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Synesthesia

Exhibiting visual languages in the digital age and the aesthetic exploration of technology

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Foreword

This thesis project has been developed in parallel to the undertaking of an academic internship at the integrated communication and design agency Quattrolinee. Quattrolinee, founded in 2012 by a group of designers from the Politecnico di Torino, has expanded into a network of experts that "share the mission of realizing innovative strategic projects of high visual quality" (About Quattrolinee, 2021). Moreover, the agency is involved in communication strategy, brand empowerment, community development and consumer experience, while also being one of the main organizers of the design festival Torino Graphic Days. The festival has been active since 2016 with the goal of supporting and giving a stage to the cultural value of visual communication and promotes new projects and forms of expression by bringing together in Turin some of the most interesting and innovative artists in the international and local landscape. The research and project presented in this paper, therefore, was born with the intention of exploring new visual avenues for the festival, now in its sixth rendition, by focusing on the distinct and original forms of visual and digital art. The outcome has been the installation of a "Dark Room" immersive and interactive exhibit based on the vision of a multisensory and data-based interaction between humans and machines.

Moreover, this thesis project is positioned at the crossroads between well-established academic discourse surrounding the philosophical implications of digital art forms and the practical avant-gardist experimentation that is a defining characteristic of the field. Therefore, while undergoing this study we wish to combine the knowledge gathered in the research stage with the material assembly of the exhibition, hoping that this can lay the basis for future endeavours and continued innovation to reach and ever greater public.

Objectives

The project presented in this paper aims to explore, study and analyse the possibilities of new visual languages through the merger of different techniques from generative art to direct user interaction thanks to the use of movement sensors, creating immersive experiences and distortions of reality in which the virtual world materializes in front of the audience's eyes. By utilizing avant-garde software such as TouchDesigner and Houdinì, taking inspiration from the experiential reality around us, an exploration of the limits of human-computer interactions and shared creativity will take shape.

Contents and structure

The paper will be structured in three main components, an initial overview of the discipline and landscape of digital and computation art and a subsequent reflection on the key theoretical frameworks that articulate the thought process behind the visual compositions designed for the exhibition at the Torino Graphic Days. Here an analysis of the concepts and characteristics that define the field of visual design and data-based artistic production in the digital age is carried out, laying the groundwork for the presentation of the projects in its details. A second section will outline a brief history of the influences and central figures of digital art that have shaped the field with their innovative thinking and creative solutions to explore social narratives with the use of technology. Moreover, this section will include a contextualization of the work done for this project by presenting the state of the art of digital and generative art and media communication with the aim of indicating where the project inserts itself and what prospects it opens up. Finally, the final section of the paper will go into detail on the project at hand, "Synaesthesia", defining its mission, concept, and technical specificities. The paper will close with an overview of the results and achievements accomplished and a reflection on the significance of such an endeavour.

Acknowledgements

At the end of a path as exciting as complex, it is right to
thank all the people who have collaborated with us and who have made it possible to complete the project Synaesthesia.
A sincere thanks goes to our coordinator Fabio Guida for having bet on us by believing in our potential despite not knowing us thoroughly, for having accompanied us along the way directing us towards progressively better results and for having never stopped spreading his passion for this work and this world.
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Consequently we want to thank all the staff of Print Club, Graphic Days Torino, Quattrolinee and Trumen for offering us the bases and resources to develop a solid project.
Finally, we would like to thank Camilla, Alessandro, Diego and Matteo for giving us a helping hand and contributing with willingness and precision to the realization of indispensable elements for the exhibition.

The realization of this project is for me a huge goal that I see coming true after long months of hard work and commitment, I was able to do it thanks to the people who have been at my side with dedication.
Thank you Mom and Dad for always supporting me and giving me a push to give my best even in the most difficult moments.
Thanks to Orlando, my brother, who with extreme patience and willpower has given me a hand.
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Introduction

“Synaesthesia”

Visual communication, although the name might suggest differently, is not solely determined by vision and sight, but it takes shape through the interaction and combination of sensorial stimuli which determine the potency and efficacy of such an endeavour. Media and tools that incorporate aspects human perception at different levels, making use of sound and images, individuality and community, are at the heart of the history and future prospects of communication design and digital art. These disciplines intertwine a desire to continuously experiment and investigate new technologies and their capabilities of expressing new visual and perceptual. The amalgam of communication styles and subjectivities upon which a visual design and digital art project is constructed can be captured by the idea of synaesthesia, phenomenon which gives its name to thesis project we are presenting here. The concept of synaesthesia is often associated with literary devices or psychological phenomena in which different senses are stimulated simultaneously or different sensations are associated with one another in apparently irreconcilable manners.

Therefore, the objective of this thesis project, “Synaesthesia”, is centred upon the interplay and juxtaposition of human perceptions in the digital space. The theoretical framework that grounds this project proposes to reconstruct a history of the influences and pioneers in the field of digital art such as Studio Azzurro that dared to think outside the box and explore innovative aesthetics, mixing traditional artmaking with data-based and state-of-the-art exhibition techniques. Moreover, the vision that guides this project is characterized by a reflection on aesthetics in the digital age, on the constant longing for experimentation and the unknown that leads to a contemporary and immersive storytelling approach using generative and kinetic art. The more literal meaning of the word synaesthesia, “sýn”, together, “aisthánomai”, feeling, determines another facet of the projects, the exhibition and physical experience hosted at the 6th edition of the Torino Graphic Days. “Feeling together”, therefore, evokes the idea of collective effort, of the collaborative and generative process of digital art creation and experience that together with the multisensory and immersive environment set the scene for the exhibition journey.

Consequently, the exhibit is spread into three crucial sections, an initial one where a darkroom environment filled with audio-visual materials projected on the walls takes the visitor into a multisensorial virtual space in which the collective experience of distortion and wonder takes place. Following this, the individual exploration of generative art and the possibilities of human-computer interactions in the realm of art and creativity takes place in the second section, where interactive artefacts utilize the input and guidance of the visitor to produce a unique piece modelled around the shared contribution of man and AI. Finally, the third and final section of the exhibit offers the possibility to reflect on the sentiments of shared creativity and community in the age of the digital by showcasing once again an interactive experience in which multiple people work together to modify and control the sounds and visuals in the room by using the technology and devices available to them. Therefore, by using shared creativity and immersive ambiance together with cutting-edge software and programming, art takes new forms and meanings, portraying different narratives and perspectives.

The digital world and aesthetic pursuit

Creating an experience made up of more than just images, filled with phenomenological entanglements, sounds and digitally altered reality allows us to explore new aesthetics and methods of visual communication that host generative and digital art.

The means and platforms of digital media fruition are often characterized by specificities and subjectivities that permit the questioning and investigation of creative routes and new perspectives, therefore being a breeding ground for reflections that need the support of the digital medium to be valorised. The foundational characteristics of products designed and created through coding and data manipulation, textual, audio-visual and sensorial stimuli re-organize the creative process in light of the new age of technology (O'Dwyer, 2021).

The complete transformation and reshaping of cultural norms and aesthetic principles normative before the rise of the internet, and the possibilities that the internet's invention has brought to all fields of human experience have had a disruptive and unprecedented impact on artistic and creative work. Thanks to the global reach and connectivity, ideas have been exchanged and artistic expressions have evolved and democratized at a speed never before

witnessed. Artists have confronted these changes through a re-writing and re-conceptualization of the role of the artist, spectator and of the narratives and sensations that can be expressed with the new means at their disposal. The technologies developed in the last few decades have moulded a completely new human experience, revolved around the new needs and desires arising from the digital world. It becomes clear, therefore, that the methodology and technical abilities of the artist to transform and manipulate audio-visual data in order to create new realities and perceptions of space is geared towards an aesthetic research that questions the constant shift of social and cultural norms.

Trying to the define the sensibility that has been shaped by the continued and growing presence of technology, of the digital space and internet on contemporary visual culture would be impossible. However, it is fruitful to pose questions on how and to what extent scientific and technological innovations have impacted artistic production and popular consciousness in the past decades, and how this fosters discussions on digital art and visual design and their future. Investigating the here and now, constantly changing and in motion, can often be challenging and bring about contentions both at a metaphysical and linguistic level, and the realm of visual and digital language is no exception. Therefore, the vocabulary to discuss this discipline can often seem absent or too abstract, only concretized when the potentialities and artistic endeavours of procedural and binary technology are experienced first-hand. The impact of digital art and digital aesthetics on popular culture is, however, undeniable. In the first place, the global reach that these forms of art can obtain in the digital space and through networks of communication and online platforms hosting these artefacts. Moreover, the allure and captivation of the human-machine cooperation that characterizes digital art and the interest for the technical and computational study behind the creation of visual products and digital composition is constantly evolving, propelled by the ease with which these contents can be consumed (O'Dwyer, 2021).

The concrete attempt at expressing the artistry and technical knowledge behind digital art results in an operational, material avant-garde made up of explorations on the interaction between man and technology and the results this can lead to. Therefore, it is important to define the theoretical background that guides this creative process and constant innovation which in the realm of digital art often take the shape of non-linear and antithetical experimentation and eagerness to find new forms of expression. The theoretical characteristics that distinguish artefacts and performances developed for and by technologies

in the 20th and 21st century can be captured by ideas of social activism, experimentalism and a constant tension and antagonism with the normative principles of art. In fact, if on the one hand these are part and parcel of visual design and its articulations, on the other hand it is the push to reject these and expand the traditional conceptions of art that propels the discipline to such unconventional and innovative ideas. Within this field, the avant-garde second guesses pre-defined aesthetics and aesthetic movements, looking for new configurations of artistic expression grounded in technology. However, much of this innovation is not only guided by trained professionals and experts but by amateurs scattered across the globe who bring new ideas to life using the means at their disposal. With the growing availability and the spread of more specialized knowledge on the technologies used to produce digital art, independent artists and individuals without an academic training can easily and with the same tools develop and innovate from the grassroots.

This is possible thanks to the non-linear and collective problem solving, aided by the digital age in which work groups and pioneers can observe their work in parallel, assimilating and influencing each other. Therefore, the hegemonic knowledge-production process that creates as hierarchization of ideas within the discipline is abandoned in favour of a bottom-up approach where individual experiences of independent artists actually matter and sustain the development of the field. In fact, many of the examples discussed later in the thesis retrace the history and achievements of design studios or individuals who not only managed to work with the technology available to them, reinventing what can be created with them and expanding the limits of the tool, but also often built a whole digital infrastructure from the ground up just for a project. By doing this, the hindrances to the creative process that characterize pre-existing software and hardware are eliminated and systems that are at the core of visual design and digital art creation such as Fuse*, found their place in the market, from the desire and eagerness to innovate and attain ever more advanced and accessible results. However, it is important to note that this constant race to exceed previous achievements is frequently associated with the development and coding of brand new software and systems able to host and exhibit innovative audio-visual products in line with the artist's vision. Therefore, it is regularly the case to see collaborations between artists, designers, IT and electronic engineers in order to collectively build new and ad-hoc digital spaces and tools. Clearly, this process precludes the use of the most cutting-edge and ground-breaking techniques to the less experienced and savvy since the use of certain technologies requires both a substantial monetary investment but also a profound knowledge of the

technical aspects of products not always designed to be user friendly but only to produce the most impressive results.

Besides the artistic direction and the technological platforms used, the distinctive character of those artefacts that can be defined digital art is not the use of technology or digital services for its production. If that was the case then almost the entirety of contemporary artistic endeavours would be so since even in the creation of the most traditional forms of art there are digital elements that shaped the process like photography or sound design. On the contrary, when it is the very materiality and aesthetic character of the product that depends on its digital, participatory and generative nature that makes it stand out. Here, the digital medium is not merely of help to the production of art but the end goal of the artistic process, only in this case then we can speak of digital art. Based on procedural, modular and often collaborative and adaptive elements, digital artefacts take on different forms, from projects entirely designed for the digital and virtual space, using only online and remote platform as distribution networks, to interactive and experiential installations in which our perception of reality is distorted (Paul, 2016). Nevertheless, the aesthetic mediation typical of digital artworks remains hard to define, there are certainly specific qualities that can be extrapolated such as the discrete, coded and informatic but these materialize in different forms and thus leave open ended questions. The overarching characterization of the digital and its aesthetic is thus ephemeral and difficult to grasp, its materiality is often mediated by machines and the extent of its content is not fully knowable by man. However, what becomes central in digital design projects is the depiction of human experience mediated through technology, the handling of data to create something visually pleasurable and stimulating that places the audience in the space of the non-human and alters the perception of reality (Cubitt, 2016).

When discussing digital art, it is important to also reflect on the relationship already mentioned multiple times that is at the basis of such artistic production, that between man and machine. If at one point during the technological revolution provoked by the invention of the internet and the availability and advancement of software and techniques of visual production quality, the creative oestrum of the artists has been supported and assisted by the same digital and technological, but this too has been changing in the past few years. The development of Ai systems able to take human creativity to the next level and gather vital information while also producing pieces in complete autonomy that can be considered truly art adds a level of

complexity to the understanding of digital art that should not be overlooked. Procedural design and computational art are core practices of contemporary forms of visual design by making use of data inputs and the mechanic calculations of software and coding that allow creativity to take new forms supported by these infrastructures. However, machine and AI creativity is still a concept difficult to grasp and raises multiple questions on pre-existing ideas and philosophies of aesthetics and human singularity. The philosopher Bernard Stiegler has long been exploring these themes in his writings, reflecting on human consciousness in relation to technology and specifically digital art production. What Stiegler has theorized is that this newness and disturbance of the senses generated by AI and the deployment of technology creates an experience outside the plane of existence, therefore revealing new epistemological avenues for art in the Anthropocene and in the age of technology (Stiegler, 2011). This, thus, translates to a shift in the quest for beauty and the very definition of sensory pleasure through art which can be reimagined using technological devices able to compute data and transform it into artworks even without the need of human input (Fitzpatrick et al., 2021).

Operating in a world were society and artistic sensibilities are spread and experienced through digital communication networks and in which virtual reality enters the everyday, it is necessary to rethink and reflect on the relationship between physicality and technology. This relationship, in fact, has become almost symbiotic, with digital sensory experiences complementing the physical existence, a phenomenon that is only exacerbated by performances and exhibitions of digital art. Indeed, it is on this very idea that the creation and consumption of digital and generative art rests upon, on a fluid subjectivity in dialogue with the technology it born out of and a crossing of boundaries between media. The complete transformation of the artistic landscape and the questioning of the spectator-artwork paradigms in the exhibition contexts are put in motion by the use of innovative tech and the exploration of contemporary and salient themes that reinvent the idea of exhibit and of its contents. Although the idea of experiential and interactive exhibition is not based on the use of digital platforms and tools, the revolution and prospects that digital art opened for the field are certainly a focal point in the history of this art form. The real-time manipulation of data and the possibilities of visualizing and communicating information in a multi-sensory and all-encompassing manner favours a completely digital aesthetic inquiry that expands human consciousness in the realm of technology (Paul, 2016).

History and current landscape

Influences and early practitioners

Having set the scene for the exhibition and thesis project “Synesthesia”, we can now delve into the history and figures that innovated and pushed immersive digital art and interactive visual design to new horizons. As previously discussed, the global character of digital forms of expression meant that new ideas and techniques sprung up from artists across the world and the avenues of experimentation therefore led to numerous schools of thought and aesthetic movements that prioritized certain visual or experiential aspects over others. Thus, in the following chapter, we have selected a limited number of key players in the field to illustrate the developments and trajectories in digital art and new media performance that have characterized the past decades and have impacted the direction and epistemological choices for the present project. Moreover, a particular emphasis will be put on the Italian as well as international artistic climate in order to narrow the scope of the project and analyse how the local influences have affected the progression and production of artefacts today. Overall, exploring the evolution of the digital medium as a space for artistic expression can provide a valuable reflection on the current state of the art and exhibition practices that deeply inform the work done for the thesis project “Synaesthesia”.

Although the so-called digital revolution took place in and around the 1990s, many pioneering artists across the world were already toying with the up-and-coming technologies and new possibilities of expression that were being developed in the sphere of technology and computer science in the years leading up to that. Starting from early kinetic and kinetics visual experimentations in conceptual art in the 1960s and 1970s to the symbolic language of the database and the employment of advanced motion, light and optics, the field of digital art has rapidly changed and adopted cutting-edge technologies and practices. Tracing an art history of the digital experience can be quite challenging, in the first place because of the hardly agreed upon definition of this form of artistic expression, and secondly because of the many approaches and branches that have sprung up in the sector and that thus produce widely different artistic experiences.

Groupe de Recherche d'Art Visuel

For instance, the collaborative group Groupe de Recherche d'Art Visuel (GRAV) utilized scientific and technological devices and materials to generate kinetic and interactive displays already in the early 1960s and thus led the way for a style of exhibition-making that has since developed into virtual reality and space-altering technologies capable of projecting the audience in a machine-made and data-based responsive environment. GRAV's goal was to converge individual identities into a participatory collective with the use of technological and scientific disciplines in a series of experimental events called Labyrinth (Paul, 2016; Smith, 2007). The French collective utilized the various renditions of Labyrinth to experiment with "subjecting the public to a series of perceptive, physical and participatory stimulations" which not only provided entertainment but allowed for a democratization of art in a time before the accessibility and availability of art and technology was far from what it is today (Hohlfeldt, 2013). The research on the physical and perceptive possibilities of interactive exhibits and the attempts of GRAV to explore the visual language of audience interaction and creative input in the production of art defines, thus, the framework in which this thesis project is positioned. By utilizing some of the very concepts formulated by ground-breaking artists like these and adapting it to the current social climate and the aesthetic pursuit that characterizes the technologies available today, we have built sections of our thesis exhibition project on the footsteps of forcible audience participation which require the collaboration between members and machines to function.

Samedi 11 mai 1968 p. 10

A LA MAISON DE LA CULTURE

Premiers pas dans la vie future avec « Cinétisme spectacle environnement »

Pour la plupart des personnes invitées hier à la « Maison de la Culture » à l'ouverture de cette étonnante exposition que Didier Béraud qualifia — à juste titre — d'événement mais aussi d'aventure, « Cinétisme, spectacle, environnement » apparut un peu comme un Luna Park de l'an 2.000, un « Tunnel des horreurs » de la Foire des Ramneaux ou un décor du feuilleton futuriste télévisé « Le Prisonnier » !

Mais pour celui qui, en fait d'initiation artistique, en est resté à Rencie et au Bateau Ivre, le Cinétisme ne peut bien sûr apparaître que comme vision folle, gadget futuriste, ou instrument merveilleux pour revue style Folies-Bergère.

Pourtant il y a autre chose, cet autre chose qui, posé par de grands techniciens de l'art et de la physique, traduit par des effets de pluie, de lumières et de mouvements, des enchaînements de vibrations, de sons et d'espaces dans l'espace, vise à adapter un décor aux sensibilités urbaines actuelles, à faire revivre la poésie dans l'inhumain du béton.

Comment ? Mais justement par ces inventions, mouvantes, changeantes, électriques, qui, exposées pour la première fois à Grenoble ont fait du théâtre mobile celui de notre environnement de demain. Certains sont signées des plus grands noms : Soto, Vasarely, Tinguely, Martin, Calder. Mais oui il est là, avec un nombre, tout discret !

Fiako, Calas etc... nous ne pouvons les citer tous, ils sont 87 !) et tout est plein d'humour ! Et ces ballons qui vous en font voir de toutes les couleurs, et ce rêve mécanisé de Tinguely dont les engrenages savants et noirs aboutissent sur une pauvre petite feuille morte et blanche !

Au coins d'un petit « pot » sympathique qui, près du musée, réunit un moment artistes — les yeux battus de fatigue — et invités, le directeur de la Maison de la Culture remercia ceux qui, près de trois mois, avaient dû travailler nuit et jour pour monter, installer leurs œuvres et notamment Frank Popper, maître de l'organisation générale, Jean-Louis Boncher, réalisateur, Philippe Nahoum, animateur.

L. D.

Hula-Hoop à la mode de demain !

Quels sont ces ballons qui se balancent au dessus de nos têtes ?

Figure 1 - GRAV, newspaper article, 1968

Figure 2 - GRAV, Labyrinth, 1963

George Coates Performance Works

A different direction was taken by the pioneering figure in the realm of digital art George Coates, whose theatre group George Coates Performance Works delved into multi-media performance starting in the 1980s, therefore developing the discipline through the incorporation of technical feats such as projected and moving environments and reworked computer-generated imagery to create hallucinatory effects in scenography and live theatre productions. George Coates, born in 1952 and active since the 1970s as an actor, producer and director, has been at the forefront of experimental visual theatre, and one of the first to adopt digital and interactive graphics and projections in performances, giving thus a chance to creative expression through technology. Coates and his team are responsible, therefore, for the introduction of a number of high-tech innovations, devised for the theatre environment but now spread to exhibition practices, such as three-dimensional and animated components that fuse with the “real” objects or artworks and thus brings virtual reality on the same plane of existence as physical experiences (Baize, 1992). Emblematic of Coates’ work is his 1991 production, Invisible Sight: A Virtual Sho, where he “perfected a technique for producing the vivid illusion of live performers fully integrated into a rapidly-moving 3D virtual environment.” With Invisible Sight, Coates put all the emphasis on technology, bringing together the computational sciences and the artistic community and changing the way live theatre is conceptualized through the implementation of techniques typically only found in cinema at the time. “The spectators wore polarized glasses to view huge, high-intensity stereographic projections of digital animations. The projections that surround the revolving stage cover not only the back wall but the stage floor and transparent black scrims in front of the performers. The digital images are manipulated interactively during the performances to maintain tight synchronization between the live performers and the media" (Saltz, 2007). In summary, Coates was able to introduce into the world of creative artistic production the valuable input of technology and the aesthetic potency of data-based and computer-generated imagery, merging the worlds of human and machine.

Figure 3 – Seehear, George Coates, 1984

Figure 4 – Invisible sight, George Coates, 1991

Troika Ranch

Still positioned in the intersection between physical performance and technological avant-garde is the creative company Troika Ranch, founded in 1994 by Dawn Stoppiello and Mark Coniglio. The creative methodology adopted by the duo involves a hybrid combination of dance, theatre and media executed through artistic cooperation and the examination of movement and technological artifices. The multi-media performances of Troika Ranch explore the relationships between viewer and object, the interactions between images, sounds and technology through live collaborations presented in the form of installations, digital files and integrated performances. The work done by Stoppiello and Coniglio reflects on the dualistic nature of the contemporary epoch's subjectivity, between the virtual and the physical, incorporating technological languages such as motion tracking, artificial intelligence, 3D modelling and animation and robotics into the corporeal experience of the art (Broadhurst, 2006). Troika Ranch set up some of the most experimental uses of existing technology, for example with the 1996 "The Electronic Disturbance" in which dancers portray the Corporeal Body that desires to be electronic while the Electronic Body is portrayed by an actor and a singer at remote sites and by using a combination of video techniques and light, their faces are combined into one, creating a dual-gender figure that appears only as a video image. Moreover, early uses of the internet in exhibitions such as the 1996-1997 "Yearbody for Solo Dancer and Internet" where throughout a year a dance performance was documented and augmented through digital imagery.

