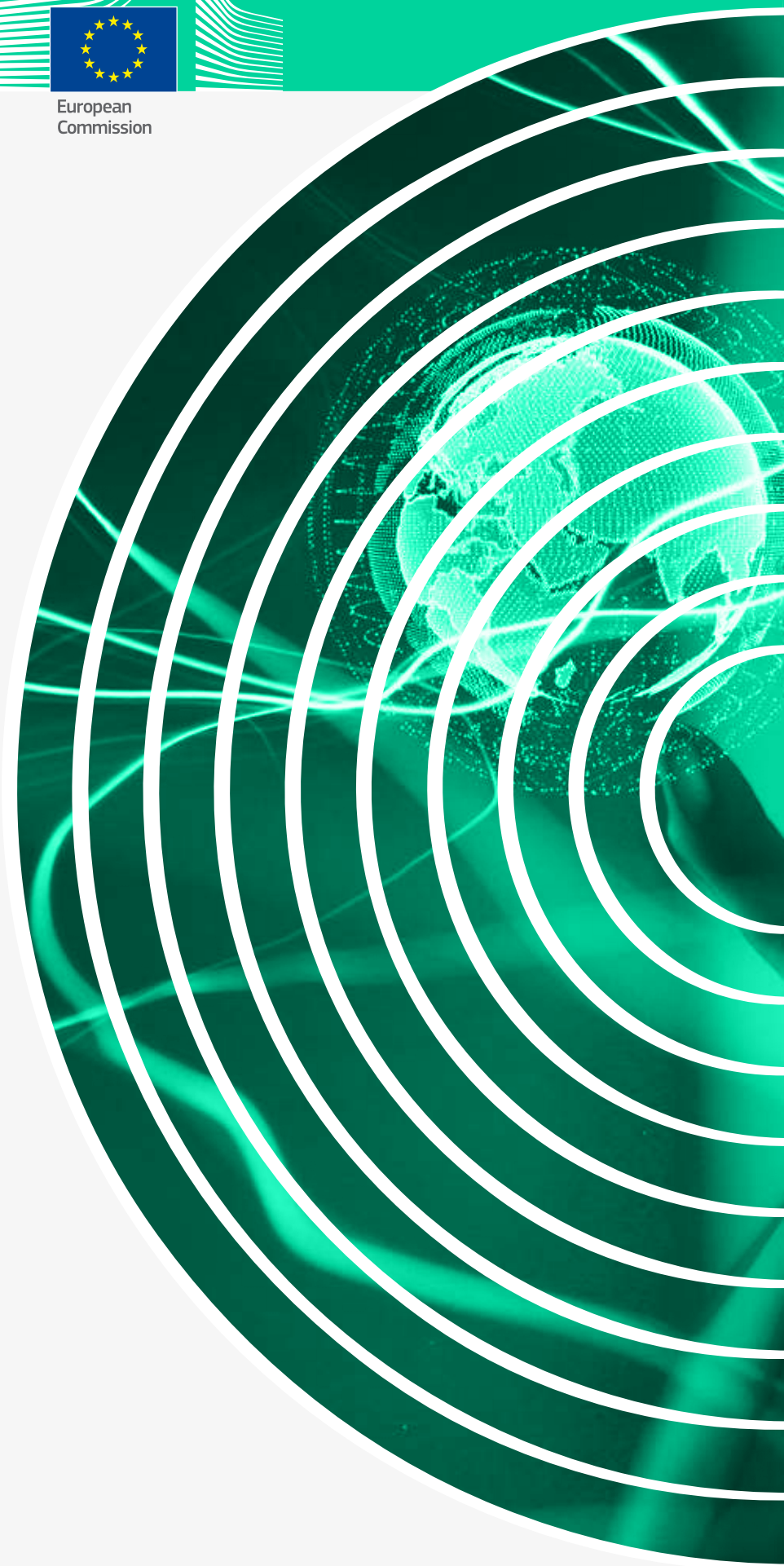



State of the Art: The Musense Project in Context





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1. Introduction

The Musense Project was designed to accomplish two equally significant goals or purposes. The first is to gather as much information as is necessary to be able to draw as comprehensive a picture of how evolving technological means and processes are and will affect the delivery and reception of virtual performance. Virtual Reality (VR) as a concept, provides the contextual background upon which the Musense Project rests. By having this as the model, not only are we able to provide the necessary information about VR, but also allow the project researchers to achieve the second of the two purposes, that being the opportunity to shape the very thought that might produce new and or added value in the creation and evolution of virtual reality itself. Often, the creative process may be viewed in two parts. The first is what is, the second being what is possible. The second of these two parts is perhaps the more speculative but certainly the one that transforms imagination into reality. As is well known, many great inventions are driven by impossible visions or seemingly unacheivable goals.

This report strives to present various aspects of the concept of Virtual Reality and how these relate to both the music world and greater society. The survey that appears as the second item in the report is a stock taking of the understanding, readiness and adoption of virtual technology project partners and stakeholders actually have. It provides a small but realistic picture of where we find our institutions and ourselves in relation to the idea of VR. It tests four main areas, the current situation, current practices, organizational preparedness, and an open-ended question section that explores how musician envision the VR concept.

The third part explores the social ramifications of VR. It does so from as many perspectives as possible because the musical society is comprised of many parts each of which is directly affected by this revolutionary technology. These include the creators, the promoters, the producers, the disseminators, and the receivers. The effects of VR have artistic, technological, financial psychological and sociological effects on each of the categories previously mentioned. Thus, the discussion is broken down into each social category of the musical realm. The supplemental materials of the fourth section are given to amplify the scope of the second part in providing further materials not covered by part two.

Section five provides a series of case studies that aims to clarify how we as a collective view and define the whole concept of cyber and then how this creates relations to the musical



realm. The result is a surprising set of new possibilities that amplify both the quality and variety of thought that might be entertained with regards to both components.

Part six delves into how The Musense project envisions how concepts and technologies presently used in the music industry may be used in the areas of cyber performance, long distance performance and education.

The second-to-last section is both a discussion and bibliographical resource that provides invaluable information not only on how the pandemic spurred and affected the adoption of technology but also on how the new Technologies and technological trends are evolving.

The final section of the report looks at how the structure and process of Musense project relates to the 2030 Agenda set forth by the United Nations. This is done with regards to the project's adherence and or affinity to the dictates of the agenda concerning the concept of sustainability in the broad sense as well as its narrower meaning when considering education.

2. The Musense Survey of the Partners and Stakeholders with re- gards to Virtual Reality

Through a digitalization of the learning experience, both instructors and students can improve their skills to create a more engaging and effective education process. Education's evolution requires a shift in administrative and educational technologies to support new and evolving ways of teaching. The powerful changes in the socio-economic-education system change specifically in higher education such as education's standard, quality, decentralization, and virtual and independent learning. We need to identify strategic technologies and learning trends to meet the needs of today's learners, faculties, and staff. For integrating digital transformation capabilities, universities leverage their delivering approaches, shaping their learning and development, delivery, and continuous improvement mechanisms. Virtual learning has established powerful informal networks, these are used by the students to share information and facilitate their connection. Virtual learning becomes an influencing process to facilitate collaborative sharing. Virtual education has increasingly challenged us to decentralize our education and adopting effective decentralization of education requires the universities to develop specific roles to support the process of decentralization.

Cyberformance is a live performance that utilizes internet technologies to bring remote performers together in real-time, for remote and/or proximal audiences. In cyberformance, we are taking digital media and information technologies and pushing them to their limits with our creative experiments, discovering insights in areas such as computer-mediated communication, social interaction, and the impact of technology on human life. This is our



contribution to “a new renaissance in the creation, distribution, and sharing of information, knowledge, and creative work” and a “move from industrial content production towards community-based inner creativity”. Using the internet to experiment and produce alternative performances, resulting in the creation of new forms. The time of this new form was a specific, limited, and shared time when performers and the audience came together in the same moment to experience a live event.

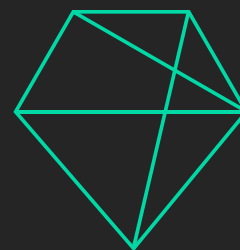
The capabilities of immersive technologies provide a stimulating experience we have never done before. Streaming technology has appeared in multiple forms and has expanded over the past decade, helping to increase our interaction and immersion in music. Screenless technologies Visual Image Displays based on the reflection of light, virtual retinal display which is directed onto the retina of our eyes, and synaptic transmitting the signals directly into our brain through the optic nerve will change the world we see. Spatialized Sound, sound processed to give the listener the impression of a sound source within a 3D environment will change the world we hear. Stimulating the senses of touch and motion in remote operation or computer simulation, especially to reproduce the sensations that would be felt by a user will change the world we feel. As storytelling platforms, immersive approaches serve us as creative tools. We have the capability to create different stories using these technologies.

As immersive technologies have become more widely known and available to the general public, “XR” (or “extended reality”) has become an umbrella term encompassing augmented, mixed, and virtual realities in ways that can merge the physical and virtual worlds. XR does not refer to specific technologies but how this entire category of technological development extends and enhances the human experience (Lee, M. J. W., Georgieva, M., Alexander, B., Craig, E., & Richter, J. State of XR & Immersive Learning Outlook Report 2021. Walnut, CA: Immersive Learning Research Network).

The Musense Project is conducting this survey to collect data that will help it forecast possible future outcomes in the area of cyber music performance. This notion forms one of the core components of the Musense Project, dedicated to the exploration of musical issues in an ever-evolving cyberspace. The pace of change of XR in education and elsewhere is due to the remarkable work of researchers, faculty, students, and artists. The survey rests partially on the belief that human premonition is helpful in forecasting future events. This report represents the collective voice and opinions of the participants.

