeda.

One final consideration for physical controls is the possibility of deactivating extraneous keys and buttons from keyboards and other controllers. To do this, one simply needs to open the controller in question and tape over the membranes that close the circuits of specific keys. This will stop users from exiting applications or inputting undesired commands. For gaming controllers, this may be done for simplicity reasons, as contemporary game controllers can be pretty daunting to the uninitiated. In this case, it may be a good idea to 3D print custom controller faceplates that lack the buttons in question. A variety of individuals can be contacted to do these modifications, including your own IT department, the installation department, or even hobbyists that specialise in creating custom game controllers.

For immaterial input devices, recommendations have to deal more with the specific sensors involved. Motion sensors may require specific light levels (consult manufacturer guidelines) and spaces have to be modified to accommodate them. For others, there cannot be other individuals near the participant or the system will misread their movements or simply not function. For this reason, it is important to remain in contact with the artist and their team, as they will most certainly be familiar with the peculiarities of their systems. In the future, it may be possible for these sensors to no longer work for a variety of reasons and should be replaced with modern technologies as the need arises, since the preservation of the old sensors is unnecessary in most cases.

In conclusion, when designing kiosks, it is important to keep in mind the accessibility of the furniture and software as well as its usability and balance, all of this with the technical requirements of the hardware, which can include heat and theft prevention as well as the wishes of the artist. Finally, while the furniture itself may be documented through a simple series of annotated construction plans and photographs of the final design, it is far more important to document the reasons for each design choice, including technical or artistic limitations. This will allow future researchers and designers to either emulate the kiosk or innovate on it without the need to rediscover challenges priorly identified and solved.

4 Memory

4.1 Introduction

One of the most important steps in the curation of Interactive new media art is the documentation step. This is important because, unlike with other artforms, interactive new media art is very unstable and mutable. Amongst the reasons for detailed documentation we can include: preservation of the display intentions of the artist for future generations, a detailed record of solutions and adaptations to the work done in prior exhibitions, details on the differences between versions of the artwork, known issues and bugs present in the artwork, solutions and workarounds to the aforementioned issues and bugs, and a historical record of all the exhibitions the work has ever been included in. As Anne Dekker says in Collecting and Conserving Net Art : Moving Beyond Conventional Methods (2018):

> An emphasis on documentation is not uncommon when it comes to ephemeral artworks such as performance art, or dance and theatre pieces. In the case of artworks that contain or consist of components prone to obsolescence, documentation, for better or worse, often becomes a substitute for the project. Some conservators and curators find these scenarios frightening and consider the approach of 'simply' changing the presentation or hardware of an installation, or of showing documentation instead of the work itself as utterly inappropriate.
>
> This fear of the new is also one of the reasons why conservators (and curators) are reluctant to discuss the conservation (or presentation) of net art. They prefer to stick to their well-known fields of interests in which they can build on works that have been recognized and validated in the past.
>
> (Dekker 2018 pp. 3,5)

Gilbertto Prado's *Desertesejo* (2000/2014/2018) is an example of a work that has benefited from a thorough documentation. As time has gone by, Prado's work has changed. For a time, it was a web-based digital space (Figure 92), then a CAVE projection, later becoming similar to a video game (Figure 93) in its presentation through large scale projection, and at times has existed as a VR experience. In addition, due to its dependence on VRLM (an outdated technology no longer supported), the work had to be recreated in newer technology through Prado's own documentation of the work (Prado and Cuzziol n.d.). Had this documentation not existed, the recreation would have been harder, if not impossible, to make. Furthermore, Prado has documented the ways he intended the work to look in spaces where later, due to technical considerations, it proved impossible to do so. This gives us an idea of possible arrangements for the work and how willing the

artist was to experiment with space. While this is not critical right now, as Prado continues to exhibit, this will not be possible in the future and all that future curators will have to go by is the notes and sketches he has left us. With these preserved in exhibition memory, it is possible to respect the artist's wishes long after they are no longer with us.

Figure 92: Prado, Gilbertto, 2000, *Desertesejo*, 3D Chat. Screenshot. Here we can see the original form for Desertesejo, a 3D chat that ran on a web page. The experience was controlled via mouse and keyboard. Image Gilberto Prado.

Figure 93: Prado, Gilbertto, 2018, *Desertesejo*, Video Game. Here we have the current version of the work projected onto a wall. The participant can move around the virtual space through an Xbox controller. Image: Gilbertto Prado.

4.2 Methodology

For each exhibition, an archive box should be created. This box should be labeled with the exhibition's name and the time period it was available. Inside this box, there should be an indexed binder containing all the memory making related to the exhibition, including marketing materials, flyers, interviews, and videos, as well as detailed notes on each work. This method is already in place in several institutions including the Laboratorio Arte Alameda in Mexico City. The following methodology builds upon LAA's methodology and the Variable Media Project but expands it to include a wider range of data than what the Art Lab currently does.