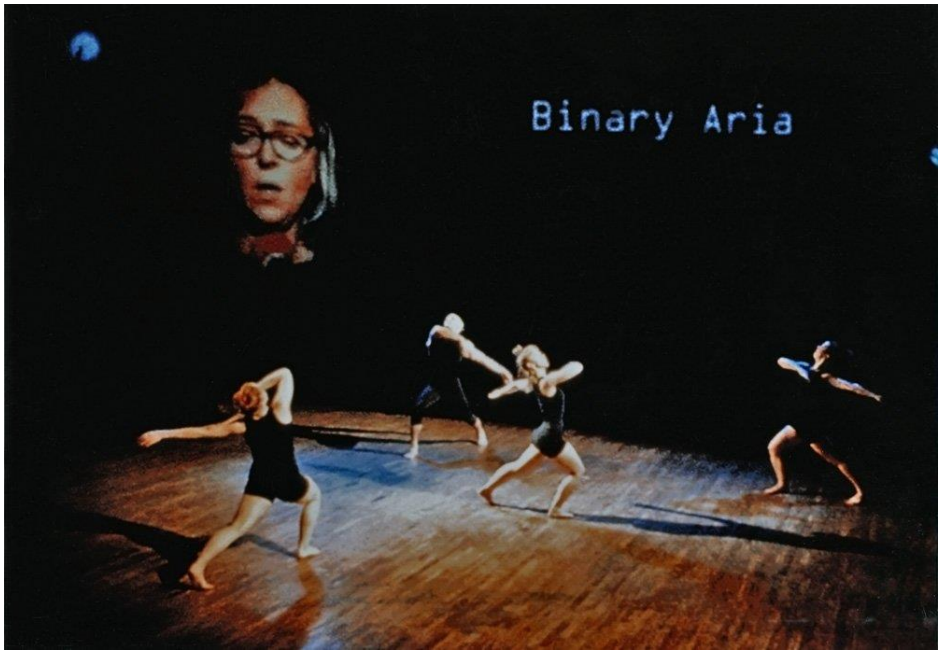


Figure 5 - Yearbody, Troika Ranch, 1996

However, as discussed in earlier chapters, a key characteristic of digital art pioneers is their desire to chase the latest tech innovations, often resulting in ad-hoc and grassroots technologies being developed by the artists in collaboration with computer scientists and engineers. This is exemplified by Troika Ranch and Mark Coniglio's Isadora software, "a flexible graphic programming environment that provides interactive control over digital media" (About the Company. (n.d.)). The software was designed specifically to cater to Troika Ranch's artistic needs, therefore including lighting and sound control by performers or audience through specific movements, real time manipulation of digital videos, sensory information gathering and responsiveness to outside stimuli. Isadora has evolved with the changing directions of Troika Ranch and has subsequently been commercialized for outside use, making available to amateurs and students the technology that helped revolutionize digital art. Troika Ranch stands out as one of the founding fathers of machine-based interactive and generative art production, but they remain relevant and constantly innovating to this day. More recent productions include the 2009 "Loopdiver", "an hour-long performance work that uses highly complex patterns of repetitive movement, music and video to portray the aftermath of an encounter with violence. The viewer is asked to go on a journey that is both dreamlike and maddening as the six performers attempt to escape from their prisons of repetition. The meaning of the materials grows and changes as it appears again and again and again, ultimately challenging us to dive in and break free of our own

repetitive and potentially destructive behaviour" (Loop Diver, 2009). The performance uses animated sculptures, video projections integrated into the dance movements and particular tools developed in the latest version of Isadora to calibrate and impose the loops onto recorded material and live performance.

Figure 6 - Loopdiver, Troika Ranch, 2009

Jeffrey Shaw

Another revolutionary figure in the world of computer generated and supported art, is the Australian visual artist Jeffrey Shaw, leading exponent of participatory, interactive, and computer-controlled forms of media art and founder of Event Structure Research Group (ERG) and director of the ZKM Multimedia Studio. Shaw has always been interested in exploring the mechanisms of information exchange and transmission across the globe in the context of immersive aesthetic experiences, therefore striving to rethink the relationship between representation and reality, visual stimuli and digital environments. Like no one before him, Shaw believed in the value of an interdisciplinary cooperation between engineers, scientists and artists to be able to fully explore the limits of technology and artistic production. In fact, among the many installations and exhibitions Shaw has produced throughout his career, him and his team have also devised a series of innovative strategies of immersive interactive visualisation, platforms and mechanical systems for the enhancement of immersive art fruition, devices and software that have radically reformed how art can be experienced (Castrillo, 2012). Among these, the Extended Virtual Environment (EVE), a large inflatable dome inside which video projectors are mounted on a motorized pan/tilt device that can move the projected image anywhere over the inside surface of the dome.

Spatial tracking devices can be worn by visitors who then control the positioning of projected 3-D imagery and digital scenography based on their gaze and movements.

Figure 7 - Jeffrey Shaw, EVE dome, 1993

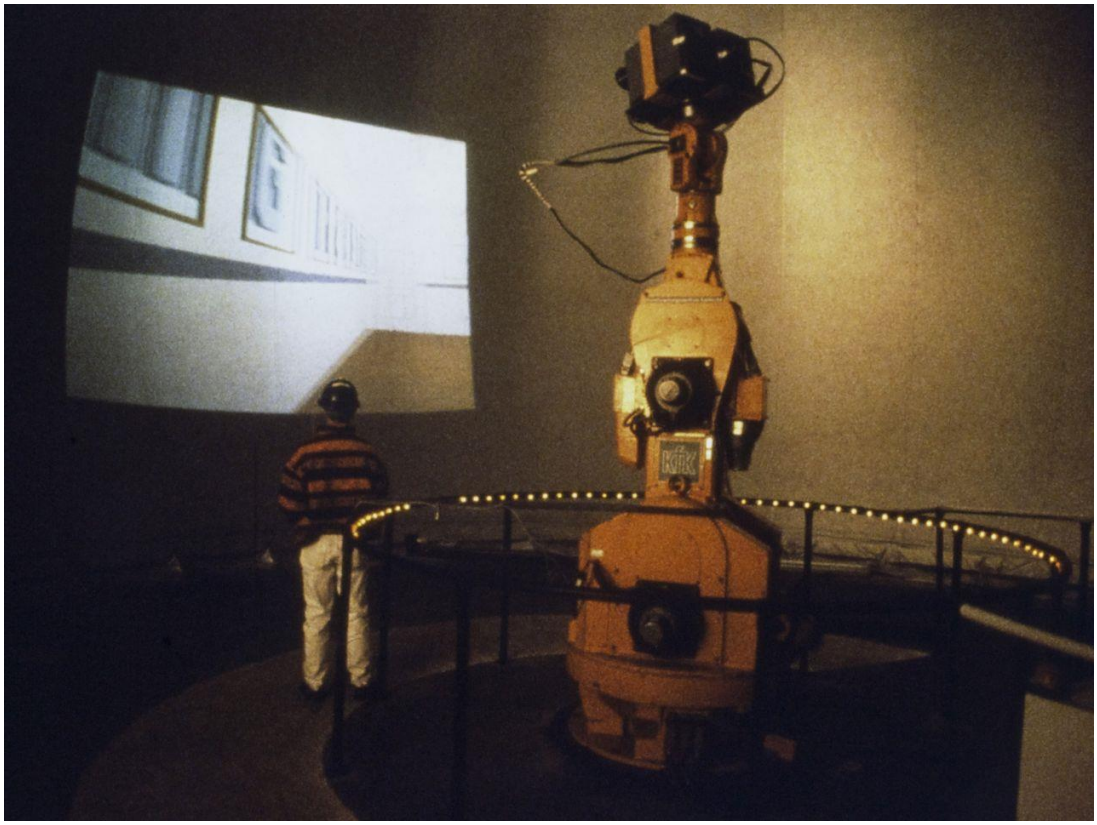


Figure 8 - EVE, Jeffrey Shawy, 1993

Figure 9 - T_VISIONARIUM I, Jeffrey Shaw, 2004

On the same trajectory as EVE, Shaw has also co-authored the Advanced Visualisation and Interaction Environment (AVIE), an experimentation on immersive cinematic visualization utilizing 360 degrees screens, rotating viewing windows and high resolution 3-D projections generated with rendering software systems. This avant-gardist project allows for a personalized and user-guided experience, where the space is inhabited by the viewer and thus the artwork's direction is left to be structured and adapted by the audience. A number of specific and custom-made software have been developed for the AVIE environment in order to alter the functionalities for the desired outcome of the artist. Shaw has put into use the AVIE stereoscopic interactive visualization system in exhibitions such as the 2014 "mARChive" in Sydney, Australia. Here, the visitor can browse through a collection of available themes filled with images and media they can then explore as it appears on the 360-degree screen. "Through metadata (database relationships), each image is also related to many other images and across different themes. This matrix of dynamic relationships becomes visible in response to the user's actions. The mARChive application is designed as a single-user, multi-spectator interaction paradigm. Visitors use a tablet interface to elicit actions on the screen. The interactive data-scape is amplified by specific sonic reflections created from the museum's archive and in response to the users' actions. Through an infinite set of permutations, visitors can navigate unfolding narratives in the data landscape that are based on their specific, and emerging, interest. The application develops a new visual paradigm for the social and collaborative exploration of big audiovisual datasets within a museum. It is a situated, participatory and collective framework that distinctly contrasts mARChive with cultural datasets found on the Internet." (Shaw, 2014).

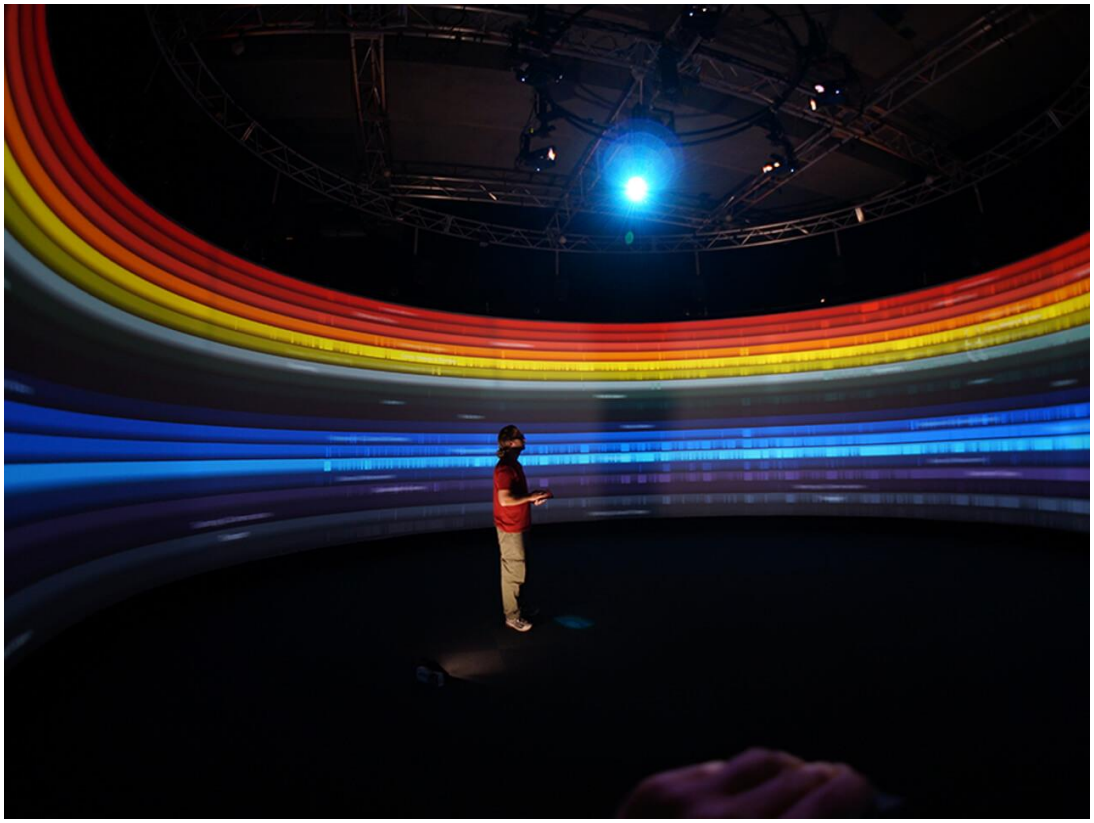


Figure 10 - MARCHIVE, Jeffrey Shaw, 2014

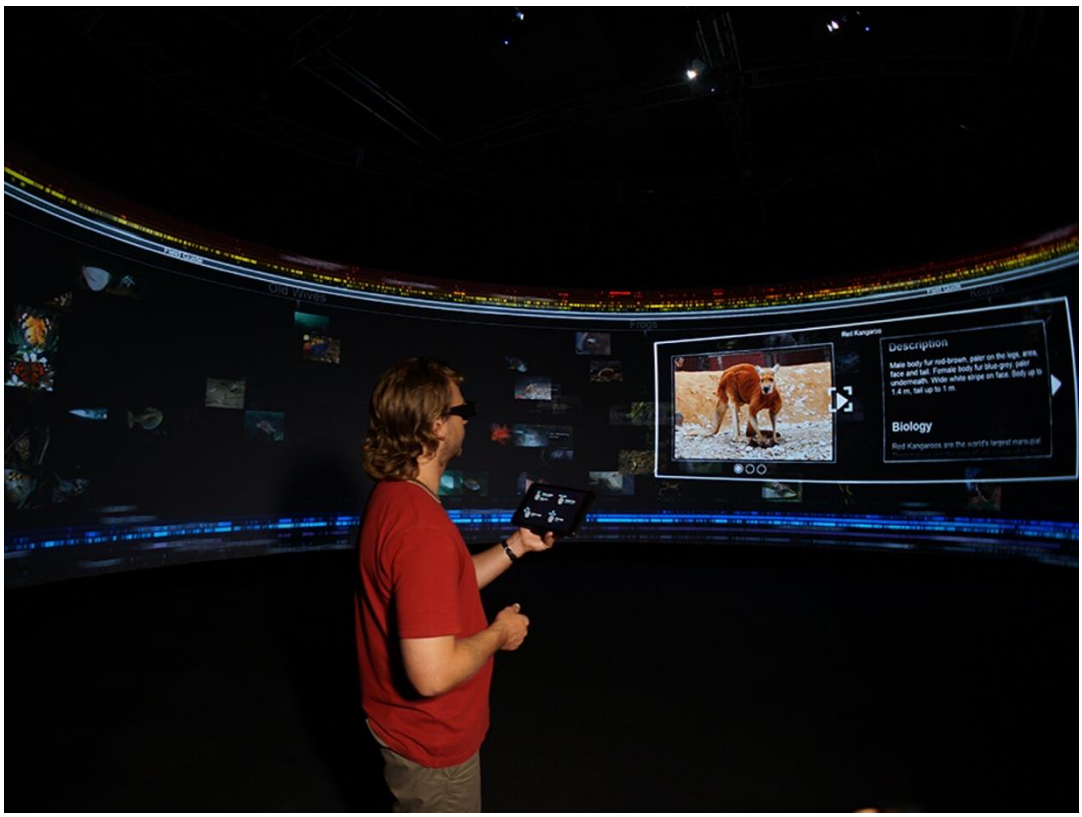


Figure 11 - MARCHIVE, Jeffrey Shaw, 2014

Jeffrey Shaw continues to this day to implement in his aesthetic pursuit the newest and most innovative techniques, adapting previously designed systems like the EVE and AVIE to incorporate more conducive and stimulating technologies in order to achieve his vision of immersive and user-generated art creation. In fact, in a 2020 installation curated by Shaw and Sarah Kenderdine in Hong Kong, China, in the aftermath of the COVID pandemic, the two have utilized augmented reality to allow the visitor to "open" the compartments of a locker cabinet by using an iPad and a patterned surface depicting the microscopic virus' shape. The pattern communicates with the device and allows content of "Safe House" to show on the screen, reflecting on the circumstances of isolation and existence with the world health crisis.

Figure 12 - Safe House, Jeffrey Shaw, 2020

As witnessed with the aforementioned artists and collectives that spearheaded the discipline of digital art and interactive exhibition practices, the knowledge produced in the early years of the technological revolution in the arts transformed the field of the imaginable and its insights contaminated all aspects of the artistic landscape from theatre to cinema and more traditional forms of expression. However, digital art also became a field of its on in the years leading up to the turn of the 21st century, with dedicated workgroups and individual artists fully engaging with the mediums of technology for their creative purposes. Therefore, a number of companies and studios researching the social and aesthetic implications of technology have emerged, leading the way for the recognition of digital art as a separate and distinct domain. Of course, Troika Ranch, George Coates and other early adopters dominate the international and academic discourse, influencing and guiding the creative endeavours of several generations of artists that harness the possibilities offered by technology. However, in the more local, Italian landscape, another group of pioneering thinkers marks the introduction and experimentation of environments where technology blends with narration and with space. Studio Azzurro, founded in 1982, follows the same interdisciplinary and experimental path as the previously mentioned pioneers of digital art, and has thus built its aesthetic research around a variety of mediums including theatre, art installations, interactive museum exhibits and virtual elements (Monteverdi, 2020). Pioneering these practices in Italy, Studio Azzurro has been innovating the field of interactive, generative and kinetic digital art for the past decades, integrating new ideas and practices to reflect on the aesthetics and cultural value of the digital medium.

Studio Azzurro

Throughout the 1990s, new media artists in Italy tended to work autonomously, showcasing their works in occasional exhibitions and sponsored by private galleries and cultural association. Studio Azzurro, although started as a collective of independent artists based in Milan Fabio Cirifino (photography), Paolo Rosa (visual arts and film) and Leonardo Sangiorgi (graphics and animation) has developed into a key collaborator of public museal institutions, gaining entrance to prestigious events such as the Venice Biennale or Documenta and partnering with different social actors to showcase their shared narrative and vision. Studio's Azzurro experimentations with interactive environments and collective experiences, merging human consciousness and interactions with the devices and technologies that host

the visual and acoustic compositions have allowed them to utilize software and advanced machinery to tell personal and deeply emotional stories, connecting human physical and sensorial perception back to community. Some of their early works explore human touch and physicality mediated by the digital medium, for example in the 1992 video-environment designed for the Milan Triennale, XVIII Esposizione Internazionale “Il giardino delle cose” in which infrared images of hands working the clay capture the heat and contact between the hands and the material. The technical difficulty of obtaining a clear picture of the thermal scan reflects the fleeting nature of touch and the continuous transformation and change of state (Studio Azzurro, 1992).

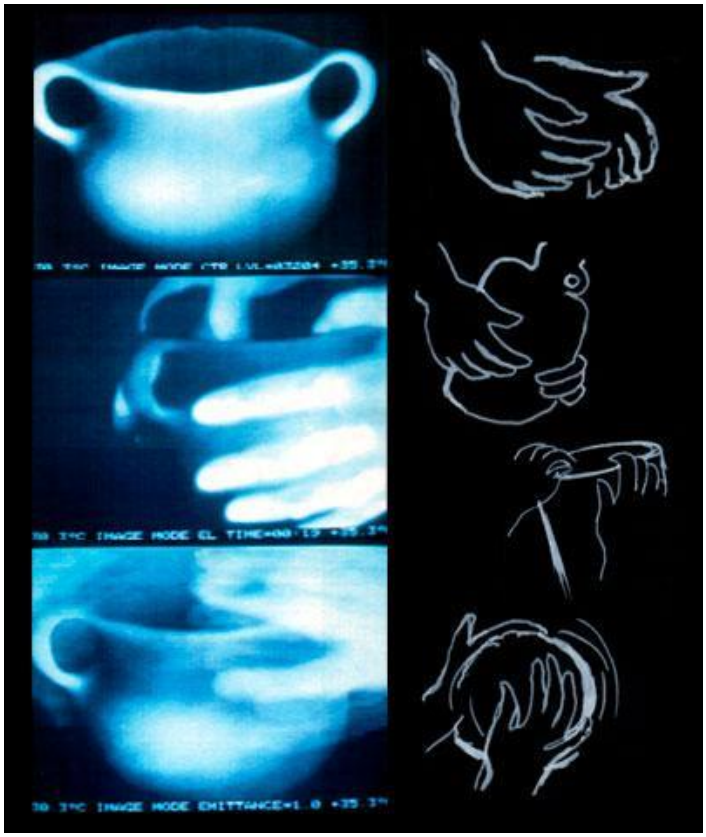


Figure 13 - IL GIARDINO DELLE COSE, 1992

Figure 14 - IL GIARDINO DELLE COSE, 1992

More recently, Studio Azzurro has also been the creative mind behind the Holy See's panel at the Venice Biennale in 2013 with the interactive video-exhibition "In principio (e poi)" where the theme of creation in which spectators could start a dialogue made of images, stories and sounds with the figures of inmates and deaf-mute individuals projected on the walls. The constrictions and impediments to personal expression experienced by these characters is contrasted with the possibility given to the audience of asking and learning, as well as contributing to the installation itself where a wall initially blank becomes filled with light traces and messages left by the gestures of visitors. The focus here was clearly experiential, made possible by the technology and sensorial devices utilized which included four video software, projectors, computers, speakers and high-tech information retrieval systems for the sensitive surfaces (Studio Azzurro, 2013).

Figure 15 - IN PRINCIPIO (E POI), 2013

Figure 16 - IN PRINCIPIO (E POI), 2013

Contemporary Avant-garde and state of the art

From these few exemplary cases it is possible to grasp the variety of influences and applications of digital art that have generated the body of work upon which the new avant-garde today has constructed its vision. As technology has advanced and the paradigms of possibilities have broadened incredibly, new sensibilities and ways of approaching popular culture, media and aesthetic canons have produced a generation of artists and collectives ever more focused on the ways digital art can generate new multisensorial languages and forms of expression. Among the current exponents of today's digital art and design we find

personalities and associations such as Onionlab, design studio based in Barcelona working with 3D mapping, optical illusions aided by virtual reality and combining space and content to create world-shifting experiences ; Klaus Obermaier, media artist and performer known for his new artistic forms of human interaction with digital systems through interactive projection mapping that goes beyond the passive reception and video-sound installations; Blast Theory, a collective of artists drawing on popular culture, technology and games to create works that blur the boundaries between the real and the fictional by showcasing reflecting on political and social issues through performance and ground-breaking technologies. It is interesting, therefore, to investigate and review some of the most representative and seminal works produced by these figures which have been instrumental in the conception and design of our thesis project “Synaesthesia”.