PART 1

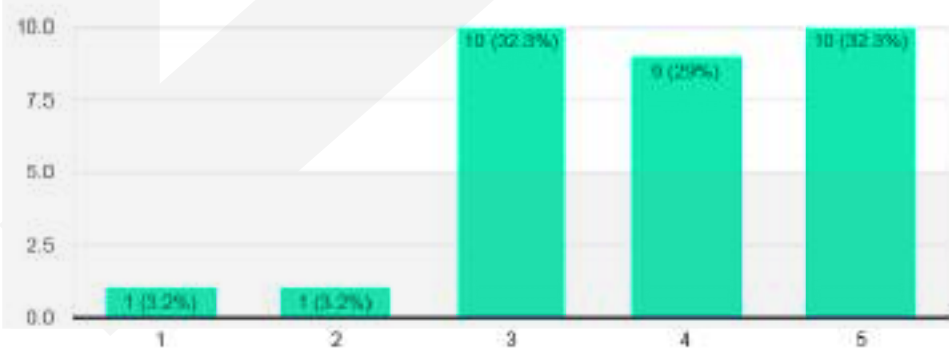
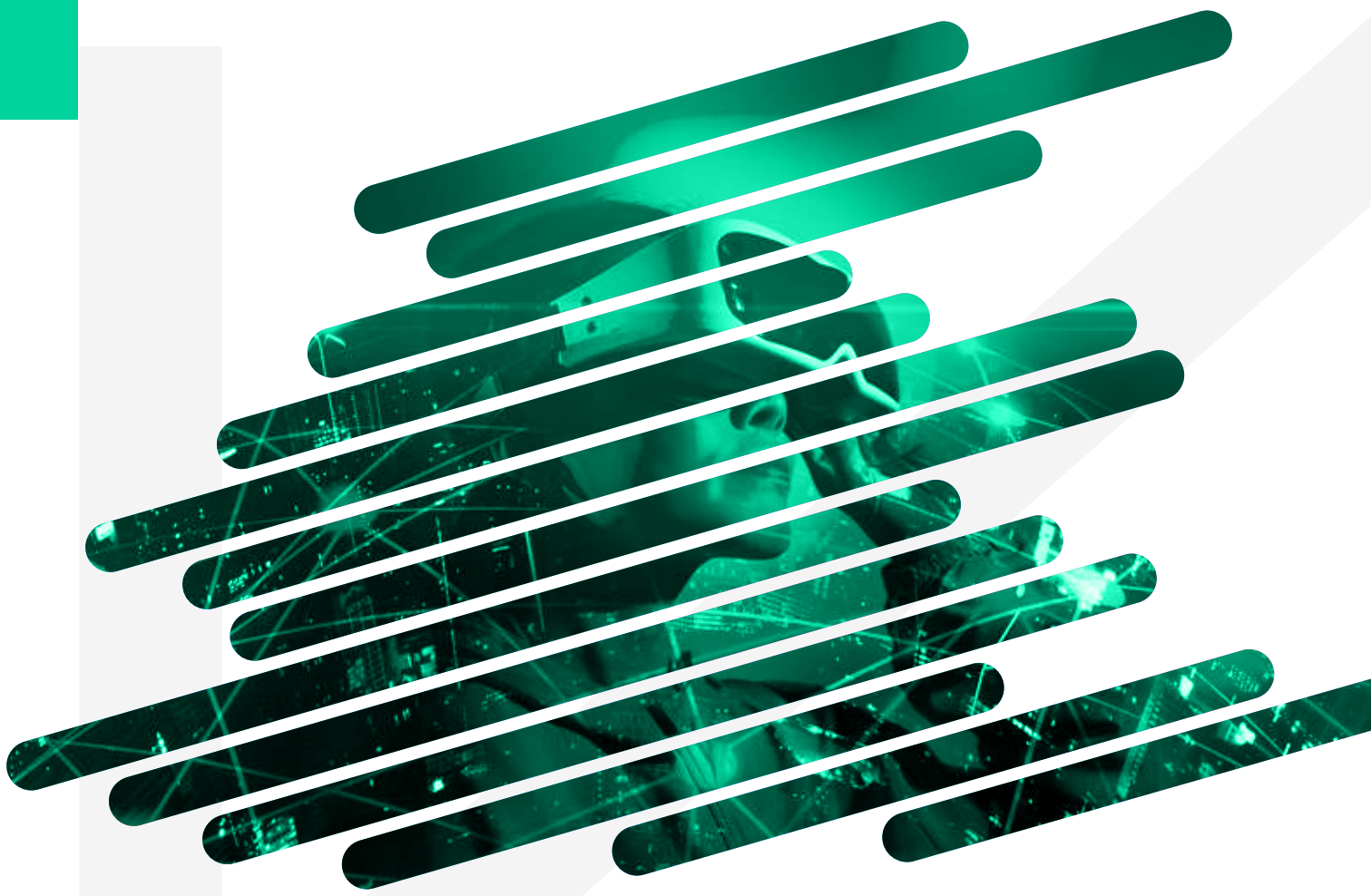
Current Situation:



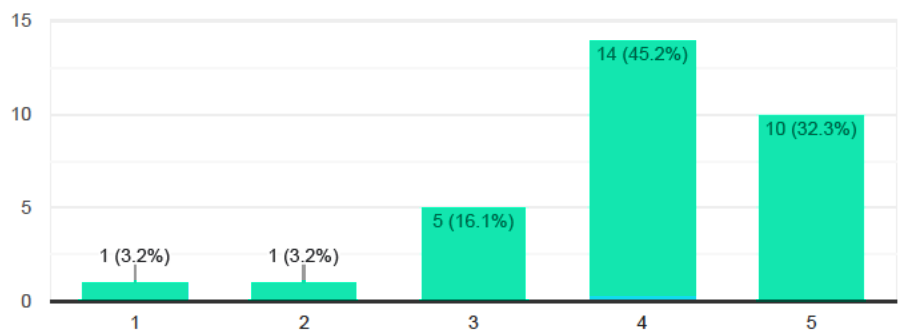
To improve this questionnaire, some questions have been asked about attitudes and thoughts about technology, their remote experiences, and preferences. 51,6% of the survey participant are female and 48,4% of them is male. Their ages are mostly 35 or more (87,1%) and fewer of them (12,9%) are between 18 and 29. They have been using digital Technologies for at least 3 years and more, they have 10 years experience (67,7%), 6-9 years experience (16,1%), and 4-5 years experience (9,7%). They describe themselves and their private use of digital technologies; find it easy to work with computers and other technical equipment (96,8%), and use the Internet extensively and competently (100%). Approximately all of them (96,8%) are open and curious about new apps, programs, and resources, and 80,6% of the members of various social networks. Only 51,6% of them develop digital content, activity, apps, programs, or resources.

Most of the participants have thought that they are skillful in using technology (93,6%), remote technologies are compatible with their work style (93,6%) and they are motivated to interact remotely (87,1%).



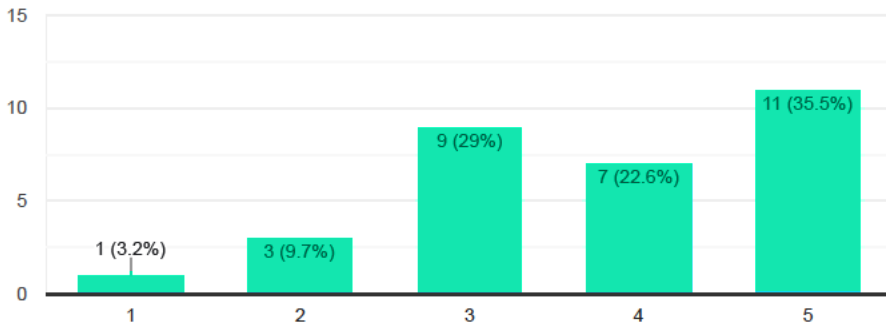


Q1.1: I am skillful in using technology



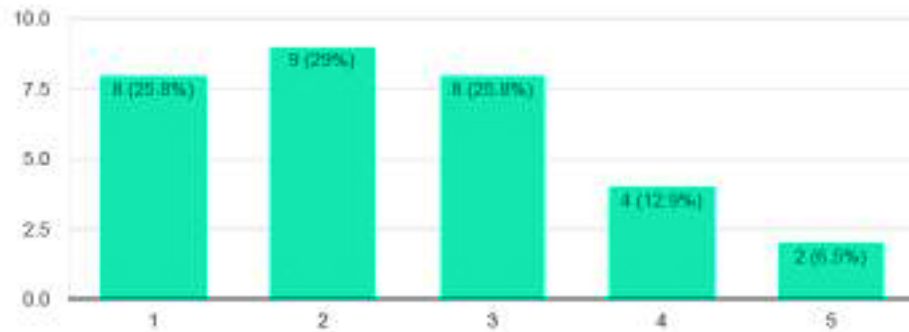
Q1.2: Remote technologies are compatible with my work style



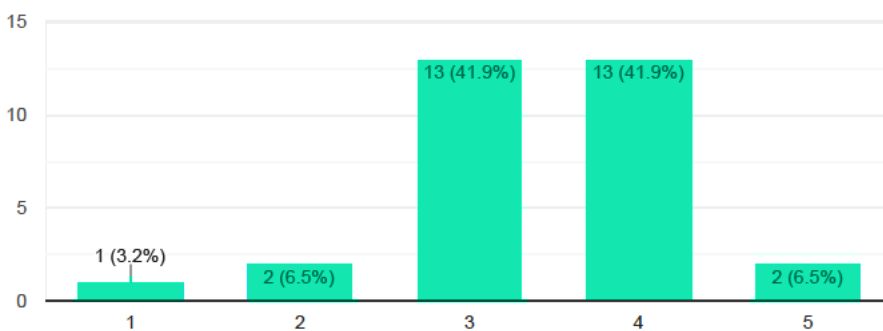


Q1.3: I am motivated to interact remotely

Although they believed that interacting remotely is stressful (83,9%) and the quality of remote experiences is not the same as face-to-face experiences (80,6%), 90,3% of them have found the advantages of remote experiences outweigh the disadvantages.

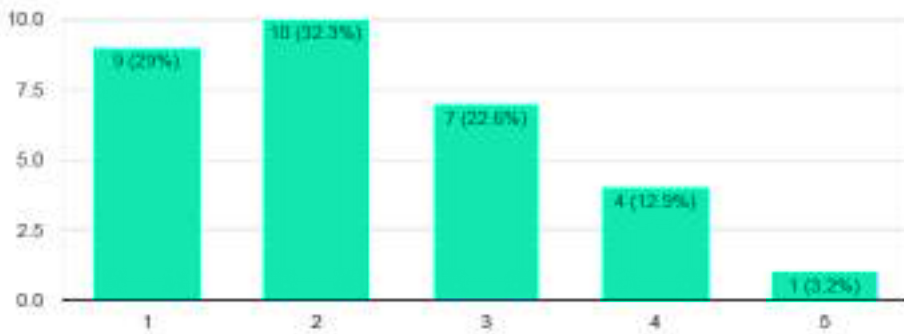


Q1.4: The quality of remote experiences is the same as face-to-face



Q1.5: The advantages of remote experiences outweigh the disadvantages



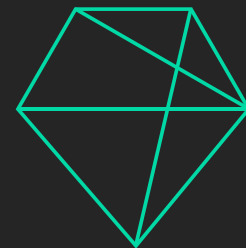


Q1.6: Interacting remotely is stressful for me

When thinking about disruptions to their learning during the COVID-19 pandemic, 93,6% of them thought that the pandemic has forced their organization to rethink how workplace training is designed and delivered to ensure that it is effective even in remote setups. The pandemic has forced 96,8% of their organization to think of new ways to increase collaboration between employees, especially when they're working remotely and the pandemic has accelerated the adoption of cloud technologies, forcing their organizations to quickly upskill employees on the technologies using innovative learning methods.

