**Master conjoint franco-hellénique**

**Université Paris 8 : *Création Numérique***

*parcours : Arts et Technologies de l'Image Virtuelle*

**Ecole des Beaux-Arts d'Athènes :**

***Arts et Réalité Virtuelle Multi-utilisateurs***

# Interacting with the machine: To the screen and beyond

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EUROPEAN

GREEK / FRENCH

MASTER

Mémoire de Master 2

2019-2020

## ACKNOWLEDGMENTS

This work could not have been held without the guidance and help of my academic tutor, Professor Jean- François Jego. Also I would like to thank Professor Manthos Santorineos for trusting me and giving me the opportunity to be part of this Greek-French master program.

I would like to mention both the Greek and the French academic team for their support. Especially, I would like to thank Tasos Kanellos and Anna Laskari for their inspiring tutoring.

Finally I would like to thank my co-students from both the Greek and the French Department for their help and especially Vicky Michalopoulou, Spyros Tryfonopoulos and Vanessa Ferle for the excellent collaboration.

## ABSTRACT

The following work is an attempt to explore the human-computer interaction, from the perspective of the art, as a concept divided to two types: WIMP and post-WIMP interaction. I tried to track the way the interface of the personal computer, the WIMP, dominated the screen-centric interactive art, how its main design principles were challenged by artists and how this changed by post-WIMP interaction practices. I chose to reference artistic projects from the sixties until the last years as my intention was to trace the originality and not the artistic success or the historical evolution.

Also, I tried to extend this work incorporating experimentations and hands-on projects of my own in order to explore this area in a creative and productive way. I chose to follow a different interaction design in each case in order to have a better overview of the field and the tools.



## RESUME

Le travail suivant est une tentative d'explorer l'interaction homme-machine, du point de vue de l'art, comme un concept divisé en deux types: WIMP et post-WIMP interaction. J'ai essayé de suivre la façon dont l'interface de l'ordinateur, le WIMP, a dominé l'art interactif qui est centré sur l'écran, la façon dont ses principes de conception ont été contestés par les artistes et comment cela a changé par les pratiques d'interaction post-WIMP. J'ai choisi de référencer des projets artistiques des années soixante jusqu'aux dernières années parce que mon intention était de retracer l'originalité et pas la réussite artistique ou l'évolution historique.

De plus, j'ai essayé d'étendre ce travail en incorporant des expérimentations et des projets de ma part afin d'explorer ce domaine d'une manière créative et productive. J'ai choisi de suivre un design d'interaction différent dans chaque cas afin d'avoir une meilleure aperçu de la zone d'étude et des outils de creation.

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## Introduction

I think that I am part of a generation that most of our experiences of art have been mediated by a screen. In fact, this is maybe the case for a variety of activities apart from art. We work in front of screens, we study, we communicate and we entertain ourselves.

As Lev Manovich discusses in his book “The Language of New Media”, “*The concept of a screen combines two distinct conventions, the Western tradition in which a screen functions as a window into a virtual space, something for the viewer to look into but not to act upon; and the more recent convention of graphical human-computer interfaces which, by dividing the computer screen into a set of controls with clearly delineated functions, essentially treats it as a virtual instrument panel”*[1]. The compilation of these two conventions led me to the concept of the screen as a medium for both acting and experiencing the results of the action in this screen-centric human-computer interaction.

On the other hand, over the last years, a lot of research has been made in the direction of a definition of a new kind of communication between the human and the machine. While the personal computer has familiarized generations of people with the WIMP (window, icon, menu, and pointing device) interfaces, smartphones, VR headsets and AR applications tend to explore different kind of interaction concepts. More and more applications are designed in order to explore the limits of eye tracking, kinectic, touch and tangible user interfaces or spatial navigation and whole-body interaction.

Also, as a computer scientist, I tend to think of the human-computer interaction as an action with a predefined aim, with a purpose and not as part the artistic experience. So for me, the human in this interaction used to be the user and not the spectator. This changed when I realized that it was an illusion and a new kind of spectatorship is already been born and that the transition was so natural for me that I did not even realize it. I was already used to the presence of the machine in all aspects of my life.

In the following chapters I will present artworks and texts that I hope will be interesting as they will extend this problematic of these three dipoles: the screen as a medium for both action and regard, the transition from the familiar WIMP interface to the new post-WIMP one and the double quality of the human as a user and spectator during artistic experiences that interaction is a decisive factor.

Following, I will discuss my own experimentations in an attempt to explore the possibilities offered by incorporating both concepts of interaction in storytelling experiences and installations in a way to express in action the ideas that influenced my thought through this research.

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[1] Manovich, *The Language of New Media*, p.95-96

# A. Tracing the Interface

## I. WIMP interfaces in the art world

In the following chapters I will center the attention on pieces of art and texts that focus on the interfaces, and mostly the graphical user interfaces. The focus will be on the staged experience and the real-time interaction. During the first chapters, I will reference artworks of non-interactive fiction and documentary and afterwards on interactive storytelling experiences and visual art.

### a. Defining the interface

The human – computer interface is defined as the ensemble of the ways (hardware and software) that the human can interact with the computer. This can be a Graphical User Interface (GUI) on the computer screen, a WIMP interface or other forms that are not necessarily graphical as most of the people used to imagine. During my research I needed to make this distinction among the interfaces.

As it is stated on the paper "Reality-Based Interaction: A Framework for Post-WIMP Interfaces", researchers have developed a broad range of new interfaces that diverge from the WIMP interaction style and as a result we can divide the interfaces to WIMP and post-WIMP interfaces. Some examples of post-WIMP interaction styles are: virtual, mixed, augmented reality, handheld, or mobile interaction[2]. This distinction was essential for my research as I would like to focus on two different things.

At first, on the way we experience the interaction with the WIMP interfaces, which is the most common human – machine interaction so far. As French academic and filmmaker Chloé Galibert-Laîné stated at her interview at the online publication of Hyperallergic *"we tend to experience reality on an everyday basis through a screen. That's how I relate to the world when I'm at home, and also how I keep in touch with my home when I go out in the world"*[3]. So if we want to observe this phenomenon, we have to capture the dialog that is formed among these graphical components and the human.

Secondly and as a continuation of the thought process, I would like to focus on the artistic practices that question this kind of "mainstream" (I use this term as a metaphor, since the use of

[2] Jacob, Girouard, Hirshfield, Horn, Shaer, Solovey, Zigelbaum, "Reality-Based Interaction: A Framework for Post-WIMP Interfaces"

[3] "Film Essayist Chloé Galibert-Laîné on the Careful Choreography of Desktop Cinema." n.d. Accessed May 23, 2020. https://hyperallergic.com/555214/chloe-galibert-laine-interview-images-festival/.

WIMP interfaces, after the command line, were the first and most wide spread ones as they became synonyms with the personal computer) interaction. In interactive art and digital art games the staging and the design of the interface is a key factor for the experience. A lot of artists question the typical practices of human – computer interaction with custom – made or physical interfaces that are placed at the center of the experience. According to a popular saying among designers, designing the spoon means designing a particular way of eating. In this way, in order to question the way of eating, a new design of spoon is necessary.

**b. Recording the interface**

I think that over the last decades, the screen-centric graphical interfaces have normalized the interaction between the human and the computer. Personal computers, laptops, smartphones are present in a bold way during our everyday life, interfering in almost all of its aspects. In this way, we have become more and more familiar with the information aesthetics and the collaborative version of the correlation of the human and the computer. I feel that there is already a kind of grammar and vocabulary that forms this interaction. So, it makes a lot of sense that this relatively new "relationship" is very valuable to observe. Also, since some of its components have already been formed to a certain extent, they maybe provide new ways and tools to tell stories, rather than observe them. As it is stated in the Handbook of Digital Games and Entertainment Technologies, *"It has been perhaps unavoidable, to some extent, that cinema would be central in the commentary of mass media and art for the greater part of the twentieth century; the impact of the moving image, particularly in terms of the reworking of perceptions of space and time and the development of new forms of mass consumption of cultural tropes and narratives, has been immense."*[4] So it comes natural to me to use cinematic references for further research on the crossroad of mass media and art, in a reversed way; how the cinema incorporates the language of the new mass media.

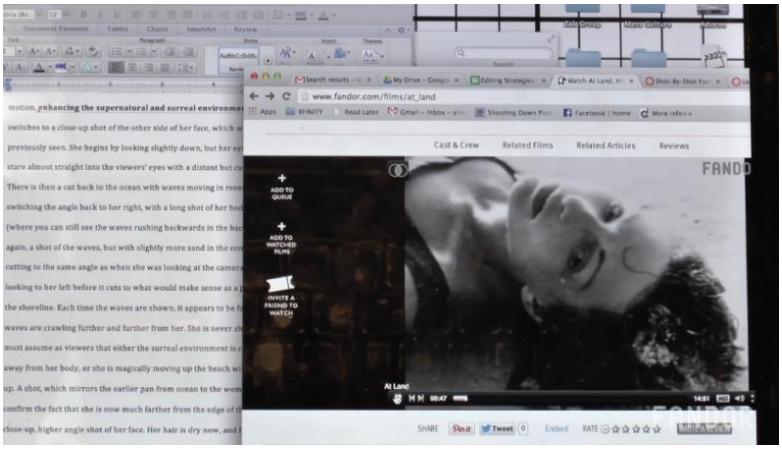


*ILLUSTRATION 1: KEVIN B. LEE, 229. FILMMAKING LESSONS FROM MAYA DEREN*

As a starting point I will use the work of Kevin B. Lee, who is a film critic, filmmaker, and enthusiast of video form film criticism. He has produced short video essays on cinema that their forms, in my

[4] Swale, "Media, Art, and Society: Interface of the Digital Image, Aesthetics, and Culture", p.866


*ILLUSTRATION 2: KEVIN B. LEE, TRANSFORMERS: THE PREMAKE*

opinion, challenge the typical cinematic language. A video essay is described as "*a piece of video content that, much like a written essay, advances an argument. Video essays take advantage of the structure and language of film to advance their arguments. While the medium has its roots in academia, it has grown dramatically in popularity with the advent of the internet and video sharing platforms […]*"[5]. In his essay, "229.Filmmaking Lessons from Maya Deren" we watch a tutorial session from The School of the Art of the Institute of Chicago about the creation of Maya Deren's film "At Land". The interesting aspect is that the only element that we see on the screen is the recorded projection of the desktop of the tutor, combined with his voice over. This graphical element, as he pauses and analyses the video, scrolling on his notes, changes the tabs and drags the windows, combined with the voice of the tutor is enough, standalone, to form an argument in a video format. Taking this idea to the next level, in 2014, Kevin B. Lee, publishes the desktop documentary "TRANSFORMERS: THE PREMAKE".

According to Wikipedia, *"Computer screen film or desktop film is a film subgenre where the action takes place entirely on a screen of a computer or a smartphone. It became popular in the 2010s with the growing impact of the internet on everyday lives. The technique is [...] considered to be born from the found footage genre"*[6], while in the found footage genre *"[…] all or a substantial part of the work is presented as if it were discovered film or video recordings. The events on screen are typically seen through the camera of one or more of the characters involved, often accompanied by their real-time, off-camera commentary"*[7].

In "TRANSFORMERS: THE PREMAKE", 355 amateur Youtube videos are used, in order to frame and outline a critique about the big budget film industry. Throughout this documentary, Kevin B. Lee, uses these amateur footage from the shooting locations of the Transformers film series, combined with various online tools like maps, wikipedia, and google search results to point out concepts or comments. It looks like a carefully planned choreography of the WIMP interfaces performing on a one – shot film.

[5] "Video Essay - Wikipedia." n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Video_essay.
[6] "Computer Screen Film - Wikipedia." n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Computer_screen_film.
[7] "Found Footage (Film Technique) - Wikipedia." n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Found_footage_(film_technique).

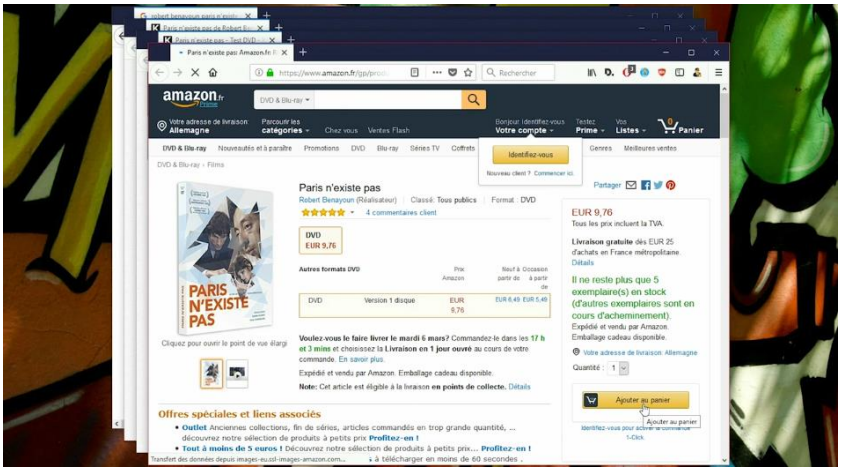


ILLUSTRATION 3: *CHLOÉ GALIBERT-LAÎNÉ, FLÂNERIE 2.0*

This desktop documentary brings up the role of the internet and the sharing platforms as a source of information but at the same time as a space of experiencing reality and a field of communication. Chloé Galibert-Laîné comments this issue as "Netnographic Cinema"[8] in order to relate this new filmmaking way to previous practices of observation and documenting human behavior through a camera and questions the limitations of the interfaces in what she calls, "*a form of desktop expressionism"*. In her work, she also uses amateur footage, fan art and desktop filming techniques but I would like to comment on her poetic video essay "Flânerie 2.0" as a piece of art that uses these components to go beyond observation and comment of human behavior. In this work, she combines voice over, film footage and desktop filming to point out a way, in her own words, "*spatial circulation and digital navigation meet"*. This is very interesting as she visualizes a concept of a new digital flaneur as Lev Manovich writes in "The Language of New Media*", "[…] the Data Dandy loves to display his private and totally irrelevant collection of data to other Net users. "[…] if the anonymous crowd in the streets was the audience of the Boulevard dandy, the logged-in Net-users are that of the data dandy.""*[9]. I consider this film as something that touches fiction with the tools of desktop filmmaking and can become the bridge to further comment on how this recorded WIMP interfaces can be staged to construct narratives for fiction films.

As the interaction of digital media and human experience is observed and composed in the examples of the artworks that were mentioned above, it is scripted and orchestrated in artworks that use this kind of "language" to narrate a fictional story. Maybe like the way that moving images were used at first to document human activities and later on to tell stories. Although during my research, I came across a lot of examples of desktop films that tried to path their way to the horror genre, I will focus on examples that in my opinion used the staging of the WIMP interfaces in a creative and coherent way. Also, I have to admit that in a lot of cases, the plot is unfolded along a research of information from the main character. This seems to me like a reasonable thing as we

[8] "Film Essayist Chloé Galibert-Laîné on the Careful Choreography of Desktop Cinema." n.d. Accessed May 23, 2020. https://hyperallergic.com/555214/chloe-galibert-laine-interview-images-festival/.
[9] Manovich, The Language of New Media, p.231

are more familiar with the interpretation of the internet and the computer screen as a tool of information.

The feature film “Searching” directed by Aneesh Chaganty in 2018 is the first full-length attempt of desktop filmmaking that found a way to the movie theaters. The story is about a teenage girl that goes missing and her father manages to break into her computer to gather evidence that he hopes will lead him to her. The impressive thing is that the creators manage to narrate a story of around 100 minutes only by actions that take place on the screen, involve a lot of characters, background stories and switching from the personal point of view of the father, to the public opinion. It is interesting to observe how the communication between father and daughter at the beginning of the film takes place only by messaging applications, how the outside world gets involved through news sites and streaming platforms and how the switching of the screens; daughter’s and father’s laptops, smartphones, CCTV systems, webcams and video calls can finally provide the whole picture of a story with characteristics of the mystery and drama genre.