Onionlab

One of the distinguishing factors and trademark techniques of Onionlab for the past ten years has been 3D mapping, a means of mapping an object’s profile to obtain its digital equivalent which can therefore be manipulated and harnessed to create distorting and captivating visual compositions. With 3D projection mapping artists can devise an audio-visual narrative where movement is added to previously static objects and augmented reality is used for virtual scenes. Artistry and creativity, thus, become intrinsically linked with technical expertise, as the tools needed to achieve such results, although available and accessible to many, require advanced understandings of the medium. 3D projection mapping can be achieved using software packages like MadMapper, HeavyM, Qlab, Troixatronix's Isadora, FaçadeSignage, ArKaos MediaMaster, Adobe After Effects or Blender Blam! and the end product is then mixed with lighting, sound and equipment that generates a totalizing experience. Onionlab has utilized these techniques for a variety of purposes, in the first place in collaboration with heritage institutions to bring to life facades, introduce new elements to historic monuments and bring together art history and new media. This was the case in their project “Evolució”, evolution, in which a 3D video production designed to be adaptable to different surfaces and spaces was projected onto the façade of the Santa Ludmila Church in Prague. “It was conceived as an open transformation process [] Evolució is available for further projections, as it can be adapted to various physical formats, e.g. indoor structures, or

different façades and so that Evolució can continue its transformation process” (Onionlab, 2019).

Figure 17 - Evolució - Signal Festival, 2019

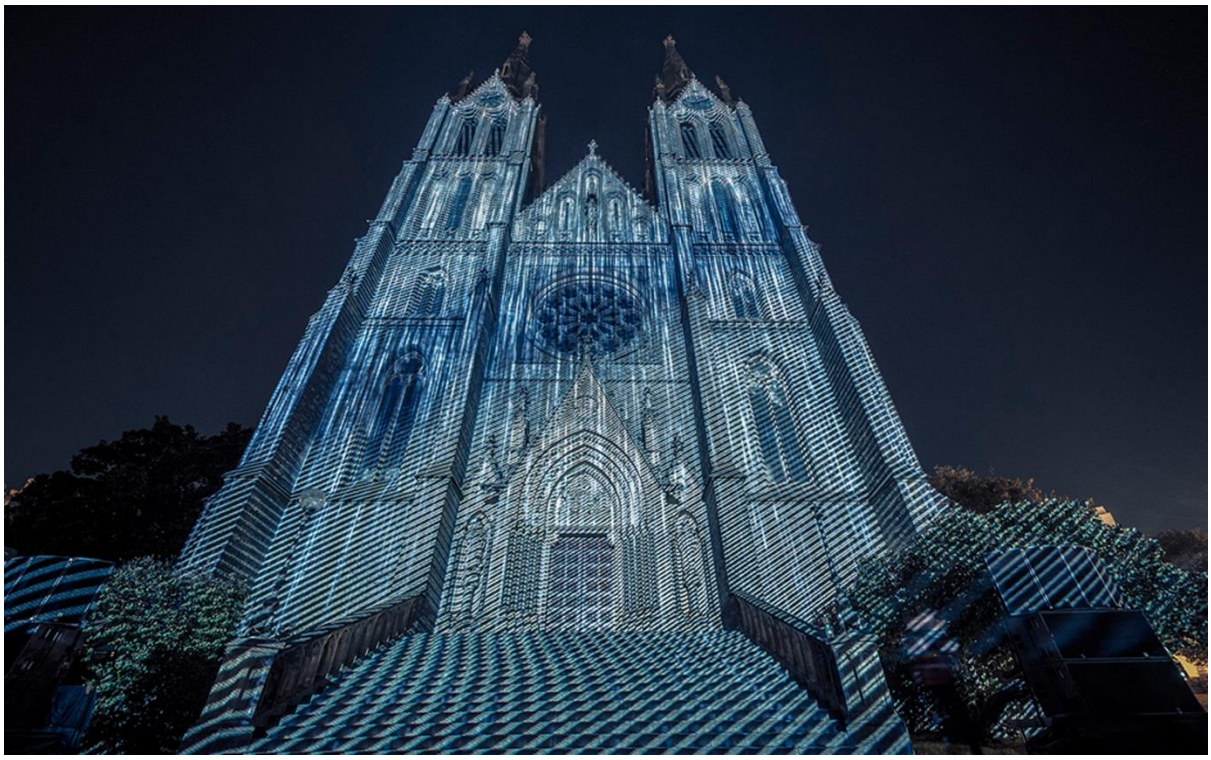


Figure 18 - Evolució - Signal Festival, 2019

A similar project was designed for the 200th anniversary of the National Museum of El Prado within the show “Museo del Prado. Un lugar de memoria y futuro”. In this case Onionlab brought to life the museum by projecting artworks, specifically designed visuals and altered special realities “transforming the inert facade of the building into something organic, creating an immersive visual journey of lights, shadows and optical illusions that recounted the history of the museum and the collections and works of art that it houses” (Evolució - Signal Festival, 2019).

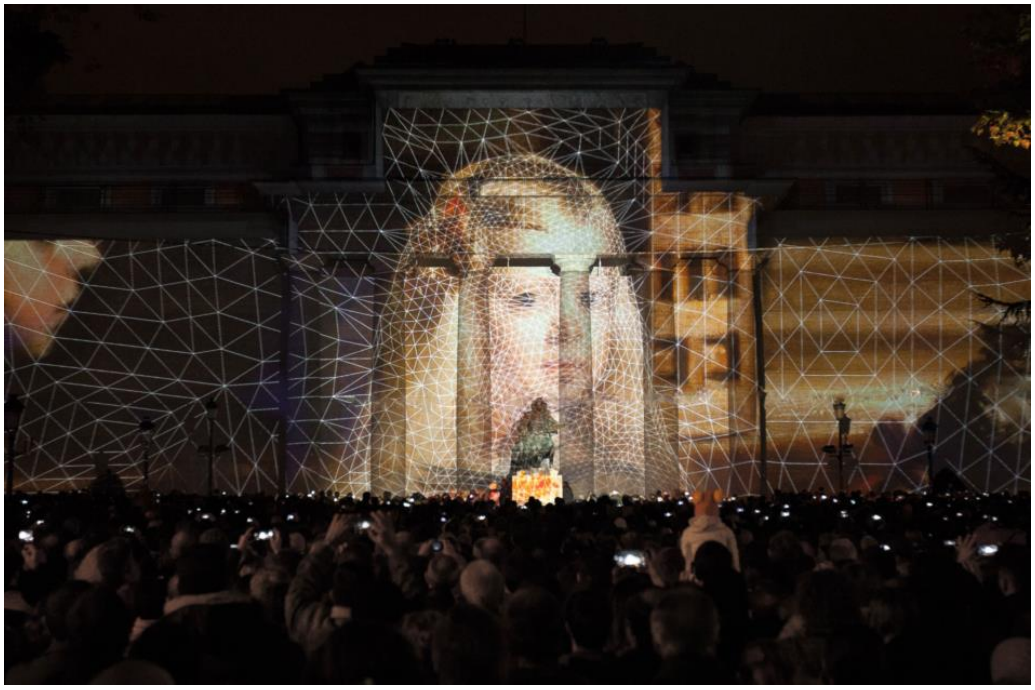


Figure 19 - “Museo del Prado. Un lugar de memoria y futuro” Onionlab

Figure 20 - "Museo del Prado. Un lugar de memoria y futuro" Onionlab

Moreover, Onionlab has also delved into interactive all-around exhibitions in which a combination of LED lights, equipment, sensors and generative art technology mediates an experience of collective effort and personal expression. Example of this was the 2019 DesigualinBeta installation at Sonar where visitors started out by walking through a kaleidoscopic mirror tunnel of lights generated by data converted from biometric sensors. Following this "a large interactive canvas that reflected all their actions and movements collectively, generating light, colour and sound through the movements, behaviour, and interactions between the participants". The audience created its own art by just existing and moving in the exhibition space where AI would then generate visual feedbacks in the forms of animations, colours and shapes. This type of installation truly captures the power of technologically informed and computational art, where the human-computer shared creativity becomes the central element rather than the visual artwork that results from the experience. Furthermore, the public is here just as vital to the aesthetic reflection as the artist itself, leaving behind ideas of passive and detached fruition.

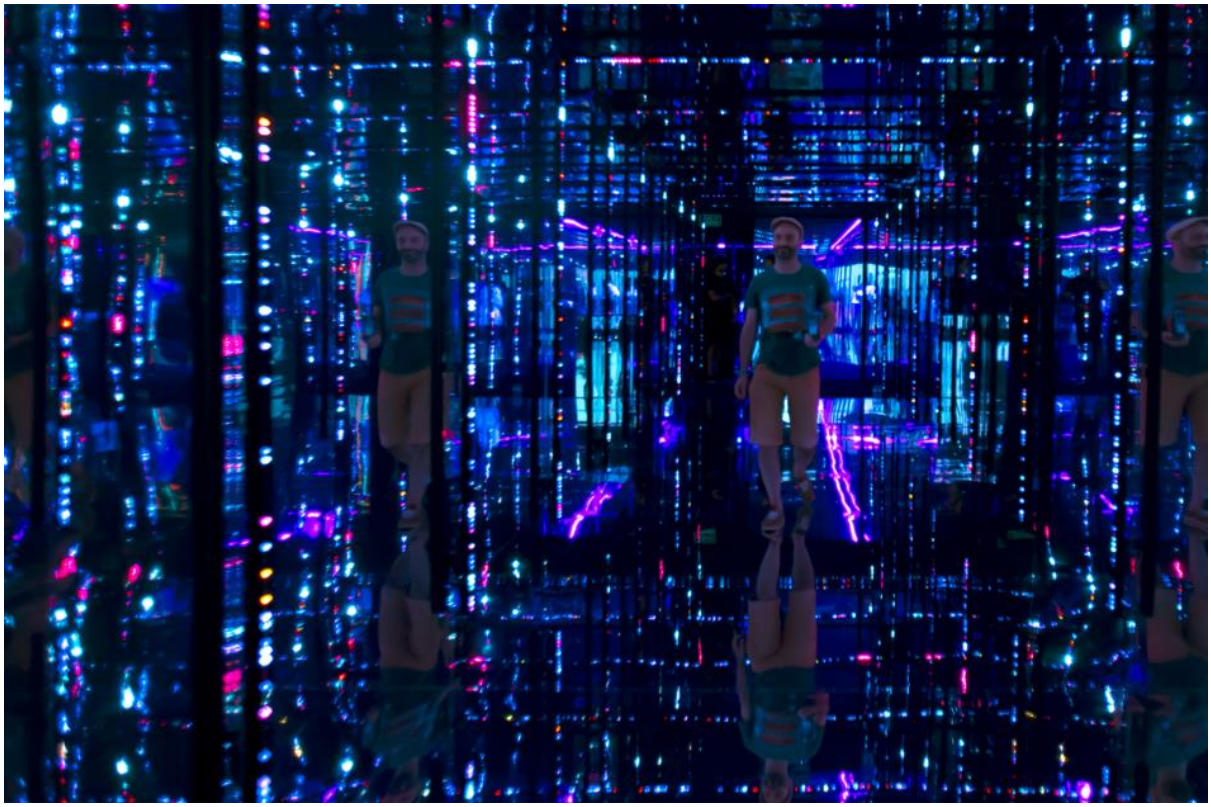


Figure 21 - Desigual Sonar, Onionlab, 2019

Figure 22 - Desigual Sonar, Onionlab, 2019

Klaus Obermaier

Projection mapping being one of the most avant-gardist techniques available to digital artists, it has been experimented with in a variety of different ways and for different purposes. Obermaier, as a proponent of wild experimentation and interdisciplinary performances has utilized projection mapping in a series of major installations titled "Dancing House" reiterated in locations across the globe. "Dancing Houses" makes use of equipment such as the Kinect to make interactive environments come to life and sound design to accompany the experience. "In Dancing House the users are called upon to move, to jump, and thereby – as indicated in the title – bringing the building and themselves to dance." (Obermaier, (n.d.)). Visualizing and integrating human movement, sound and images into the artwork are goals that Obermaier has stated numerous times, and with this type of project he is able to influence his art in real time by feeding back into the system the input of the audience, a characteristic of live performance that become part of digital art.

Figure 23 - Dancing House, Klaus Obermaier

Figure 24 - Dancing House, Klaus Obermaier

Obermaier defines himself as an intermedia artist, dipping his toes in installation art, dance and theatre performance, sound and video, 3D and interactive exhibitions and real-time generated content. This mix of influences and aesthetic frameworks allows his work to be fluid and creative, an enthusiastic exploration of how the digital can enhance and generate new realities (Mocan, 2013). Emblematic of this is his 2006 rendition of Stravinsky "Le sacre du printemps" in which Obermeier generated a stereoscopic experience in which all the virtual objects and environments were created live by the dancer Julia Mach and generated in real-time. "Time layers and unusual perspectives overlay one another and multiply themselves, and enable a completely new perception of the body and its sequences of movements. Real-time generated virtual spaces communicate and interact with the dancer. The human body is once more the interface between reality and virtuality" (Obermaier, K., 2006). Moreover, the orchestra and the music also influence the virtual worlds that appear in front of the spectator's eyes and help build a universe completely designed by the artists together. Obermaier not only pushes the boundaries of technology to observe the aesthetic results of such new media, but also tries to imbue his work with reflective significance on the role of art and audience which is perfectly described in his avant-garde theatrical endeavour

as he describes himself: “'Le Sacre du Printemps' brings up for discussion the complex relationship between music, dance and space. In conventional productions of 'Le Sacre' one choreographs and dances to the music. In this case, though, the dynamics and structure of the music interactively transform the virtual presence of the dancer and her avatars and thus produce a sort of 'meta-choreography. Stereoscopic projections create an immersive environment, which permits the audience to participate substantially more closely on this communication than in traditional theatre settings.”

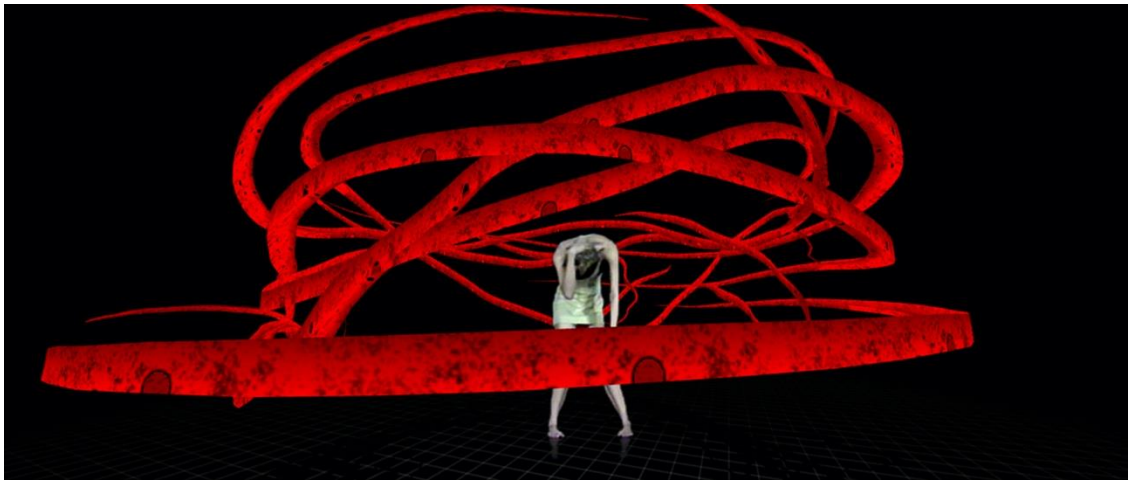


Figure 25 - Obermaier, K., 2006

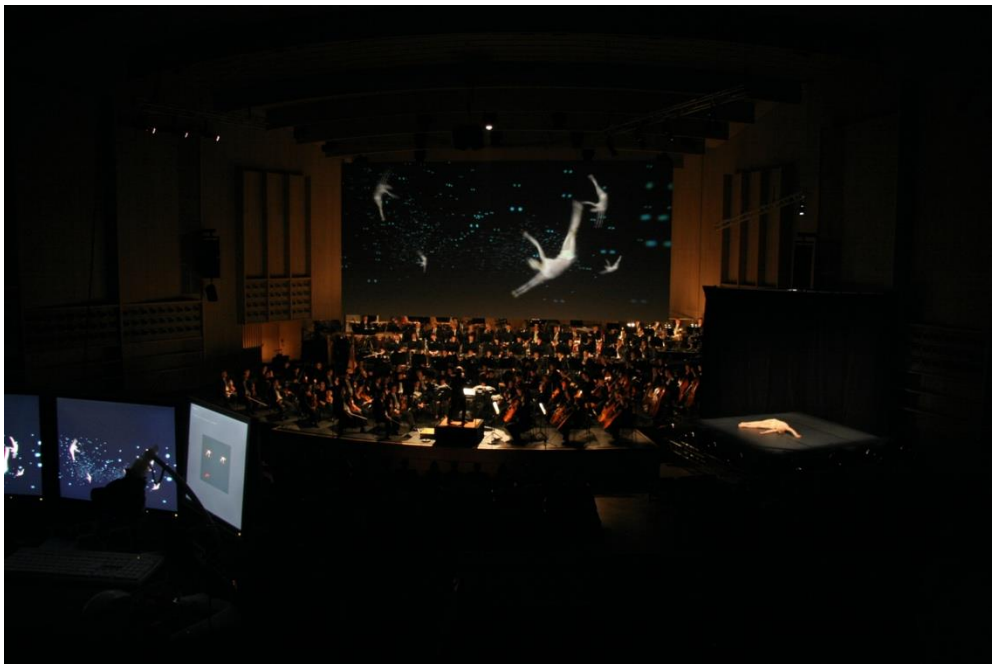


Figure 26 - Obermaier, K., 2006

Blast Theory

The British art and design agency Blast Theory has, over the years, approach questions of political and social relevance, explored the world of art and artistic research by means of digital, online and interactive exhibits but also in the form of videogames and roleplays. Studying the ramifications of online and digital presence and bringing virtual experiences into the physical sensorial word has allowed the group to take risks and thus come up with some of the most conceptual and immersive proposals in the field. Their 1999 response to French philosopher Jean Baudrillard statement about the Gulf War being a “fiction” given its extreme media coverage and emotional distancing generated by the press materialized into the “Desert Rain” virtual reality installation and performance. The exhibit worked exactly like a video game would, with players having to complete a task but outside of the computer and in the exhibition space. Here they entered a darkroom where a virtual world projected on the walls would guide them through the experience, posing questions about the lines between physical and virtual perception, the role of media and personal consciousness. The artists stated themselves the goal of the project: “Desert Rain therefore attempts to bring visitors to a new understanding of the ways in which the virtual and the real are blurred and, in particular, the role of the mass media in distorting our appraisal of the world beyond our own personal experience.” (Blast Theory, 1999).

Figure 27, - Desert Rain, Blast Theory, 1999

Figure 28 - Desert Rain, Blast Theory, 1999

Again reflecting on the blurred distinctions between real life and digital presence in the age of technology and virtual reality, Blast Theory developed an experiential role play

exhibit proposing a meditation on the themes of terrorism and its consequences on perceptions of human morality and ethics. At the 2009 Venice Biennale, therefore, Blast Theory staged “Ulrike and Eamon Compliant” an interactive game in which the visitor is led through Venice impersonating a character, beng questioned and making choices to proceed and interrogating popular conceptions of violence and moral pendulums. Based on philosophical themes and thorough backgorund research, Blast Theory was able to invite a reflection on current and relevant issues by the audience who experiences the performance while also expressing their personal artistic vision.

Figure 29 - Ulrike And Eamon Compliant, Blast Theory, 1999

Figure 30 - Ulrike And Eamon Compliant, Blast Theory, 1999

Ouchhh

Building on the same desire for multidisciplinary interaction and technological innovation, the global creative Ouchhh has obtained in the last decade incredible results in its pioneering of data paintings and sculptures, artificial intelligence, data-driven sculptures, kinetic public arts and immersive experiences. Their team is, again in line with the discipline's variegated interests, composed of engineers, academics, creative coders, designers, media artists and motion graphic designers that share the vision of a global communal experience of technology and art. Central to Ouchhh's program is generative art, which features in many of the studio's major works, among which "homeomorphism" and "ocean data". In "homeomorphism", Ouchhh modified a topographical map of New Mexico's geological formations by projecting abstract representations of geometrical shapes to reflect on the continuous transformation represented by the soil and landforms. The visuals portraying complex morphological and geometrical representation of the information contained in natural images are then projected on cubes, domes and prisms to enhance the

distorting effects. A similar approach was taken for the “Ocean Data” installation which utilized scientific data from the North Atlas Ocean and Bay Of Biscay and Bordeaux to create an immersive experience aimed at sensibilizing the audience to its relationship with nature and the world around us. This results in an ocean of visual stimuli showcased on gigantic screens in darkrooms that completely transform into virtual spaces filled with light.