PART 2

Current Practices:



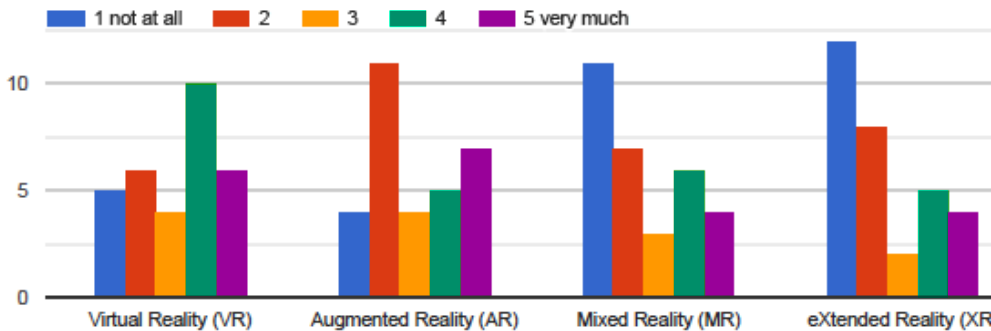
The immersive technique combines digital and real-world elements in a way that enables users to interact in a virtual environment naturally. In an immersive environment, the user may come to accept artificial parts of the environment as a piece of the total and lose awareness that they are present.

Virtual worlds are both hardware and software products that give users the ability to modify and replace real-world environments to get more information than they can from them. And along the virtual world spectrum, which extends from a purely physical world at one extreme to a fully virtual reality experience at the other, immersion technology is available in various places.

The virtual world refers to augmented worlds and virtual reality which substitutes for the person's surrounding world. The marketplace for interactive technology is developing quickly, with participants using a variety of tactics to draw customers, solidify their positions, and keep up with industry developments. To improve customer experience, industry companies are applying immersion technology in a variety of contexts, including e-commerce, interactive web applications, immersion marketing, brand experiences, and specific geographical explorations. Technological development and digitalization have been primary forces behind the adoption of emerging technologies across sectors. The workforce is being significantly influenced by new technology like virtual reality and artificial intelligence. In addition, immersion technology is evolving from a mere marketing trick to a useful instrument for creating value for such a community and the economy as a whole. This growing use of augmented worlds in manufacturing provides a chance for the interactive virtual industry to expand over the coming decades. These tools are used to deliver instruction in a variety of fields, such as defense, aviation, construction, academia, and

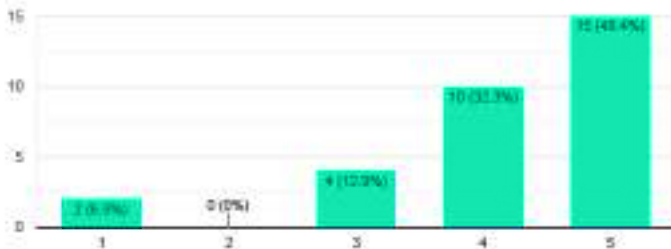


medical, and they employ interactive images to show a broad range of scenarios. Organizations are always pursuing technological advancements in this area to order to give clients a more interactive experience. Virtual reality (VR), augmented reality (AR), mixed reality (MR), and extended reality (XR) are examples of immersive technologies that have the potential to enrich our lives in so many ways. Immersive technologies are moving out of laboratory settings and theoretical applications and becoming fully-fledged, revenue-generating marketplaces. Their current practice of immersive technology in their experience has shown that 54,9% of them have the opportunity to try any type of VR/AR/MR/XR system (mobile, desktop, glasses, etc.). Only one-third of them (32,3%) have an opportunity to try more than once and approximately half of them (45,2%) have no experience with these technologies. The figure below shows that half of them are aware of the potential of VR and AR. While some capabilities are technically possible today, most of them are not aware of the potential of these systems.



Q2.1 I am well-aware of the potential of VR/AR/MR/XR

Although most of them (93,6%) are in favor of experimenting and testing new technologies, 22,6% of them is used these different kind of AR/VR/MR/XR devices and solutions.



Q2.2 I am in favor of experimenting and testing new technologies



Q2.3 I use a different kinds of AR/VR/MR/XR devices and solutions

Based on their VR/AR/MR/XR experience only a few of them find the sensory perception in a virtual environment analogous to reality, thinking that the movement inside a virtual environment is real. They didn't think their senses were stimulated by the virtual environment and they felt that they could perfectly control their actions. Only 25,6% of them have thought that their work promotes the use of AR/VR/MR/XR devices and solutions. 71% of these participants have said that they need external support for technological issues and how to use these technol-



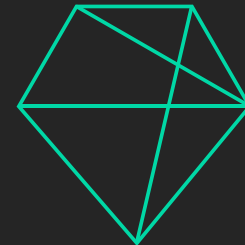
ogies and need external support when adapting business processes of these technologies. 74,9 % of them need external support with training their colleagues to use these technologies and 80,7% of them need financial support to buy them. 74,2% of them prefer to resist using AR/VR/MR/XR solutions. Half of them (54,8%) have no plans to adopt these technologies (virtual/augmented or mixed reality) in their life and or work. Only 12,9% of them have adopted it, 12,9% of them are in the initial phases of implementation and 9,7% of them plan on adopting these technologies next year. Although 6,4% of them have no plan they thought they should adopt these technologies to their work and 3,2% of them try to find a budget for adopting these technologies. Their attitudes and desires with regard to the adoption of VR/AR/MR/XR Technologies in their life and or work are given below:



Q2.4 What are your attitudes and desires with regard to the adoption of VR/AR/MR/XR Technologies in your life and or work? (Multiple Choice)

PART 3

Current situation of organizations:

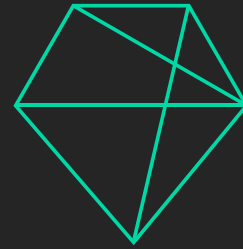


Participants have mentioned that they have or access to VR/AR/MR/XR compatible devices like Oculus and software/hardware packages that allow musicians to perform and interact together synchronously in real-time with high-quality audio headsets, LOLA (LOW LATency audio visual streaming system) and Polycom. For the digitalization of content, process, or product they mostly prefer digital learning environments, giving concerts, lessons, workshops, podcasts via the internet, live events, and networked music performance and teaching activities. Not only digitalization of contents they also prefer to use digital technologies for registration processes, application forms, tutorials, and advertisements. The education response during the early phase of COVID-19 focused on implementing remote learning modalities, concerts, lessons, workshops, masterclasses, lectures, and performances as an emergency response. These were intended to reach all learners. Also, some remote conferences (Teams, Zoom, YouTube Streams), and remote collaborative concert performances (Sonobus), use digital tools to organize events (Whoova) that makes events modern and trendy, attract and engages attendees effectively and help event organizers save time when managing event logistics.



PART 4

Open-Ended Questions



The open-ended question “How can we engage both proximal and online audiences?”, “What is your thought about communication and interaction in a cyber performance between audience members, and between audience members and performers?”, “How does cyber performance transform the role of the performer?”, “What are the new skills for cyber performance?” and “Which technologies do you think will shape cyber performance in the next decade?” are asked to reveal their opinions, experiences, and narratives.

How can we engage both proximal and online audiences?

In a virtual environment, engagement isn’t just getting people to watch or listen to the content you’ve created. The objective of your engagement strategy should be one step further: to inspire your participants to tell you, and one another. By ensuring an acceptable art experience to both of audiences and providing significant additional experience through the XR or giving them a feeling to be part of the event and the group experience. It can be possible with a hybrid/merged reality approach. First of all, we need ideas and things to say. Whatever the tool, the quality and content should be the priority, then, technology can help us make our life easier and connect people around the world.

What is your thought about communication and interaction in a cyber performance between audience members, and between audience members and performers?

Remote and hybrid teams can now connect easily with colleagues they would never meet in their everyday work. Getting to know team members from other functions, in other job roles, across regions and countries helps build relationships, trust, and collaboration, in and out of training. But we have to be careful not to substitute real performance. Cyber performance should be aesthetically justified. It can be greatly enhanced by listening, playing, and enjoying. The audience loves to be involved and then the choice of technology comes later, according to the problems that have to be solved.

How does cyber performance transform the role of the performer?

Over the years, technology has played a key role in shaping the music industry. Technology has changed how people create music. Musicians can play for fans around the world through live-streamed performances. The role of the performer needs to be rethought. The audience is unknown, rather than in front of them, and this makes a performer less able to respond to the nature and needs of their audience. The cyberspace allows the audience to be closer to the artist without compromising the performance. The performance can be perceived as a collective event or even a private one.

What are the new skills for cyber performance?

First of all, the performer needs to have strong skills as a performer. Musicianship cannot be replaced. Then, the performer can enhance his/her work through means of technology, streaming music all around the world, or inventing new performing styles and strategies. Knowledge of the medium is an essential skill for reaching the audience. Artists should be fully aware of the possibilities of the new media. It’s too early to say, but flexibility and openness are crucial.

Which technologies do you think will shape cyber performance in the next decade?

Visual and sound aspects are quite well developed, even if they still need optimization. Other sensory feelings are still to be developed. Also, a great effort should be done for reducing the digital divide and make XR more democrat-



ic. This should be done by optimizing the use of low-cost and traditional technology, such as improving XR in mobile and low-cost desktop apps. As we move forward, digitalization will continue to shape us and the way work is being distributed (remotely, asynchronous, through collaborative teams) takes us a step further. The human mind. All dreams start from that. Especially merged and extended reality, mobile networks (6G), automation and AI-based solutions will bring higher productivity, improved performance, and a greater need for new skills.

3. The Social Implications of Virtual Reality

A Brief Historical Background

The origins of Virtual reality (VR) technology can be traced to the 1960s when the earliest theories and applications were developed by Ivan Sutherland at the Massachusetts Institute of Technology (MIT) who created the world's first virtual reality head-mounted display (HMD) . In 1968, Myron Krueger developed the world's first interactive art installation using a computerized vision system. It allowed users to interact with virtual objects projected on a screen.

In the following decade, a variety of researchers began exploring the potential of VR technology for practical applications. Thomas Furness III of the US Air Force developed the first flight simulator using a variety of sensors, displays, and computers . At the University of North Carolina at Chapel Hill, researchers developed the first immersive virtual environment, called the Aspen Movie Map. This system allowed users to explore a 3D representation of Aspen, Colorado.

During the 80s, virtual reality technology advanced significantly. Jaron Lanier created VPL Research, a company that developed several products, such as the DataGlove and the EyePhone HMD . In 1989, Lanier coined the term "virtual reality." During this decade, several experiments involving VR were conducted in various fields, including psychology, medicine, and education. The concept of virtual reality evolved to encompass a variety of technologies, such as virtual reality gaming systems and virtual reality simulators. In the early part of the decade, Sega released the Sega VR-1, the first commercial virtual reality gaming device. By the mid-90s, the Virtuality Group released the Virtuality 1000CS, a full-body virtual reality simulator. By the end of the decade, a number of companies were developing virtual reality products for the consumer market.