*ILLUSTRATION 5: ANEESH CHAGANTY, SEARCHING*

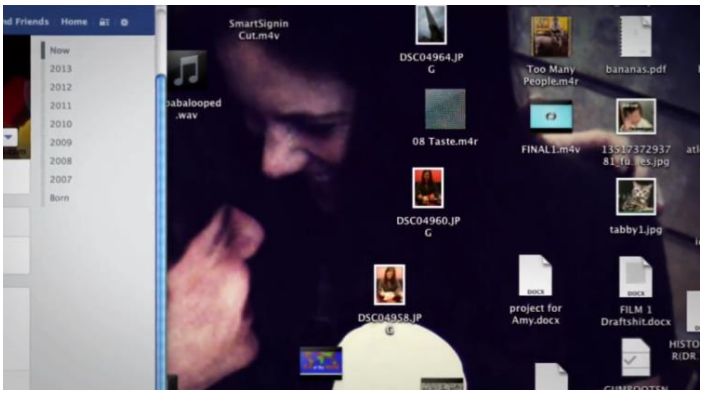


*ILLUSTRATION 4: PATRICK CEDERBERG, WALTER WOODMAN, NOAH*

On the other hand, there is the example of the short film “Noah”, directed by Walter Woodman and Patrick Cederberg in 2013. In contrary with “Searching”, this one is an intimate close-up on a break up of a couple on long-distance relationship so it is not about investigation, plot twists and a lot of screens. It is just Noah’s screen during a personal moment of suspicion and disappointment. As Jason Sondhi pointed out on Short of the Week online platform of film curation, *“It’s familiar, but different […] that our interactions follow the same patterns even as they are mediated differently. But there is the specter that those interactions are qualitatively inferior, the way Noah is doing 4 things at once […]”*[10].

[10] Jason Sondhi,“Noah by Patrick Cederberg & Walter Woodman | Short Film.” n.d. *Short of the Week* (blog). Accessed May 23, 2020. https://www.shortoftheweek.com/2016/08/22/noah.

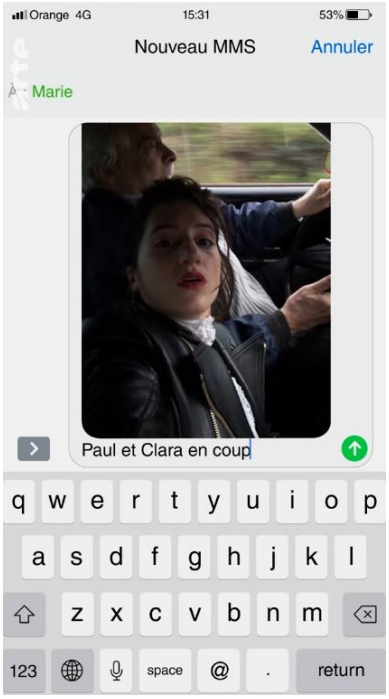


*ILLUSTRATION 6: TOMMY WEBER, JE NE T'AIME PAS*

Also, in this kind of filmmaking, the audience has the illusion of a single-shot film with a steady camera. It is very interesting that since the camera is stable, the content is moving and even if the audience sees the cast on the camera feed of a webcam, still the framing or the zoom is configured by the perspective of the content that is being filmed. It is like the post production process of the movie involves compositing rather that sequencing. In this kind of films, the change on the framing is done by zooming in and zooming out in different parts of the screen so there is no clear cut between the actions. In similar way to desktop recording, there are films that are completely based on the screen of a smartphone. In this case, the zooming in and out is not used maybe because of the screen size that is considerably smaller than a desktop or laptop monitor. On the other hand, using the smartphone screen, the camera movement is possible. The first-person perspective is very bold, it seems to me that this kind of filmmaking feels even more intimate and personal, but the parts of the film that are shot with the smartphone's camera can have characteristics from the "tradition" of the cinema like panning, travelling or handheld shooting.

*ILLUSTRATION 7: ZACH WECHTER, MISHKA KORNAI, POCKET*

An example of desktop film with a smartphone device is the work of Tommy Weber in 2018, "Je ne t'aime pas". This is a short film of vertical fiction that uses the screen recording and the camera feed of the smartphone. In this case, the screen that is been recorded accompanies the main character both during the time and along the space. This changes the way the story is being told. This movie is about a girl who travels to her hometown to visit her father who she has not seen for a lot of years. The smartphone screen seems like a companion to this trip. In a similar way, the work of Zach Wechter and Mishka Kornai challenges the limits of the vertical format in video. The short film of 2019 "Pocket, is about the daily life of an American teenage boy. As Céline Roustan points out "*Different generations experience the world in different ways […].Capturing the film entirely from the iPhone screen is probably the best way of telling the story, making sure social media and our cell phones occupy*

*the space in the narrative they do in our real lives—they are omnipresent.*"[11] Again, the story components consist of notifications, social media, selfies, browsing, chatting, scrolling, alarm clocks and communication through screens.

Finally, I would like to present the last film of this chapter. The difference this time is that in the case of the short film of 2016 "Hyper Reality" of Keiichi Matsuda, the interface is still at the center of it but it is not fiction or documentary. This is considered as a science-fiction film as the creator tries to document a human-computer interaction that is not already happening from an interface-centric perspective. Throughout this film we follow the main character as she makes her way to work. It is a first person narrative, similar to the point of view of the FPS (First-person Shooter) video games, where the physical world merges with digital interfaces in a way that is close to our conception of augmented reality. Almost all of the things and surfaces of the film are interactive but the designed interfaces are post-WIMP ones and most of them are tangible. The story has a lot of science-fiction elements and it is more or less like living inside a game console with health bars, restarting options and point collection systems but it is impressive that despite this fact, the story is told completely by the interaction of the main character with these imaginary interfaces.


*ILLUSTRATION 8: KEIICHI MATSUDA, HYPER-REALITY*

**c. Interactive Storytelling**

[11]Céline Roustan,"Pocket by Zach Wechter & Mishka Kornai | Short Film." n.d. *Short of the Week* (blog). Accessed May 23, 2020. https://www.shortoftheweek.com/2019/02/27/pocket.

*ILLUSTRATION 9: PRESENTATION OF KINOAUTOMAT AT THE CZECH PAVILION DURING THE 1967 UNIVERSAL EXPOSITION IN MONTRÉAL*

Interaction, as computer science defines the term, is not a typical cinematic component. Since the growth of the video game industry and the establishment of the personal computer in the daily practices, technologies and concepts that were initially developed for the video game industry, are tested for their value for the cinematic experience. What Radúz Činčera conceived back in 1967 with the "Kinoautomat", the first interactive movie ever, is now part of the biggest film festivals around the world as an official festival section. The difference is that the moderator, who used to appear on stage in order to ask the audience to vote between the next two scenes, nowadays is the computer.

As it is stated on the paper "Interactive Cinema: Engagement and Interaction" by Mirjam Vosmeer and Ben Schouten, *"[…] many scholars have focused on questions concerning the relative freedom the user may have in choosing alternative outcomes for stories (Stern, 2008)"*[12]. I think that this is the luggage that the term interaction carries from science. A user provides the machine with an input and the machine produces an output. As Pablo Gervás writes on the article "Computational Approaches to Storytelling and Creativity", "*The restrictions that an output must satisfy to be considered useful differ greatly between art and science*"[13]. So maybe is more useful to consider what Tanenbaum argues about, that "*It is common within the interactive narrative research community to conflate interaction with changing the outcome of a story. […] Reimagining interaction as participation in a story opens up an important new design space for digital narratives: one which emphasizes the readerly pleasure of transforming into a character rather than the authorial pleasure of rewriting the events of the story*"[14]. During my research on the interactive cinema I felt that the interaction was mostly part of the way that the story was evolving and it did not affect the storyline. So the way that WIMP interfaces made their way to the cinema field was as visual components that can also serve as a comment on the content or as a regulatory factor. It is not that the audience will co-produce a story with the computer rather than it will co-edit the story, like a participatory montage. In a way, the creator provides the rough cut and the audience, during the experience, will form the final cut.

[12] Vosmeer, Schouten, "Interactive Cinema: Engagement and Interaction.", 141
[13] Gervas, "Computational Approaches to Storytelling and Creativity", 50
[14] Tanenbaum, "Being in the Story: Readerly Pleasure, Acting Theory, and Performing a Role", 55

As Veugen has pointed out, videogames and movies are being classified differently into genres as for the first one the classification is based on the content, while for the game industry it relies on the gameplay[15]. In the next chapter I will use the movies classification as I will present some examples of fiction and documentary that in my opinion manage to propose interesting ways to incorporate interactivity to the cinematic experience.

***c.i. Interactive Fiction***

Firstly, I would like to talk about an artwork that is not an interactive film but due to its uniqueness of the form it is often included in references about interactive art, design, illustration or even sound and I think that is relevant at this point, as a start. "The boat" is an interactive graphic novel about a 16 years old refugee from Vietnam who was found traveling alone towards Australia. It is based on the short story "The boat" by Nam Lee and it was created and adapted for the interactive version by the artist Matt Huynh with the sound of Sam Petty in 2015. According to the Special Broadcasting Service (SBS) who launched the project *"The finished work contains 300 illustrations – 59 of which include custom animation, FX and/or layering"*[16]. It is created to be watched on a browser mostly by scrolling. In some points it is possible to jump on a small side story that will enrich the main storyline. The experience involves a continuous soundtrack, motion graphics and FX that the speed is based on the scrolling speed, while the story and the dialogs are texts. So the interaction dictates the rhythm of the evolvement of the story.


*ILLUSTRATION 10: MATT HUYNH, THE BOAT*

As Benjamin Hoguet argues in his book "Le pouvoir narrative des interfaces", there are five different human attitudes towards the narrative interfaces: consumption, navigation, engagement, creation and waiting. The moments of consumption are very valuable during an interactive experience as it is the attitude that the audience is the most familiar with. In this way, it is understandable why the most accessible artworks seem to be the less interactive ones[17].

[15] Veugen, "Computer Games as a Narrative Medium"
[16] "The Sound and Vision of The Boat." n.d. SBS Movies. Accessed May 23, 2020. https://www.sbs.com.au/movies/article/2015/04/27/sound-and-vision-boat.
[17] Hoguet, *Le pouvoir narratif des interfaces*, p. 39-40

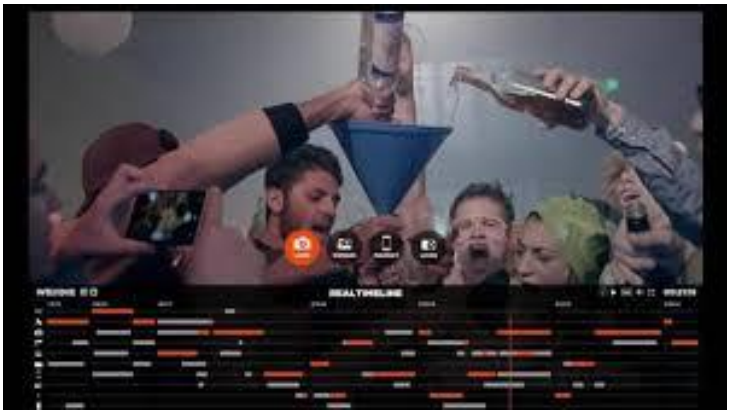

*ILLUSTRATION 11: SIMON BOUISSON, WEI OR DIE*

In the interactive movie “Wei or Die” by Simon Bouisson, co-written with Olivier Demangel, the interface is present in a very bold way. The main story involves a student trip that ends up in a really bad way with the discovery of a young man’s body. The police gather evidence from cameras and smartphones of the students and the spectator is called to watch the trip from the compilation of all the gathered footage in a chronological order. In every part of the story, we can choose the point of view that we want to explore. The interesting detail is that from some point of view, one can see the others as if everything is happening simultaneously. For example, at some point we can see the footage from the drone in which we can see one character of the story taking selfies and another one on a video call while the interface which is basically a timeline gives the audience access to all the three different footage.

In another example that comes from the independent game industry, “Her Story”, an interactive film video game as the creator Sam Barlow describes it, a woman is interrogated by the police as a suspect for murder. The audience is called to navigate in a database through an old-fashioned WIMP interface and watch footage of the interrogation in order to solve the mystery. The footage is retrieved by keywords on a search bar and can be tagged by custom keywords. The interface looks like the desktop of an old version of Windows and all the action is happening there.

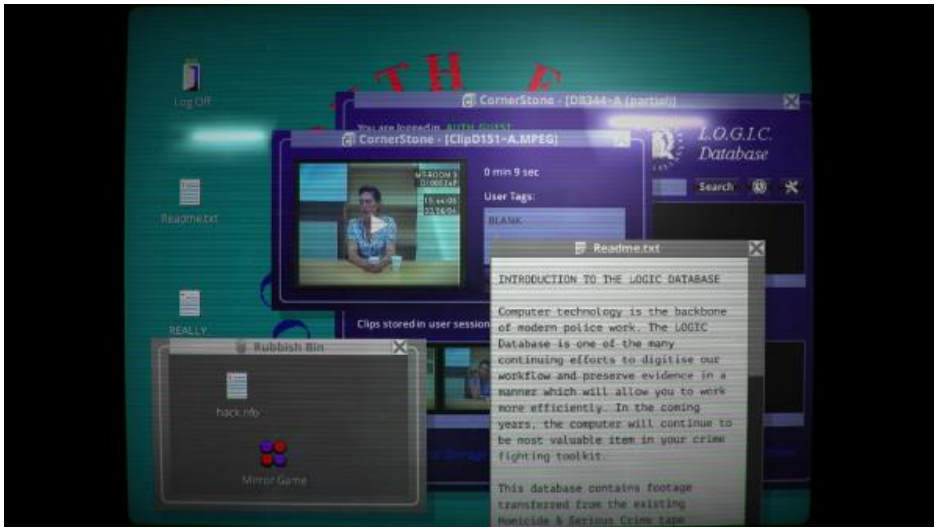


*ILLUSTRATION 12: SAM BARLOW, HER STORY*

As the medium and the interface of the game, the computer screen and the old desktop screen, are combined successfully in a creative but familiar way, imitating the established interaction between the user and the computer, the same happens in the “Burry me, my love”, an interactive

storytelling experience for smartphone devices. This application is about the main character's journey from Syria to Europe and it is entirely told by a messaging interface, like Whatsapp. The user is receiving messages from Nour, chooses among one to three answers to reply and gathers the main character to make choices. There is a map with the journey so far, illustrations like photographs that the user exchanges with Nour in order to increase the immersion. The impressive part is that the story is constructed in a way that the rhythm is similar to a real time interaction of two people on messaging applications. Nour runs out of battery, sleeps at night, loses service and the user has to wait for the time to pass, receive a notification and go back to the application to find out the rest of the story.

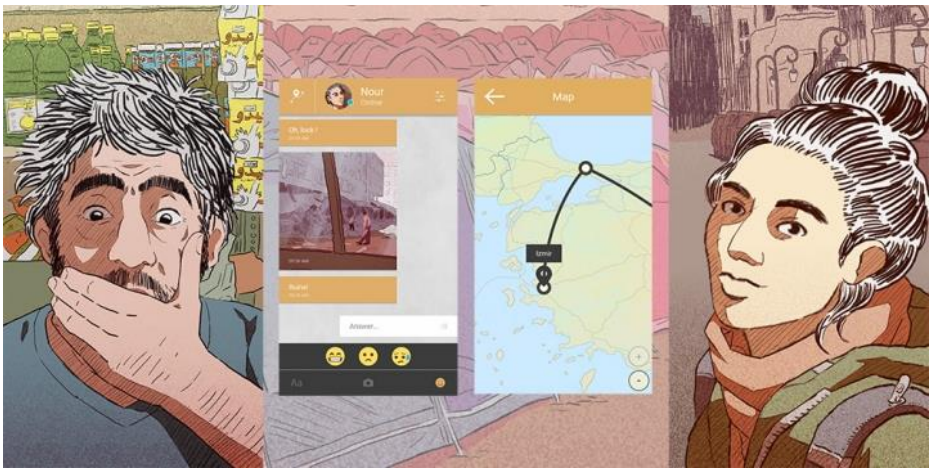


*ILLUSTRATION 13: THE PIXEL HUNT, ARTE FRANCE, FIGS, BURY ME MY LOVE*

### *c.ii. Interactive Documentary*

As the interactive fiction uses the interface to define the rhythm and give the control of it to the audience, interactive documentaries use the interface for a better data visualization, categorization of the content and encouragement of participatory content creation.