Figure 31 - Ouchhh, HOMEOMORPHISM

Figure 32 - Ouchhh, HOMEOMORPHISM

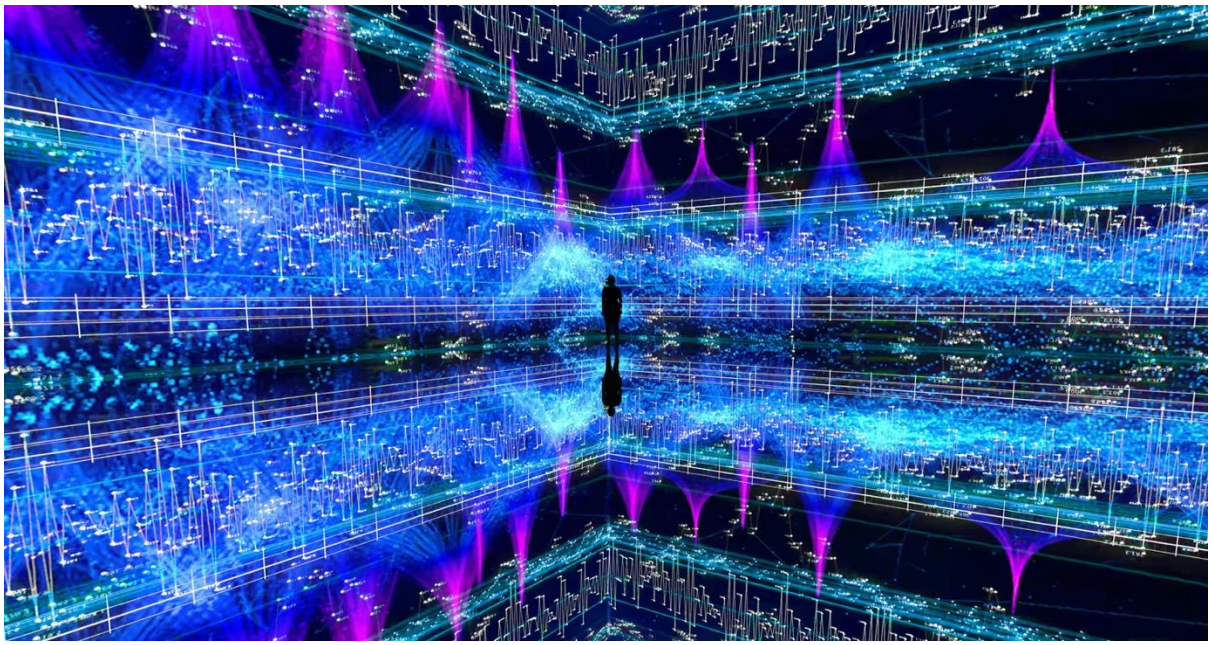


Figure 33 - Ouchhh, ATLAS OCEAN DATA_BORDEOUX

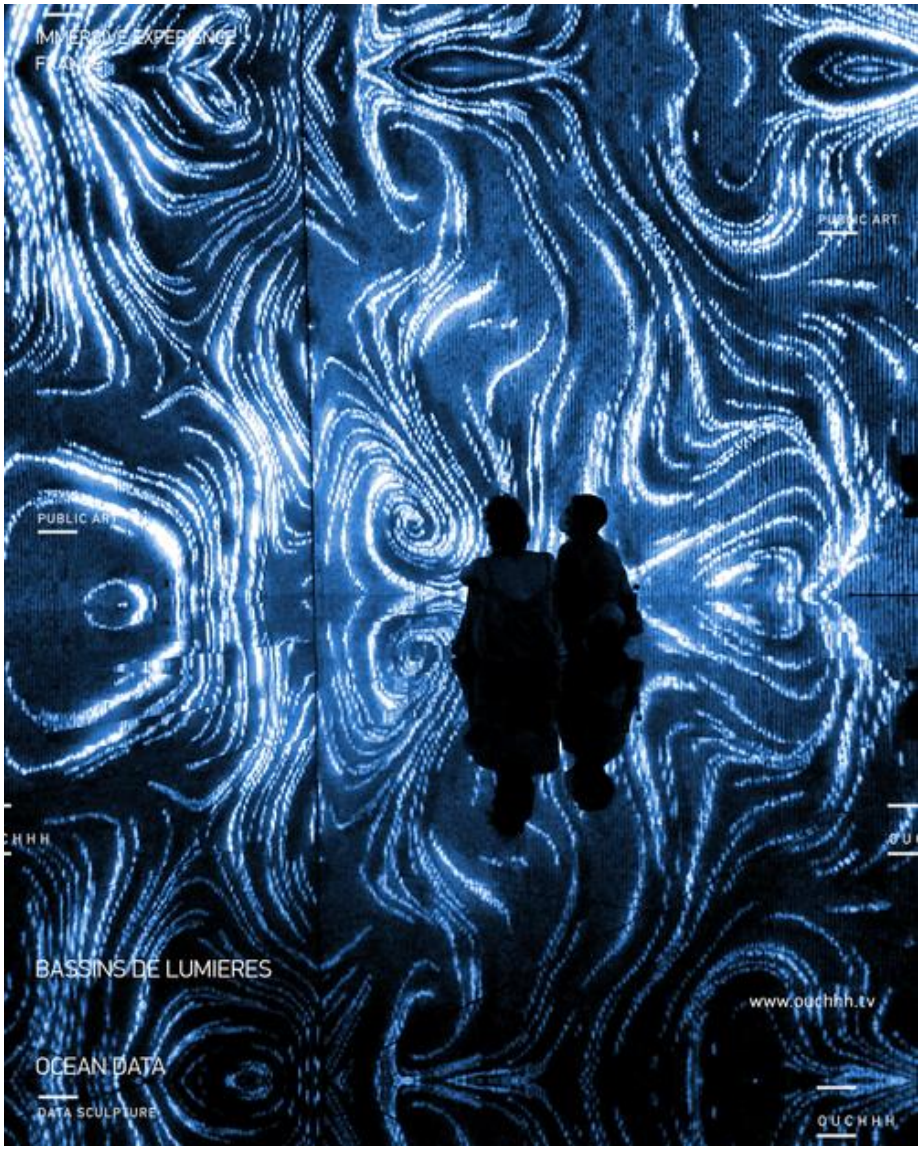


Figure 34 - Ouchhh, ATLAS OCEAN DATA_BORDEOUX

Fuse

Looking again at the local expressions of digital and interactive art, the Italian creative group Fuse stands out as a contemporary and topical example of technological artistry. Founded in 2007 with the goal of rethinking the complexity and nuances of human and natural phenomena, the studio has produced multimedia and interactive installations able to amplify and expand the emotional force of the artwork. Starting from community engagement and pure experimentation, the group has been able to find new and innovative ways of blending space, light, sound and movement into pieces of consumable, experiential art. Fuse has reached international success, connecting its audience with educational and cultural institutions dedicated to outreach and giving a stage to artists. Among many Mutek,

TodaysArt, Sónar Istanbul, Artechouse, STRP Biennial, Kikk, Scopitone and the National Centre for the Performing Arts of China.

Some of Fuse's most notable works include the 2019 solo exhibition "Everything in Exitance" in which the group toys with artistic, scientific and technological languages to explore human perception through special and visual alterations of reality, challenging the audience's sense of existence and inserting them into the bigger picture of human progress and regress. "Everything in Exitance" features a series of previous artistic experiments proposed by Fuse in an updated and re-adapted version. The exhibit is thus divided into four interactive and immersive installations in which the visitor in part and parcel of the creative process by generating parts of the exhibit himself. "Multiverse" presents a modified version of the original 2009 software designed to create a virtual reality simulation that encompasses the whole gallery room and reflected by mirrored surfaces on the floor. By doing this, Fuse is showcases the raw power of software and machinery to create a different reality. The second section, an updated version of the 2016 "Amygdala" provides a look into the constant flux of data stored and gathered on the internet, building a network of information and connections. This is translated in the exhibit by collecting "Sentiment Analysis" data found on social media messages and outputs and transforming it in audio-visual stimuli. "Clepsydra", the third part of the installation utilizes two massive screens facing each other where visual and audio material immerses the visitor into the concept of gravity and its interpretations by the artists. Finally, the last section, "Snowfall" processes data captured in the room by cameras and sensors in real time and generates a responsive visual on the screen.

Figure 35 - fuse, EVERYTHING IN EXISTENCE, 2019*

Figure 36 - fuse, EVERYTHING IN EXISTENCE, 2019*

Figure 37 - fuse, EVERYTHING IN EXISTENCE, 2019*

Figure 38 - fuse, EVERYTHING IN EXISTENCE, 2019*

Honorable mentions and key influences for “Synesthesia”

It would require an entire project of its own to analyse and properly evaluate the impact and significance of the work and innovations of all the relevant artists that have pioneered the sphere of digital and multimedia art. Therefore, the figures selected for the a more in-depth exploration represent either historical milestones or avant-gardist explorations of human experience and technology. However, given the academic and practical nature of the present thesis project, there are a number of other key artists that have served as case studies, inspiration and that thus solidify the theoretical framework of exploration that guides our project. Among these, Japanese artists Ryoji Ikeda and Ryoichi Kurokawa have both in distinct and specific ways the combinations of sound compositions with visual and architectural elements that jointly create interactive and immersive experiences based on the mathematical and scientific principles of technology. Further leading names that have had critical impact on the international scene are Alex Guevara with his data and music visualization and generative designs that bring the audience into a new plane of existence constructed by digital manipulation of data; Vincent Houzé and his astonishing interactive performances where the human connection to the natural world is narrated through simulations of physical phenomena that generate colourful and dreamlike scenarios; and Refik Anadol who has dedicated his work to the research of the aesthetics of machine intelligence, tackling themes of human existence in the age of AI, perceptions of space and post-digital architectures which re-define a hybrid relationship between architecture and digital media arts.

Figure 39 - Aurora Cerebralis, Alex Guevara, 2019

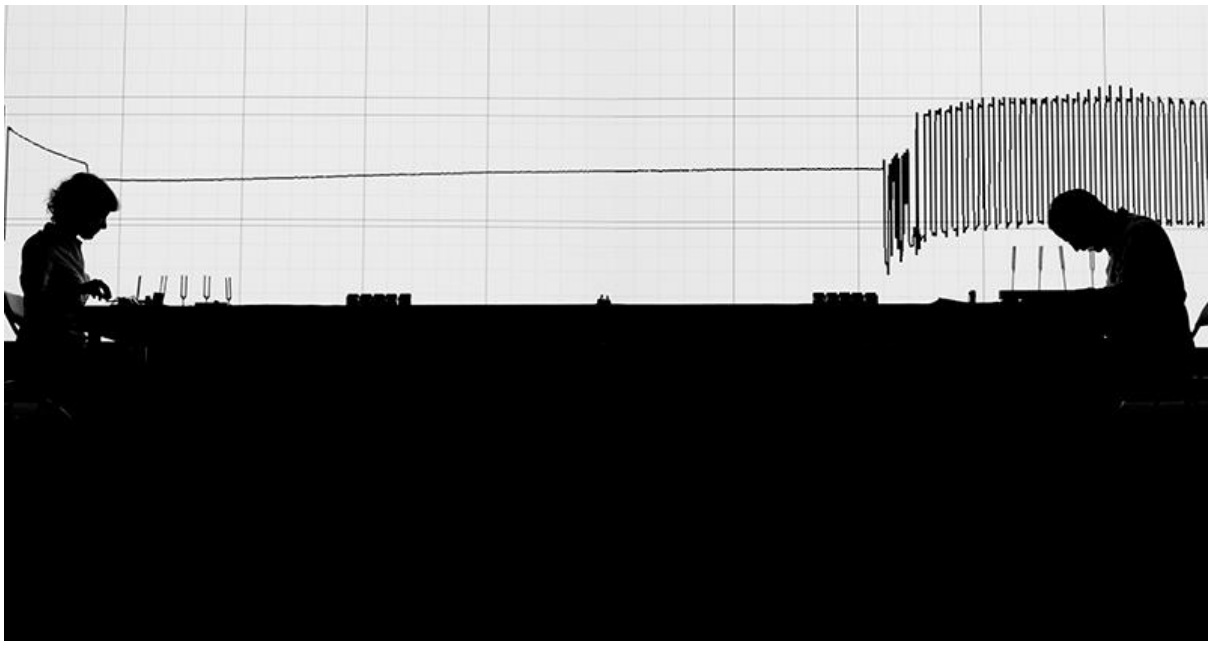


Figure 40 - ryoji iked, superposition, 2012

Figure 41 - Refik Anadol Studio,Infinite Space, 2019

Figure 42 - RYOICHI KUROKAWA, 2020

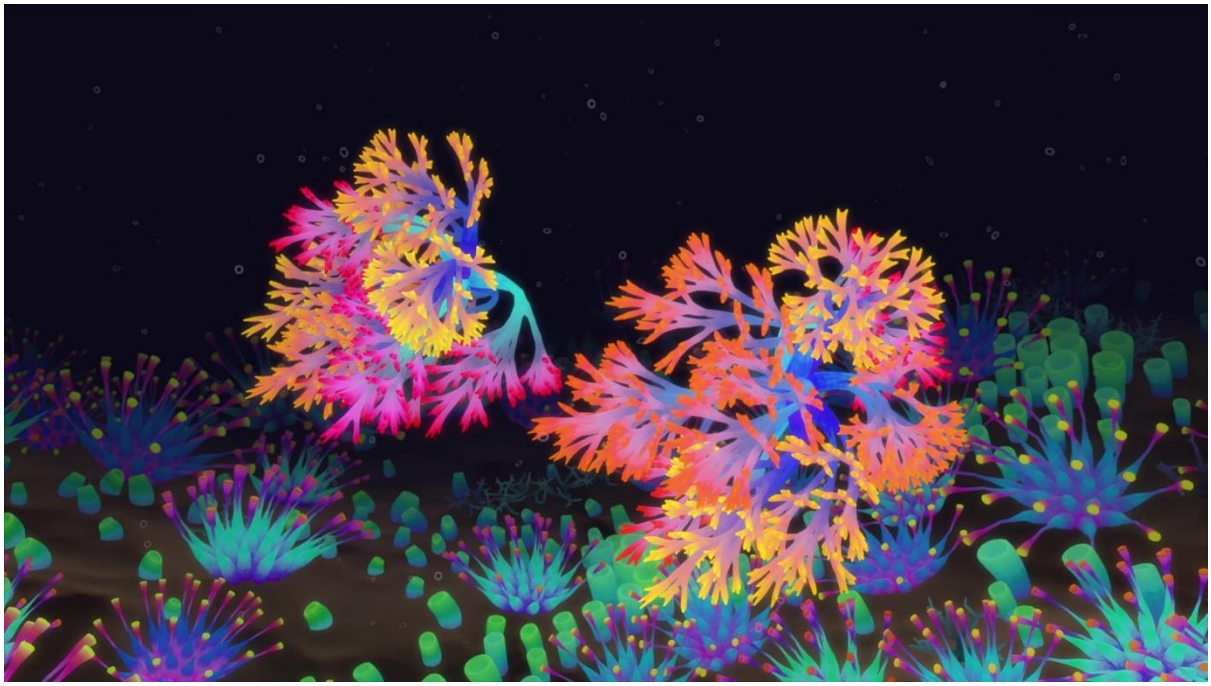


Figure 43 - Max Cooper & Vincent Houzé, 2017

Future prospects in the field of Digital Art

Given the history and quick developments of the discipline and artistic field, and the growing interest and possibilities for creating, consuming, and appreciating this type of art, it also a valuable exercise to establish what the prospects for the future are and the directions where artists and the public are going towards. In the first place, also due to the last year and a half being occupied by a global pandemic which has reshaped the way content is consumed, there has been an intensified push towards the idea of virtual museums, fully online and remote spaces of assimilation where art can be viewed and displayed. Of course, the question of authenticity and the millennial fascination with the concept of the "original" is a big obstacle for the true rise of this type of museum. However, this type of convers is often less accentuated in the field of digital art given the nature of the medium and its intrinsic existence in the virtual space. Nevertheless, much of the work of the artists mentioned earlier focuses on the physical presence of the audience, on the blurred lines between corporeal sensory stimulation and digital technology. Therefore, the prospect of virtual, web museums remains relegated to a certain kind of artefact for the time being, while different versions of technological devices in the space of the museum become ever more common. These include

virtual or augmented reality interfaces that have been in use in the digital arts for decades but are only now taking hold in more traditional art galleries (Walczak et al., 2006).

As visitor experience and experiential enjoyment become more salient factors in the decision-making frameworks of institutions and galleries, and as our day-to-day lives become infused with virtual stimuli, the future of art consumptions is turning more and more towards the digital. The accessibility of software and equipment to produce digital art as well as the fascination and infinite sensory possibilities of computational and generative artworks has shifted the paradigms and traditional structures of art and led the way for new explorations and expressions of creativity and reflections on cultural phenomena.

“Synaesthesia” in its physical form

Torino Graphic Days

Having explored the progression and development of the field of digital art from its earliest stages to the latest pioneering works, it was possible to grasp the extent to which technology, human perception and artistic push can influence each other and result in inspiring works born from technical knowledge and human creativity. Building on the knowledge and experiences of the past, the present thesis project “Synaesthesia” aims at creating an immersive and interactive artistic reflection in the space of the 6th edition of the Torino Graphic Days. This year’s iteration of the festival focuses on the theme of “Touch”, how this has change as an effect of the almost 2-year long global pandemic and reflection on how this idea can be interpreted through the means of visual design, digital art and interactive installations.

Torino Graphic Days is an international festival dedicated to visual design and the large scope of its powerful visual communication. Engaging every year with different artists, professionals and relevant studios in the international landscape, the festival explores the many influences and cross-contaminations between the arts. The project was born in 2016 with the goal of giving a space to share and emphasize the cultural value of visual communication methods, providing a platform for the development of new projects, exchange of ideas, involvement of the public through workshops, exhibitions, conferences, performances and much more. Among the themes and core focuses of the festival are the mix and conglomeration of local and global symbols and voices united by a modern and universal language. Traditional and cutting-edge techniques and instruments work in synergy, proving an anchor to the past but always looking towards new creative directions. Moreover, the involvement of the public has always been a central concern for the festival, with the objective of bringing to the world of the design and visual art the non-experts and casual visitors. This has been achieved both with the intriguing and captivating themes and installations at the festival itself and with the “in the city” extension of the Graphic Days format. With these parallel events the festival breaks down the barriers with its wider

audience and invites Torino's very citizens to join in the events and installations for the month-long period of the festival.

In close partnership with the Festival is Print Club Torino, a lively, community-driven association that brings together the city's creative community with the aim of promoting experimentation, exchange of ideas, techniques and projects thanks to the mesh of visual communication and social innovation. The association, together with institutional actors of the sector, operates from the perspective of sustainable design, with a considerable part of its activities being geared towards territorial co-designing, developing permanent hubs for research and partnership with local museal and cultural institutions, schools and independent stakeholders. From sustainable urban planning to active civic involvement on the local territory, the organization makes local development one of its core values which defines its identity and strategic goals.

Another partner of the festival that is active year-round for the promotion of sustainable design and social communication is the non-profit "Plug". Plug is made up of professionals coming from a variety of backgrounds, from visual communication to design and has been involved in cultural, educational, social and environmental projects to promote territorial development thanks to a consolidated network of partners. Focusing specifically on social issues and on the encouragement of an open debate on ideas, lifestyle and awareness amongst the community towards social and environmental sustainability.

Finally, the point of contact between our thesis project and the Torino Graphic Days environment is the 2012 brand agency Quattrolinee. Quattrolinee brings together strategy, design and technology to generate effective and innovative communication practices. The agency is involved in strategic communication, technological development and retail and exhibition architecture. As of today, the team is composed of different professional figures with different backgrounds but with the same objective of creating original and high-quality, impactful projects.

Objectives and vision of the exhibition

The main goal of this thesis project, “Synaesthesia”, is the exploration of the interaction and juxtaposition of human perception in the digital space. Our aim is to develop an experience made up of more than mere images and visual artefacts but a multisensory conjunction of sounds, digitally altered realities and phenomenological intricacies which together allow us to examine and observe new aesthetics and means of creating a visual narrative that are possible through generative digital art. However, as we have discussed earlier, the vocabulary to fully comprehend and address these almost metaphysical questionings of art and technology does entirely grasp the potentialities of procedural and binary artworks as well as first-hand experience does.

In order to reach a wider audience, such as that of the Graphic Days, and draw them into this new visual language, we have chosen to focus on the binomial interaction between man and machine. In popular discourse we often hear a lot of talk about human-tech relationships or artificial intelligence, accompanied by speculations on possible future prospects and sometime dystopic vision. However, within “Synaesthesia” and the exhibition we have created, we have shifted away from these generalized and overarching discussions and have instead presented the personal interpretation of Riccardo Lucii, Paolo Rucci and Andrea Scelfo. In doing so we have merged out own unique vision with the idea of the constant chase and tension between the two elements of man and technology which are at the same time contradictory and complementary. In fact, if on the one hand man is no longer able to carry out most tasks without the help of technological tools that facilitate its actions, on the other machine also necessitate man’s intervention since without it they would be void of function and use.

The exhibition space for Synaesthesia is divided into 5 distinct experiences. Initially, the visitor is led through a sensory deprivation corridor where they are removed from their specific reality in order to enter the second room without any remaining influence of the outside environment. Here, the visitor experiences the collective event of distortion and abstraction through technological manipulation of visual and spatial features. Following this, the third section proposes a reflection on shared creativity and community in the digital age through an interactive experience that explores human-computer interactions and cooperation between individuals. The fourth space, moreover, provides a more individualistic connection to the technology presented, in which the visitor can explore generative art and become the artist himself. Finally, the last section allows the visitors to confront themselves with each

other' work and experience by joining together the outputs generated from the previous room into a collective artwork. Here out objective is to create a space in which the visitor is the central figure who leads the experience, putting on the same level the audience and the installations produced for their fruition.

In order to create the visual composition for the project we have utilized data and photographic material obtained from the environment around us, taking inspiration from natural elements, textures and fabrics. These were then converted into shapes, colours, numbers and binary codes thanks to the use of software systems able to generate graphic and visual components using parametric and generative techniques. The resulting visual design of the project was constructed to be eye-catching and engaging, thus focusing particularly on our quest for "beauty" and aesthetic sensory pleasing. To obtain this idea of "beauty" we have trialled a number of different visual effects and editing options, and often some of the most particular and innovative designs have been the result of chance or mistakes. This trial-and-error process has pushed us to test and discover the limits of visual and sensorial expression of the tools we used in order to get to the most complete composition.

Within "Synaesthesia" the exhibition space becomes part and parcel of the art, with a 3D mapping of the walls and the resulting projections it was possible to devise an audio-visual narrative in which movement is added to previously static objects and utilized for virtual compositions. Art and creativity, therefore, become intrinsically linked to technical expertise since the tools used to create the art, although accessible by many, require an advanced and deep understanding of the technology. In fact, to finalize the visual design and all the multisensory and atmospheric elements of the exhibit it was necessary to collaborate with several professional figures, among which artists, sound designers, computer engineers and electronic engineers to bring together the project.

Rethinking the relationship between physical and digital presence, the exhibit allows visitors to explore this realm of existence through direct contact between man and technology. The audience is, therefore, able to create its own art by just existing in the installation space where computer-generated visuals react to the feedback of the individual and create shapes and colours. This type of interactive experience summarized the power of generative and user-responsive art, in which a shared creativity between man and machine becomes productive and original. Moreover, the public is as much a part of the aesthetic

reflection as the artist, leaving traces of its presence and doing away with passive and dethatched art consumption.

Finally, given that the exhibit within the Torino Graphic Days will remain open to the public for a total of ten days, we are designing a virtual addition to the physical experience through which the visitor can relive the installation an infinite number of times. Moreover, the goal of the exhibit is also to provide a new and never-before seen experience to the audience by taking advantage of new methodologies and visual communication strategies, hoping for a positive reception of the work. In conclusion, we hope that by laying the foundations and experimenting with our abilities and varied theoretical frameworks within the scope of the Torino Graphic Days, we will be able to expand and advance out skills from this incredible opportunity.

Case Studies

Given the vision and aim of the exhibition, in line with the more general and festival-wide theme of "Touch" and the specific focus of "Synaesthesia" on sensory perception and communal design, there are a number of specific influences that have proved essential in devising the themes, visuals and techniques behind our own project.

The 2021 audio-visual installation by Ryoji Ikeda "X-verse" serves as a core inspiration for the First section of "Synaesthesia". Here, screens that wrap around the whole length and height of the walls show complex and abstract computer-generated graphics which are the visual translation of mathematical code and large amounts of data. Ikeda is interested in articulating the invisible structures of reality through visual and sound representations of data that would otherwise be incomprehensible. The installation features fast-moving black and white visual abstractions accompanied by white noise that over time shifts and changes with the images. The music itself is completely digitally created and a reflection of technology's capabilities to interpret data and transform it.

The exhibition requires complete immersion into the cyber virtual world that Ikeda creates around the visitor and that distorts the sense of reality and space. The audience,

therefore, is challenged at a subconscious and conscious level to take in the chaos and reflect on human perception.