The first decade of the 21st century saw the emergence of a new generation of VR technologies. Among these are the Oculus Rift, the HTC Vive, and the Samsung Gear VR. These devices enabled users to experience a real sense of immersion and interact with virtual environments. In addition, a variety of augmented reality (AR) platforms were developed during this period, allowing users to view a combination of real-world and virtual elements. In the subsequent decade, advances in virtual reality technology, with the development of haptic feedback devices and more sophisticated virtual reality headsets emerged. In addition, a variety of applications were developed in fields such as education, healthcare, and entertainment. During this period, social VR platforms such as AltspaceVR and VRChat enabled users to interact with each other in virtual environments .

1 Aryabrata Basu. A brief chronology of Virtual Reality. arXiv:1911.09605v2 [cs.HC] 22 Nov 2019.

2 <https://voicesofvr.com/245-50-years-of-vr-with-tom-furness-the-super-cockpit-virtual-retinal-display-hit-lab/> virtual-world-society/

3 <https://www.vrs.org.uk/virtual-reality-profiles/vpl-research.html>

4 <https://fortune.com/2015/05/20/altspacevr-social-vr/>



Today, virtual reality technology is being used in a wide range of fields, from entertainment to healthcare. The technological advances taking place at present are so numerous and occurring at such a pace that it is almost impossible to list them all.

General Infrastructure and Virtual Reality Music Concerts/Performances

At present Virtual reality (VR) technology is showing immense potential for applications in many different areas. In recent years, the technology has been used in a variety of industries, from gaming and entertainment to healthcare and the military. As technology improves and becomes ever more accessible, it has acquired the potential to revolutionize the way people interact with each other and their world. The technological infrastructure for virtual reality is presently composed of various components. At its most basic level, VR technology requires a computer and a headset used to access and display the virtual world. The headset must be connected to the computer and have an appropriate display, such as an LCD or OLED one. The headset must also be equipped with sensors to enable motion tracking, allowing the user to move through the virtual world .

In addition to the headset and computer, the technological infrastructure for virtual reality also includes software and hardware components. Software components such as game engines and 3D engines enable the creation of a virtual world. Hardware components such as motion controllers and haptic feedback devices enable the user to interact with the virtual world.

Advancements in VR technology have led to the development of virtual reality experiences that are ever more engaging. Companies such as Facebook and Microsoft have developed their dedicated platforms for virtual reality, with Facebook's Oculus Rift and Microsoft's HoloLens being some of the most popular. These platforms enable the user to experience virtual reality more interactively and realistically .

The development of more powerful graphics cards and processors has also enabled the creation of more realistic virtual worlds. This has allowed developers to create even more immersive experiences that are capable of providing a more realistic sense of presence in the virtual world.

When we consider the musical realm, VR has been transforming the live music experience for audiences. Technological advancements of the most recent years have made possible a new type of virtual reality music concert. It is one which allows concertgoers to be fully immersed in a 3D environment that features their favorite artists and musical genres.

To best tackle the subject, it is incumbent on one to understand what a VR music concert is. The concerts themselves consist of live performances that take place in a virtual 3D environment that allows the audience to immersively experience both the auditory as well as visual aspects of the performer and performance.

5 Oluleke Bamodu and Xuming Ye. Virtual Reality and Virtual Reality System Components. Proceedings of the 2nd International Conference On Systems Engineering and Modeling (ICSEM-13). file:///C:/Users/paolo.susanni/Downloads/5686%20(1).pdf

6 <https://cointelegraph.com/metaverse-for-beginners/microsoft-metaverse-vs-facebook-metaverse-what-is-the-difference>

This type of concert is typically created and streamed with the help of advanced technologies such as motion capture, virtual reality headsets, and 360-degree cameras. The audience can join the concert from anywhere in the world, and they can select the viewpoint they wish to take during the performance. In some instances, they may even interact with one another and even give feedback. VR music concerts offer several advantages compared to traditional live performances. They allow the audience to experience the concert without the need to travel to a physical venue. VR concerts offer a level of customization that is not possible with traditional concerts in that the audience can select their own viewing angle as well as the type and intensity of the visual and audio effects they wish to experience. This makes the experience more personal and allows the audience to be more engaged in the performance. In a certain sense, the audience customizes the experience to best suit themselves. They are interpreting the concert in some ways similar to what the performer does with the music they are performing.

Despite these advantages, there are still several challenges that need to be addressed for VR music concerts to reach their full potential. One major challenge is the need for more advanced technologies and platforms that can stream high-quality 3D content in real-time. There is also a great need for more content creators and promoters to produce and distribute virtual reality music concerts. Because we find ourselves in the earliest stages of this evolution, much must be solved to understand how these events can be used to engage new audiences and create meaningful relationships between artists and their fans. VR music not only brings the live music experience to audiences but also provides a level of customization that is not possible with traditional concerts. As technology continues to improve, the potential of VR concerts to revolutionize the way audiences experience live music will only continue to grow.



Latest Technological Advances

In recent years, advancements in VR have enabled the creation of more immersive and realistic experiences that allow users to explore and interact with digital spaces in extraordinary ways. This statement is not meant to impress but rather to allude to the most obvious implications for the future of this technology. Hardware advances are directly responsible for the growth of virtual reality technology. Over the course of the last few years, the cost of producing high-quality VR hardware has decreased significantly. As a result, it is now possible to access sophisticated devices at a fraction of the cost of previous generations of hardware. This trend is expected to continue, with the introduction of more powerful and affordable headsets and accompanying hardware. Just as critical to that growth are the advancements in software. Companies are now producing highly sophisticated software tools and engines to create immersive and interactive virtual environments. These are designed to provide users with a more realistic and immersive experience. The development of these tools and engines has allowed for the creation of increasingly sophisticated and realistic virtual worlds that can be experienced in real-time.

7 MichelWedel, EnriqueBigné, JieZhang. Virtual and augmented reality: Advancing research in consumer marketing International Journal of Research in Marketing Volume 37, Issue 3, September 2020, Pages 443-465

The development of virtual reality technology has been driven by advances in sensory technologies. For example, haptic technology, which allows users to feel a sense of touch, has been widely used in the development of sophisticated virtual environments. This technology seems to dominate as a central force for development.

The development of virtual reality technology has also been supported by advances in artificial intelligence (AI). AI technology has been used to create more sophisticated and responsive virtual environments. AI-driven simulations enable users to experience complex scenarios with realistic reactions and reactions from virtual characters. This technology has the potential to create highly realistic experiences that could not be recreated in the real world. In recent years, the emergence of virtual reality (VR) technology has allowed for new possibilities in the realm of music performance. These advances allow musicians to create immersive, interactive experiences for their audiences, creating new ways of engaging with music. One of the most notable examples of this is the emergence of "haptic" or tactile-based performances. Using a combination of sophisticated haptic feedback technology and motion capture systems, artists can create musical performances that are responsive to the movements and interactions of their audiences. The result is a high level of interactivity which allows the audiences to become more deeply immersed in the music experience. For example, the group Spatial Pathway has used haptic technology to create a performance experience where audiences can interact with the music through physical movements such as pointing, waving, and gesturing. Additionally, advances in 3D audio technology have allowed for immersive soundscapes and spatialized sound to be integrated into VR music performances that yield unique sonic experiences in the creation of soundscapes that move and shift with the movements of the audience. The group 3D Audio Lab has utilized this technology to create a performance that allows audiences to move and explore the soundscape using their own body movements.

8 <https://www.devteam.space/blog/10-great-tools-for-vr-development/#:~:text=Oculus%2C%20a%20well%2Dknown%20provider,the%20VR%20assets%20you%20create.>
9 <https://www.opengrowth.com/resources/bringing-a-sense-of-touch-to-virtual-reality>
10 <https://news.stanford.edu/2021/11/12/using-ai-create-better-virtual-reality-experiences/>
11 Stefano Papetti, Charalampos Saitis Editors: Musical Haptics. Zurich Switzerland. Springer Open. 2018. P1-11.

With further advances in 3D mapping techniques, projected images can be transformed and manipulated in real-time which generates dynamic visual displays responsive to the movements of the audience. Examples of this can be seen in performances from artists such as Glitch Clothing, who used 3D mapping and projection mapping.

Effects on Industry

Virtual reality (VR) has had a profound impact on a wide variety of industries and sectors. This technology has been used to create immersive experiences in educational and entertainment settings, to design and interact with complex 3D models, and even to simulate scenarios in the military and energy sectors. Research suggests that the use of virtual reality can increase efficiency, reduce costs, and improve communication and collaboration in the workplace. However, there are also potential negative effects that must be taken into consideration, such as potential health risks due to prolonged virtual exposure.

In the education sector, virtual reality has enabled new ways of teaching and learning. For example, virtual field trips can be used to take students to places they may not be able to visit in person. VR can also be used to simulate experiments and practice procedures, allowing for hands-on learning in a safe and controlled environment. Additionally, this technology can be used to create interactive 3D models of complex concepts, helping to engage



students with the material being presented.

The entertainment industry has also benefited from the use of VR. The immersive nature of the technology has enabled novel experiences for gamers and movie-goers alike. Companies such as Oculus, Playstation, and HTC have released headsets and other hardware specifically designed for virtual reality gaming experiences. Additionally, films are now available in 360-degree formats, allowing viewers to become fully immersed in the action. In the medical field, virtual reality has been used to help train doctors, nurses, and first responders. By using realistic simulations and scenarios, medical professionals can practice procedures and hone their skills in a safe and controlled environment. Additionally, VR can be used to help patients with psychological disorders and phobias by exposing them to controlled and virtual versions of their fears. The military and energy industries have been utilizing virtual reality for a variety of purposes, such as training personnel. By creating realistic simulations of real-world environments, soldiers and engineers can practice and prepare for tasks without risking injury or death. The use of virtual reality has been applied to many other industries, including engineering, architecture, and product design. By allowing designers to interact with 3D models, they can quickly test different designs. This saves time and money by reducing the need for costly prototypes and physical models.

While there are several advantages to using virtual reality, there are also drawbacks. The cost of hardware and software can be prohibitively expensive, and the technology may not be accessible to all users. Further research and development are needed to ensure the safe and responsible use of virtual reality in the workplace.

12 <https://www.anses.fr/en/content/what-are-risks-virtual-reality-and-augmented-reality-and-what-good-practices->

13 <https://www.uschamber.com/technology/how-virtual-reality-is-transforming-healthcare#:~:text=VR%20has%20proven%20to%20be,and%20chronic%20pain%2C%20and%20more.>

The music industry has been transformed by the emergence of virtual reality (VR). In the past, music has been experienced linearly i.e. the listening of a composition or the attendance of a live performance. With the advent of VR, consumers now have an immersive and interactive musical experience. It has also had a far-reaching impact on music production. By using a combination of sound design and visual effects producers can generate entirely new experiences. This has allowed for experimentation with sound design, leading to more complex and dynamic audio experiences. Producers have also been able to use VR to create virtual instruments, which allow users to create their own music in a virtual environment. In Music Education, VR has had a profound effect on the way music is taught and learned. By allowing students to interact with music in an immersive and interactive manner, educators have been able to create a more engaging and effective learning environment. Additionally, by using virtual reality, educators have found that VR can help to improve student engagement.