The "Welcome to the Pine Point" interactive documentary can be an analogy to "The Boat". It is described as "*part book, part film, part family photo album*"[18] and it is the story of a small town and its community that is driven to distinction because of financial issues. The story is presented by text, the illustration is very interesting, with a lot of layers and instead of scrolling, the participant clicks to the next page, like a family photo album.

[18] Canada, National Film Board of. n.d. "About | Welcome to Pine Point." National Film Board of Canada. Accessed May 23, 2020. https://www.nfb.ca/interactive/welcome_to_pine_point/.


*ILLUSTRATION 14: MICHAEL SIMONS, PAUL SHOEBRIDGE, WELCOME TO PINE POINT*

In the documentary "Unspeak", the spectator can watch a series of videos about "*how language can smuggle persuasion into description*" [19]. Each episode comes with extra informational material like participatory dictionary, data visualizations and comment section for the audience and the whole project is accessible from a browser. "Unspeak" is about language and their deceptive use in some contexts so it is strongly political. The creators encourage the participation but they moderate the comments and they demand to make an account to participate in order to avoid the usual mess of the comment section.

Another example of participatory documentary is the "Immigrant Nation". On this platform, immigrants from all over the world can share their experience about immigrating to the U.S.A. and browse to the stories of others. This project is part of a bigger one that includes also documentaries and events. There is a template for those who want to add a story. It consists of two slides each of them can have an image and a text while at the end the participant forms a question. For those who browse there is the option of answering that question with a small text and post it on the platform. Most of the stories are very intimate, especially when combined with personal photographs and intimate answers at the end of the story when anonymous people with similar lives are trying to relate with each other.

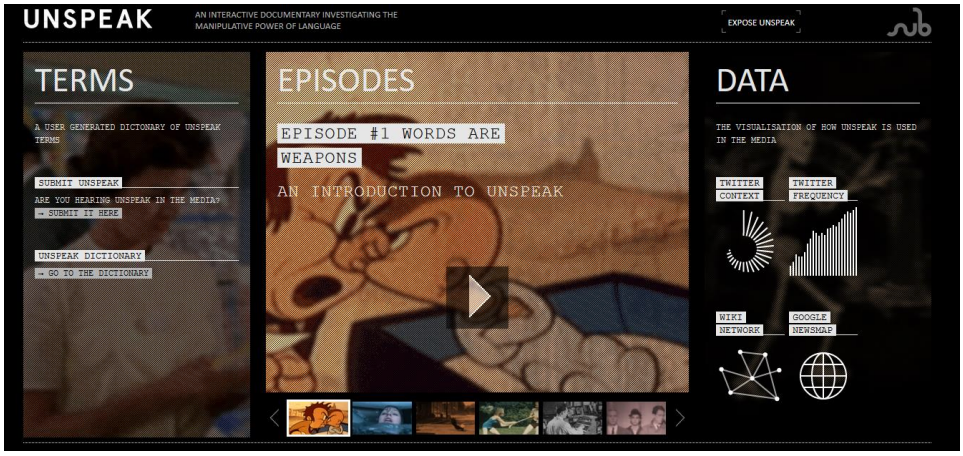


*ILLUSTRATION 15: TOMMY PALLOTTA, UNSPEAK*

[19] "#1 / Words Are Weapons - Episodes - UNSPEAK." n.d. Accessed May 23, 2020. http://unspeak.submarinechannel.com/episodes/words_are_weapons.


*ILLUSTRATION 16: THEO RIGBY, IMMIGRANT NATION*

On the other hand, "Do not track" is an interactive documentary that encourages the interaction between the spectator and the computer instead. In fact, the browser. As the creators describe it, it is a *"personalized documentary series about privacy and the web economy"*[20]. It is impressive how the creators visualize each participant's data. As we watch the episodes, we can see part of the data that we expose with or without knowing it. For example, during the introduction, we see our location, tracker information about the sites that we visit but on a video format not as an informational part of the interface. So for the participant it is just like watching a video.


*ILLUSTRATION 17: BRETT GAYLOR, DO NOT TRACK*

This informative aspect of the interface and the playfulness of the interaction are used also from news sites. The project "Firestorm" from the Guardian, uses personal footage, television excerpts, interviews, text and sound in a multimedia informative project about a family hiding from a bushfire in Tasmania. Again it is formed in a vertical way and the story progresses via scrolling.

### *c.iii. Interactive visual art*

Visual artists have also tried to incorporate the computer screen on their creative process or their visual language. They managed to bypass the traditional concept of experiencing art in certain places like galleries and exhibition halls and used the screen and the internet in order to have direct access to the public. Also, the option of interactivity was explored, in the sense of both participation and exploration. In fact, in some cases, a new way of dealing with WIMP interfaces

[20] Upian. n.d. "Do Not Track." Do Not Track. Accessed May 23, 2020. https://donottrack-doc.com/en/.

was proposed as the design of the graphical interface itself was incorporated in the form experimentation of the artist. In contrary with interactive storytelling that was discussed above that tried to incorporate a more or less already familiar way of dealing with a GUI, I would like to discuss the following examples that in my opinion propose new things in terms of creativity and improvisation.

Cassie McQuater's Black Room is a browser based game for people dealing with insomnia problems. It is a journey of tabs and digital rooms accompanied by a dream-like soundtrack. The experience is described as a game but it is more like an exploration. The navigation through the digital rooms, in a hypnotizing and seemingly endless way, according to the artist, offers an opportunity for meditation. It is a calm corner in the crazy place that is called internet. The aesthetics is based on "*mythologies that recontextualize hyper-sexualized female video game character sprites*"[21]. During this navigation the user can interact with some of the graphic elements by clicking with the mouse and with some others by pressing keys on the keyboard. Cassie McQuater made use of the HTML elements in a very creative way as she "hided" the way that the user can progress, using the interface to block the interactive parts of the GUI. For example, in order to go from one room to the other at some point the user needs to resize the browser's window so that the HTML elements will resize too, in a problematic way as for the responsiveness of the site. In this way the hidden elements will appear and they will be clickable. In her own words: "*The player would have to look underneath the facade of the browser in order to progress through the game. Like leaving unrelated comments in your code, and the comments would be where the actual game took place*"[22].

*ILLUSTRATION 18: CASSIE MCQUATER, BLACK ROOM*

[21] "Black Room ::: Cassie McQuater | TRANSFER." n.d. Accessed May 23, 2020. http://transfergallery.com/black-room-cassie-mcquater/.

[22] Couture, Joel. n.d. "Road to the IGF: Cassie McQuater's Black Room." n.d Accessed May 23, 2020. /view/news/336846/Road_to_the_IGF_Cassie_McQuaters_Black_Room.php.

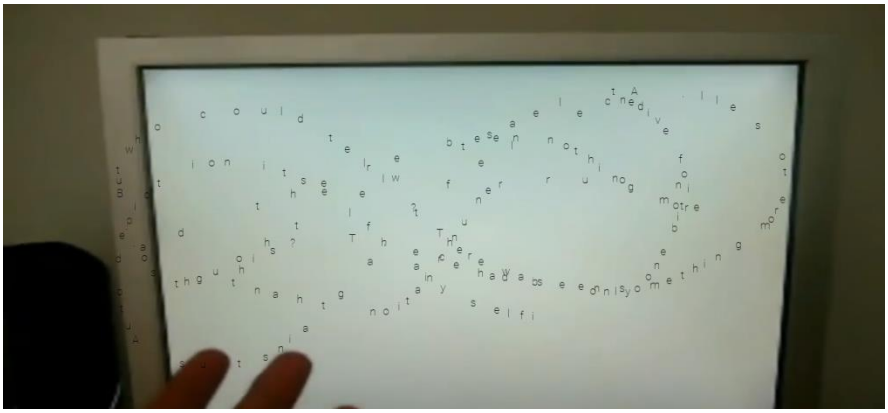

*ILLUSTRATION 19: CONSTANT DULLAART, CHORUS*

Constant Dullaart is also an artist that "hacks" the typical ways that we relate to computers and internet. He is the creator of the project of 2.5 million Instagram followers[23] that were bought and distributed amongst a selection of Instagram accounts of artists that are active on Instagram. He also created a website that by clicking and moving the mouse the lines of a sonnet based on a monologue from "The Picture of Dorian Gray" appear. The letter will appear normally or mirrored according to the mouse direction and they are sung by a crowdsourced chorus. Even his personal webpage[24] forms an argument on the internet and the browsing era, as the URL is reloaded all the time making it impossible to go back to the previous page that the user visited before landing there. The slash at the end of the URL is reloaded constantly by random emojis that are used as metadata that did not correspond to any useful information and therefore they are ignored by the browser.

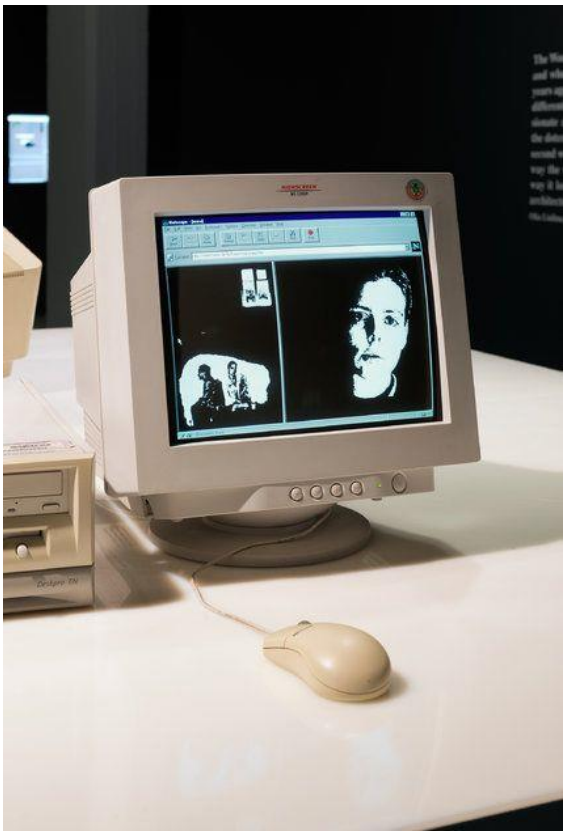

*ILLUSTRATION 20: OLIA LIALINA, MY BOYFRIEND CAME BACK FROM THE WAR*

[23] "Constant Dullaart: 100,000 Followers for Everyone! «DIS Magazine." n.d. Accessed May 24, 2020. http://dismagazine.com/dystopia/67039/constant-dullaart-100000-followers-for-everyone/.

[24] "Constant Dullaart." n.d. Accessed May 24, 2020. https://www.constantdullaart.com/%E2%98%81%E2%98%A0%E2%9B%94%E2%98%81%E2%98%81%E2%98%81%E2%8F%B3%E2%98%94%E2%9A%A0%E2%98%81%E2%98%81%E2%9B%94%E2%8F%B3%E2%98%A0%F0%9F%92%A3%E2%9C%8A%F0%9F%8F%BE%E2%9C%8A%E2%98%94%E2%98%81%E2%98%81/.

Another artist that experiments a lot with browser based art is Olia Lialina. Her work “My Boyfriend Came Back From the War” in 1996 is a landmark in net art and has been reproduced and adapted in different technologies so many times that in 2016 she curated herself a collection of the remakes for her online project “Last Real Net Art Museum”. As it is described in Rhizome's digital preservation department, Net Art Anthology: “*The work brought filmic motifs such as intertitles, flickering imagery, and close-up shots of actors into the interactive, multilinear format of hypertext. The user advances the story by clicking on hyperlinked, fragmentary phrases and images. With each click,the browser viewport subdivides into smaller and smaller frames*”[25].

The active participation and the interaction through the internet and the digital media as a way to experience presence together that Lialina illustrates in her work, take me to “Screen Time: a community clock”[26] project Helmut Smits in collaboration with V2_Lab for the Unstable Media. In this participatory project, the participants are called to take a screenshot of the lock screen of their smartphone, uploaded to a website and allocate the slot of the corresponding minute that it was taken. In this way they construct a different visual for every minute of the day. The interface of the lock screen usually reflects the current state of the user, his favorite people and places or something that he thinks that characterizes him but it is a private element. It is not a profile picture on a social media platform. It is very interesting that in this way it is transformed to a public picture.

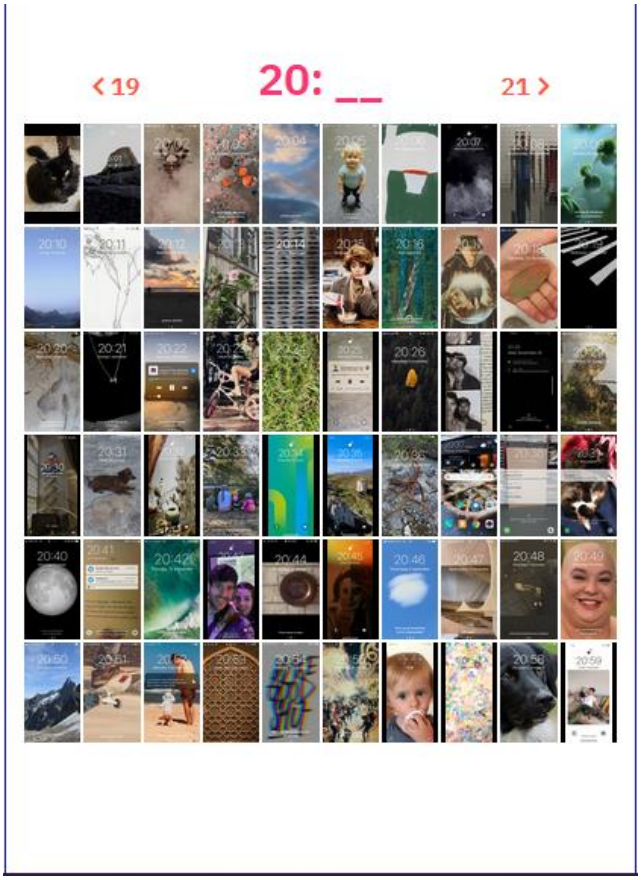


*ILLUSTRATION 21: HELMUT SMITS, SCREEN TIME*

Another project that explores the concept of the interaction among graphic elements is the “Haiku Interactifs”, an experience of 12 short interactive games. Although a term from poetry is used to name the project, “haiku” seems to me as a very successful term to describe small interaction between geometrical colorful elements. Some of them include also sound and they are fast and

[25] “My Boyfriend Came Back From the War | Net Art Anthology.” n.d. Accessed May 23, 2020. https://anthology.rhizome.org/my-boyfriend-came-back-from-the-war.

[26] “Screentime.” n.d. Accessed May 24, 2020. http://screentimeclock.net/.

sarcastic as they do not obey to the typical game concept since the user can never understand from the beginning how he can interact on screen and what is his aim.

Finally, I would like to reference two online exhibitions. It makes sense that since a lot of artists choose to use the browser as the main "frame" of their artworks, online exhibitions are born. Especially in terms of accessibility it is a great opportunity also for the audience. "We=Link: Ten Easy Pieces"[27] by Rhizome and the New Museum hosts the work of Jodi "ICTI.ME" that uses strobe effects, tones of code lines and frenzy rhythms of changing colors making the screen go crazy. In the same exhibition the "Screen Time" platform is also included.