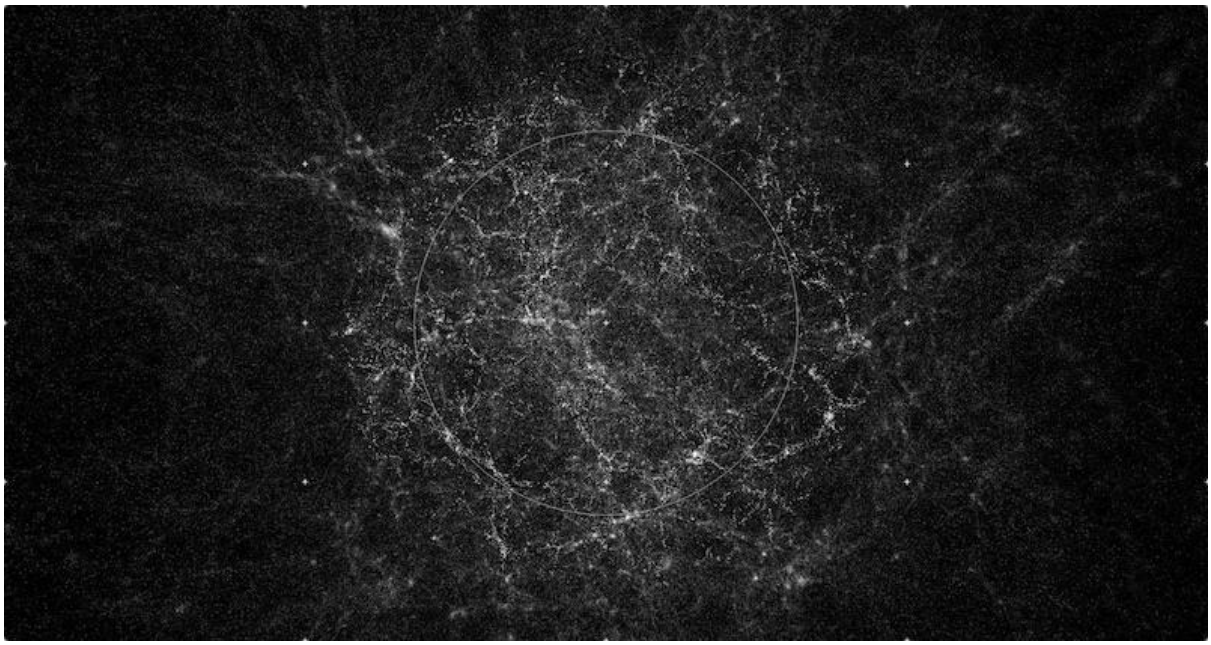


Figure 44 - ryoji ikeda, X-verse, 2021

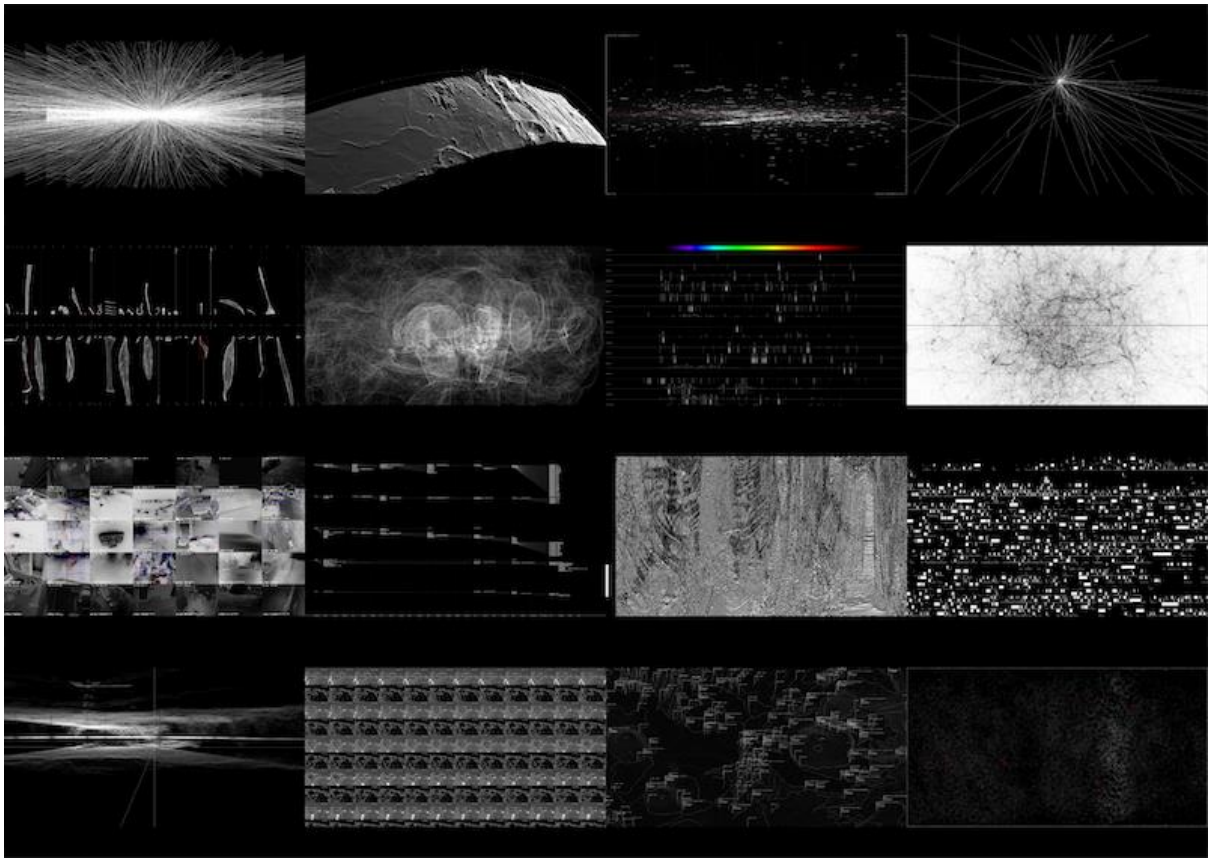


Figure 45 - ryoji ikeda, X-verse, 2021

Figure 46 - ryoji ikeda, X-verse, 2021

Similarly, in Ikeda's 2006 "datamatics", the artist is able to use pure data as a source for sound and visuals, questioning the essence of matter, time and space. Again, the visuals

are computer-generated and based on collected data such as errors, software code studies and imagery transformed in 2D patterns, 3D creations all followed by a layered soundtrack.

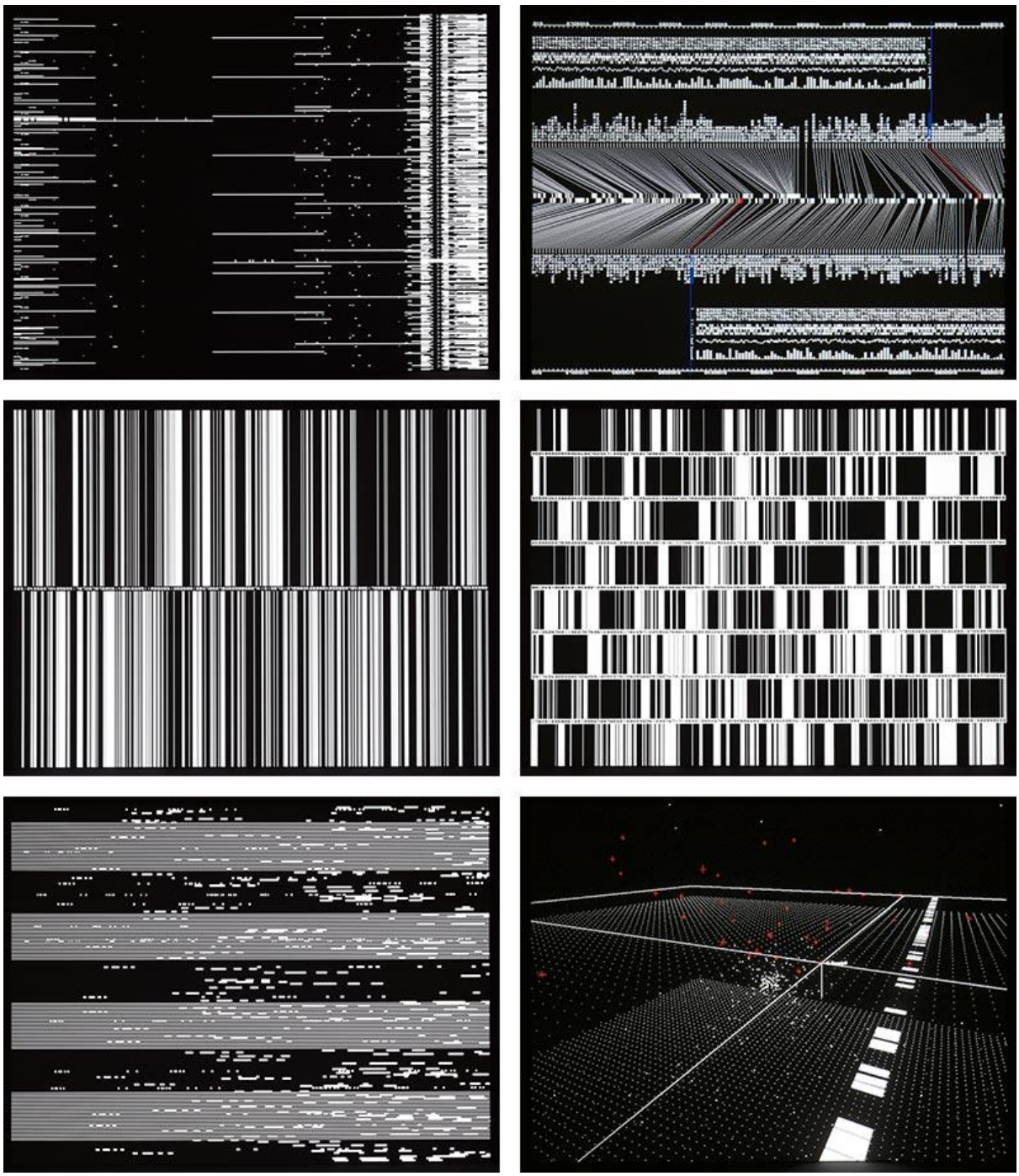


Figure 47 - ryoji ikeda, datamatics, 2006

On the same line as Ikeda's works, a key inspiration for the project has been the work of Refik Anadol and his data-paintings/sculptures. Particularly, his 2018 "Melting Memories"

in which he explores an aesthetic interpretation of human data-processing through memories and artistic production. Anadol was able to capture the complexity of the ideas of "recollection" of memories via data streams transformed into contemplative visual compositions projected on huge and immersive LED media walls. The data used in the project was actually collected through EEGLearn brain imaging from subjects that were focusing on distinct memories that activate specific parts of the brain, later converted by the artist into digital art pieces. Anadol has been, thus, a driving force in the conception not only of the visual and aesthetic elements of our project, but at the theoretical level thanks to his well-developed and thought-out study of human perception and sensory activation.

Figure 48 - Melting Memories, Refik Anadol, 2018

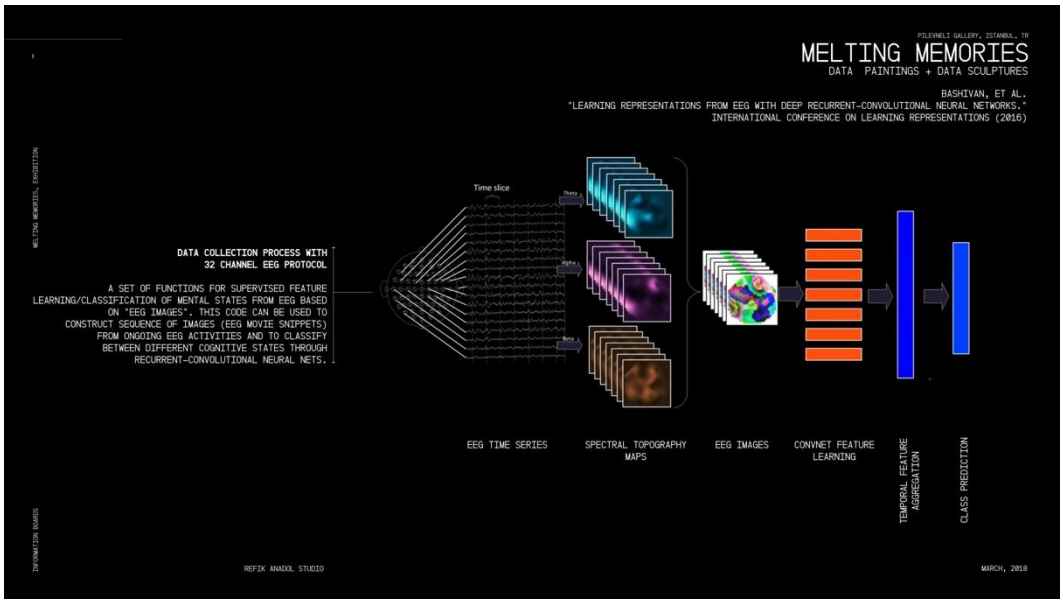


Figure 49 - Melting Memories, Refik Anadol, 2018

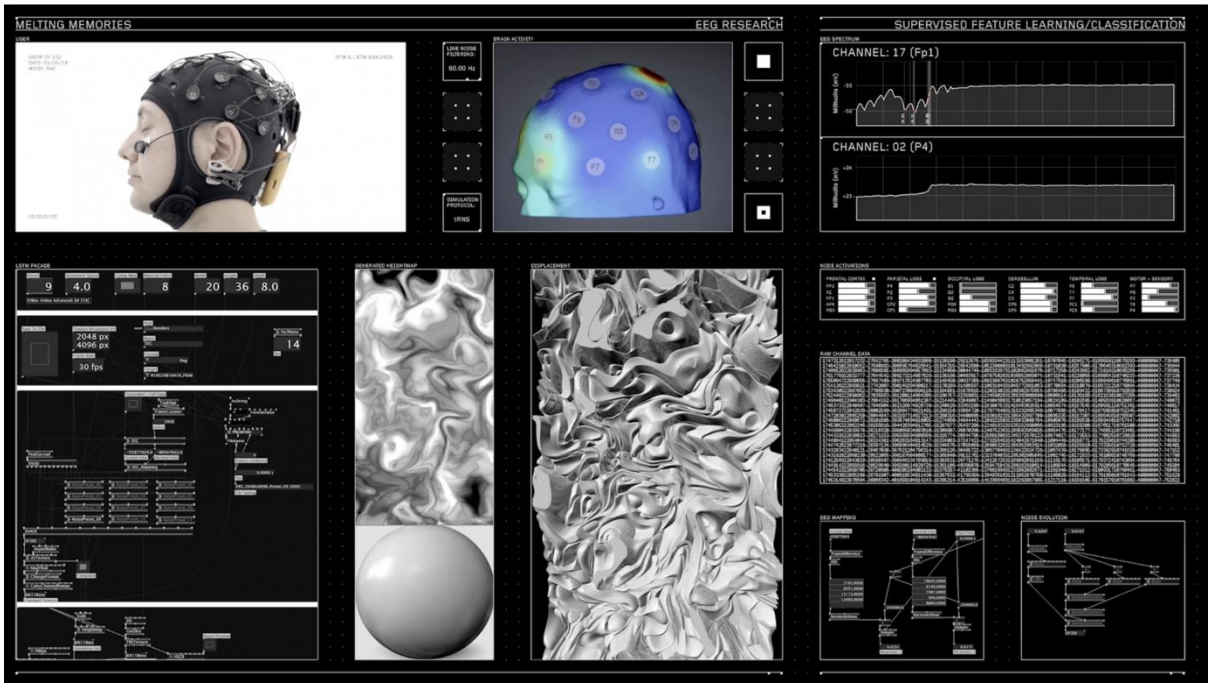


Figure 50 - Melting Memories, Refik Anadol, 2018

Finally, a last example of work that has influenced the design and conception of our project is Vincent Houzé's 2018 "Fluid Structure 360". In this immersive digital artwork that engulfs the audience by stretching all around the room, projectors shine on the walls of the darkroom

and together with motion sensors and computer-generated visuals creates a spectacle where the visitor is constantly influencing and changing the look and state of the artwork. The whole installation is an exploration on how outside stimuli can guide and transform the shapes produced by the software, putting the audience at the centre of the scene by allowing them to leave marks on the art around them. The system is driven by a state-of-the-art fluid solver able to process in real time the forces and constraints the shape is subjected to.

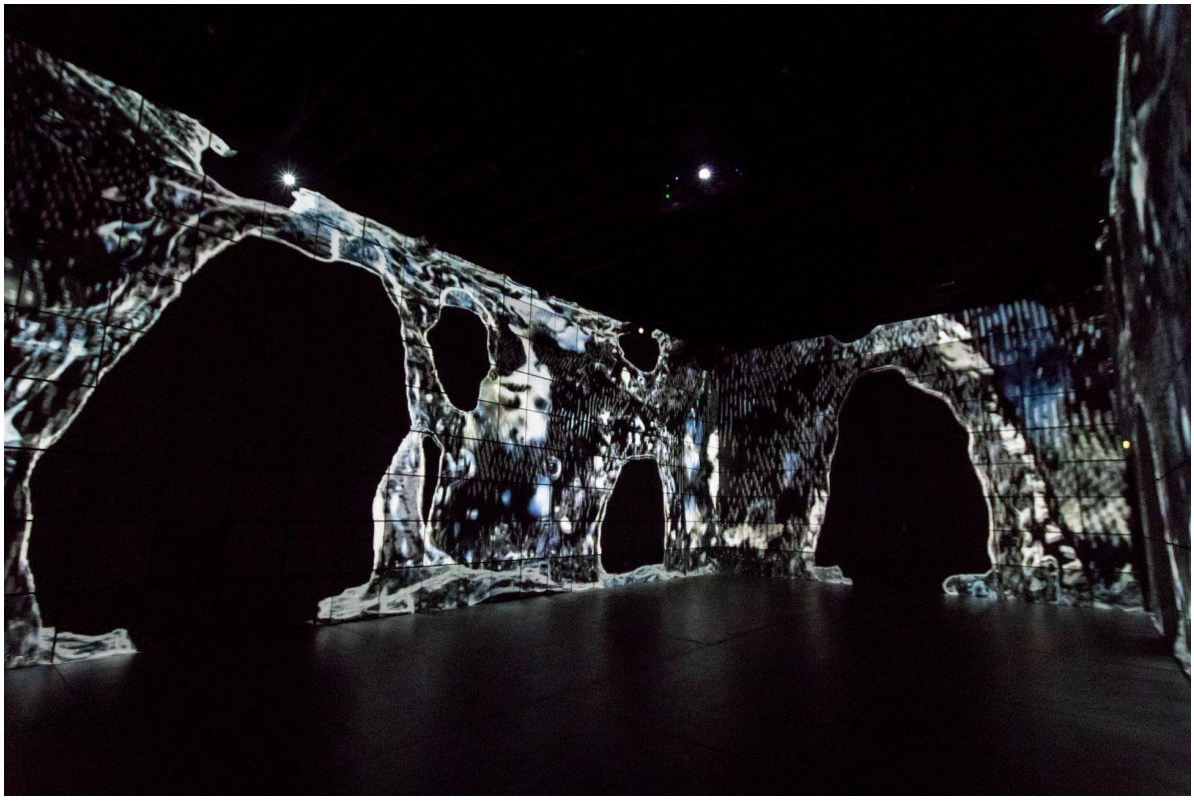


Figure 51 - Fluid Structure 360, 2018

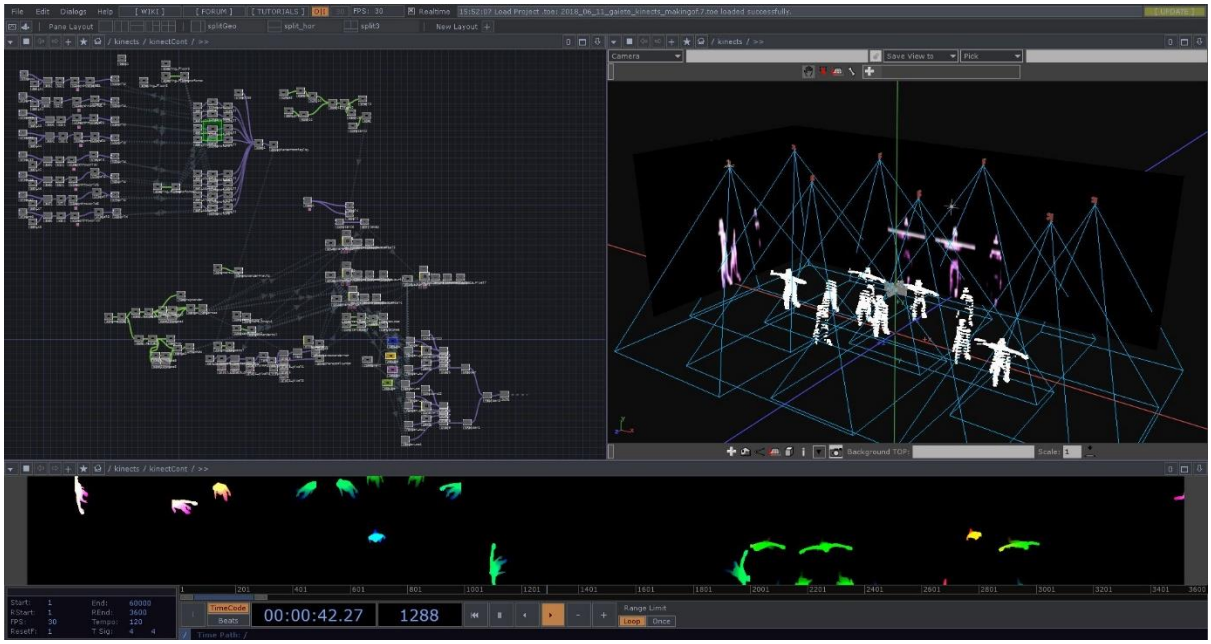


Figure 52 - Fluid Structure 360, 2018

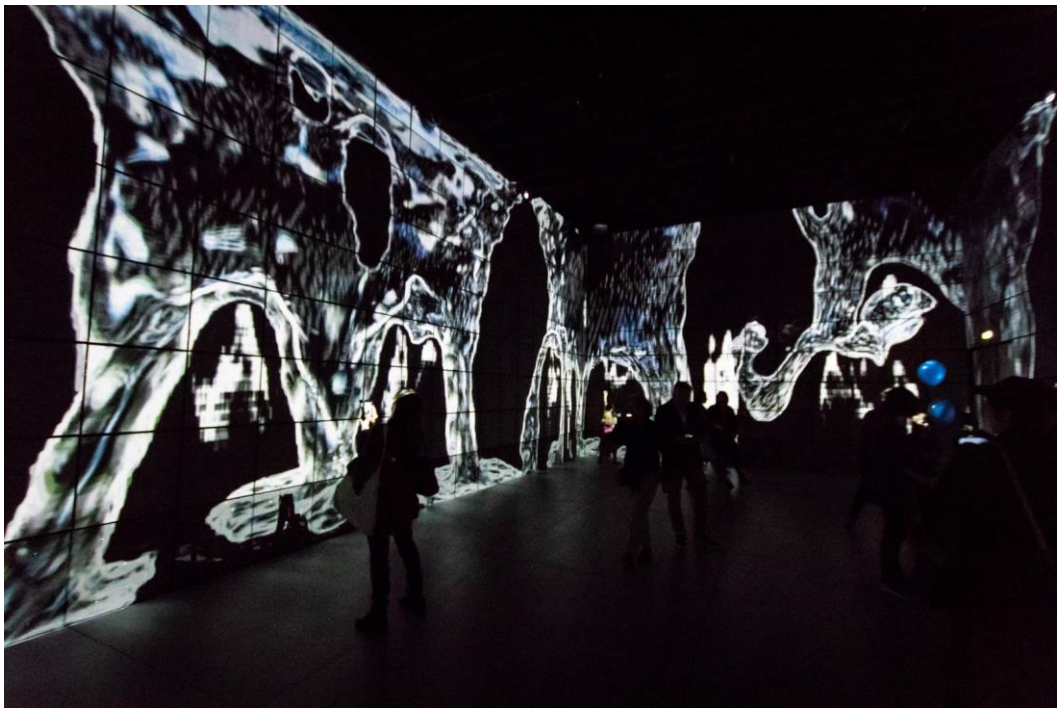


Figure 53 - Fluid Structure 360, 2018

Technical elements and process

Provided the references and starting points for the visual and theoretical portion of our project, the following section will outline the technical equipment and software utilized in the creation of the art displayed in “Synaesthesia” at the Torino Graphic Days 2021. Moreover, a detailed explanation of the artefacts and their production process will be defined in order to provide an overview of the elements and functionalities of the project.