The potential applications of VR in the music industry are vast, and this technology is only just in its infancy. We may shortly see more innovative uses of VR, such as virtual reality music festivals, virtual recording studios, and virtual music lessons. The latter are already a reality with a host of musical instruments being generated. Virtual reality has the potential for further applications in the music industry and they are virtually limitless. It will be exciting to see what new and innovative uses of this technology will come in the future.

Audience Experience of AR Performance

The growing popularity of virtual reality (VR) technology has revolutionized the music industry, allowing concertgoers to experience live music performances, no matter their physical location. With the possibility of entering a virtual concert hall, VR music concerts have the potential to draw an enormous and more greatly diverse audience than ever before.

The first benefit to concertgoers is the ability to experience live music from the comfort of their own home. With virtual reality technology, fans can be transported to a fully immersive concert environment, allowing them to not only listen to the music but also to be a part of it and enjoy a more intimate and personal experience than that found in traditional concert venues. This can be especially beneficial for fans who are unable to attend a physical concert due to financial, geographic, or physical constraints. VR technology allows fans to interact with the musicians and other fans in attendance, as well as engage in different activities and games. Thus, fans should tend to have a more meaningful and personal experience with the artist, while also providing an opportunity to connect with other fans. Virtual reality music concerts can help to break down distinctions between artists and audiences. The use of VR technology allows artists to create a more intimate and personal experience, as fans can be placed in the same virtual environment as the artist allowing for a more meaningful experience.

14 <https://virtuosovr.com/>

15 <https://dergipark.org.tr/en/download/article-file/1705401>

16 <https://musictech.com/news/gear/you-can-now-use-vr-to-learn-piano-for-free/#:~>

Virtual reality music concerts offer a unique and innovative way for fans to experience live music. Unlike traditional concerts, VR technology



allows fans to explore and engage with the performance in ways that are not possible in a physical environment. For example, fans may be able to explore different angles of the performance and even be able to interact with the environment as well as other fans thus becoming an integral part of the performance. This is not at all possible with trad settings as the performers and the audience are confined to their confined and separate physical spaces. We cannot know what the outcome of the new kind of contact will spawn but it is entirely possible that it may influence both the modes of performance and reception. VR concerts have the potential to revolutionize the live music experience.

Performer Experience of AR Performance

The development of virtual reality (VR) technology has enabled performers to revolutionize the traditional style of music performance. In the new immersive environment, the performer perspective shares some significant similarities with that of the audience in that the boundaries of each have been removed and one cannot be sure how this will influence performance practices. Using VR, performers can create new immersive experiences and engage audiences in entirely new ways. VR performance provides the opportunity to experiment with different performance styles and approaches. This can range from interactive visualizations to interactive instruments and even virtual worlds.

VR technology offers performers the ability to access larger audiences. By leveraging the capabilities of VR, performers can perform to a much wider audience than would otherwise be possible. This enables performers to reach a wider range of potential audiences and engage more fans of their music. This is borne out by the attendance at several VR concerts given by a number of famous artists. Below are two such examples with relative audience numbers.

17 <https://weraveyou.com/2021/05/music-concerts-virtual-reality/>

18 Najereh Shirzadian, Judith A. Redi, Thomas Roggla, Alice Panzq , Frank Nack , Pablo Cesar. Immersion and Togetherness: How Live Visualization of Audience Engagement Can Enhance Music Events. 1Centrum Wiskunde & Informatica Science Park 123, Amsterdam. P. 1-20

1. Marshmello's Virtual Reality Concert: In March 2019, Marshmello performed a virtual reality concert that was streamed to millions of viewers across the world. According to Forbes, the performance was watched by over 10 million viewers, making it one of the most successful virtual reality concerts to date.

2. Travis Scott's Astronomical Performance: The performance on the game Fortnite was watched by over 12.3 million viewers making it the largest in-game performance ever. The show featured original visuals, music, and choreography, as well as a special appearance by Travis Scott himself.

Online music rehearsal platforms, though not yet in the realm of VR, are a relatively new technology that allows musicians to rehearse and collaborate via the internet. These platforms are normally hosted by third-party providers, and provide users with a range of features such as an online chatroom, audio streaming, and video streaming. In this way, musicians connect and rehearse together without having to be in the same physical space. The benefits of these platforms are numerous. Musicians can save time, money, and effort on traveling to rehearsals. These platforms provide musicians with a safe and secure environment to work in, as the platforms typically feature various security features such as encryption and authentication. This technology enables musicians to share and store audio and video recordings of their work, allowing them to review and refine their performances. The platforms also allow instant feedback from other musicians, enabling musicians to quickly evaluate and improve their work.

Much like the VR technology used presently for virtual reality concerts, it will provide an immersive and realistic environment used to recreate a physical rehearsal space and to simulate the experience of playing in a live event. VR can be used to create interactive tutorials and lessons for users, allowing them to learn and practice musical concepts in a more immersive and engaging way. Yaşar University is embarking on such a project, one that intends to use VR technology in the creation of an interactive ear training platform where the user will respond to training exercises with physical movements to play virtual keyboards and manipulate virtual notes to create a variety of musical structures. These features can help musicians enhance their skills and develop a deeper understanding of music.

If one were to integrate VR into online collaborative platforms, one might even be able to tackle large-scale projects, such as orchestras, in which coordination and collaboration are essential.

New Forms of Artistic Experience

It is unavoidable that new technology changes the way in which music is conceived and composed. One need only look at the creation and development of new musical instruments to understand how the power of technology influences art. This is true for any art form. Virtual reality (VR) technology is no different in that it has the potential to revolutionize how musical artworks are created. VR technology can be used to create and manipulate soundscapes in a virtual environment, using a variety of tools and software. It may also be used to explore sound design with unprecedented freedom by manipulating the space, creating unique sound layers and effects, and experimenting with different sound frequencies. By immersing themselves in a virtual environment, musicians can explore and experiment with sound without the constraints of physical instruments and auditory cues.

Dissemination of AR

VR music performances are becoming a popular form of entertainment and the music industry is taking full advantage of the technology to promote and disseminate. Because these kinds of performances are becoming increasingly more accessible and offer a unique experience to both the artist and their fans the music industry is utilizing a variety of methods, including social media, streaming platforms, and virtual reality advertisement networks to disseminate.

Social media platforms such as Instagram, Snapchat, and Twitter are used to spread the word about upcoming VR music performances in much the same way that they did for traditional concerts. The platforms allow artists to post photos and videos of VR performances, as well as their tour dates and locations. Streaming platforms such as YouTube, Spotify, and Apple Music are also being used to promote and stream VR music concerts. These platforms



allow fans to access performances from anywhere in the world and often provide additional content such as interviews, behind-the-scenes footage, and other forms of media. Virtual reality advertisement networks are becoming increasingly popular in all sectors including music.

Psychological and Social Implications

The emergence of virtual reality (VR) in the music world has had a profound impact on both psychological and social aspects of life. While the technology has the potential to enhance the music experience for some users, it can also lead to serious psychological and social consequences.

Studies have shown that VR technology can provide experiences that can lead to improved emotional engagement. VR technology can also be used to generate a much-enhanced sense of presence and pleasure, creating a unique and powerful experience that can be felt by the user. As a result, the use of VR technology in music can help to create a more immersive, intimate, and powerful listening experience.

However, the psychological effects of VR technology on music listeners can also be negative. Research has demonstrated that VR technology can lead to a feeling of being overwhelmed, due to the heightened level of sensory stimulation that is experienced. This can lead to negative psychological effects such as anxiety, irritability, and confusion. Furthermore, the use of VR technology in music can also lead to a sense of detachment and estrangement from reality, which can be detrimental to social functioning.

Overall, the psychological and social effects of virtual reality on the music world are both complex and varied. While the technology can provide an immersive experience that can lead to improved emotional engagement and connection, it can also lead to feelings of anxiety, isolation, and alienation. Therefore, it is important to be aware of both the potential benefits and risks of VR technology to ensure that users can enjoy the positive aspects of the technology without experiencing the potential negative consequences.

21 <https://musictech.com/features/trends/vr-music-making/>

22 <https://www.adsoftheworld.com/collections/vr-in-advertising>

Summary

Virtual reality has the potential to revolutionize the way music is composed and performed in the future. By allowing users to interact with sound through a virtual environment, virtual reality could allow for a more immersive and interactive musical experience. Composers could create new musical works that take advantage of spatial audio and multi-dimensional visuals, and performers could engage their audiences more interactively. Virtual reality could also enable new forms of collaboration with remote musicians, allowing them to join together in a shared virtual space that would enable them to collaborate in real-time and share their musical ideas. Furthermore, virtual reality could open up new educational opportunities, allowing students to explore different musical styles and instruments in a detailed and engaging way. Finally, virtual reality could enable new forms of musical performance, allowing performers to interact directly with their audience in a virtual space, enhancing the live performance experience. All in all, virtual reality has the potential to dramatically enhance the way we compose and perform music in the future.

23 <https://tmb.apaopen.org/pub/vr-improves-emotional-empathy-only/release/2>

24 Si JuTeemu H. Laine, Hae Jung Sukng Kim. Presence Effects in Virtual Reality Based on User Characteristics: Attention, Enjoyment, and Memor. College of Engineering, University of Nevada Las Vegas, Las Vegas, NV 89154, USA 2021

25 <https://techmonitor.ai/technology/emerging-technology/is-virtual-reality-bad-for-mental-health>



4. Supplementary Materials in Support of VR in the Musical Sphere

General Infrastructure and Virtual Reality Music Concerts/Performances

Print

[What You Need to Know About AR and VR Concerts](https://www.tickpick.com/blog/what-you-need-to-know-about-ar-and-vr-concerts/)

<https://www.tickpick.com/blog/what-you-need-to-know-about-ar-and-vr-concerts/>

Gives a simple explanation of the general infrastructure of a virtual reality concert/Performance

Video

<https://youtu.be/HoDqeuNBH10>

Is virtual reality the future of concerts? Imogen Heap is a Grammy-award-winning singer/songwriter/audio engineer who has explored various emerging technologies in the past several years -- from creating music with her MiMu motion-controlled gloves to Mycelia, an experimental music distribution platform using blockchain-based technology.

<https://youtu.be/y0k8Akk1yN0>

360° Immersive Experience

<https://youtu.be/wYeFAIVC8qU>

Travis Scott and Fortnite Present: Astronomical (Full event Video)

Latest Technological Advances

Print

[12 Augmented Reality Trends of 2023: New Milestones in Immersive Technology](https://mobidev.biz/blog/augmented-reality-trends-future-ar-technologies)

<https://mobidev.biz/blog/augmented-reality-trends-future-ar-technologies>

Gives a detailed but easy-to-understand summary of the latest technological advances and future trends in the field of Virtual Reality

Video

[The Future of VR is INSANE - CES 2022](https://youtu.be/XsPnP05kPtM)

<https://youtu.be/XsPnP05kPtM>

CES 2022 VR technology exhibition reveals all-new Technologies together with their prices and availability



Effects on Industry

Print

Exploring the Impacts of Virtual Reality on Business Models: The Case of the Media Industry

https://www.researchgate.net/profile/Joschka-Muetterlein/publication/318674426_

The findings show that the impact of VR on companies that produce and distribute VR content for external purposes is large and even increases when more technologies are needed to create content and when the content is more interactive.