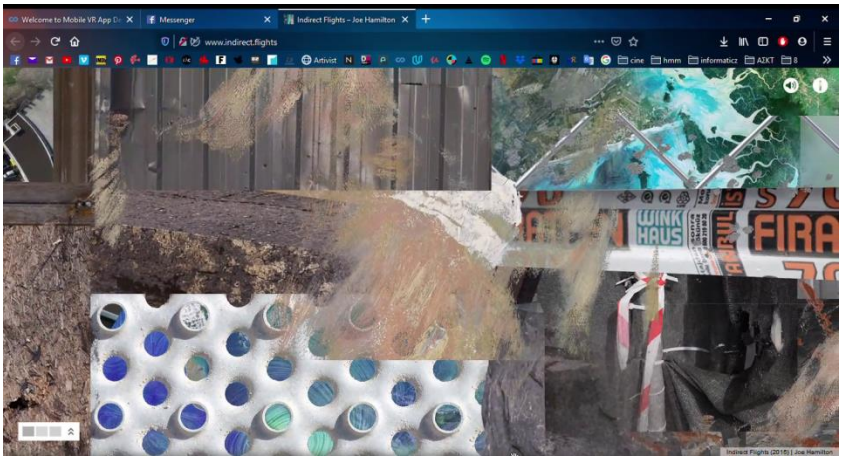


*ILLUSTRATION 22: JOE HAMILTON, INDIRECT FLIGHTS*

"Brushes", presented by the same organizations, asked artists to paint with their computer and hosted the results on a webpage. I would like to comment on artworks that gave to the computer a level of autonomy and addressed the machine as a collaborator in the artistic practice and not the artistic experience. "Indirect Flights"[28] by Joe Hamilton is an endless landscape of layered images. "*Raw materials, satellite images, organic textures, brush strokes and architectural fragments are all blended together into a dense panorama extending in all directions […]As you pan, the layers move at different speeds, giving the illusion of depth, constantly changing what is hidden and exposed*" [29] . Finally, the website by Michael Manning, with code by Zach Shipko, "100paintings.gallery" [30], combines pieces of one hundred paintings and produces a unique

[27] "WE=LINK: | TEN EASY PIECES 十个小品." n.d. Accessed May 24, 2020. http://we-link.chronusartcenter.org/?utm_source=New+Museum&utm_campaign=1b4add5964-EMAIL_CAMPAIGN_2020_03_30_HomeDelivery_COPY_01&utm_medium=email&utm_term=0_6c3938a7e5-1b4add5964-409880091&mc_cid=1b4add5964&mc_eid=192a00d872.

[28] "Indirect Flights – Joe Hamilton." n.d. Accessed May 24, 2020. http://www.indirect.flights/.

[29] "Brushes: An Exhibition of Digital Painting for the Net." n.d. Accessed May 23, 2020. http://media.rhizome.org/brushes/index.html#section-9.

[30] "100 Paintings . Gallery." n.d. Accessed May 24, 2020. http://www.100paintings.gallery/.

composition for every visitor every time he refreshes the page. According to the artists, *"this set of parameters allows for over 9 billion unique works"*[31]. Both of the websites use the machine and the code as a constructive, partly autonomous part of the final version of their concept.


*ILLUSTRATION 23: MICHAEL MANNING, 100 PAINTINGS . GALLERY*

**d. Conclusions**

I am sure that there are a lot of artworks of the above categories that have succeeded in proposing a new, innovative and creative way to incorporate the WIMP interfaces that I have missed. My intention was to try to define the attitude that these art fields have towards the screen and not to find some bright exceptions. I referenced only artworks that I had the opportunity to watch and play during festivals or free on the internet and that in my opinion can represent their field.

I believe that it is more and more difficult to manage to escape from the usual concept of the WIMP interaction that computer science has introduced as we are getting used to this because of its bold presence in the daily practices. As a result, art tries to adapt and adjust in a way that its form and practice will become more relevant to the current behavior of the spectators.

Cinema, as a form of mass media, tried to take advantage of the option of interactivity in order to give the control of the rhythm of the storytelling to the user. Also, this new feature was used as a tool that can provide even more information in order to proof the main concept of the creator. I think that was one of the reasons why in the case of participatory interactive cinema (documentaries) the content that is created by the audience, most of the times, is curated by the main creators.

On the other hand, visual arts that are not part of the mass culture provide the audience with more freedom. I believe that this happens because in visual arts, the form and the concept is a key

[31] "Brushes: An Exhibition of Digital Painting for the Net." n.d. Accessed May 23, 2020. http://media.rhizome.org/brushes/index.html#section-9.

element of the creation, while in cinema it is the content. So, visual artists had the intention to experiment more with their new “material”.

Finally, a general observation that I would like to make is that although interaction is a concept related to the machine and not necessarily to the internet, during my research I realized that very often these two concepts were bonded together. Computer screen is used as an access point in order to reach more people or in order to provide people with tailor-made experiences on the time that they want, interrupting as many times as they want, watching as many information as they want in order to be persuaded and setting the parameters of the artistic experience themselves. This customization is not possible on a movie theater or a gallery but the concept of customized and personalized experiences, since the internet advertisement, has become a public demand (unfortunately).

## I. Post-WIMP interfaces in the art world

Over the last decades, scientists have made a lot of research towards a new concept of interacting with a computer that will be more similar to our interaction with the physical world so it will not have to be learnt by the users. "*A natural user interface (NUI) or natural interface is a user interface that is effectively invisible, and remains invisible as the user continuously learns increasingly complex interactions*"[32]. As it is stated on the "Reality-Based Interaction: A Framework for Post-WIMP Interfaces" by the Tufts University and MIT Media Lab, "*all of these new interaction styles draw strength by building on users' pre-existing knowledge of the everyday, non-digital world to a much greater extent than before. They employ themes of reality such as users' understanding of naive physics, their own bodies, the surrounding environment, and other people*"[33].

A lot of artists incorporated these kinds of new technologies in their work in order to test their limits or propose new concepts. Also, there are examples of artists that experimented and conceived this interaction concept before it was being introduced and normalized by computer scientists with works that used custom-made not screen centric natural user interfaces during the even the 70s.

In the following chapters I will present some of the artworks and texts that I think are relevant in the context of the discussion of NUI and art and that influenced me during my own experimentations with interactive works with invisible interfaces.

### a. Locative Media and Smartphones

Locative media is "*a term used to describe a form of mobile media that is emplaced in a specific physical site, accessible with a mobile computing device and uses a telecommunications system such as a mobile phone network*"[34]. It is a way to use mobile devices to mark the physical space in a way that it is like creating an invisible informational digital layer of human activities in space. It is possible to mark specific GPS coordinates or follow the path of a user in a landscape via smartphone devices or other custom-made devices connected to a network. In their essay "Beyond Locative Media"[35] Marc Tuters and Kazys Varnelis suggest that *"locative media projects can be categorized under one of two types of mapping, either annotative—virtually tagging the world—or phenomenological—tracing the action of the subject in the world*". Either way, these mobile media narratives, in my opinion offer a kind of augmented artistic experience as they "*aim*

[32] "Natural User Interface - Wikipedia." n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Natural_user_interface.
[33] Jacob, Girouard, Hirshfield, Horn, Shaer, Solovey, Zigelbaum, "Reality-Based Interaction: A Framework for Post-WIMP Interfaces"
[34] Berry, *Creating with Mobile Media,* p. 110
[35] Tuters, Varnelis. "Beyond locative media: Giving shape to the internet of things."

*to capitalize on the idea that there is value in standing at the site where an event took place; far more than simply reading about an event, being in the place where that event happened offers experiential value that gives us a deeper sense of the story and the ways that story affects the meaning of the place*"[36]. It is a way to overlap the invisible digital world that the artist use as a medium and relate to the artwork in a more familiar, spatial way.

*ILLUSTRATION 24: ESTHER POLAK, AMSTERDAM REALTIME*

Esther Polak's work "Amsterdam RealTime" is a very good example of phenomenological locative media project. During this project, approximately seventy-five residents of Amsterdam were tracked as they moved around in the city wearing a tracer unit, which included a PDA (Personal Digital Assistant) with a built-in telephone and a GPS receiver. The tracer unit constantly transmitted the coordinates that were being recorded and "painted" in a black screen in a way that the final result was a plan of the most frequently visited places of these people.


*ILLUSTRATION 25: BLAST THEORY, CAN YOU SEE ME NOW?*

[36] Farman, "Site-specificity, pervasive computing and the reading interface"

*ILLUSTRATION 26: RIMINI PROTOKOLL, BUBBLE JAM*

A very interesting hybrid project that combines locative media, games and wearable technology is the project “Can you see me now?” by the collective The Blast Theory. In this game, online players in front of their screens interact with performers on the streets of the city in a merged virtual and physical world. Players use the arrows to go around a virtual city that is a replica of the city that the game takes place, while performers are on the street, wearing tacking devices and trying to locate and “catch” the players. I think that on this project, Blast Theory use successfully the tools provided by the technology to make a bold statement about proximity and distance.

Locative media is not the only way that the mobile media contribute to new artistic practices. There are a lot of times that mobile applications are used as a medium that connects the audience with the artwork or as a tool for collaboration among the spectators. The German theater-label Rimini Protokoll has experimented a lot with technological tools and their contribution or modification of the theatrical experience. Especially among young audience, the technology-mediated theater can be very attractive. An example of a work for young audience is their project “Bubble Jam” in which they used a custom made game platform that connects the audience via their smartphone devices. In this way they chat with the developers, who are located elsewhere, and respond to their directions and questions with the aim to construct a game in order to use the technology in a creative and constructing way rather that consuming ready-made content.

**b. XR storytelling and installations**

The term XR is a used to include all the different kinds of immersive technologies that have been introduced the last decades. The letter “x” is like a variable that can store various values like A (augmented), V (virtual) or M (mixed).

Although these immersive technologies became widely used during the last decades, early examples of them can be discovered in the world of art since the sixties. “Sensorama” was a machine which was introduced in 1962 by Morton Heilig and it is considered to be one of the earliest virtual reality systems. The Sensorama was “*a mechanical device, which includes a stereoscopic color display, fans, odor emitters, stereo-sound system, and a motional chair. It*

*simulated a motorcycle ride through New York and created the experience by having the spectator sit in an imaginary motorcycle while experiencing the street through the screen, fan-generated wind, and the simulated noise and smell of the city*"[37]. This project was very innovative not only as a concept, but also in terms of the technological aspect of the composition as the machine was able to render stereoscopic 3D images and provide stereo sound.


*ILLUSTRATION 27: MORTON HEILIG, SENSORAMA*

In 1975, Myron Krueger created the "Videoplace". It is a project that consists of two rooms and each of them has a screen. This screen projects the same image in both rooms. When a participant enters one of them, he can see himself projected on the screen (as an outline, closed and filled shape). In this way the participants see only their two silhouettes and they can interact with each other virtually on the screen. *Krueger called this approach "artificial reality" and set it apart from what would later be called "virtual reality"[theater]*.

*ILLUSTRATION 28: MYRON KRUEGER, VIDEOPLACE*

According to the game designer Brenda Laurel "Virtual Reality (VR) is a medium in which the human sensorium is surrounded by (or immersed in) stimuli that are partially or wholly generated or represented by artificial means and in which all imagery is displayed from the point of view of an

[37] "Sensorama - Wikipedia." n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Sensorama.

*ILLUSTRATION 29: MAURICE BENAYOUN, WORLD SKIN*

individual participant, even as he or she moves around"[38]. An early example of works of this form is the World Skin installation of 1997 by Maurice Benayoun. In this interactive artwork the participant wearing a headset is immersed in a war landscape in which he can navigate. By a handheld device he can take pictures like a tourist by in this case, as the artist claims, "photography is a weapon of erasure. […] Each photographed fragment disappears from the screen and is replaced by a black silhouette"[39]. Afterwards, the photograph is printed and by the time that this happens, this section is no longer visible from the screen.

While this kind of installations need a lot of equipment and hardware to function, newer technologies are introduced. Especially since NY times delivered to its subscribers Google cardboards during 2015, VR technologies were widely introduced to the audience as low cost and mobile friendly alternatives. Also a lot of technology companies manufactured VR headsets for desktop VR applications and immersive VR cinema or games for the wide audience to start to be involved. Since then, the conversation about VR creation changed a lot trying to include XR narratives to mass media.

Muted is a VR experience designed by Christophe Monchalin in 2019 for Oculus Rift and HTC Vive about the story of a girl that she dived into the silence after she was abandoned. Kinoscope on the other hand is made for mobile devices and it is an immersive experience about the history of the cinema that can be watched on a smartphone device. During these experiences there is always a sense of being present in a place that our body is not currently located as VR is basically a first-person point-of-view medium.

### c. Interactive Installations

[38] Brenda, *Computers as theatre*, p. 183
[39] "MOBEN | World Skin, a Photo Safari in the Land of War." n.d. Accessed May 23, 2020. https://benayoun.com/moben/1997/02/12/world-skin-a-photo-safari-in-the-land-of-war/.

**ILLUSTRATION 30: NAGOYA, LEGIBLE CITY**

Another form of art that became possible since the creative collaboration of the artist and the machine is the interactive installations. In my opinion, this kind of artistic experience is immersive in a different way as the machine is replaced by objects created by the artist so it is more invisible than ever. Also, it is a way of interacting with the original artwork in a physical way and this is not the common case in a gallery or exhibition hall. Following, I would like to comment three interactive installations that I came across during my research and affected my reflection during my experimentations.

In Legible City, created in 1989 by Nagoya, the visitor "rides a stationary bicycle through a simulated representation of a city that is constituted by computer-generated, three-dimensional letters that form words and sentences along the sides of the streets"[40]. I was very impressed by this artwork that combines physical interaction and the concept of navigation as I think that before the domination of the internet and the PC navigation and browsing were not yet formed as a way of relating the user and the computer.

In more recent examples, the work of Daniel Rozin Mechanical Mirrors that began in 1999 is composed of kinetic sculptures made of different materials that reflect on their surface the visitor standing in front of them.

*ILLUSTRATION 31: DANIEL ROZIN MECHANICAL MIRRORS*

Finally, I would like to make reference of the artists Claire Bardainne and Adrien Mondot (Claire B & Adrien M) and their large-scale and truly atmospheric interactive installation "L'ombre de la vapeur" that includes sound and visual projection on a surface made of wires at the ceiling of a 900 m2 space. As the visitor walks on the floor the visuals on the surface are responding to the movement in a lyrical way that is inspired by the movement of the steam. A smaller version of this artwork was presented in La Gaité Lyrique and it was the last collective artistic experience I had before the COVID-19 lockdown in Paris.

[40] "Legible City." n.d. Accessed May 23, 2020. https://www.jeffreyshawcompendium.com/portfolio/legible-city/.

*ILLUSTRATION 32: CLAIRE B & ADRIEN M, L'OMBRE DE LA VAPEUR*

**d. Conclusions**

In the above chapters I tried to present some of the reference artworks that influenced me a lot during my experimentations on post-WIMP interaction. I wanted to explore interesting concepts in both form and content as the non-screen interaction style demands a new concept of design that we are not familiar with yet.

I think that during this kind of interaction, a lot of artists tried to make the machine "invisible" as they replaced it with custom devices that did not relate with machines in common knowledge (e.g. bicycles). In this way they managed to design immersive experiences that give the audience more freedom (or the sense of more freedom). Also, the fact that the visitor can most of the times physically experience the artwork rather that only seeing it offers a totally new perspective.

Another thing that caught my attention was the fact very often artists try to come up with ideas and interaction concepts that do not have to be explained or taught. These concepts are based on previous knowledge about how to interact with a medium (e.g. bicycle, camera), or they involve the body awareness (e.g. videoplace).

## B. Experimenting with the interface

In the following chapters I will present and describe some of my experiments. The first one, “Deus Ex Machina”, is a group project that was developed during an intensive workshop of three weeks. The team included also the members: Vanessa Ferle, Vicky Michalopoulou, Spyridon Tryfonopoulos and Feodor Cardenas. The second one is the “Tweak” that was a personal project. Finally I will present “Pixcell”, an interactive installation that I developed with Vicky Michalopoulou.