Kinect 2.0

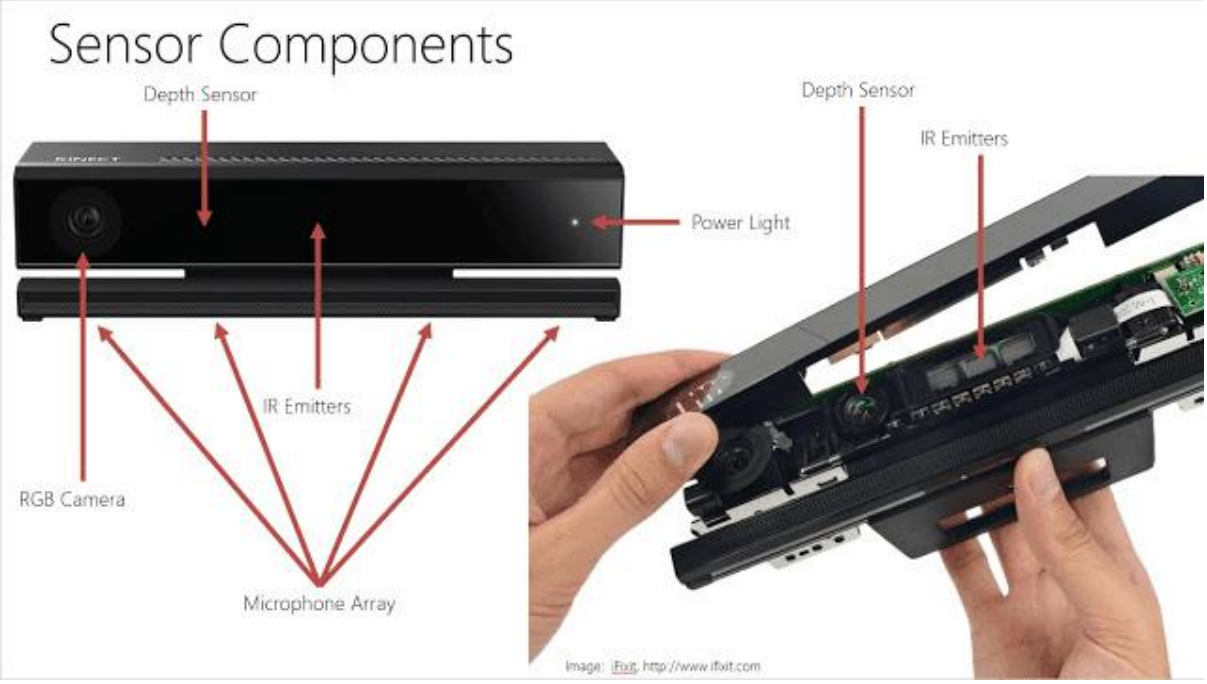


Figure 54 - Motion and depth sensors were used in the thesis project in order to allow the audience to be active makers of the art through their body (Crussell, 2017)

The Kinect One presence detector, also known as Kinect 2.0, is the direct evolution of the Xbox 360's Kinect. It was released in November 2012 by Microsoft with the aim of enhancing the consumer gaming experience. To do this, the Kinect is equipped with an RGB

camera with a resolution of 1080p that captures images and colours and a depth sensor (which exploits the Parallax effect, an event that occurs when an object appears to move relative to the background when the viewing point is changed), which works with four infrared cameras that generate a virtual point cloud representing a three-dimensional visualisation of the space in front of the cameras.

The identification of the human body is the result of a two-stage process: first the Kinect calculates the depth map, then assigns different colours based on the arrangement of objects in space. From each individual depth image, the positions of the body parts are calculated (each colour indicates approximately the joints of the user's bones).

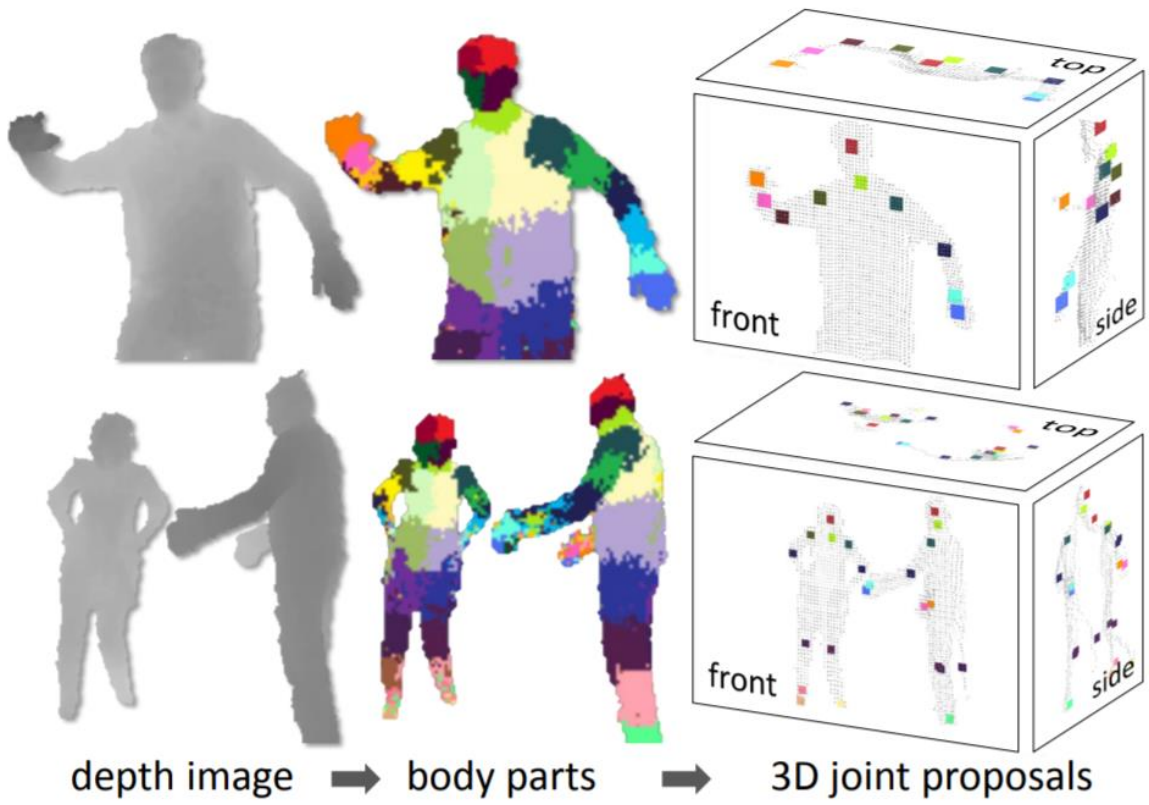


Figure 55 - visualization of Kinect functioning (Shotton et al., 2011)

The Kinect then compares the input image with hundreds of thousands other images from Microsoft's database. By executing this action 30 times per second, it is possible to have an accurate representation of the movements (MacCormick, 2011).

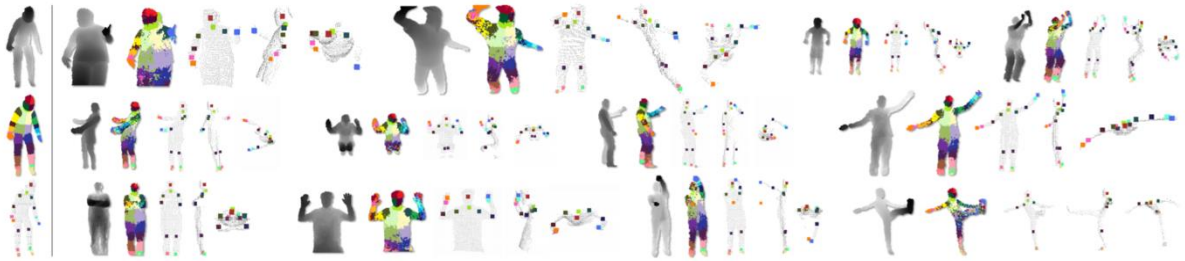


Figure 56 - visualization of Kinect functioning (Shotton et al., 2011)

Software TouchDesginer

TouchDesigner is a node-based programming language for real-time multimedia and interactive content creation. Developed by Derivative, a Toronto-based company, it is used by artists, programmers, and software designers to create performances and installations. Born in 2000 when Greg Hermanovic, Rob Bairos, and Jarrett Smith founded the company from the source code of Houdini 4.1, after eight years of development, Derivative released the first beta of TouchDesigner, version 077. In the software, the operators are called 'nodes' and each performs different calculations with customisable parameters.
The software was used in the third room for the design and realisation of the three visuals and in the programming of the console interface in the second room. In addition, some parts of the video projected in the first room were created through Touchdesigner.

Software Blender

Blender is an open-source 3D creation suite. It supports the entire 3D pipeline: modelling, rigging, animation, simulation, rendering, compositing and motion tracking, video editing and 2D animation pipeline.
In the project, Blender was used for the 3D models of the different exhibition areas and for substantial parts of the video of the second room.

Software Houdini

Houdini is a 3D animation software developed by SideFX, which adapted it from the PRISMS suite of procedural generation software tools. The procedural tools are used to produce different effects such as complex reflections, animations, and particle system. Houdini is widely used for creating visual effects in movies and games. It is used by major VFX companies such as Walt Disney Animation Studios, Pixar, DreamWorks Animation and Sony Pictures Imageworks.
Was harnessed its computing power and generative method of use to create highly complex and abstract parametric visuals for the second room.

Software AferEffects

Adobe After Effects is a software for digital visual effects, motion graphics and compositing developed by Adobe Systems and used in the post-production process of film, video games and television production. Among many other things, After Effects can be used for keying, tracking, compositing and animation.

Software Resolume Arena

Resolume Arena is an advanced software tool for video and light mapping. Adapted to multiple fields, such as architectural video projection, art installation, set design and live performance, Resolume Arena software has made thousands of projects possible around the globe thanks to an extremely active user community of creators looking for fast, efficient and user-friendly mapping software.
Was used this software to map the two walls of projections in the second room and to manage audio visual streams.

Ableton Live

Ableton Live is a digital audio workstation. Unlike many other software sequencers, Ableton Live is designed to be a live performance tool, so it is a tool for recording, composing, arranging, mixing and mastering. It is also used by DJs, as it offers a suite of controls for beatmatching, crossfading, and other various effects used by turntablists, and was one of the first music applications for automatic beat matching of songs.
this software was used to create both the sound mixing of the second room and the active parametric composition of the third one.

Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Layout of exhibition space and specifications

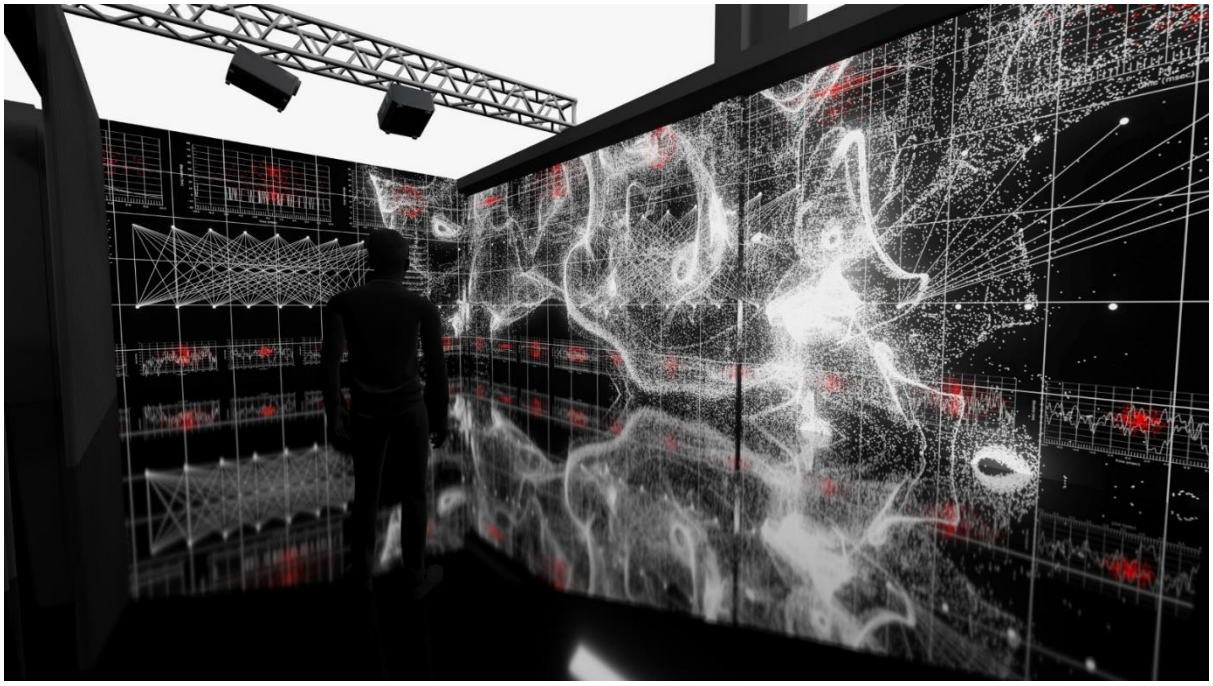
Already from the research phase we had in mind a collective space of creation, a hothouse of ideas that would generate art autonomously. To achieve this goal we understood that we needed a complex experiential process. The result, which was in agreement with the space we were given, was to have an introductory corridor, necessary to detach and define itself from the rest of the Graphic Days exhibition; a large environment with visuals we developed to immerse the visitor in the multisensory language and visual codes of generative and kinetic art; a third room, where the visitor starts to have an active function through the relationship with other people; a fourth room where it is possible to create individually; and a final room where the visitor can get his creation and can collaborate in the creation of a collective work.

Portal

The first section presents a corridor devoid of lights and sounds, to simulate a room of sensory deprivation so as to allow the visitor to enter a new world, hence the name.

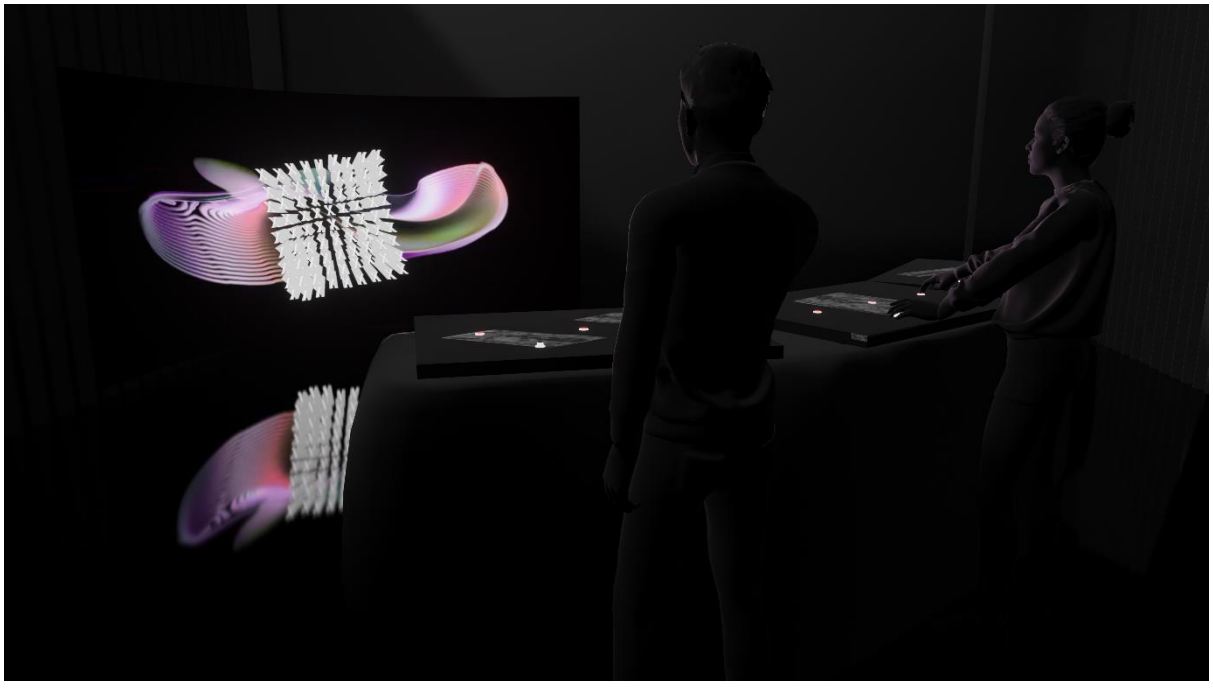
Odissey

For this exhibition area, the original setup of the room was changed, to create a dark and lightless environment, the walls were painted black and every light source was covered with black cloths
Three PTDZ1200E projectors were installed on two trusses fixed on the lintels. A visual was designed to cover two walls of the room with a surface area of 21 by 4 meters.
The audio configuration features two stereo cases placed at the corners of the wall to envelop the audience and enrich the overall experience. The mirrored effect was achieved by using a layer of reflective adhesive on half the floor of the main space.



Link

The third section of the exhibition connects the visitors stimulating them to collaborate in order to generate a complex and articulated visual projected by a curved LED wall with dimensions of four meters by two.
The intent is to create an interactive space with audio visual feedback, to do this was installed a console with buttons, sliders and knobs that when activated change both the visual and the soundtrack that accompanies it.



Alter ego

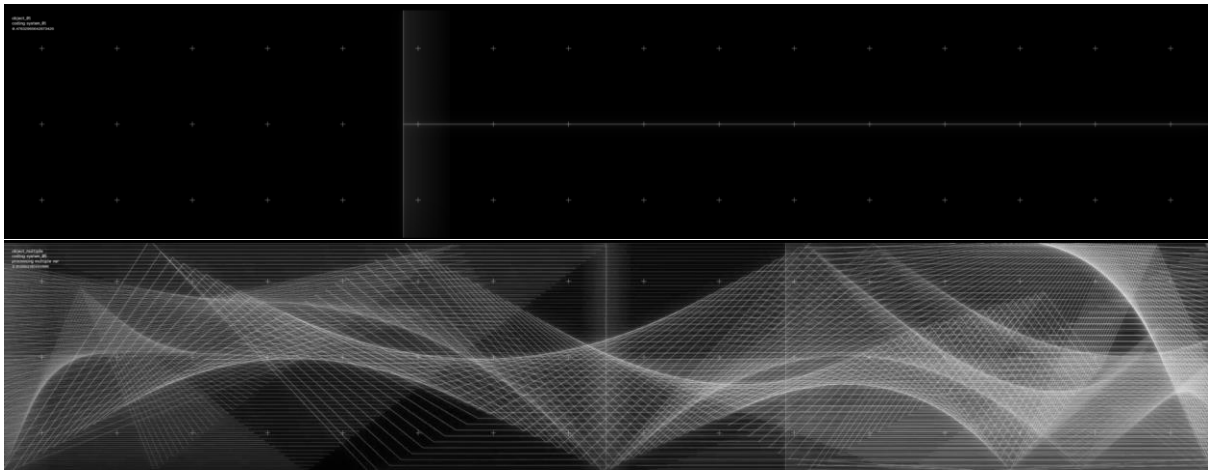
The fourth section of the exhibition presents a direct confrontation between man and technology thanks to presence detectors connected to 55" 4k monitors. The visitor, in this room, positioning himself in front of the installations is able to generate unique and personal visuals. This is made possible thanks to the Touch Designer software, which is able to record the values of the user's spatial coordinates in real time and convert them into useful data for the creation of the visual.