Figure 94: Each of the boxes in the top shelf contains the collected memory of an exhibition shown in the Laboratorio Arte Alameda. Image Rene G. Cepeda

Figure 95: Example of an exhibition memory box at the Laboratorio Arte Alameda. The box contains all promotional materials, curatorial texts, and interviews made with the artists. Floor plans and other technical details are included as well. Image: Rene G. Cepeda

- Go through existing documentation and try to determine if it mentions issues with display, curation, or installation. Lack of documentation in these areas does not mean the work has no issues; they may have been solved as they appeared and were never documented.
- If issues are mentioned, take extra care to document what was done this time to address them.
- During talks with the artist and/or curators, make sure you ask about any known issues.
- If the work has parts that will be shipped to the institution, make a note of any issues with imports/transportation as well as the solutions attempted and the outcome. These will be useful for future curators to calculate costs and viability.
- If any hardware was obtained by the institution, make a list of each part and where it was gotten from and the costs. Then, take down any notes about installation, configuration, and compatibility. Make these annotations especially if the results were satisfactory.
- If any software has to be acquired, make a list of each program/plugin/app and where it was gotten from and the costs. Then, take down any notes about installation, configuration, and compatibility. Make these annotations especially if the results were satisfactory.
- Include APK (installation files) for all android apps as well as other executables for any software used in the exhibition.
- Keep copies of the source code of any artwork. In the case of works commissioned by the institution, this is not an optional step.
- Create a file of all people involved in the artworks, especially suppliers and specialists, so if artworks require support, it is easier to track specific individuals later on.
- Keep all notes and sketches made about the exhibition space, this includes digital and paper notes. While digital storage is a good way to save space and make the documentation accessible, make hard copies of everything, as these are more durable than digital versions. The American Library Association recommend making hard copies of any important data, this applies to memory making in the institution as well.
- Minutes and all material submitted during meetings pertaining to the artworks should be included in the archival material. This will create a historical record of all steps taken in the creation of the exhibition.

- If the exhibition layout changes during the process, all new floor plans as well as the reasoning behind the changes should be included.
- Every time an issue is raised in relation to an artwork, this issue should be documented. Error messages, screenshots, and pictures, as well as a brief explanation of the issue and steps taken to fix it, should be included. Specific details are valuable and should not be omitted.
- All custom furniture should be documented, including sketches, photographs, and any notes pertaining to their success or failure after the opening.
- Take detailed photographs of the furniture and hanging arrangements. Wide shots are not enough. Ideally, you will photograph all devices, connections, and hangings from different angles.
- All photographs, diagrams, plans, and documents should be annotated, explaining the reason for their existence.
- Document each web artwork using Rhizome Conifer. Conifer works with most web pages, flash applications, and social media sites such as Facebook and Instagram. You need to access EVERY FACET of the work, as Conifer cannot access anything that has not been interacted with. This includes pressing play on videos and clicking on every link and every button. Create a list of links linking to these recordings, both on a digital file and a printed one. If the links are too long, use goo.gl to create short easy-to-access links.
- For works that Conifer cannot access (offline works, robotics, AI, live streaming), create recordings and take photographs of the works functioning.
- Once the exhibition is ready to open, a video walkthrough, ideally narrated, should be made of the space. This can be done after the opening or before it depending on the circumstances. Photographs should be taken as well.
- During the exhibition, document visitors interacting with the works as well as their complaints regarding usability and accessibility. These can be summarised notes highlighting the most prevalent issues.
- After takedown, include minutes for the closing of exhibition meetings as well as any observations made by the staff.

All this information can be collected into a Word document that then can be printed out and turned into a bound document and placed within the exhibition box alongside all other materials. This memory will create a more transparent exhibition that will provide valuable knowledge for future generations. Of course, this is an ideal of what proper documentation should look like and institutional realities may make such methodology unworkable. Regardless, the

implementation of some parts of this process will enhance the quality of the documentation available in an institution.

4.3 Data Storage

While it is tempting to create an all-digital archive of the exhibition, this option is highly volatile and may result in entire exhibitions being lost should this data become corrupted or the technology needed to access it changes. For this reason, any digital information added to this archive should be checked every 5 years and migrated to new storage solutions. Alongside this process, format compatibility should also be checked because, as older software falls out of use, you may end up with documents that are being preserved but their contents cannot be accessed. To avoid this situation, you should make sure that current software is able to access files, starting from the most important ones to the least important, and if they do not, find a way to migrate this information to newer software. In some cases, all that is required is to use an older machine with the old software and save it in another format that is still in use, and from there do a full conversion to newer software. In some cases, this will require the entire recreation of the file. In others, the best solution is to create hard copies of the file. One technology that, in the future, may prevent the need to migrate storage technologies due to deterioration of the physical media is the M-Disc with its theoretical 1000-year life span. It is an optical disc that requires a special type of DVD and a special burner, but afterwards it can be read by any DVD player. The only other limitations to these drives are the cost per unit and their storage capacity, which caps currently at 100 Gb. Until M-Drives prove their reliability, however, tape backups remain the best option for data storage. In all cases, create 3 copies of all data: one in hard drive, one on the cloud, and one in a secondary location as well as a hard copy printed in acid-free paper.