I tried to explore the range of the possibilities that the smartphone device offers and experiment with its limits. I explored the smartphone device as a medium of both spectatorship and active participation at the same time, and the interaction as a concept of a whole-body version or an interface-centric one.

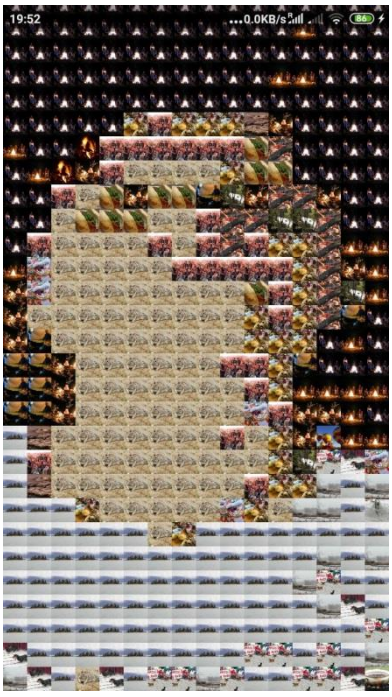


*ILLUSTRATION 33: SCREENSHOT FROM TWEAK*

*ILLUSTRATION 34: SCREENSHOT FROM PIXCELL*

## I. Deus Ex Machina

During the intensive three weeks project, I had the opportunity to work with colleagues with various research interests. It was a very creative experience. It was a chance to think differently, share ideas with people with a different focus on their research and explore different ways of creating.

Each member was responsible to deliver a different part but we had the chance to discuss and define the conceptual axes of the project all together. My main responsibility was the Unity Project development, the scripting and the problem solving of the technical issues that occurred with the equipment and the different media we wanted to include. It was the first time that I had the opportunity to work on a completed version of an interactive storytelling experience and have the chance to participate in all the different stages of the development. It was very interesting that I had the chance to be the main developer of the application. That had as a result my involvement in the pipeline that was created. Also, the fact that I had to integrate all the content (animation, video, sound etc.) that was delivered from my colleagues in Unity first and then in Android was a very tricky but educative experience as I came up with a lot of problems that were finally solved with very creative ways.

The project was implemented in Unity and Unity Remote was used for testing on the mobile devices. The main mobile device that was used for development and testing is Xiaomi Redmi 4X with android version 7.1.2(N2G47H).

### a. Introduction

The final version of our project is an android mixed reality application for Google Cardboard (or any other VR headset that can be used with a mobile device). We decided to build it for android devices for portability reasons as one of the main subjects the team wanted to explore was how the different environment and scenery affects a mixed reality experience.

The main concept of the application is the story of the Apocalypse of a digital female God. In short, the viewer can install the application on an android mobile phone, place the device in a VR headset, plug in earphones with an integrated microphone and start walking around. A set of actions will take place in front of him that consists of videos, 3D animated objects, sounds, music and image distortion. Throughout the experience, the viewer is guided by the female God who is explaining the short stories that are taking place, constructing in this way the main narrative. The story lasts approximately seven minutes. Also, during the experience, we tried to involve the viewer as much as possible so we integrated three kinds of interaction :

i. Head movement. The actions take place around the viewer so he always needs to turn around and discover new things.
ii. Walking. Depending on the viewer's steps the story changes paths. There is a point during the story that the narrator's answer depends on the fact that the viewer is walking or not.
iii. Interactive sound. The input from the microphone is used to distort the environment sound of the viewer in real time.

The things that I had the chance to experiment and research as I was working on the team project and were related to the main axes of this thesis and were later used in the personal project can be summed up to these axes:

i. the android development using unity
ii. the ways that interactivity can be designed and the effect on the storytelling process
iii. the effect of the use of special equipment had on the experience
iv. the effect of an invisible interface that requires movement based interaction

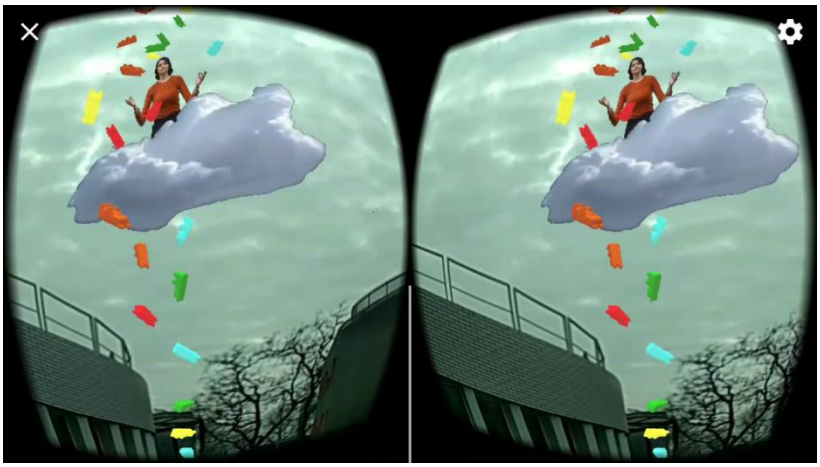

*ILLUSTRATION 35: SCREENSHOT FROM DEUS EX MACHINA*

**b. Project Development**

***b.i. Initial Implementation of movement in space***

The main axe in relation to which the interaction design was formed was the idea that the viewer should be walking throughout the experience. That concept led to the first experiments that involved GPS data manipulation.

The first steps of development were made using Unity and Mapbox sdk. Mapbox is a free, well-documented tool for unity (and other platforms) that has a version that supports Android development. It offers functionality for maps and GPS usage inside a Unity project.

Although there are a lot of examples and documentation about this utility, it ended up to be a bad decision for the case of that project as the testing was very inconvenient. Every time something

new is added to the project, this has to be built at the mobile device so that someone can cover some distance holding the device. Also, the minimum distance that can be detected is approximately ten meters long and the device needs to be outdoors. The possible solution to that was to record an itinerary and use it as an input for testing purposes. All these led to the conclusion that this kind of implementation is too unfriendly to use it for development.

### *b.ii. Alternative Implementation of movement in space*

These tests led to the idea that although movement in space is required, we don't actually care about the exact position of the viewer in space. Movement detection and not tracking is enough as well as the direction of the device.

The second experiment involved data manipulation of the gyroscope and the step counter sensor that android devices have. The gyroscope was used as an input for the rotation of the virtual camera inside the Unity scene and the step counter for detecting the viewer's movement when the returned values of the sensor are changing. The access to the gyroscope info is pretty straightforward inside C# in Unity. For the step counter sensor I had the option to access directly the sensor's values by building an Android library or use the free API Pedometer I found on Github from olokobayusuf which is what I finally did.

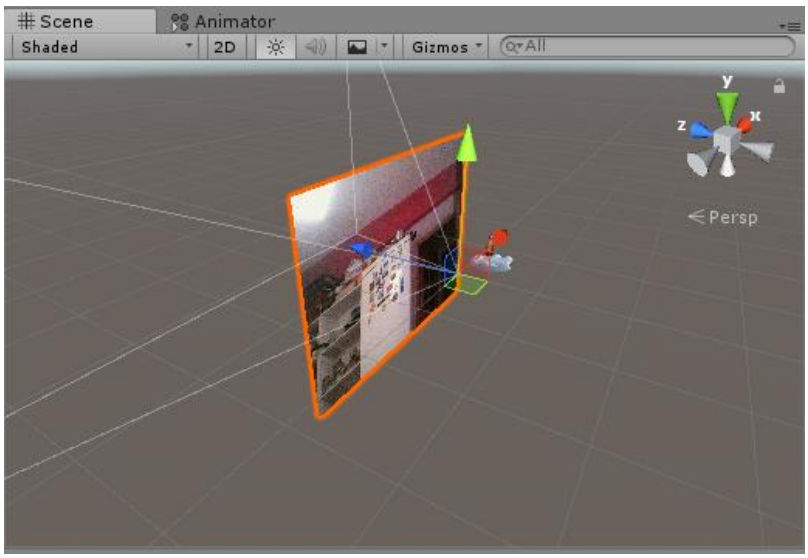


*ILLUSTRATION 36: SCREENSHOT FROM UNITY EDITOR. SETUP OF DEUS EX MACHINA*

This kind of setup was the most convenient for the development stage and worked fine in the devices that were tested in so it was also the final. For testing purposes since Unity Remote didn't give any access to sensor values (while giving access to gyroscope information) a testing version that steps are counted either by hitting a button on laptop or touching the phone's touch screen was implemented.

### *b.iii. Video Integration*

Some of the actions that took place in the application as well as the appearance of the female God are videos. For better visual integration, since the square format was visible and looking bad inside a mixed reality experience, we decided that the background should be transparent for all videos. The shooting of the female God who was performed by Vicky Michalopoulou was done in the Motion Capture room of the University using a green fabric for background so that it can be

easily removed during post production. For the correct export video format of all the videos Adobe Premiere was used with the following details for Android integration[41]:

i. webm video format
ii. VP8 video codec
iii. VORBIS audio codec

Inside the Unity scene, the videos were played as rendered textures on planes with the use of unlit unity shaders for complete background transparency.

***b.iv. 3D animation integration***

The 3D animations that were delivered by my colleagues were easily integrated in Unity. Some of them were made inside Unity so they were integrated as packages while some others were made in 3D software and they were imported along with the fbx files.

***b.v. Image Distortion***

Since the viewer can see through his mobile phone camera it was decided to include some kind of image distortion. The Post Processing Stack unity plugin doesn't support lens distortion [42] and similar effects on a VR environment so this option was excluded.

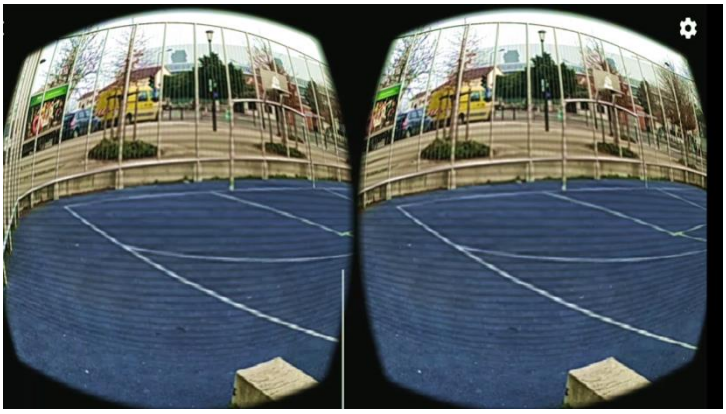

*ILLUSTRATION 37: SCREENSHOT FROM DEUS EX MACHINA*

At first, inside Unity, the camera's feed is projected full screen as a raw image on a canvas. Since the distortion was not possible via post processing stack, the canvas was replaced by a plane, on which the camera's feed was projected. The field of view of the camera was limited to include just this plane, and the plane's animation was used to cause effects similar to lens distortion.

**c. Interaction Design**

***c.i. Unity Setup***

[41] "Unity - Manual: Video Transparency Support." n.d. Accessed May 24, 2020. https://docs.unity3d.com/Manual/VideoTransparency.html.

[42] "Lens Distortion | Package Manager UI Website." n.d. Accessed May 24, 2020. https://docs.unity3d.com/Packages/com.unity.postprocessing@2.1/manual/Lens-Distortion.html.

The first version of the application was completely based on viewer's steps. I tried to implement the main functionality in a user friendly way so that during development all the actions and in fact the direction of the experience can be done by customizing only one main script from the inspector of the Unity editor. That was necessary because a lot of testing and experimenting had to be done.

So I constructed a new class that represented an action in the following way:

i. each action (video, 3D, etc.) is a Game object
ii. number of minimum steps that triggers this action
iii. distance from the camera's plane in which it should appear
iv. name tag

At the same script, a flag was included for testing mode (fake steps as mentioned before or pedometer info). Also, two other scripts were created, one of which had to be attached in every game object, and involved the deactivation. The one disables the game object and the other triggers an animation after some seconds and disables the object by the end of it.

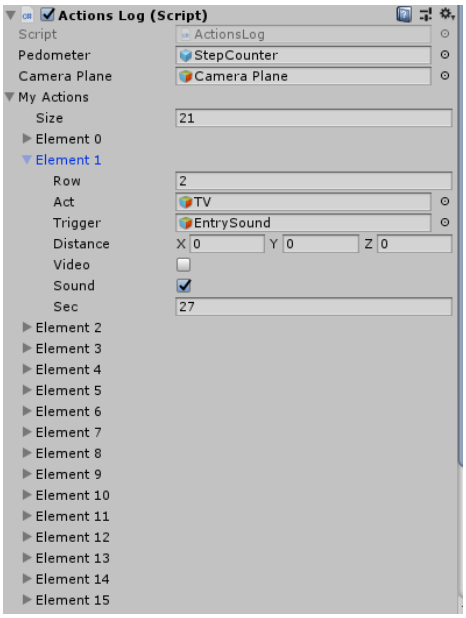


*ILLUSTRATION 38: SCREENSHOT FROM UNITY EDITOR. MAIN SCRIPT FOR EDITING THE TIMELINE OF THE STORY OF DEUS EX MACHINA*

In this way every action can be designed in a separated way in any local Unity project and include all the different parts of itself. The main Unity project is responsible for putting everything in a row, based on user interaction and does the garbage collection for better performance.

### *c.ii. First Tests*

In the first place, the above implementation was tested. During these tests, the storytelling experience wasn't satisfying. The VR headset made the walking a bit difficult. Also the viewer was outdoors, wearing the headset in the street, trying to walk along strangers. That had as a result that the viewer stopped walking every now and then so there was no rhythm during the storytelling and after a certain point the steps were just a trigger for the next action and didn't contribute to the immersion or the involvement of the viewer.

### *c.iii. Alternative Version*

The storytelling mechanism had to change. At this point we decided that the voice-over of the female God can give the rhythm of the storytelling, so the succession of the actions will be time-based and the user input will be used to add more details that will enhance the experience in a way that the viewer will feel special as the application will visibly consider his actions.

The main script changed in the following way:

i. every action is a game object
ii. number of the row in which the action will appear
iii. trigger of the next action (game object)
iv. flags to characterize the trigger (sound or video)
v. seconds to trigger the action
vi. number of the first action for testing purposes

In this way, the testing can begin in any point of the story and the action can be triggered from a sound or the speech of the female God in any second. Every action is like giving the baton to the next one but this can be in relation to any previous action as the trigger can be the current or any other game object. When the trigger is empty, the next action will appear by the end of the current. All this functionality was visible from the inspector for easy experiments. The two scripts that concern the deactivation remained the same.

At the beginning of the experience, the female God asks the viewer to take a walk with her. If steps are detected in the next seconds then the story will be continued. If not, another video will be played that the female God will comment on the fact that the viewer didn't walk and after that the story will be continued. This functionality was implemented in a script that can be attached every time we need steps interaction. The actions should be designed in the main script in the following way:

1. action that involves user input
2. action for the case that the viewer didn't walk
3. action for the case the viewer walked
4. next action

The script should be attached to the action number one so it can skip the next action for one case or show everything in a row.

Another element that was used for the viewer's immersion was the activation of the microphone at some point and for some seconds and the application of a reverb filter on the microphone's feed. That was implemented by an empty game object that had attached the sound components.

This kind of implementation was the final as during the tests the rhythm of the storytelling was better, so as for the immersion as well. The viewer's involvement was made in a fun way rather that a sense that he is following instructions and he has to walk so that he can see the next part of the story.

**d. Experiments that were not integrated**

***d.i. ARcore***

Since the application is in mixed reality, I made an effort to involve interaction with the environment using computer vision. First I tried ARcore by Google which is an Augmented reality package that offers computer vision functionality for plane and face detection.

The first problem was that ARcore was not supported by my device so testing was difficult. Anyway, I borrowed another device to test it. ARcore supports face detection for front camera only so in this case it wasn't useful for the application as we need the back camera feed. Plane detection works for back camera but since it is an AR package, when the application is built for VR with Google Cardboard sdk for stereoscopic rendering, the positioning of the 3D objects that are supposed to be projected in relation to the horizontal or vertical plane is affected.