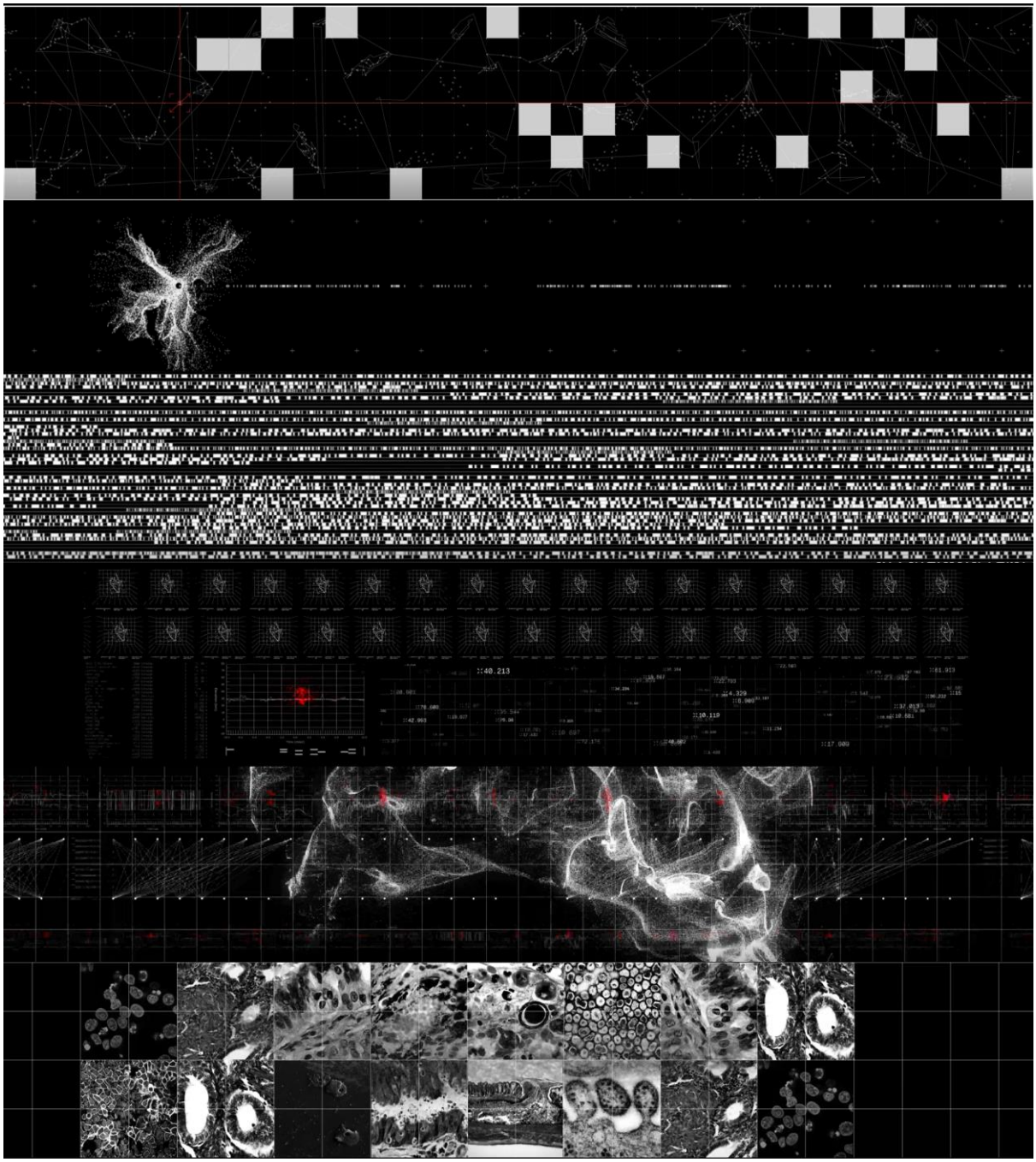
Synthesis

The last section of Synesteisa's exhibition is dedicated to the printing of the visuals generated in the previous room and to the creation of a collective work by applying the prints on a 6 by 3 meters surface. The user, through a dashboard designed by us on monitors, is able to print and send the visual independently.

Odissey

In the second environment using the visual codes of generative and kinetic art as a language, an immersive, multi-sensory environment is being created. The visuals created are the aestheticization of data composed on a narrative ideal based on action-reaction. The data are collected from heterogeneous banks such as nature, man, space, computer and artificial intelligence creating a result that although complex and abstract is familiar to the visitor.
The projected visuals are obtained more technically through software: Touch designer, Houdini, Blender and composed later with After Effects.
Here we sequentially display some frames from the 10min video:





Link

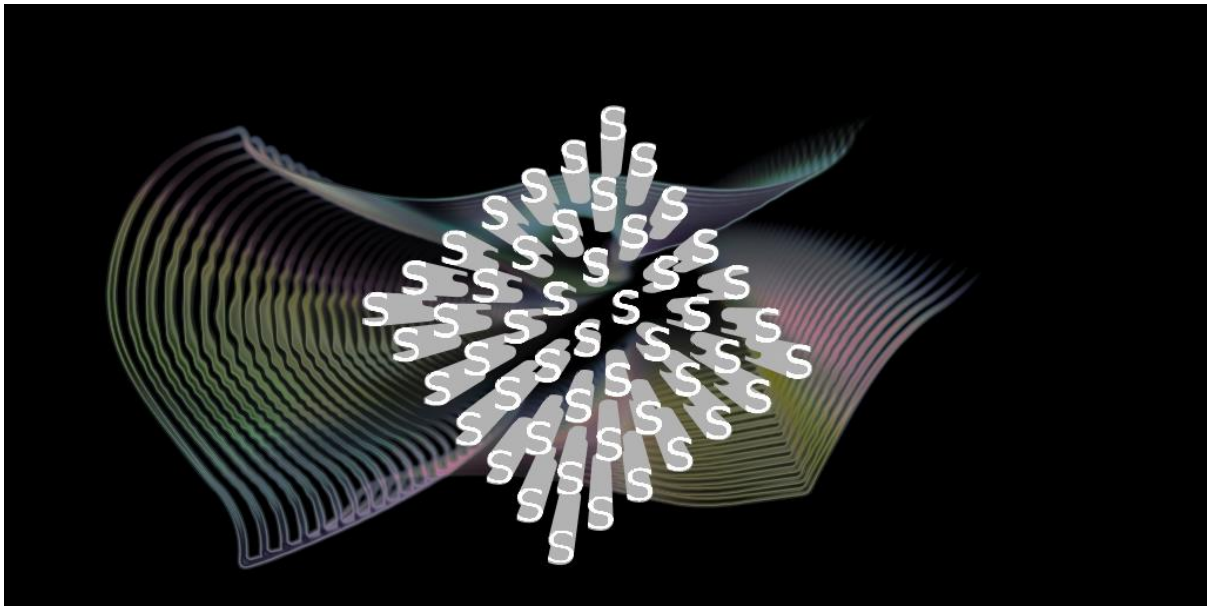
In the third exhibition area, the installation we devised allows the public to experience a direct and immersive interaction with an audio-visual system using a MIDI console. The programming and design of the installation allows even less skilled users to create and modify very sophisticated generative visuals.

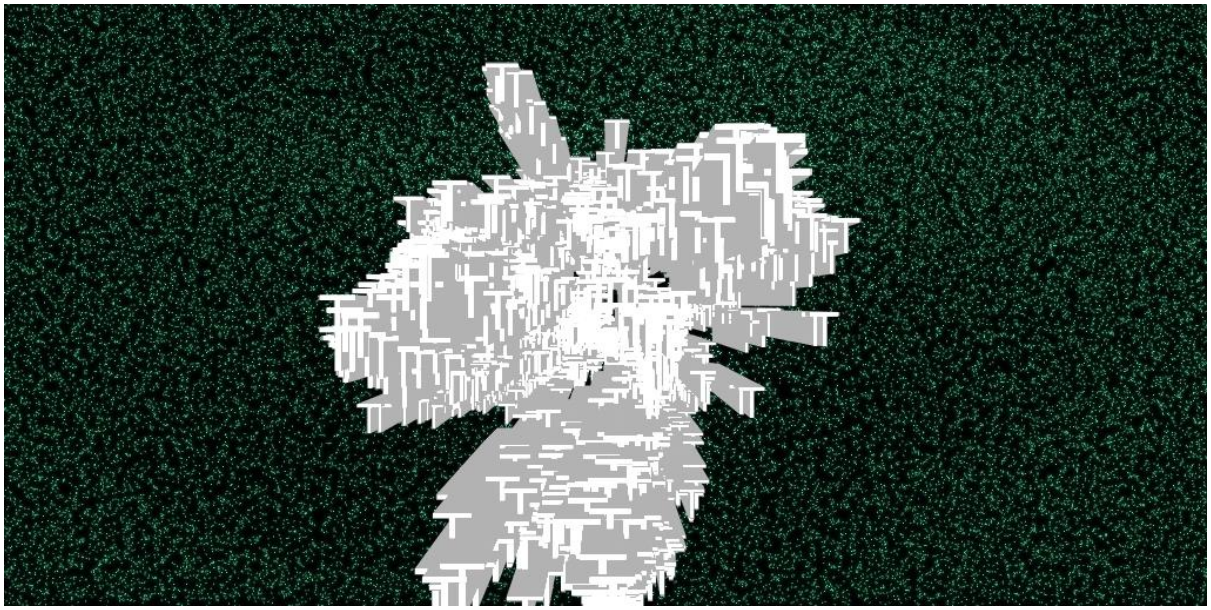
The installation consists of 32 LED monitors with modules of 50 cm x 50 cm each forming a four-by-two metre wall screen, with each monitor column rotated five degrees to create a curved screen. This allows absolute immersion in the environment. The idea is to place the visitor at the centre by allowing them to experiment in the field using various sliders, knobs and buttons. Indeed, in this space it is the audience who, through a console, can modify the visual output. The MIDI, which is approximately four metres away from the screen to guarantee the best possible resolution, has been custom designed and built so that it can be used ergonomically by one, two or three people at the same time. The visitor, through a series of commands on the console, sends inputs to the connected computer, which translates the information into numbers, which in turn modify the visual parameters. The installation, therefore, consists of a computer running TouchDesigner, a 4x2m wall screen composed of 50cmx50cm modular elements and a MIDI console containing 10 buttons, 3 sliders and 3 knobs. An Arduino platform connected to a bread board was used to make the installation. All the commands in question were soldered to 30 AWG wires. To connect the console to the computer we installed two software LoopMIDI and Hairless MIDI respectively one for encoding input and one to allow communication between input and Touchdesigner.

The visual composition featured in the second section has been designed according to the exhibition's overall concept of. In fact, through the language of visual design, a reflection is developed on communal interaction, on how sensorial stimuli that come from the combination of audio-visual and physical inputs can create an experience of distorted reality and shared creativity. The project on TouchDesigner consists of two elements: the background and the lettering. The background was created using a *feedback* loop with *transform* applied to a *circle* previously connected to a *noise* that varies over time with a *displace*, so that the output of these elements changes constantly without any repetition. Lettering is at the very centre of the visual: starting with a simple, recognisable element such as a letter of the alphabet, we move on to complex visualisations and elaborate spatial

arrangements. This was made possible by using the *instancing* technique, which made it possible to replace every point on a two- or three-dimensional figure with a letter-shaped solid. Thus, any changes that the user makes to the solids are transposed to the letters. In addition, the solid is subject to an intrinsic noise, inserted at the programming stage, but the user can vary its intensity to their liking. Finally, the visitor, through physical controls can make changes to the lettering itself, such as changing the lettering, the font, making it bold, italic or extruding it into space.

The combination of these changes makes the visual output always different and appealing. Moreover, Touchdesigner has been linked to Ableton in order to provide sound feedback to each user input. Directional speakers have been installed above the console stations to make the experience even more immersive. The visual projected on the LED monitors is accompanied by a parametric soundtrack designed in Ableton, so by using the controls mounted on the console, the user can manipulate the sounds and add sound components such as Kik, Snare and Clap.

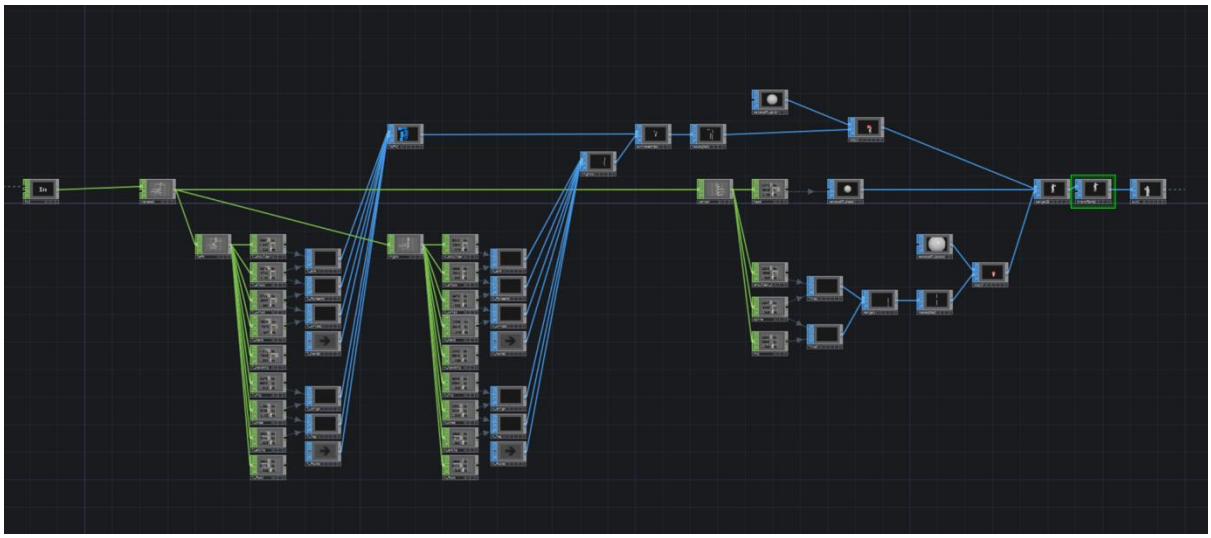




Alter Ego

The fourth section is called “Alter Ego” and allows you to use your body as a means of communication with the aim of creating unique visuals in an immediate and intuitive way. There are three workstations, each equipped with a 55' monitor, a computer (put into specifications) connected to a Kinect 2.0. The projected visuals allow the audience to investigate the three fundamental aspects of graphic design: colour, shape and lettering.

Colour:



The first workstation is dedicated to the colour, where the human figure is the central theme of reflection. The representation of the body was achieved thanks to the Microsoft® Kinect

2.0, with which it was possible to record the user's movements and actions and convert them into spatial coordinates that TouchDesigner software can read. From this data, it was then possible to create a virtual skeleton of the user.

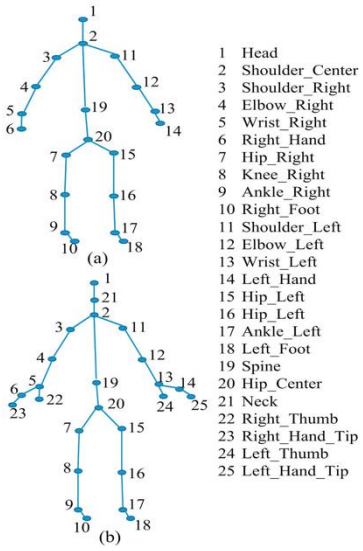
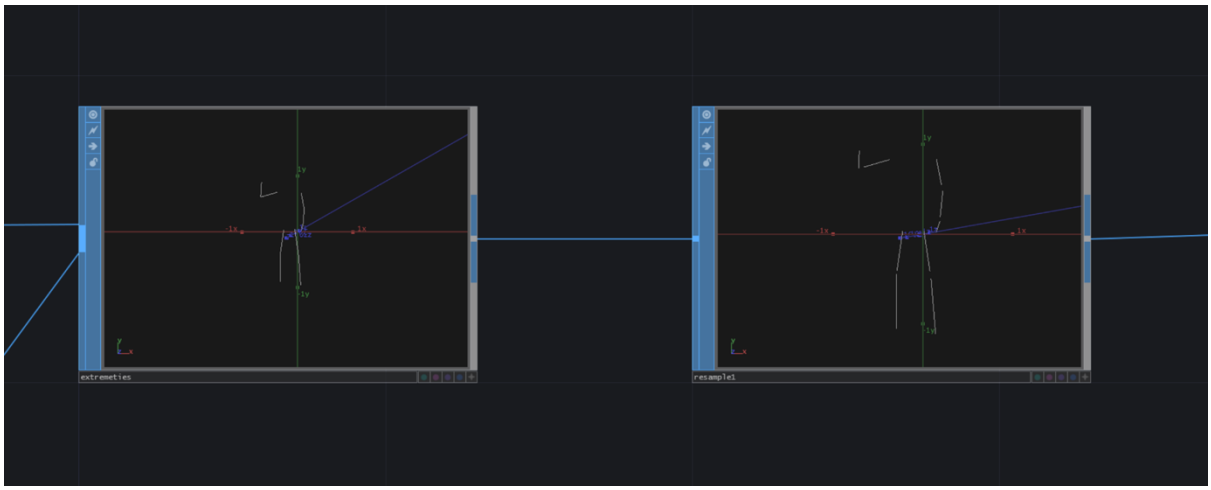
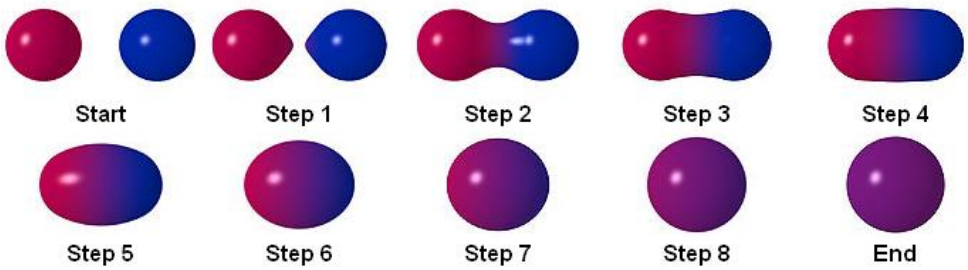


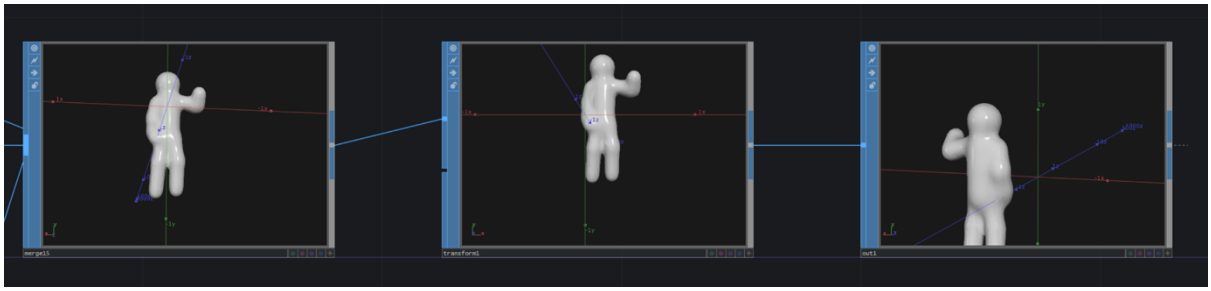
Figure 57 - (Naveenkumar & Domnic, 2018)



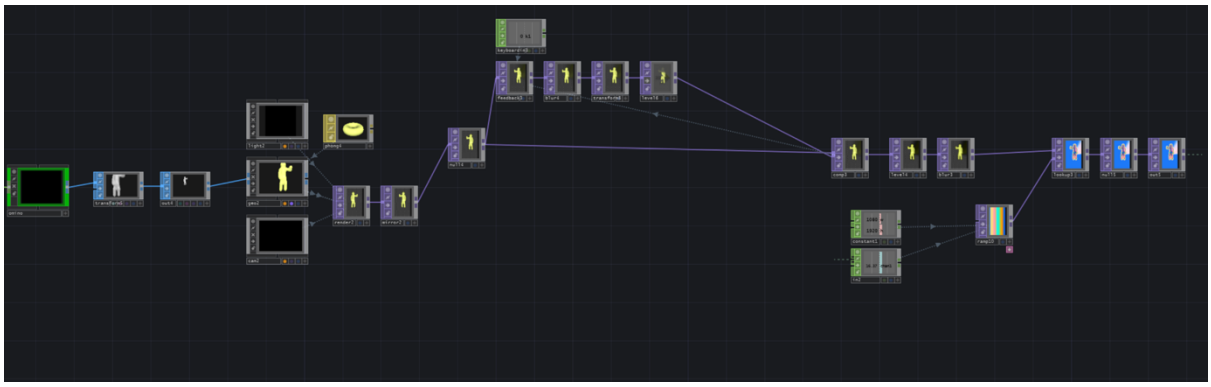
Subsequently, to obtain stylised human features from a skeleton, *metaball* was applied to the skeleton. They are implicit surfaces, i.e in other words they are not explicitly defined by vertices (such as mesh) or control points (such as surfaces), rather than pure mathematical expressions that allow interaction between them through additive (AND) or subtractive (OR)

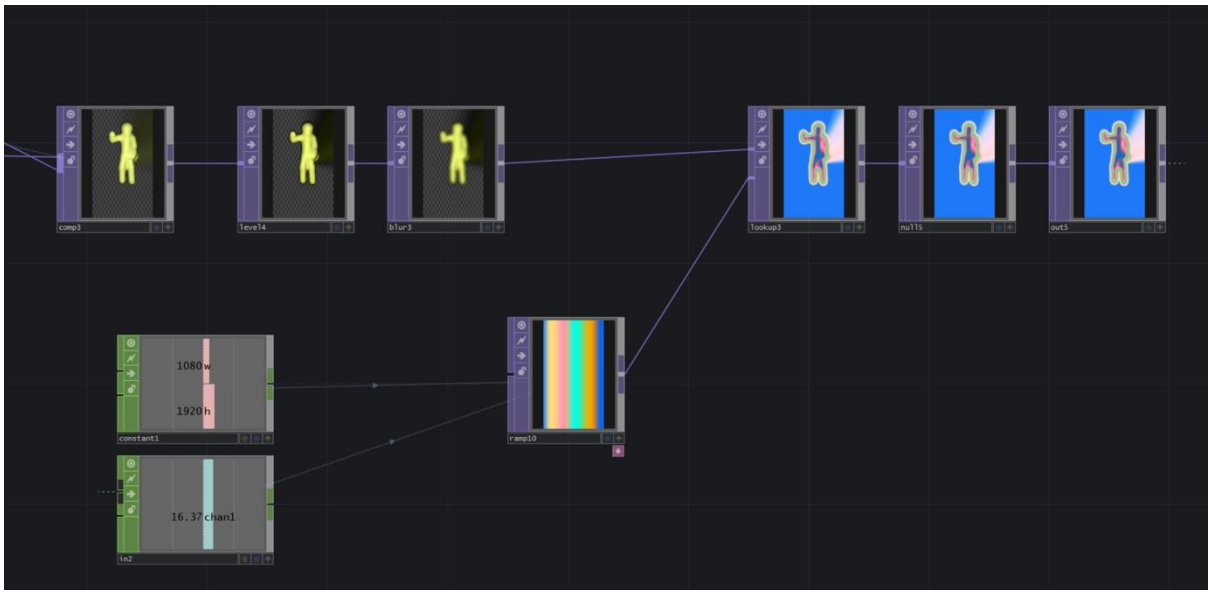
logical operations. Metaballs exercise a reciprocal influence, if it is positive, attraction effects will be noted, while if it is negative, repulsion effects will be present. In this way the user is represented as a stylised man in three-dimensional space.