How VR is Changing the Music Industry

<https://arpost.co/2019/01/23/vr-changing-music-industry/>

Explains the many ways in which Virtual Reality is having far-reaching effects on the music industry.

The Impact of Virtual Reality (VR) on the Music Business

<https://youtu.be/RxtwTWwgmPI>

Virtual Reality (VR) is in the early stages, and new developments are happening every day. We have asked ourselves what impact Virtual Reality already has on the music industry.

Video

How Immersive Technologies (AR/VR) will shape our Future.

https://youtu.be/QcANba_1xg8

Immersive (AR/VR) technologies are past the hype now. They are already being used across multiple industries outside of what many think is just gaming and entertainment. And now, they are slowly entering the consumer market - so what does this mean for us and our society? Over the next years, we have to completely reset our thinking on how we interact with digital information.

Musical experiences in virtual worlds. The film, music, and future technologies come together in Berlin.

https://youtu.be/Xi_r9b4pxKU

Concepts and technologies in the field of augmented, virtual, and mixed reality (AR/VR/MR for short) open up new possibilities of expression for musicians.

The Future of AR and VR Marketing in the Music Business

<https://youtu.be/dtemFvT5MCM>

This panel discusses what goes 'into branding, multi-disciplinary teams, and what the future of advertising and partnerships look like.

Audience Experience of AR Performance

Print

Audience Experiences of a Volumetric Virtual Reality Music Video

<https://ieeexplore.ieee.org/document/9756804>

Discusses how accession and presentation of new music videos using extended reality technologies.

Virtual auditory reality: Inhabiting digital pop music as simulated space

<https://www.soundeffects.dk/article/view/124199>

This article examines popular music listening in light of recent research in auditory perception and spatial experience, record production, and virtual reality while considering parallel developments in digital pop music production practice.

Liquid Hands: Evoking Emotional States via Augmented Reality Music Visualizations

<https://dl.acm.org/doi/abs/10.1145/3452918.3465496>

Liquid Hands aims to enrich the music listening experience in one's personal space and bridge the gap between virtual and physical concerts. We intend to explore the emotions our system induces by conducting a pilot study, in



which we measure the user's psychological state through Electroencephalography (EEG)

Liveness in Network Music Performance.

<http://chadmckinneyaudio.com/WP-Content/resources/papers/Liveness2013.pdf>

This paper considers notions of liveness in the context of network music performance, where through technological mediation performers may be distributed not only within a given space but also in remote locations.

Music Audiences 3.0: Concert-Goers' Psychological Motivations at the Dawn of Virtual Reality

https://www.researchgate.net/publication/317389859_Music_Audiences_30_Concert-Goers'_Psychological_Motivations_at_the_Dawn_of_Virtual_Reality

The paper discusses consumers' motivations to attend performances in a continuously evolving social and technological context is essential because live concerts generate an important and growing share of revenues for the music industry

Video

Post Malone - Pokemon 25 Virtual Concert

<https://youtu.be/G-kGzeZbEV4>

Reaction to PostMalone Pokemon Concert. These are to be found in the comment section. There are more than 4000 comments of various kinds. The concert was viewed by 5 million people.

Travis Scott and Fortnite: Astronomica

<https://youtu.be/wYeFAIVC8qU>

More than 144 000 reactions to this concert, viewed by 198 million people.
Performer Experience of AR Performance

Print

Experiments with Virtual Reality Instruments

https://www.nime.org/proceedings/2005/nime2005_011.pdf

This article introduces and analyzes four gesture-controlled musical instruments.

Effect of Virtual Reality Graded Exposure on Anxiety Levels of Performing Musicians: A Case Study

<https://academic.oup.com/jmt/article-abstract/41/1/70/1035041>

Measures the Psychological effects of Virtual Reality on performing musicians

Physically Colliding with Music: Full-body Interactions with an Audio-only Virtual Reality Interface

<https://dl.acm.org/doi/10.1145/3294109.3301256>

Discusses how the integration of AVRL and VR systems This integration results in an expansive and augmented performance environment that facilitates full-body musical interactions.

Video

The rise of the virtual singer: the making of Fox's "Alter Ego"

https://youtu.be/rGL61F_cXWE

Lulu AR and Silver Spoon Animation created the world's first avatar singing competition, Fox's Alter Ego' using Unreal Engine.

Digital Pop Stars, Virtual Influencers and The Future of Music And Celebrities In The Metaverse

<https://youtu.be/2AepNNfBHv0I>

interview of digital popstar Polar about what this means for the future of music.
New Forms of Artistic Experience

Print

Onyx

<https://onix-systems.com/blog/virtual-museum-experiences-taking-the-cultural-mission-to-a-new-level>

The article is an in-depth discussion on how VR is revolutionizing not only the art museum experience - giving an



entirely new perception of art – but also how VR may be used in science expositions in different museums. Embedded are a series of video trailer that explain the text.

First Steps Towards Augmented Reality Interactive Electronic Music Production

<https://hal.science/hal-03183302/document>

Explains how an AR compositional platform allows to create interactive music experiences through the creation process of an electronic piece.

Video

8 Best uses of Virtual Reality in Musicians

<https://mbryonic.com/vr-music/>

Is a set of text and related videos that elaborate on how VR is being used to change the musical experience.

Dissemination of AR

Print

The effects of augmented reality mobile app advertising: Viral marketing via shared social experience

https://www.sciencedirect.com/science/article/pii/S0148296320305439?casa_token=4KPMoj3bOScAAAAA:

Explores the use of virtual reality in certain aspects of marketing

Psychological and Social Implications

Print

Outcomes associated with virtual reality in psychological interventions: where are we now?

<https://www.sciencedirect.com/science/article/abs/pii/S0272735814001391>

Shows how VT is most effective in face to face psychological interventions

Virtual experience, real consequences: the potential negative emotional consequences of virtual reality gameplay

<https://link.springer.com/article/10.1007/s10055-020-00440-y>

Because of its augmented absorption, VR has the potential of seriously affecting subjects in various negative ways.

Video

Virtual Reality's Psychological and Behavioral Effects

<https://youtu.be/Cil7OT8bGik>

Stanford University's Virtual Human Interaction Lab explain VR demos and explain what researchers have learned from these VR experiments.



5. Models and Best practices in Innovative Forms of Cyber and Distance Performances.

One of the main difficulties of researching, reflecting and expanding on the convergence between cyber and music, as proposed by the MUSense project, is the notion of cyber itself. What is cyber, and what are we talking about when we talk about cyber?

The prefix has been used profusely since the start of the digital age, very often with the conscious goal of making the resulting term sound futuristic and innovative. According to Foerster, H., Mead, M., & Teuber, H. L. (Eds.). (1951), cybernetics, from which the prefix cyber can be derived, can be defined as the study of "circular causal and feedback mechanisms in biological and social systems". Since the start of the digital age, the concept of all things cyber has developed and morphed substantially, paralleling the evolution of existing technologies. It has subsequently disassociated itself exclusively to the field of cybernetics, to become a broad umbrella concept, under which every aspect of digital reality can be covered.

CyberArt is understood as any artform which is produced with the use of computer software or hardware, often having a focus on interactivity and mutability. Today's CyberArt is an extremely vibrant and broad field of artistic production, and with the ubiquitous use of the computer in daily life, almost every artistic activity which is technology dependent falls into the cyber category.

It is therefore evident and natural that CyberArt would bring to the forefront, to collective consciousness, the very nature of the technologies on which it relies, and to enlighten and problematize the challenges that the pervasiveness of these technologies poses on the present and future of modern civilization. Today's CyberArt's subject matter is made of the very same issues with which digital societies grapple, be it climate change, the development of AIs, questions of genetics and biology, digital ethics, racial and gender identity, just to mention a few. In our present society, where digital and technology is, quite literally, omnipresent and omniscient, and where digital proficiency increasingly translates into geopolitical domination, reality itself is the realm of CyberArt.

How do we then as researchers position the attitudes of Music HEIs in the context of the digital revolution? How can music practice and cyber interact? How can institutions rooted in long, rich and proud traditions, where knowledge is for the most part transmitted in the same century-long chain between professor and student (master and pupil), be modernized to reflect today's issues and today's potentialities into its fabric?



The music Conservatoire is, as its name already indicates, an institution which has historically aimed to preserve and build upon, forms of musical art which it deems especially meaningful culturally. Therefore, the substantial majority of practices, repertoires, and performances proposed by the Conservatoire, are artistic manifestations that intend to reveal new insights, to build on existing traditions or to revive forgotten ones, on artistic artifacts which are, for the most part, centuries old. Modernizing this praxis, exposing it to the issues of our times, imbuing it with modern techniques and potentialities, is a difficult, albeit fascinating challenge, one which can only add value to the already valuable activities of music HEIs.

To have a better glimpse on the way that digitization might be integrated into music performance, one can and perhaps should turn to other artistic areas where this attitude is already the normative one. Naturally, the field of contemporary music and composition, especially of Electronic Music, is one which has always integrated in its praxis the contemporary technological state of the art. But other emerging artistic fields, such as Computer Animation, Artificial Intelligence Art, Sound Art, Bio Art, which by nature have a much greater degree of technological integration and interdependence than that of "traditional" classical music performance, might provide us with deep insights and inspiration on how a future "modern" musical performance (even of Beethoven's music!) might look or sound like.

There are plenty of publications, conferences and festivals that deal with the problematic of the convergence of Art and Technology, but we will at the present limit ourselves to two examples which have attained a referential status worldwide, that of Ars Electronica, a Linz (Austria) based Festival since 1979, with an annual Ars Electronica Prix since its 1987 edition, and the STARTS Prize, sponsored by the European Commission, recognizing innovative projects at the nexus between Science, Technology and the Arts.

The artistic projects recognized by either Ars Electronica or by the STARTS Prize, are truly cutting edge and future looking, not only in their performance and deployment, but also in their conceptualization and in the way they raise meaningful questions or provide insights into our present and future. Besides case studies arising from these two important events, we have included examples from Ohme, a Brussels-based production company curating and producing installations, performances and events, bringing artists, scientists, technologists and researchers together to create new paths for scientific mediation through the arts.

Also represented are Brussels-based artists who are themselves exploring the boundaries of music-making and technological integration, in their quest to illuminate artistically aspects of the human condition, such as Benjamin Van Esser, Igor C Silva, or Nazanin Fakoor. Lastly, we include two examples of AI and software which are already powerful tools in artistic creation but whose future potentialities are beyond envisioning. Specifically in the case of Midjourney, an AI creating images from a human text prompt, its ground-breaking technology is proving to be a remarkable advancement in AI, opening the doors to countless possibilities (and uncertainties) for future applications. By adopting these case studies, by exposing ourselves to their attitude and their modern positioning, their innovative ideas and techniques, we can certainly emerge reinvigorated with the possibilities that the future holds for a modern realization of Art in general and Music in particular.