These problems in addition to the fact that this implementation couldn't run in some of the devices of the members of the team, including me, led me to exclude ARcore for this time and try OpenCV.

***d.ii. OpenCV***

OpenCV is an open source library for computer vision. Its integration to Unity projects and especially android is kind of tricky. OpenCV supports face detection and I had tested it last year for a Processing and OpenCV experiment and I was satisfied by the results. Also the image effects that can be done with OpenCV can be very interesting.

Any OpenCV functionality should be written in C++ with all the functions that need to be called from C# exposed[43]. Then, with all the dependencies included, a dynamic Android library should be built and put it in the unity project as a plugin. Then, from C# you can call the exposed functions. I had a lot of trouble to be able to make this work because when unity fails to find a dependency, the error message is unclear. Also the library is different for testing in the Unity player and Android device so each time something works on the player I needed to change it for Android and test it again.

When I finally managed to do it, the pixels had to be sent from Unity to OpenCV for the detection and the effect application so the application was slowed down a lot. Especially for the image effect the pixels had to be received back too. Face detection worked fine in the Unity editor but for making it work on Android I needed more time. Since it was not an efficient thing to do anyway

[43] "Unity and OpenCV – Part Three: Passing Detection Data to Unity – Thomas Mountainborn." n.d. Accessed May 24, 2020. http://thomasmountainborn.com/2017/03/05/unity-and-opencv-part-three-passing-detection-data-to-unity/.

and slowed down the image so much that the viewer's experience was destroyed this tool was also rejected.

**e. Feedback**

The whole experience lasts approximately 7 minutes. We asked from friends with Android devices to test it by downloading and installing the apk.

The most common observation from all was the weird feeling that was provoked by the fact that although there was an interaction between the viewer and the device, there was no graphical interface. In the case that the viewer had to actively participate, he was asked to do so by the performer. This led to confusion. Viewers couldn't tell if this was part of the performance or if they should act. For those who decided not to follow the instructions of the female God, the fact that on the next step, she seems to know their reaction and comment on it was a funny plot twist.

For the tests that were made with a VR headset the fact that the viewer had to walk in the street, in an environment with a lot of things that he couldn't control added to the fun for some but for others made the experience more difficult as they felt unsecured even if they could see everything through the camera feed.

*ILLUSTRATION 39: SCREENSHOT FROM DEUS EX MACHINA*

Since the female God is visible a lot of time throughout the experience, we thought it is a nice idea to change her position sometimes. Since she was talking, the viewers had to be concentrated on that, so they were distracted by the change of her position. In the end, it turned out that the experience was too short and the new elements that the viewer needed to adapt were already enough.

**f. Conclusions**

Our need to combine an outdoor mixed reality experience with the equipment that is used for virtual reality applications was a very interesting motive for research.

Our initial thought was that the viewer should not feel insecure with the fact that the experience takes place outdoors. Of course the VR headset is blocking the view but since the camera feed is rendered in front of him it should not feel like something different than a pair of glasses. This

proves to be wrong as the majority of the people are not familiar with this kind of equipment so they don’t feel comfortable at the beginning.

Also the fact that there was not an interface or any visual instructions like arrows or banners explaining the way this experience will evolve added to the immersion but for some viewers caused a little confusion. The voice over and the almost constant presence of the performer was unexpected for most of the viewers and added to the sentiment of their uniqueness. In order to encourage more the active participation of the user more interaction was needed so that the viewer can choose not to participate the first time that the performer asks him to, realize that it was an actual call to be part of the experience so the next time he can be proud he reacted on time.

## II. Tweak

Tweak is an Android application that uses photographs and images, that are stored in the mobile device, to implement an image effect on the front camera feed. The application accesses the folders of the device, picks twenty random images from the internal storage space and uses them to produce a photo mosaic effect.

More specifically, the image effect that is produced by the randomly selected images of the device is reduced and encoded into two png images. Using these two images, the effect can be reproduced in any camera feed or image. In fact, the application is divided into two parts. The first one is the collection of the data and the second one is the application of the image effect that is based on the two png images that were produced.

Tweak application is part of a bigger project. Its aim is to offer the ability to the spectator to join in a participatory video installation. By sharing the images that were produced by the application, viewers can see their personalized image effect on a video installation with screens that project the feed of the connected cameras like altered mirrors.

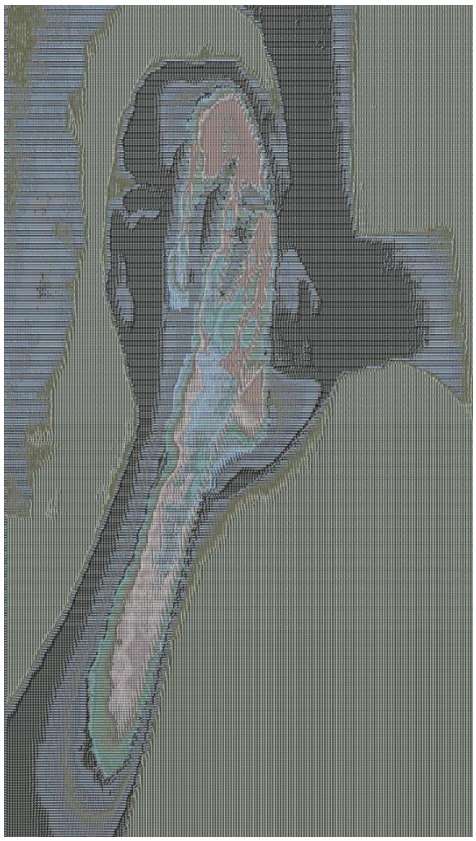

*ILLUSTRATION 40: SCREENSHOT FROM TWEAK*

The project was implemented in Unity 2018 and Unity Remote was used for testing on the mobile devices. The main mobile device that was used for development and testing is Xiaomi Redmi 4X with android version 7.1.2(N2G47H).

### a. Artist Statement

It seems to me that mobile phones store the most private and public version of ourselves at the same time. The smartphone devices “carry” our social media and private messaging applications. Our GPS information as we navigate through the public space and our biometrical data as we customized a fitness application. Our photographs of personal moments and the selfies we post online.

Smartphones have become the most used device for social networking since social media are most of the time mobile-centered platforms. At the same time, these devices have centralized services for personal needs like alarms, notes, agendas. In fact, smartphone devices have replaced a lot of tools and mediums people used to employ before our phones become smart.

All these different applications we use on our phone store preferences, tracking information, in fact, data in different kind of structures and files. The more we use the smartphone instead of another medium, the more we provide a variety of data. At the same time, in recent years, users produce tones of data themselves. It is very often that users produce content for the web or the social media.

I see the smartphone as a device of contradictions. It is the medium that concentrates data that will later be defined as private or public and that the user as the maker of that data produces them on purpose or without even realizing it. In contrary with the personal computer that the user builds the folder structure of the storage, in the case of the smartphone devices the user is not involved in this. The smartphone will never ask the user where to save a file and this is a design principle that although the user can manipulate, he never chooses to do so.

This idea led to the Tweak application. If I take a photograph, upload it to the social media, post it in the comment section of a news site and go viral, the possibility of it to be stored at the same folder with one photograph of myself in an embarrassing moment is legit.

## b. Project Development

### *b.i. Camera Feed*

Since this application was about an image effect, I wanted to use the smartphone's camera feed from the start. I decided to use the front camera instead of the back as I wanted this experience to feel more personal. I thought that the user we feel more playful if he observes himself in a kind of altered mirror in comparison to the back camera version.

The camera was on from the beginning of the experience as a background. At first, the user can see himself from the front camera, without any effect applied. Furthermore, two buttons were visible. One for starting the automatic navigation at the internal storage and one for restarting the application.

For the first scene, I wanted two buttons and the camera feed as a background so I decided to use the user interface elements of Unity. I used a Canvas, buttons and a Raw Image as a background. A webcam texture was streaming the data of the front facing camera that was detected and that was the main texture of a material. This material was assigned to the Raw Image.

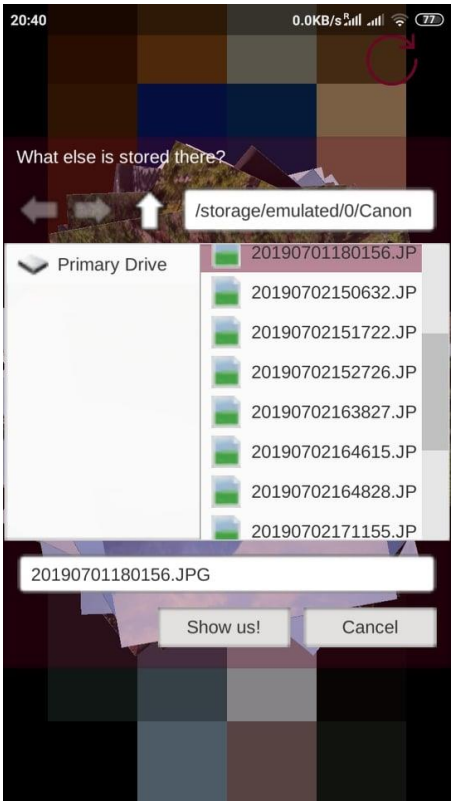


*ILLUSTRATION 41: SCREENSHOT FROM TWEAK DURING FOLDER NAVIGATION*

The problem was that the application is portrait oriented while the raw data of the camera is on landscape mode. So the camera feed is shown sideways[44]. I had to rotate the Raw Image but in this way it would not fit the entire screen. I wanted this background to be on full screen[45] so I had to scale it. By width I had a lot of blank space over and under the image and by height the side of the camera was cut so the framing was different.

The solution I found was to rescale the rotated Raw Image to fit the screen and apply the material. Although I tested a lot of different parameters for the aspect ratio fitter component I couldn't find the best settings for the image not to be rendered a bit squashed. What I found weird was that Unity provides some useful flags for this kind of issues like the video rotation angle integer. In my case, even if the image was shown sideways this variable was always equal to zero.

### *b.ii. Retrieval of images*

The application uses the files of the user's device to compose the image effect. The problem was that Unity does not offer a default set of tools for browsing the file system of an Android device. I decided to use the Unity Simple File Browser asset from Süleyman Yasir Kula. This is a very useful asset that offers functionality similar to Windows file chooser. Apart from the functions that can be called in any script, the asset includes an already implemented simple user interface that can be modified. This is very helpful for a demonstration of all the different functions and the ways that they can be combined so that the developer can have an overview of the tool quickly.

I used the functions that this asset includes for reading the bytes of the randomly chosen image. More specifically, the application reads the bytes of the image file through the functions of this asset, creates a new texture and applies these bytes as an image. This texture is later assigned on a Raw Image. Each time an image is chosen, a new Raw Image is created and placed in a position close to the previous one, with a rotation too, in order to give the impression of a slowly developed pile of photographs.

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[44] "WebCamTexture Flipping and Rotating 90 Degree (IOS and Android) - Unity Forum." n.d. Accessed May 24, 2020. https://forum.unity.com/threads/webcamtexture-flipping-and-rotating-90-degree-ios-and-android.143856/.

[45] "Issues with Getting a Portrait WebCamTexture Working... : Unity3D." n.d. Accessed May 24, 2020. https://www.reddit.com/r/Unity3D/comments/689w1e/issues_with_getting_a_portrait_webcamtexture/.

Apart from the demonstration of the file to the user, there is a need for the application to "remember" it in order to use it later for the creation of the effect. Also, since the creation of the effect will take place during the runtime, in a total of twenty images, there is a need to modify the quality of them so that the manipulation can be faster. As a result, the initial image files were not possible to be used as their quality and resolution was too good for the case. So, every time a new image is selected, the application demonstrates it to the user and saves it in a downsized quality. In order to achieve that I used a function that exists at the Unity's wiki by Eric Haines. This function[46], resizes a Texture 2D along with the content of the texture. Unity's default scale function keeps only a part of the image, depending on the new size of the texture so a lot of information (in this case, color) was lost so that was the reason it was not an option.

### *b.iii. Pixelation effect*

During the first part, the user can see the interface of the file explorer as the automatic navigation through his files takes place. This is interrupted by the demonstration of the image, if the loop ends up at one. As the application runs, the pile of the images is built.


*ILLUSTRATION 42: SCREENSHOT FROM TWEAK DURING THE DEMONSTRATION OF THE FOUND IMAGE*

All along this procedure, I wanted to have the front camera feed as a background but I did not like it to be "clean". I wanted to add an effect that will not distract the user and it will not need a lot of computational power so that it could be used as a background.

I decided to apply a pixelation filter on the camera feed. Some seconds before the appearance of the interface and the start of the automatic browsing, the camera feed is turned into a geometric pattern that looks more like a mosaic of colors that depend on the camera's feed. For this effect, I used an asset, the Pixelation Creator of the ImagineVR. This tool gives the ability to add a pixelation shader either to objects of the Unity scene separately or the whole scene. In my case, I wanted this effect to be applied only on the background so I had to use two Unity UI canvas components, one to render the buttons, without the effect, and one to render the front camera feed with the pixelation creator shader.

### *b.iv. Photographic Mosaic effect*

[46] "TextureScale - Unify Community Wiki." n.d. Accessed May 24, 2020. http://wiki.unity3d.com/index.php/TextureScale?_ga=2.121215240.1891790393.1586702345-984516322.1526037330.

As soon as the image collection has been done, the selected files are used for generating a photographic mosaic effect. In order to achieve that, I used the tool I found on github, that is the PhotoMosaic Unity package from keijiro.

In order to construct the photographic mosaic, the tool needs all the necessary data in the asset folder. All the images that will be used must be 256 x 256 pixels. The downsize of the selected files had been done after the demonstration of the image to the user as described above in section b.ii. More specifically, this tool needs a folder with the images from which the effect will be produced and one folder for the two images that will be produced. These two images are :

- one png image with width 256 * (total of the selected images) pixels and height 256 pixels. This will be the texture of the mosaic. It contains the total of the selected images merged side by side.
- one png image with width 256 pixels and height 16 pixels. This will be the LUT texture.

The color correction LUT stands for lookup texture and is used for color grading. More specifically, since the texture will be created and applied on runtime, it is not possible to configure the color channels via curves. *"The lookup will be performed by using the original image color as a vector that is used to address the lookup texture."*[47] .The dimensions of the file, 256 x 16, stand for 16x16x16 color lookup texture.

*ILLUSTRATION 43: EXAMPLE TEXTURE IMAGE OF TWEAK*

*ILLUSTRATION 44: EXAMPLE LUT FILE OF TWEAK*

The problem with that tool is that it cannot be configured on runtime. All the images and the textures they produce should be in the right folders inside Unity's Asset folder. From the editor, the functions can be called and update the produced images. On runtime, if the necessary script is attached to the camera, the already configured effect can be applied.

In my case, the images will be gathered on runtime so the texture files should be created also during runtime. It is not possible for Unity to call an editor function at that time because of the script compilation order. So I had to rewrite the functions. In order to have a version that can run both on PC in edit mode and on Android for the final application, I had to use some compiler directives so that different parts of code will be compiled and executed depended on the platform.

[47] "Unity - Manual: Color Correction Lookup Texture." n.d. Accessed May 23, 2020. https://docs.huihoo.com/unity/5.6/Documentation/Manual/script-ColorCorrectionLookup.html.

This had to be done mainly because of the different default application path of the images that the application will store and load.

### *b.v. Multiple cameras rendering*

The image effect is applied to the camera feed but not to the rest of the graphic elements that are rendered on the screen. In order to achieve that I used two cameras, one for the background and another one for the foreground.

For each camera, I used another Depth value to set the rendering order. Also I used a culling mask to make visible to each camera only the elements that I wanted to render each time. Finally, buy setting the Clear Flags flag to Depth only I managed to combine both layers on the final screen.

## c. Interaction Design

### *c.i. File browsing*

During the first part of the experience, I wanted to have a visible interface with an ordinary design. The navigation through the file system would be automatically generated and not user provoked. Anyway, I wanted to give the user the chance to interfere if he wanted to so this file dialog window is also clickable.