In terms of archiving the artworks in a database, it is important to make sure the database used supports the creation of custom metadata fields, as not all content management systems dedicated to museums support the creation of custom fields and lack predetermined fields required for new media art. Some of these limitations include the lack of fields to document interactivity, connectivity, store source codes, and versioning, to name a few of the most important factors in new media art. One of the solutions that may be of interest to any institution dealing with new media art is Binder, an application that runs alongside Archivematica and

is compatible with the Museum System (TMS). This application simplifies many of the aforementioned issues with new media collections and is a free open source solution to the issue.

4.4 Record Structure

Example of the structure of an artwork memory document based around Jon Ippolito's Variable Media Questionnaire:

Work: Name of the artwork, Dates, etc.

Stakeholders: A stakeholder is anybody or anything that participates in the creation, exhibition, or archiving of a work. This includes individual artists, artist groups, gallerists, curators, conservators, executors, institutions, and even outside viewers whose input has been used to create an interview.

Media: Images, videos, diagrams, plans, audio interviews, anything media related to the artwork that is not a Part.

Parts: Anything that is used in the construction or display of the work, they may fall into the following categories:

Source: The content of a work. This is usually specific and unique; a program, a video, even a mood or concept to be portrayed.

Material: A generic component that is required to supplement the work's source elements; a video monitor, a display stand. Materials are fungible, though they may have to fit certain specified parameters.

Environment: The environment in which a work is shown; a display area, a network.

Interaction: Intended interaction between the piece and its consumers; touching, manipulating, passive viewing.

Interview: The interview serves to answer questions relevant to the work and its parts. The interviewee should state their authority in dealing with the work. The questions should try to solve questions of intention of display, how each part is to be preserved, fixed, migrated, or emulated, as well as other practical issues. You may record multiple answers for each question, such as ideal and preferred options.

Resources: Research papers, catalogues, web pages, and any other document or research resource relevant to the work or published about said work.

Having laid the basic structure, here is an example taken from the variable media questionnaire demo. For brevity's sake only the contents of one part and one interview will be shown in italics.

While this is an example of how a hand-made questionnaire may be made, it is possible to gain access to the system and create an online version through the web page variablemediaquestionnaire.net. Once the record is created, it can be copy-pasted and turned into a text file and printed as a hard copy to be included in the exhibition binder. A planned update to the system will allow for the creation of a pdf file that can be printed in the future.

4.5 Links to Resources on Conservation and Preservation

For further information on the conservation and collection of interactive new media art, the following resources may be of use:

The Variable Media Questionnaire: Created by Jon Ippolito and John Bell, with major contributions to previous versions by Jennifer Crowe and Alain Depocas. The Variable Media Questionnaire can help by recording opinions on how to preserve creative works when their current medium becomes obsolete (Ippolito 2004).

Digital Preservation, Association for Library Collections & Technical Services: By the American Library Association, provides a series of recommendations on how to preserve various types of new media, from email to social media websites (American Library Association, 2014).

Conifer: Conifer is both a tool to create high-fidelity, interactive recordings of any website you browse and a platform to make those recordings accessible. Created by Rhizome (Rhizome, 2014).

Re-collection: Art, New Media, and Social Memory: By Richard Rinehart and Jon Ippolito. Rinehart and Ippolito, both museum professionals, examine the preservation of new media art from both practical and theoretical perspectives (Rinehart and Ippolito, n.d.).

Matters in Media Art: A resource for the collection of new media art. This site provides recommendations and practical guides for the acquisition and preservation of new media art (New Art Trust et al., 2015).

New Collecting: Exhibiting and Audiences after New Media Art: The collections of museums, galleries, and online art organisations are increasingly broadening to include more new media art. Because new media is used as a means of documenting, archiving, and distributing art, and because new media art might be interactive with its audiences, this highlights the new kinds of relationships that might occur between audiences as viewers, participants, selectors, taggers, or taxonomisers. New media art presents many challenges to the curator and collector, but there is very little published analytical material available to help meet those challenges. This book fills that gap. Drawing from the editor's extensive research and the authors' expertise in the field, the book provides clear navigation through a disparate arena. The authors offer examples from a wide geographical reach, including the UK, North America, and Asia, and integrate the consideration of audience response into all aspects of their work. The book will be essential reading for those studying or practicing in new media, curating, or museums and galleries. (Graham, 2014)

Collecting and Conserving Net Art: Explores the qualities and characteristics of net art and its influence on conservation practices. By addressing and answering some of the challenges facing net art and providing an exploration of its intersection with conservation, the book casts a new light on net art, conservation, curating, and museum studies. (Dekker, 2018).

Amanda Dekker's personal website: Has a collection of her writings on archiving and preservation (Dekker, 2020).

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