CASE STUDIES



(The descriptions of the artworks are catalogue texts or are publicly available on the artists' websites)

Category: Digital Musics & Sound Art

CONVERGENCE

Alexander Schubert



<https://archive.aec.at/prix/showmode/67735/>

Convergence uses the concept of Artificial Intelligence to learn features of human musicians and then recreate new entities based on these recordings. In the piece the players interact with their generated counter-parts. They see themselves transform and reshape. The technology used is centered around Auto-Encoders (and GANs). Metaphorically they demonstrate a world that is constructed and parametric. The friction between machine perception and human world perception is the starting point for questions that address the fluidity of the self and the restrictions of perception.

Keywords: AI, Body Scan, Deep Learning, Perception.

CONVERGENCE

Douglas McCausland



<https://archive.aec.at/prix/showmode/66389/>

Convergence is a work composed for live augmented double-bass and electronics performer in third-order ambisonics, which explores performative agency between acoustic / electronic elements, the interaction of gesture and sound, and sound design in three-dimensional space. Convergence is the second piece in a small collection of works developed for five-string double-bass and ambisonic electronics, in collaboration with bassist Aleksander Gabryś.

Keywords: Extended Composition, Electronic Music, Gesture and Sound.

SUBNORMAL

EUROPE

Óscar Escudero & Belenish Moreno-Gil



<https://archive.aec.at/prix/showmode/67070/>

Subnormal Europe is a 60-minute music theater play co-created by Óscar Escudero & Belenish Moreno-Gil. The performance involves a singer/performer and a sound engineer/performer, whose physical and virtual personas are staged in an installation composed by 3 large screens, 9 loudspeakers, MIDI-DMX lighting, and a wooden cube.

Keywords: Working conditions, Identity Search, Nature of Documentary, Personal Freedom and Control, European Values.

WIKI-PIANO.NET

Alexander Schubert



<https://archive.aec.at/prix/showmode/62392/>

Wiki-Piano.Net is a piece for piano and the internet community. It is composed by everyone. At every time. The composition is notated as an editable Wiki internet page and is subject to constant change and fluctuation. When visiting the website *wiki-piano.net* everybody can see the current state of the piece and make alterations. The website allows the visitor to place media content, comments, audio, and pictures in the piece but also provides tools for traditional score editing.

When a performer decides to play the piece in a concert, the current version of the website score at that date will be



be the score for the player, who follows all instructions of the page from top to bottom. Hence no performance will ever be the same. Through the editing process of the community, new versions of the piece will constantly evolve.
Keywords: Ownership and Intellectual Property, Randomness, Community-based creation.



<https://archive.aec.at/prix/showmode/55682/>

Corpus Nil is a music performance exploring hybrid forms of identity and musicianship. It does so through an intense and ritualistic interaction between an artificially intelligent musical instrument, a human body, and sound.

The space is completely dark. The player, whose body is partly naked and partly painted in black, performs a tense choreography that gradually morphs his body. Two types of wearable biosensors transmit data from his body to a software. Chip microphones capture sounds from muscles and internal organs (mechanomyo-

gram or MMG) and electrodes capture muscle voltages (electromyogram or EMG).

The instrument uses special filters to generate a description of the amplitude and frequencies of all sounds produced within the performer's body (between 1-40 Hz), as well as their variations over time. Then, it re-synthesizes those sounds by orchestrating a feedback network of twenty digital oscillators. Because the choreography demands slow, subtle, and iterative physical movements, the resulting music is equally slow and recursive, mutating across microtonal variations of a minimal set of pitches.

Keywords: Bio Music, Biodata, Gesture and Sound.



<https://archive.aec.at/prix/showmode/49159/> Staged solo concert for percussion and electronics

Since the mid-1980s Josef Klammer has been continuously working as a musician and media musician on the tonal enhancement of his instrumentarium, and on the exploration and transformation of media-immanent music potentials.

Keywords: Extended Composition, Instrument Expansion, Electronic Music, Gesture and Sound.



<https://archive.aec.at/prix/showmode/67636/>

The Home is a headphone-based sound experience for one participant at a time in a physical installation—a custom-built house—situated in public space. Conceived to give each participant a visceral experience of the problematic question “Why don't you just leave?” the binaural sound design is comprised of numerous elements and layers, built from interviews we conducted with eight survivors of domestic abuse. Their voices are used as compositional elements both to convey information and experience as well as elicit non-linguistic or pre-verbal emotion and specific visceral feelings, such as entrapment or romantic intoxication, for each solo participant. The women's voices are layered into multifac-

eted sound design: participants might hear dishes being done, radio interview or news clip from a TV in another room, footsteps, a constantly intensifying phone notification, with voices which are at times isolated, montaged, or layered into sound. Each physical room and object was designed and chosen in response to the sound design. As the participant moves through the house, the environment becomes more surreal and the element of surveillance increases: after passing through a foyer, a bedroom, and a laundry room, they enter a space that is part-museum and part-police evidence room.

Keywords: Domestic Violence, Augmented Reality, Binaural Sound Design.



TORSO #1

Peter Kutin



<https://archive.aec.at/prix/showmode/62469/>

With his kinetic sound-sculpture *TORSO*, Peter Kutin explores how the movement and acceleration of sound-sources can be used from a musical or compositional perspective. With this project, Kutin is referring to the philosopher Paul Virilio's concept of dromology (the science of speed):

"[Speed] ostensibly perverts the illusory order of normal perception, the order of the arrival of information. What could have seemed simultaneous is diversified and decomposes."

- Paul Virilio, *The Aesthetics of Disappearance*

For this first version of *TORSO (#1)*, Kutin created a quadrophonic

system consisting of four old 100-volt speakers, which he rotates at varying speeds on a 2.5m long horizontal axis. The speakers' movements are visible, affecting the audience in unusual and confounding ways. Observing the speakers' circular movements while perceiving the ever-changing composition and how it develops over time combines to create a wholly unorthodox listening experience. For the structure of the object, Kutin drew inspiration from a klopotec—a variety of bird-scaring windmill found in central Europe.

Keywords: Spatial Perception, Aural Perception, Kinetic Art.

WE ARE NOT ALONE

Natasha Barrett, Anthony Rowe



<https://archive.aec.at/prix/showmode/55676/>

A sphere stands alone, suspended in the middle of a blacked-out room. When first entering, the eyes take a few moments to become accustomed to the darkness. A wash of 3D sound slowly penetrates the space. Every so often the space is disturbed, and the sphere and the sound field erupt into life, forming vortices of luminescence and living sound. What first appears as a single volume of beguiling glowing liquid is in fact a vast colony of living organisms; bioluminescent bacteria have been breeding in the sphere. Although we are looking onto them, enclosed in glass, we are ourselves enclosed inside a space of waves and points of sound, behaving as if it too were alive.

Keywords: Bio Art, Luminescence, Spatial Perception.

I'M HUMANITY

Etsuko Yakushimaru



<https://starts-prize.aec.at/en/im-humanity/>

The project I'm Humanity is based on the concept of "post-humanity music" and explores how new music will be transmitted, recorded, mutated, and diffused whether sung or played via word of mouth, as scores, through radio, records and CDs, or cloud computing.

In I'm Humanity, Yakushimaru makes pop music with the use of the nucleic acid sequence of *Synechococcus*, which is a type of cyanobacteria. The musical information is converted into a genetic code, which was used to create a long DNA sequence comprising three connected nucleic acid sequences. The DNA was artificially composited and incorporated into the chromosomes of the microorganism. This genetically-modified microor-

ganism with music in its DNA is able to continuously self-replicate. So even if humanity as we know it becomes extinct, it will live on, waiting for the music within it to be decoded and played by the species that replaces humanity.

When thinking about the lifespan of recording media, for example, CDs are said to last for decades and acid-free paper is said to last for centuries. In comparison, DNA's lifespan as a recording media is 500 thousand years, physicochemically speaking. Because the lifespan of DNA is so long, it has great potential as a recording media.

Keywords: Biodata, Data Transmission, Data Recording, DNA.



RAINBOW

Nazanin Fakoor



<https://www.nazaninfakoor.com/rainbow-performance.html>

For her new creation, the artist Nazanin Fakoor took on The Conference of the Birds, a literary masterpiece by the Persian mystic poet Farid ud-Din Attar. In Attar's story, thousands of birds search for Simorgh, the mythical bird that symbolises the truth. After many hardships on their journey, only 30 birds reach the end of their quest. Only then do they realise that they themselves are the Si (thirty) morgh (birds). This beautiful poetry provides the basis for the libretto of Rainbow written by the Iranian composer Aftab Darvishi for the Swara Ensemble. The immersive installation - literally- reflects our differences and multiple identities. In this way, Fakoor reflects on the myth of a clear-cut national identity and the celebration of difference.

Keywords: Identity, Integration, Culture.

MIKROMEDAS

ADS/CFT 001

Valery Vermeulen,
Concertgebouw Brugge, Baltan
Laboratories



<https://starts-prize.aec.at/en/mikromedas/>

Mikromedas AdS/CFT 001 is part of the multimedia project Mikromedas. Mikromedas is a data-driven music project in which the compositions produced use data stemming from space, deep space, and astrophysical simulation models. Unique systems and innovations in using astrophysical data and models as new tools for artistic creation were designed to realize the project. These include data sonification, data visualization, and algorithmic composition. The first work in this series, a 45-minute music piece, is the proposed work Mikromedas AdS/CFT 001. The central focus is the fascinating world of astrophysical black holes. All of the music in Mikromedas AdS/CFT 001 is composed using data stemming from numerical simulation models of astrophysical black holes and regions of extreme gravitational fields. Data used includes gravitational wave data, elementary particle

trajectory data near black holes, and observational white dwarf data. The work is presented in different forms—as a musical concert, a live audiovisual show, or an audiovisual installation.

Keywords: Data Stream, Astronomy, Quantum Physics, Sonic Visualization.

VARIATIONS OF DISARRAY

Laura Colmenares Guerra



<https://ulara.org/selected-work/variations-disarray>

A particular way in which a thing exists and appears, gradually developing, manifesting. The process of destruction of matter as the particular condition or state of someone or something alters. Deconstruction, revolution of form.

Video commissioned by Numédiart Institute.

The façade of the Faculty of Engineering of the University of Mons becomes the medium for a giant sound map. The 14 central windows of the building are back-lit by 14 projectors linked to 14 networked computers. The 3D mapping software developed by the Numédiart Institute of the University of Mons, enables the images to be synchronised, distorted and merged in real time.

Keywords: Visualization, 3D Video Mapping.