I wanted to visualize the access of the folders so that the user can see the different paths that the application will choose. Also, I wanted to expose the file structure of the data on the smartphone device and the various folders that are created in the internal storage from all the installed applications. The automatic navigation can choose paths that do not contain files that can be used for a photographic mosaic, but it could also access folders that the owner of the smartphone does not know that they exist so I wanted all the paths to be visible.

In order to access the Android file system I used the Unity Simple File Browser plugin as mentioned above on section b.ii. I customized the User interface and I decided to implement the automatic file browsing by evoking fake clicks[48]. The file browser plugin had its own Custom Event System so I had to cause fake events for clicking or double clicking.

I decided to implement the navigation using Coroutines instead of functions so that I can have some delay along the steps in order to slow down the process so that it can be visible. The call of the Coroutines had to be recursive for a pseudo in-depth search of the folders. I did not want the

[48] "BoredMormon / Youtube-Tutorials / UI / Fake Clicks / FakeClick.Cs — Bitbucket." n.d. Accessed May 24, 2020. https://bitbucket.org/BoredMormon/youtube-tutorials/src/master/UI/Fake%20clicks/FakeClick.cs.

search to be exhaustive because this was not the point. The recursive call is implemented with yield returns[49] in every routine.

The navigation is implemented in the following way: in each step, there is a total of files or folders that are visible inside the interface without scrolling. In each step, randomly, one of them is clicked. This will lead to new files and folders. When a folder is empty or it does not contain image files, the routine returns to the previous level. Another folder or file from the rest of them is chosen. When all of them are clicked, the scrollbar moves to the middle and the procedure continues. Finally the scrollbar moves to the end. At this point when all the files and folders have been accessed the procedure is terminated. When an image file is clicked, while the image is demonstrated to the user, a flag pauses the routines and makes the procedure continue after some seconds, when the user interface is visible again. During the time that the file dialog window is opened, the user interface is clickable so the user can interfere by clicking on files and folders.

In order to facilitate the development I implemented a testing flag that when it is true, the application always follows the same path for the first two levels so that the different stages of the app could be tested by creating different data structures. Also, two variables that concern the time can be edited from the inspector. They concern the seconds between clicks and the seconds that each image will be demonstrated.

### *c.ii. Buttons*

During the first part of the application, there are two buttons, one for the start of the experience and another one for restarting it. I chose to keep the restart button always visible in case the user does not want to share the selected picture. I did not want to give the user the opportunity to select images and exclude the ones he did not want so in this case he should start the procedure from the beginning.

During the second part of the application, the front camera feed is shown on the background with the image effect on it. At the bottom of the screen there is a slider that controls the size of the block of the photographic mosaic. That means that the screen is divided in squares, each of them is one part of the mosaic and by moving the slider the dimensions of the square change in order to produce a different effect.

On the top, there are two more buttons visible. The first one is for taking a screenshot. Since the user can see himself in this kind of altered mirror I wanted to give him the opportunity to save screenshots. Although there is a default function to encode and save an image as jpg or png on

[49] “How to Create a Recursive Call with Unity’s Coroutines // MikeaDev.” n.d. Accessed May 24, 2020. http://mikeadev.net/2015/02/how-to-create-a-recursive-call-with-unitys-coroutines/.

the application's folder, it was not enough. It is not very often for the user to access the application folders. They are usually used to store data that the application needs to function and not images or data that the user wants to store. I wanted to have access to the native gallery of the smartphone so that the images will be visible from there.

In order to access the smartphone's gallery, I used the Native Gallery for Android & iOS by Süleyman Yasir Kula. This plugin offers functions that give the possibility to interact with the gallery of the photos of an Android mobile device. So I created a separate Album for the screenshots and saved them there. I thought that these images will be like a souvenir for the people who participated to this experience.

Finally, since the final version of this artistic attempt would be a participatory video installation, I wanted to facilitate the user to share the two texture images of the photographic mosaic that his data have created. In order to achieve that, I added a share button that triggers the native share options of the smartphone. I used the NatShare API which is a cross-platform social sharing tool.

*ILLUSTRATION 45: SCREENSHOT FROM TWEAK*

The two images, the texture and the LUT file, are stored at the application's folder (not at the Gallery). I chose to store them there because their purpose is to produce the image effect and they are not of any use to the user himself. Also, if the user decides to run the application several times, I wanted to have the control of the files that where created so that I can do the garbage collection. I did not want to fill the storage space with downsized copies of photographs. So by hitting the button, the user can choose in which platform he wants to share the images but both of them have already been selected so that he does not have to look for the in the internal storage.

**d. Future Plans**

As I mentioned before, the application is part of a bigger participatory video installation project. The setup of the installation will include a camera that will stream the video feed to a projection machine or a screen. This setup will be used to add to the experience the feeling of an altered mirror.

The viewers will have the possibility to download the application and install it on their phones. By running it, the application will use their images to implement their own version of the image effect. In a similar way with the sharing button that already exists, they will have the option to send the two images that encode the image effect to a server. This server will apply the different image filters of the people that participated.

Another interesting aspect will be to extract other kind of data from the smartphone, too. I would like to find a way to visualize different data structures that are stored in the smartphone devices like location, trackers for advertisements or preferences for color themes that are used.

**e. Feedback**

I asked from some friends to test the application so I can have the first evaluation results. I wanted to test both the functionality and the responsiveness of the application as well as the experience.

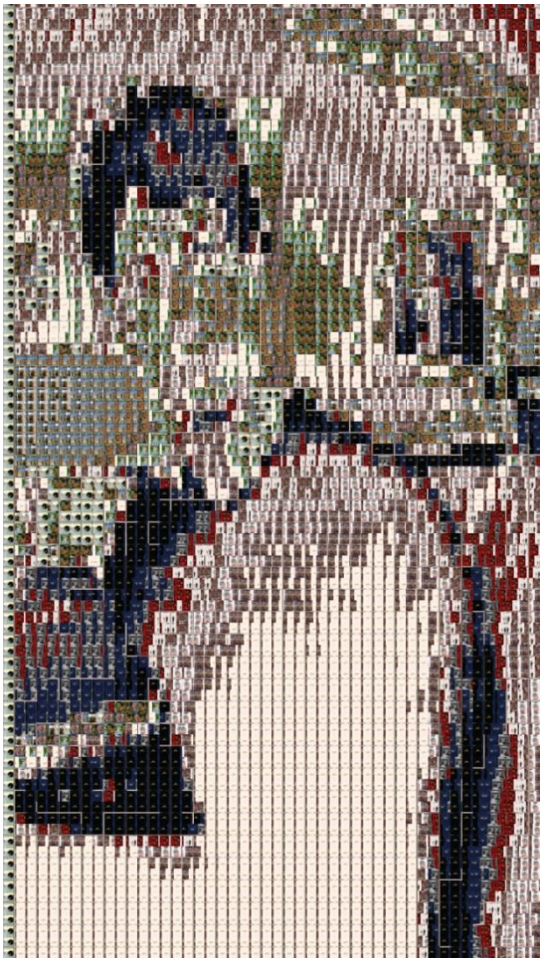

*ILLUSTRATION 46: SCREENSHOT FROM TWEAK*

For most of the participants, it was a fun experience. They liked the image effect, and the way the different light conditions affected the colors of the filter. They found interesting that the application accesses random folders so they “discovered” images that they did not remember that they had saved on their devices. Some of them commented on the fact that they saw images that they did not even know that they had been saved. Also, they commented on the fact that they did not know the folder structure that they saw on the file explorer and in fact, they did not know the way that the internal storage of their device is organized.

I also received some comments on the different colors of the filter depending on the sex of the participant. Some of them found interesting that they could guess the sex of the participant based on the colors of the filter. Also, often, the majority of the images that were chosen corresponded to the same subject or involved images of the same people. In a way, this random access exposed some of the obsessions of the participant.

There were also some people that refused to participate. In fact, they used the application but they did not want to send back the images because they thought that it was too personal. Also, I received some comments on the way that the chosen images were presented to the viewer. Some people thought that the application worked as a virus that pops up a lot of windows and colorful images.

Finally, for the participants that had downloaded a lot of applications in the past, they had a lot of folders that contained different kind of data but not images. For them, it took some time for the application to find the images so they had to stare at the interface for more time that I had planned.

**f. Conclusions**

In conclusion, working on that project was a very interesting experience for me. I had the chance to work on post processing effects and graphics in Unity, so it was very challenging and fulfilling.

Via this application, I had the chance to explore the field of interactive creation and face the difficulties that this brings. It was challenging to find ways to include the viewer and personalize the experience. Especially in this case, that I was interested to use the smartphone device as a creative medium and involve personal data. It was challenging to construct something that will include the spectator in an active way.

In fact, although I used a simple user interface for the file browsing that was clickable, nobody decided to click on it. Of course the file navigation was automated but everything was clickable and the participator could interfere on it. It was very interested that the participants find it difficult to switch from a passive to an active role when dealing with the same artwork.

Finally, when personal data is concerned, it is difficult to convince people to participate, but when it comes to convenience (online shopping, music preferences, social media) some of them are less skeptical. Also it is very interesting that in the case of this application any image that the participant will share with the rest of the audience will be in his knowledge. The images that are stored in the device are personal but the participant has the control while in other applications the way that the personal data are used is less visible to the user himself.

## III. Pixcell

The aim of this project is to make use of a two dimensional Totalistic Cellular Automaton (CA) based on Conway's Game of Life in order to design an interactive audiovisual installation. It was a group project that I implemented with my colleague Vicky Michalopoulou during the first year of this master program. Vicky was responsible for the audio synthesis while I was the main developer. The tools we used were the Super Collider, Processing, Kinect and the OSC protocol.

### a. Artist statement

We were very interested in exploring the non-predictive autonomy of this system and how this element can be incorporated in a project that will constantly change offering every time a unique experience. Given that we wanted to experiment on the way this randomness can produce music and how the visual representation can change in case we rearrange the neighboring rules.

Also we wanted to construct a physical experience that will include the whole body of a user. Through this installation, the visitor can interact with the CA producing music and visuals.

The installation includes a surface that the visual is projected and an area in front of it in which the visitor can be tracked by the Kinect camera and interact with the application.

### b. Project Development

The CA was considered as a musical instrument playing in C major. We used down sampling in order to construct a two dimensional array 7x7 in which the rows will represent the octaves and the columns the notes. The sound is produced like in a pianola or a needle player.

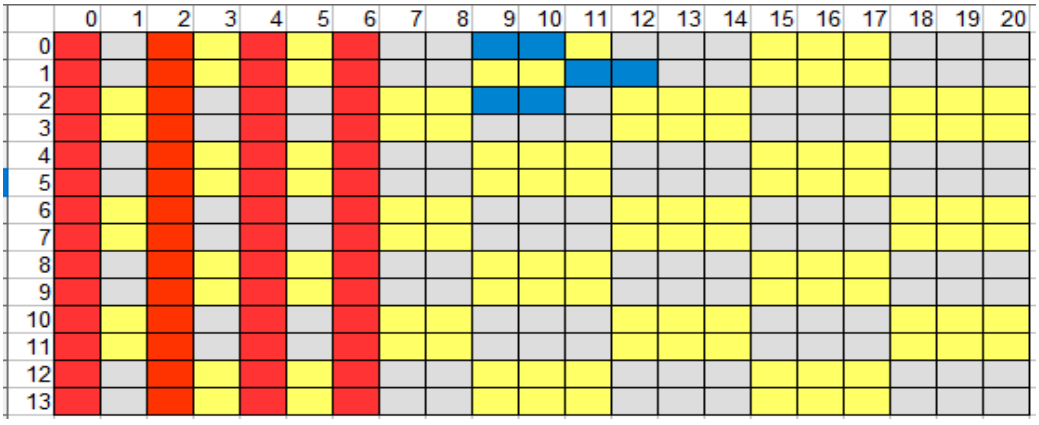


*ILLUSTRATION 47: PARENT CELLS ARE PAINTED IN RED. NEW SHAPE OF THE CELL IS PAINTED BLUE. STEP SIZE 2*

So there is a vertical line that scans the surface from the left to the right direction and "reads" the sounds that each column contains only if new cells were born in this area of the CA. In this way, when new cells are born on the column that the line currently is, Processing sends OSC messages to SC and according to the position (number of the column) the corresponding sound is

produced. The volume of each sound depends on the number of the new cells that were born in the area.

We also wanted to experiment with the change of the shape of each cell. In order to do that, every time that the shape changes, new cells are defined as “parents” and the rest of the population is the “children”. So in order to change the shape, we merge the cells. In every frame, we calculate the status of the father and this is inherited to his children. There are also two variables that store the number of the merged cells vertically and horizontally, the “steps”.

During the initial state, all of the cells are parents and the steps are equal to zero. If for example, we change the horizontal step by merging one cell, then all the cells that are placed in columns indexed by even numbers are defined as parents. The parents are checked by the rules of the Game of Life and they inherit their status to their children that are in the distance that the variable step defines. The same happens with the vertical steps. So in every change of shape new parents are defined.

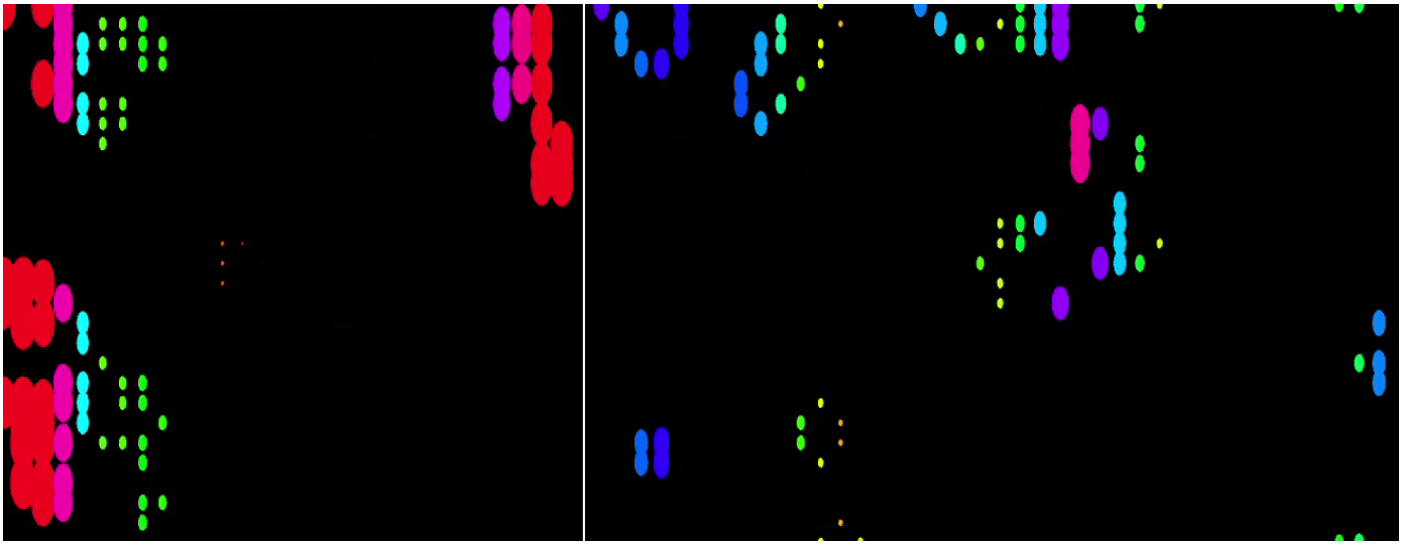

*ILLUSTRATION 48: SCREEN CAPTURE FROM PIXCELL. INTERACTIVE VISUALS. LINE SCANS THE SURFACE AND PRODUCES SOUND*

**c. Interaction Design**

The concept of the change of the shape of the cells was implemented based on visitor’s interaction. In fact, it is like a collaborative musical instrument that needs at least two people to function.