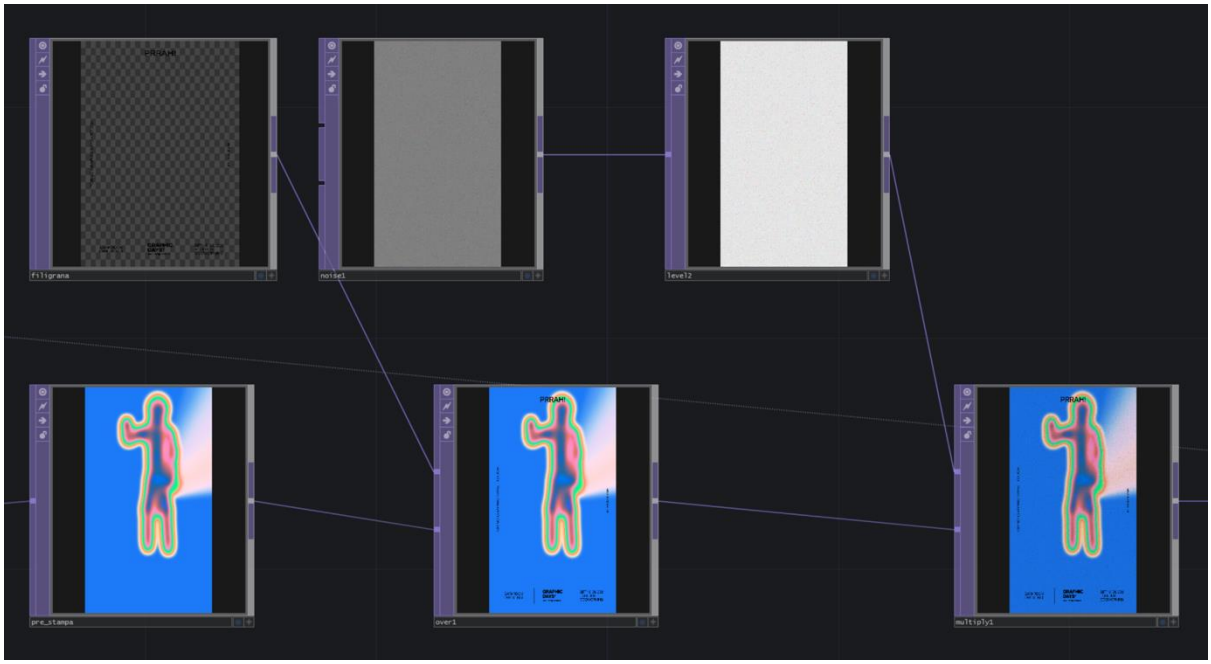


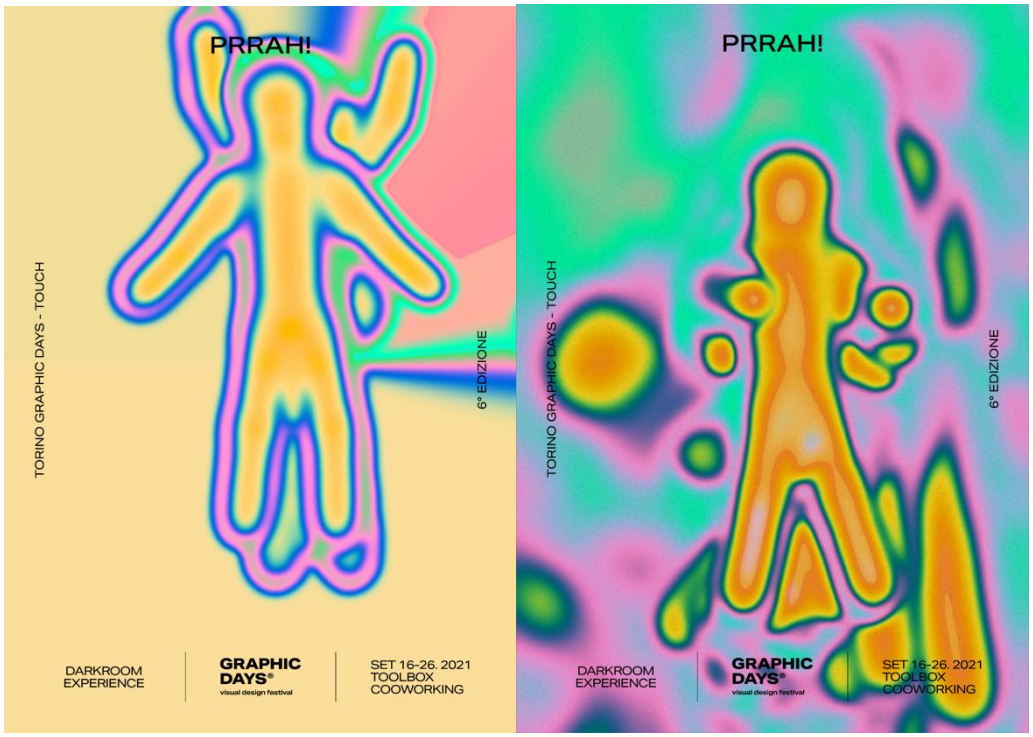
Having designed the human figure in the manner illustrated above, the proportions of the user are respected but at the same time its distinctive features are deliberately left out, thus making it an anonymous and thus universal subject. To achieve the visual composition, it is necessary to decide how to colour the human figure and the background against which it stands. Numerous tests were carried out to determine the best material and colour for the human figure in order to obtain a good colour rendering of the visual.





The colour presented in the visual is obtained by the *lookup* function, which uses the *render* of the 3D object as the first input and a *ramp* with a palette of 6 colours as the second input. The result is eye-catching tones. To achieve the ethereal effect of the colours and the outline of the human figure, a feedback loop with different blur operators was designed to soften the edges of the outlines. The overlay function was used to add the lettering and grain effect. Thus, the person is the very “brush” of the work since when movements are made abruptly and quickly, curious compositions are obtained.


filigrana
noise1
level2
pre_stampa
over1
multiply1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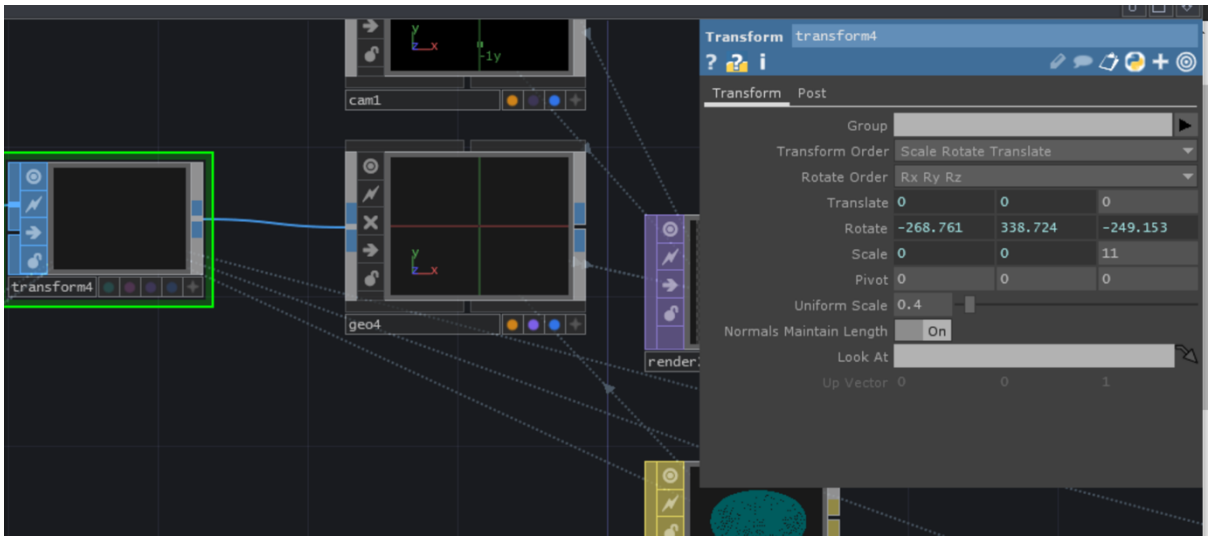
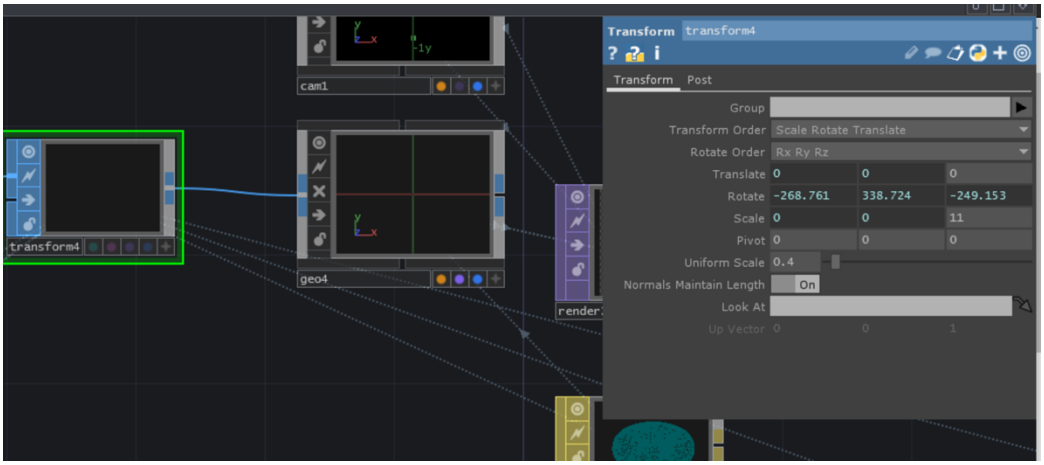
Form:

The second visual composition and panel is focused on the concept of form. A Kinect 2.0 motion detector is used at this location, which picks up the position in space of the visitor's hands and translates them into useful information for the composition of the visual. At the beginning of the experience, an ellipse is projected on the monitor, rotating in space around all three axes at different frequencies to achieve a randomness effect.

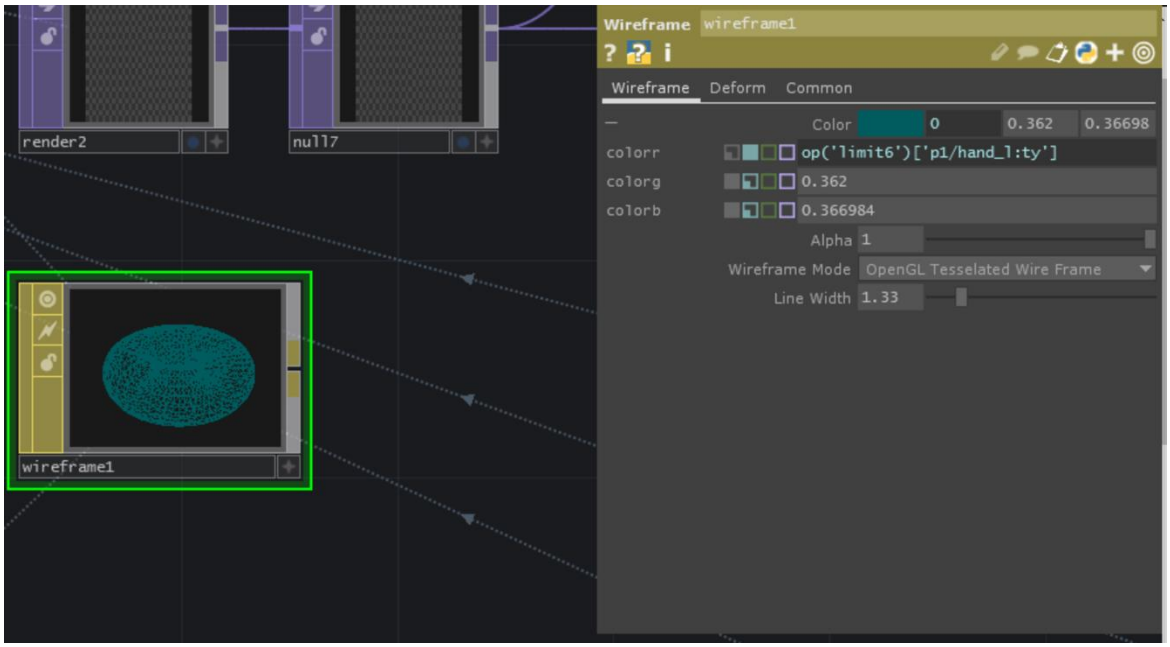


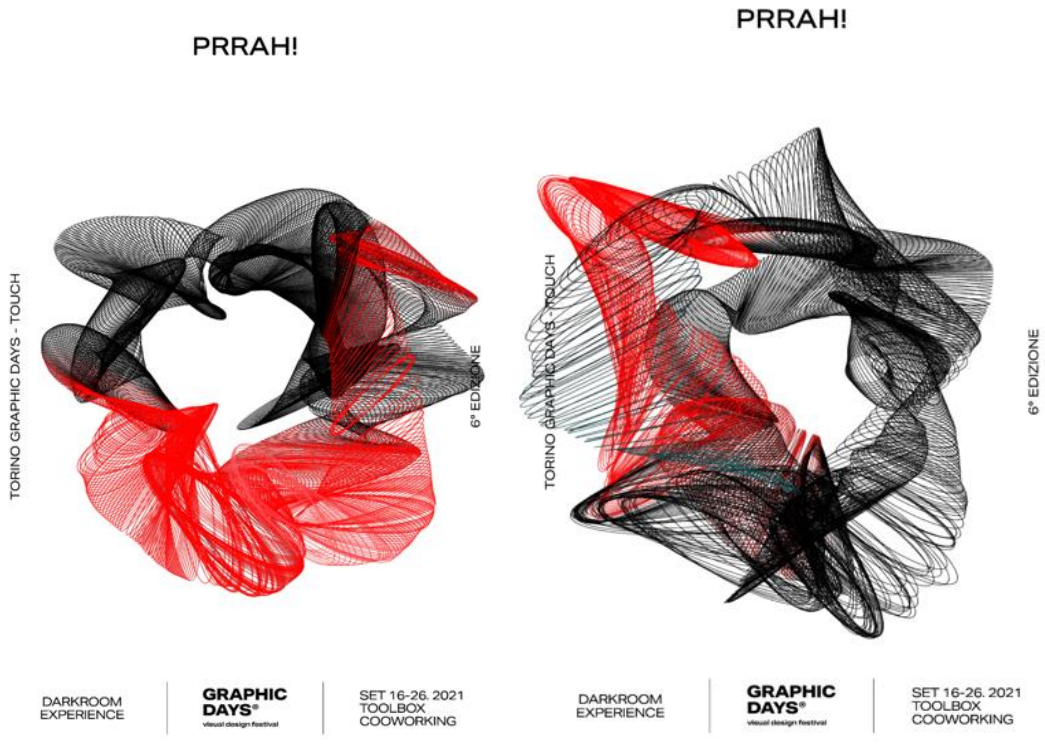
The three nodes shown in the figure are LFOs (low frequency oscillators), they synthesize curves using a choice of common waveforms like Sine or Pulse, or it repeats a

prepared incoming curve (LFO CHOP, 2021) The values are exported upon rotation of the ellipse as shown in the figure.



Its position is determined and synchronised by the movement of the user's right hand in the YZ plane. This allows the user to move the plane figure inside the layout to create the desired composition. In addition, with the depth of the right hand (XY plane) the diameter of the ellipse varies to make the output even more complex. With the left hand, in the XY plane, it is possible to vary the colour (going through all degrees of hue). The expected result is an irregular solid composed of the extrusion of the starting ellipse space.


render2
null7
wireframe1
Wireframe
wireframe1
Wireframe
Deform
Common
Color
0
0.362
0.36698
colorr
op('limit6')['p1/hand_l:ty']
colorg
0.362
colorb
0.366984
Alpha
1
Wireframe Mode
OpenGL Tesselated Wire Frame
Line Width
1.33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Lettering:

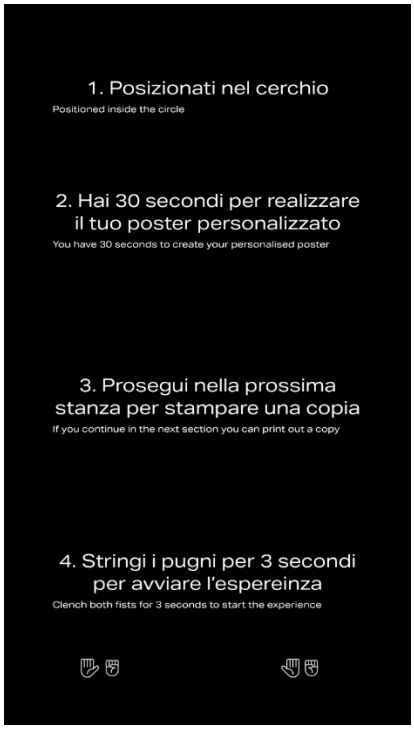
The last visual installation is based on lettering, in other words the customisation of a typeface. The user can choose a letter of their preference by the movement of their right hand in the YZ plane. With the movement of the left hand, it is possible both to change the size of the letter along the Y and Z axis and to choose the font with the depth along the X axis. Furthermore, depending on the distance of the user from the presence detector and the inclination of the head, backgrounds with different colours and effects are achieved. From a technical point of view, the method for changing letters and fonts is the same: the height of the right hand, relative to the user's body, is converted into a number, which in turn is converted into a letter.

The data collected by the Kinect 2.0 is read by the Touchdesigner software and converted into integers; they start at 0 and go up to a maximum of 25 (corresponding to the 26 letters of the alphabet) and are used to select the cell of a vector containing the required letter thanks to the equation: op('table1')[int(op('limit2')[0]),0]

Letters are thus positioned against a backdrop defined by a *noise* with the following parameters. Based on the final choice of the user, the colours of the background are obtained through the use of a *lookup* between *noise* and a *ramp*, while the variations of the visual are generated by the *noise*.

Each workstation has a layout with a black background and white overlays to provide the necessary information for the visitor to make the most of the experience and fully understand the instructions to be followed. What the three stations have in common is the way the experience is triggered. Thanks to Touchdesigner and the Kinect 2.0, it has been possible to implement a loop whereby, when the user stands in front of the monitor and clenches both fists for three seconds, the projection of the visuals begins. There is a visual loading feedback on the screen that allows the visitor to understand the consequences of their actions. The subject then has thirty seconds to create their own visual before a photo of it is

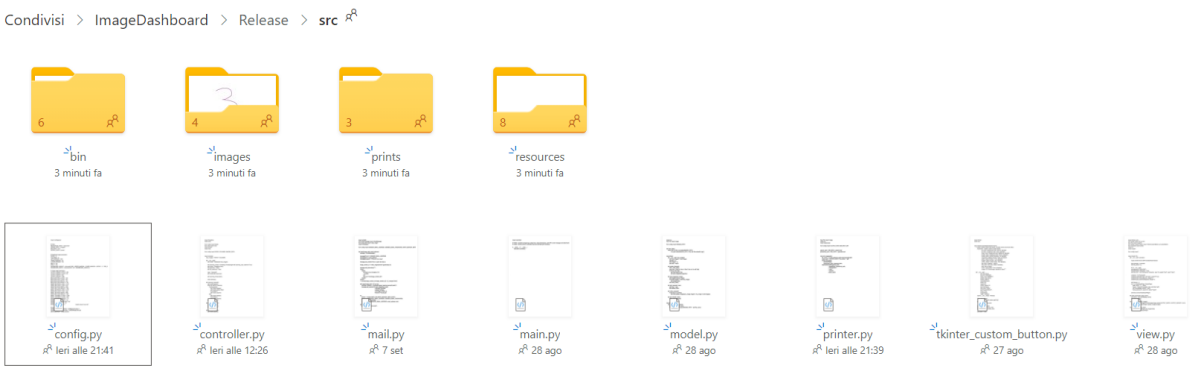
taken. Once the experience is over, a screen appears with further instructions for printing the visual, and then, after 3 seconds, the screen appears with instructions for the next user, then it is possible to continue to the next location or go directly to print it.



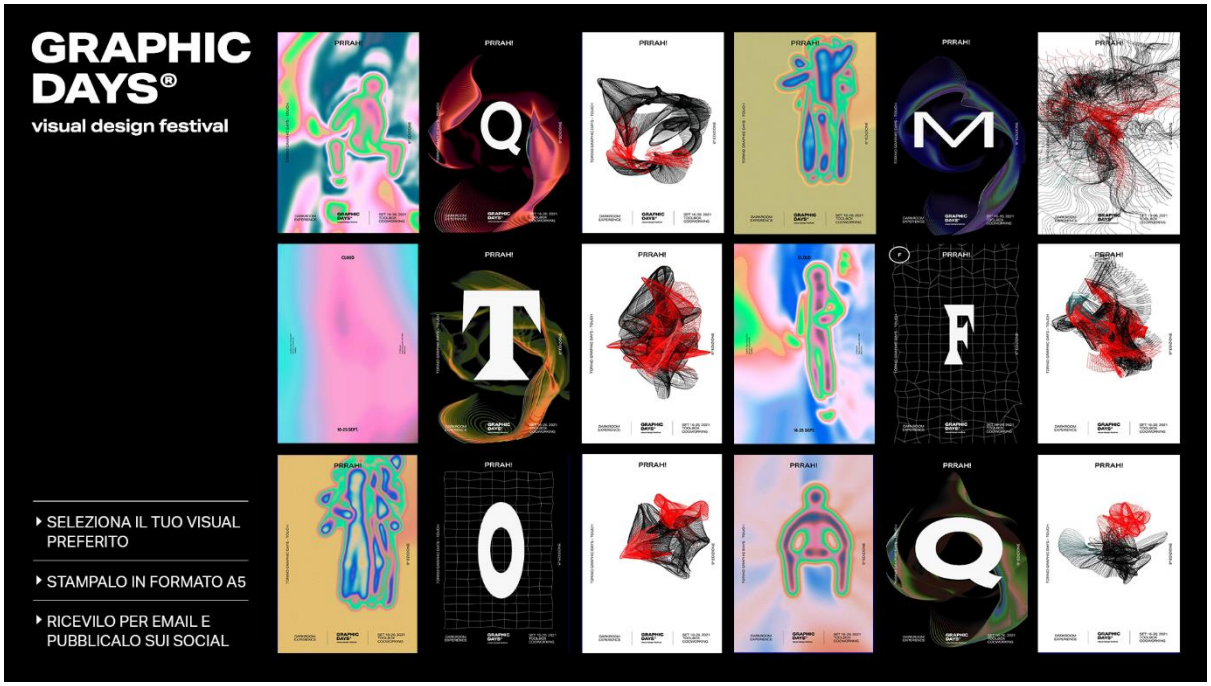
Synthesis

In accordance with the theme of the Graphic Days ® exhibition in September 2021, which focuses on the concept of Touch, a printing station has been set up in the last section of the exhibition area dedicated to the project. In this space visitors can materialise their own artwork created in the previous area. The aim is to get the works the public generates into their own homes and, at the same time, to share them with others. In fact, each visual will be printed in two copies: one to take home and the other to pin on the walls of the room to create a collective composition.

In order to realise the print flow, a Python program has been programmed, which allows a direct link between the visitor and the printer. To allow the user to print their own copies, a computer network was set up connecting a folder for each of the three PCs in the fourth room to a router communicating with another computer connected to the printer in the fifth room.



Upon arrival in the printing room, the visitor will find a computer with the following interface:



After selecting your own visual, you can use a further screen to print and e-mail your output. In fact, the software has been programmed to recognise the validity of an email and send the visual in 1748x2480 pixels, in other words, 300DPI quality in a A5 format.

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