One participant will interact with his hands in front of the projection area. A kinect camera will track his hands and produce new cells in these coordinates. The camera will detect the position of the thumb and will draw a circle on these coordinates so that the participant can relate to the surface. At the same time, the other participant will have a keyboard with which he can change the shape

of the cells. By pressing the buttons “q, a, w, s”, the participant can merge one cell horizontally, vertically or unmerge one in the same way.

A microphone was also included to the installation. It was a way to produce interesting visuals and also encourage the visitor to interact with his voice apart from his body. The sound that the microphone records, is the one that was produced by the CA, the surrounding sound and the voice of the participant (if he chooses to speak or sing). The volume of that sound affects the colors and the size of the visual that represents each cell. When the volume is low, the cells are small and colored in tones of blue. As the volume increases, they become bigger and colored with more warm colors until they hit maximum and become red.

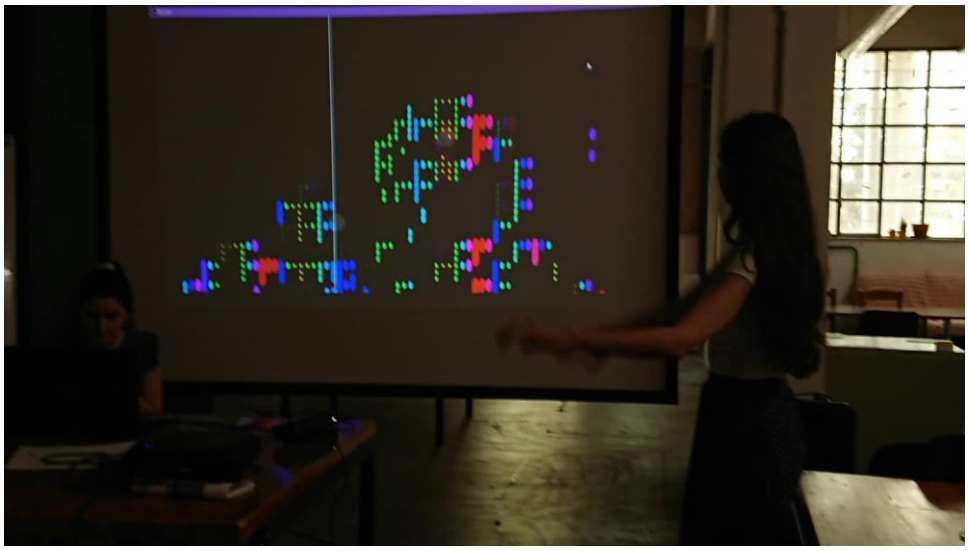

*ILLUSTRATION 49: PHOTO FROM TESTING PIXCELL INSTALLATION*

**d. Conclusions**

One of the main concepts that we wanted to explore as an artistic team was the possibility to “translate” the CA rules to produce something else, in our case music. Through a lot of experimentations we managed to come up with this idea of the two dimensional array that is also easy to customize so it opened the way to new future experimentation too.

The change of the size and the color of the cells produced by the constant and random change of the recorded volume produce very interesting visuals. On the other hand, the change of the shape, although it can produce interesting results, leads to the reduction and therefore the death of the cells. This is something that through the interaction with the user can change as he can produce new cells with his hands.

From a few testing sessions that we arranged we realized that the way that the two users have to interact makes the experience unequal as the keyboard version was considered less exciting than the full body one.

## Conclusions

The interactivity in digital art forms was studied through selective projects in both concepts of WIMP and post-WIMP interfaces. The experiments that were presented were my attempt to apply ideas and concepts that draw my attention throughout this research. This is why I wanted to explore different kind of interaction style in each case.

A general observation that I would like to make is that I found some bold contrasts among the pieces of art of these two categories. In screen-centric art, I felt that artists worked towards concepts in which the presence of the computer was part of the experience or the subject that was commented. They wanted to include the computer screen itself in their art and not always alter they typical relation that a user has towards it. The way that the audience interacts with the work or the way that the interactivity was structured in these cases was more visible and part of the artistic experience. In this way, the WIMP interface sometimes was not a narrative or performative factor rather that a regulatory tool.

On the other hand, in post-WIMP interfaces, I felt that artists wanted to make the computer invisible by replacing it with other mediums that were related more to the content of the art piece. I think that in interactive installations, artists try to separate their work from the typical user's experience in front of a machine and invent a new way of relating with it.

In all of these cases, art is an "action co-created by the human and technical forces at play. The difference in emphasis may be the impetus of the trend toward replacing the term "human-computer interface" with "human-computer interaction" in recent years"[50].

[50] Brenda, *Computers as theatre*, p. 2

## Bibliography

[1] Benjamin Hoguet, *Le pouvoir narratif des interfaces*, Dixit Editions, 2016

[2] Berry, Marsha. *Creating with mobile media*. Springer, 2017.

[3] Farman, Jason. "Site-specificity, pervasive computing, and the reading interface." In *The mobile story*, pp. 15-28. Routledge, 2013.

*[4]* Gervás, Pablo. "Computational approaches to storytelling and creativity." *AI Magazine* 30, no. 3 (2009): 49-49.

[5] Jacob, Robert JK, Audrey Girouard, Leanne M. Hirshfield, Michael S. Horn, Orit Shaer, Erin Treacy Solovey, and Jamie Zigelbaum. "Reality-based interaction: a framework for post-WIMP interfaces." In *Proceedings of the SIGCHI conference on Human factors in computing systems*, pp. 201-210. 2008.

[6] Laurel, Brenda. *Computers as theatre*. Addison-Wesley, 2013.

[7] Manovich, Lev. *The language of new media*. MIT press, 2001.

[8] Quaranta, Domenico. *In Your Computer*. Lulu Press, Inc, 2014.

[9] Swale, Alistair D. “Media, Art, and Society: Interface of the Digital Image, Aesthetics, and Culture.” In *Handbook of Digital Games and Entertainment Technologies*, edited by Ryohei Nakatsu, Matthias Rauterberg, and Paolo Ciancarini, 859–80. Singapore: Springer. 2017

[10] Tanenbaum, Joshua. “Being in the Story: Readerly Pleasure, Acting Theory, and Performing a Role.” In *Interactive Storytelling*, edited by Mei Si, David Thue, Elisabeth André, James C. Lester, Joshua Tanenbaum, and Veronica Zammitto, 55–66. Lecture Notes in Computer Science. Berlin, Heidelberg: Springer. 2011

[11] Tuters, Marc, and Kazys Varnelis. "Beyond locative media: Giving shape to the internet of things." *Leonardo* 39, no. 4 (2006): 357-363.

[12] Veugen, Jacoba Ida Louisa. "Computer games as a narrative medium." (2011).

[13] Vosmeer, Mirjam, and Ben Schouten. “Interactive Cinema: Engagement and Interaction.” In *Interactive Storytelling*, edited by Alex Mitchell, Clara Fernández-Vara, and David Thue, 140–47. Lecture Notes in Computer Science. Cham: Springer International Publishing. 2014

## Webography

[14] “#1 / Words Are Weapons - Episodes - UNSPEAK.” n.d. Accessed May 23, 2020. http://unspeak.submarinechannel.com/episodes/words_are_weapons.

[15] “Black Room ::: Cassie McQuater | TRANSFER.” n.d. Accessed May 23, 2020. http://transfergallery.com/black-room-cassie-mcquater/.

[16] “BoredMormon / Youtube-Tutorials / UI / Fake Clicks / FakeClick.Cs — Bitbucket.” n.d. Accessed May 24, 2020. https://bitbucket.org/BoredMormon/youtube-tutorials/src/master/UI/Fake%20clicks/FakeClick.cs.

[17] “Brushes: An Exhibition of Digital Painting for the Net.” n.d. Accessed May 23, 2020. http://media.rhizome.org/brushes/index.html#section-9.

[18] Canada, National Film Board of. n.d. “About | Welcome to Pine Point.” National Film Board of Canada. Accessed May 23, 2020. https://www.nfb.ca/interactive/welcome_to_pine_point/.

*[19]* Céline Roustan,“Pocket by Zach Wechter & Mishka Kornai | Short Film.” n.d. *Short of the Week* (blog). Accessed May 23, 2020. https://www.shortoftheweek.com/2019/02/27/pocket

[20] “Computer Screen Film - Wikipedia.” n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Computer_screen_film.

[21] “Constant Dullaart.” n.d. Accessed May 24, 2020. https://www.constantdullaart.com/%E2%98%81%E2%98%A0%E2%9B%94%E2%98%81%E2%98%81%E2%98%81%E2%8F%B3%E2%98%94%E2%9A%A0%E2%98%81%E2%98%81%E2%9B%94%E2%8F%B3%E2%98%A0%F0%9F%92%A3%E2%9C%8A%F0%9F%8F%BE%E2%9C%8A%E2%98%94%E2%98%81%E2%98%81/.

[22] “Constant Dullaart: 100,000 Followers for Everyone! «DIS Magazine.” n.d. Accessed May 24, 2020. http://dismagazine.com/dystopia/67039/constant-dullaart-100000-followers-for-everyone/.

[23] Couture, Joel. n.d. “Road to the IGF: Cassie McQuater’s Black Room.” Accessed May 23, 2020.https://www.gamasutra.com/view/news/336846/Road_to_the_IGF_Cassie_McQuaters_Black_Room.php

[24] “Film Essayist Chloé Galibert-Laîné on the Careful Choreography of Desktop Cinema.” n.d. Accessed May 23, 2020. https://hyperallergic.com/555214/chloe-galibert-laine-interview-images-festival/.

[25] “Found Footage (Film Technique) - Wikipedia.” n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Found_footage_(film_technique).

[26] “How to Create a Recursive Call with Unity’s Coroutines // MikeaDev.” n.d. Accessed May 24, 2020. http://mikeadev.net/2015/02/how-to-create-a-recursive-call-with-unitys-coroutines/

[27] “Indirect Flights – Joe Hamilton.” n.d. Accessed May 24, 2020. http://www.indirect.flights/. “100 Paintings . Gallery.” n.d. Accessed May 24, 2020. http://www.100paintings.gallery/.

[28] “Issues with Getting a Portrait WebCamTexture Working :Unity3D.” n.d. Accessed May 24, 2020.https://www.reddit.com/r/Unity3D/comments/689w1e/issues_with_getting_a_portrait_webcamtexture/.

[29] Jason Sondhi,“Noah by Patrick Cederberg & Walter Woodman | Short Film.” n.d. *Short of the Week* (blog). Accessed May 23, 2020. https://www.shortoftheweek.com/2016/08/22/noah.

[30] “Legible City.” n.d. Accessed May 23, 2020. https://www.jeffreyshawcompendium.com/portfolio/legible-city/.

[31] “Lens Distortion | Package Manager UI Website.” n.d. Accessed May 24, 2020. https://docs.unity3d.com/Packages/com.unity.postprocessing@2.1/manual/Lens-Distortion.html.

[32] “MOBEN | World Skin, a Photo Safari in the Land of War.” n.d. Accessed May 23, 2020. https://benayoun.com/moben/1997/02/12/world-skin-a-photo-safari-in-the-land-of-war/

[33] “My Boyfriend Came Back From the War | Net Art Anthology.” n.d. Accessed May 23, 2020. https://anthology.rhizome.org/my-boyfriend-came-back-from-the-war.

[34] “Natural User Interface - Wikipedia.” n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Natural_user_interface.

[35] “Screentime.” n.d. Accessed May 24, 2020. http://screentimeclock.net/.

[36] “Sensorama - Wikipedia.” n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Sensorama.

[37] “TextureScale - Unify Community Wiki.” n.d. Accessed May 24, 2020. http://wiki.unity3d.com/index.php/TextureScale?_ga=2.121215240.1891790393.1586702345-984516322.1526037330

[38] “The Sound and Vision of The Boat.” n.d. SBS Movies. Accessed May 23, 2020. https://www.sbs.com.au/movies/article/2015/04/27/sound-and-vision-boat.

[39] “Unity - Manual: Color Correction Lookup Texture.” n.d. Accessed May 23, 2020. https://docs.huihoo.com/unity/5.6/Documentation/Manual/script-ColorCorrectionLookup.html.

[40] “Unity - Manual: Video Transparency Support.” n.d. Accessed May 24, 2020. https://docs.unity3d.com/Manual/VideoTransparency.html.

[41] “Unity and OpenCV – Part Three: Passing Detection Data to Unity – Thomas Mountainborn.” n.d. Accessed May 24, 2020. http://thomasmountainborn.com/2017/03/05/unity-and-opencv-part-three-passing-detection-data-to-unity/.

[42] Upian. n.d. “Do Not Track.” Do Not Track. Accessed May 23, 2020. https://donottrack-doc.com/en/.

[43] “Video Essay - Wikipedia.” n.d. Accessed May 23, 2020. https://en.wikipedia.org/wiki/Video_essay.

[44] “WE=LINK: | TEN EASY PIECES 十个小品.” n.d. Accessed May 24, 2020. http://we-link.chronusartcenter.org/?utm_source=New+Museum&utm_campaign=1b4add5964-EMAIL_CAMPAIGN_2020_03_30_HomeDelivery_COPY_01&utm_medium=email&utm_term=0_6c3938a7e5-1b4add5964-409880091&mc_cid=1b4add5964&mc_eid=192a00d872

[45] “WebCamTexture Flipping and Rotating 90 Degree (IOS and Android) - Unity Forum.” n.d. Accessed May 24, 2020. https://forum.unity.com/threads/webcamtexture-flipping-and-rotating-90-degree-ios-and-android.143856/.

## Videography

[46] Chloé Galibert-Laîné.2018. *Flânerie 2.0 [ENG SUBS]*. Accessed May 24, 2020. https://vimeo.com/259579651.

[47] Lee, Kevin B. 2014. *229. Filmmaking Lessons from Maya Deren*. Accessed May 24, 2020 https://vimeo.com/88841695.

[48] Lee, Kevin B. 2014. *TRANSFORMERS: THE PREMAKE (a Desktop Documentary)*. Accessed May 24, 2020 https://vimeo.com/94101046.

## Filmography

[49] Cederberg, Patrick, and Walter Woodman. 2014. *Noah*. Animation, Short, Comedy, Romance.

[50] Chaganty, Aneesh. 2018. *Searching*. Drama, Mystery, Thriller. Screen Gems, Stage 6 Films, Bazelevs Production

[51] Cincera, Radúz, Ján Rohác, and Vladimír Svitácek. 1967. *Kinoautomat*. Comedy.

[52] Kornai, Mishka, and Zach Wechter. 2019. Pocket. Short, Drama, Romance. Pickpocket, The Whitelist Collective.

[53] Matsuda, Keiichi. 2016. *Hyper-Reality*. Short, Sci-Fi.

[54] Weber, Tommy. 2018. *Je Ne t'aime Pas*. Short. ARTE, Tuco.

## Table of figures

## Additional Information

| Programming Tools | |
|---|---|
| Unity 3D (2018.2.14f1) | https://unity.com/ |
| Processing (p3) | https://processing.org/ |
| Super Collider (3.10.0.) | https://supercollider.github.io/ |
| Kinect (pv2) | https://github.com/ThomasLengeling/KinectPV2 |
| Mapbox API | https://www.mapbox.com/unity/ |
| Pedometer API | https://github.com/olokobayusuf/Pedometer-API |
| Post Processing Stack | https://docs.unity3d.com/2018.3/Documentation/Manual/PostProcessing-Stack.html |
| ARcore | https://developers.google.com/ar/develop/unity/quickstart-android |
| OpenCV | https://opencv.org/ |
| Runtime File Browser | https://assetstore.unity.com/packages/tools/gui/runtime-file-browser-113006 |
| ImagineVR Pixelation Creator | https://assetstore.unity.com/packages/tools/particles-effects/imaginevr-pixelation-creator-77357 |
| PhotoMosaic | https://github.com/keijiro/PhotoMosaic |
| Native Gallery for Android & iOS | https://assetstore.unity.com/packages/tools/integration/native-gallery-for-android-ios-112630 |
| NatShare API | https://github.com/natsuite/NatShare-API |