[IN]VISIBLE

Benjamin Van Esser



<http://www.benjaminvanesser.be/invisible/page/extras.html>

[IN]VISIBLE finds its main inspiration in tinnitus, a condition I'm dealing with since 2009. Throughout the performance the different stages of this condition are translated into an electro-acoustic, multi-medial frame. From the disorientation that strikes at the initial 'attack' to experimental electro-shock-therapy, the paralysing tranquillisers to the eventual cure, every aspect finds its own shape in an often hard, raw, minimal musical language where the use of glitches, artefacts, micro loops and other electronic adaptations play an important roll. It's in this detachment of the classical, acoustical environment that [IN]VISIBLE finds a new reality in which this apparently virtual but very present condition finds its resolution.

Keywords: Electronic Music, Glitches, Physiology.



I'M BORED AT HOME (2020)

Igor C Silva



<https://www.youtube.com/watch?v=AfJwJRht-hs>

Born in Porto and currently living in Amsterdam, Igor C Silva is a composer devoted to electronics and new media music, creating projects where performers, computers and many noisy and psychedelic things happen on stage, creating a multi-sensorial experience. Silva works regularly with ensembles, performers and orchestras, receiving several commissions from ensembles and festivals, and publishing recordings of his music. Igor C Silva also collaborates regularly with soloists, ensembles and jazz groups, devoting part of his musical and composing activity to improvisation and interactive performances with electronics and multimedia tools.

Keywords: Electronic Music, Glitches, Synchronization, Video Art.

Category: AI and Music Making

RICERCAR

Ali Nikrang



<https://ars.electronica.art/futurelab/en/fie-ricercar/>

Ricercar is an interactive AI-based music composition system. The word Ricercar refers to a musical form of the Baroque and Renaissance and means “to search out” in its Italian origin. Composers used this term for pieces in which they experimented with a theme or musical idea and discovered its qualities such as permutation and variation possibilities as well as its harmonic potential.

Ricercar: An AI-based Musical Companion follows a similar idea. It aims to create an intuitive interface between human artists and an AI-based composition system, where human users and the AI system can discover

the potential of a musical idea (given to the system by the users or initialized by the system itself) in a collaborative way. The interaction takes advantage of the benefits of artificial creativity, together with the ability to control and personalize the output of the system by human users.

Keywords: AI Composition, Deep Learning.

HOLLY+

Holly Herndon, Mathew Dryhurst,
Herndon Dryhurst Studio



<https://starts-prize.aec.at/en/holly-plus/>

Holly+ is Holly Herndon’s digital twin. She is using machine learning to create freely available online instruments and tools that encourage anyone to create art with her AI voice and image, as part of an expansive art and research project experimenting with the economy around her digital likeness.

The first Holly+ instrument allowed anyone to upload polyphonic audio to <http://holly.plus> and receive a version sung back in Holly’s voice. There have since been more instruments made, allowing for people to upload scores for her voice to sing, and for people to perform in her voice in real time (premiered at Sonar 2021). These instruments so far have been created in a

joint collaboration between Herndon Dryhurst Studio, Never Before Heard Sounds (NYC), and Voctro Labs (Barcelona).

This new model for the stewardship of digital identities challenges common pessimistic narratives around “deep-fakes” while addressing relevant concerns. Hundreds of people now hold partial governance of Holly’s digital twin as part of Holly+ DAO, which provides an incentive to vote on appropriate usage. Once approved, any art made with her voice can be verified by tracing its provenance back to the public Holly+DAO identity. This means that if a piece of media is created that is offensive or uncharacteristic, it can easily be dismissed unless approved by voting stewards.

Keywords: AI, Timbre Transfer, Ownership and Intellectual Property.



Category: Biology & Music

TALES OF ENTROPY

Guillaume Schweicher, Nicolas Klimis



<https://ohme.be/studio/tales-of-entropy/>

Tales of Entropy stages the irresistible beauty and the poetry of an organic compound changing its physical state in a thermal gradient, under polarized light. As the thermodynamic conditions evolve, the compound gradually evolves from crystal, to liquid-crystal, to liquid, before recrystallisation and re-orientations, displaying striking color patterns with a profound dramatic effect. The choreography of matter on this video happens live over the space of 1mm of the entire sample.

Keywords: Biodata.

SINE

François Gaspard & Boris Wilmot



<https://ohme.be/studio/sine/>

Sine is an interactive audiovisual lecture-performance illustrating, from the point of view of the physicist and the musician, the way in which electronic music producers envision sound and compose music. Starting from a simple sine, the lecture performance elaborates on sound physics, synthesis and electronic music production. The public participates in scientific explanations and composes music in a collaborative way via an individual controller, designed and produced specifically for the show.

Keywords: Music Interactivity, Collective Participation.

FOREST UNDER-SOUND

Tosca Terán



<https://archive.aec.at/prix/showmode/66859/>

Forest UnderSound is an invitation to consider the sentience of fungi. For Forest UnderSound, mycelium from *Ganoderma lucidum* (Reishi/Lingzhi) and *Pleurotus ostreatus* (oyster mushrooms), along with mycorrhizal fungi growing and connecting within the roots of various plants, have been cultivated. Both the plant roots and mycelium have electrodes connected to them that send biodata into purpose-built circuits, which detect micro-fluctuations in conductivity between 1,000-100,000 of a second. This biodata is then translated in real-time to control analog and digital synthesizers. Empirically, when fully connected and music is being generated, Mycelium consistently generates periodic patterns that are

both enigmatic but also very musical. For reasons that I do not fully understand, Mycelium reacts to the proximity of some people more than others. Growing more frenetic or more harmonic or completely silent, when humans are present.

Keywords: Bio Music, Biodata, Flora Sentience.

CHATAIGNE

Benjamin Kuperberg



<https://benjamin.kuperberg.fr/chataigne/en>

Chataigne is a free, open-source software made with one goal in mind : create a common tool for artists, technicians and developers who wish to use technology and synchronize software for shows, interactive installations or prototyping. It aims to be as simple as possible for basic interactions, but can be easily extended to create complex interactions.

While Chataigne won't do much by itself, its purpose is to be the central hub in a project involving multiple interfaces, software, devices and sensors. You can see it as a Conductor, which will control all the software with the big picture in mind. Chataigne has been designed to fit both linear shows and realtime/interactive project needs.

Keywords: Synchronization, Software Interactivity, Cross Protocol Communication.



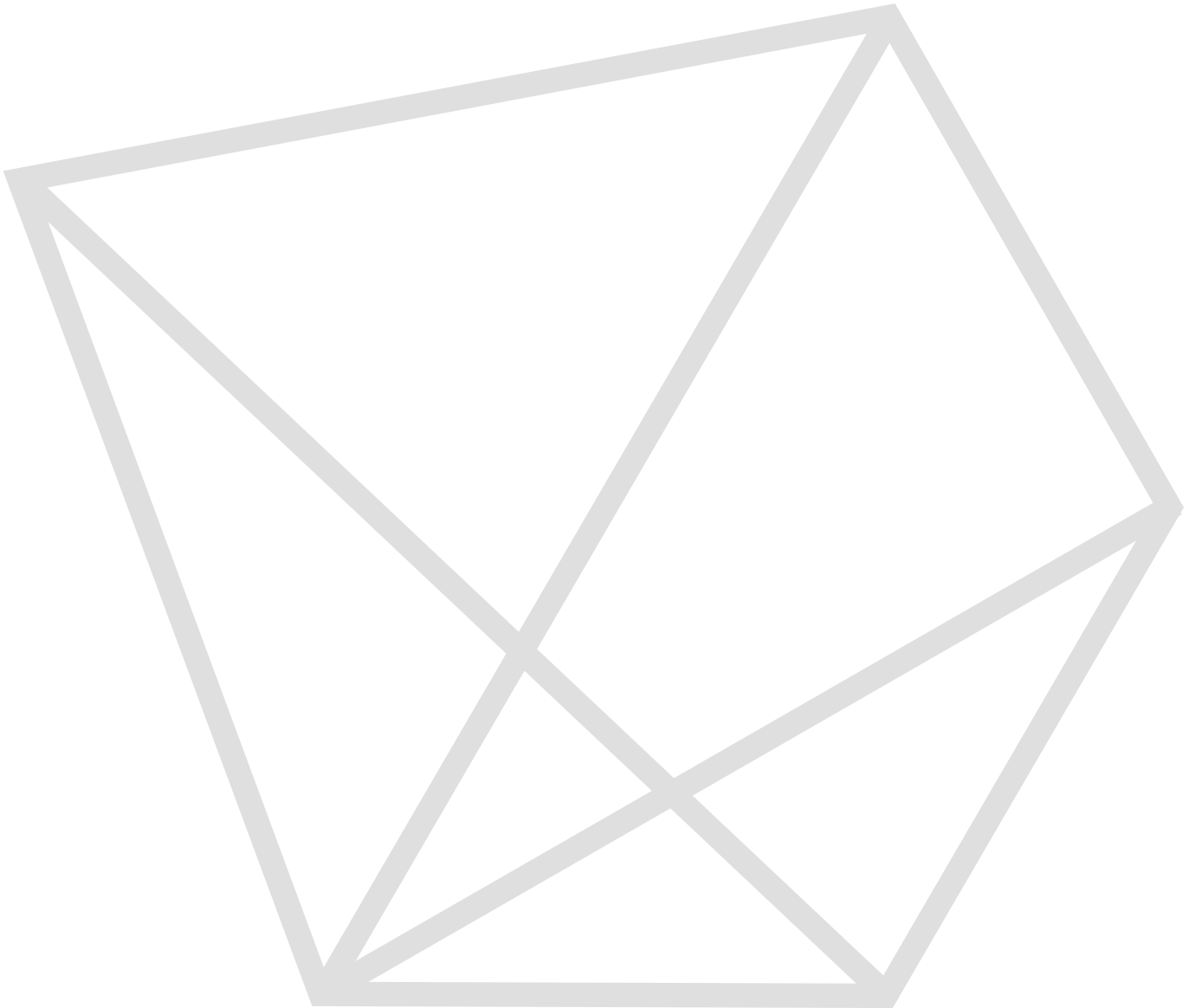
MIDJOURNEY



<https://www.midjourney.com/>

Midjourney is a research lab and the name of the lab's popular artificial intelligence program that creates images from textual descriptions, similar to OpenAI's DALL-E.[1][2] The tool is currently in closed beta. The program was used by the British magazine The Economist to create the front cover for an issue in June 2022.

Keywords: AI, Deep Learning, Prompt-based Image Creation.



6. Extending the MUSENSE project from the Music Industry to the Wider World of Performance

The MUSense project is a unique effort to identify and collect innovative models and practices related to cyber and distance performances in the music industry, and to provide training and education to music students, teachers, technicians, and staff on these new models. The project also plans to create an online repository in the form of an open platform to organize and share the results of these efforts with higher education institutions and other stakeholders, providing a sound reference point. This paper presents the design of MUSense and its intended use, including the project's implementation strategies and expected outcomes. We also argue that the MUSense project has the potential to be extended to the wider world of performance and new media art, as many of the same principles and technologies that are being explored and utilized in the music industry can also be applied to other performance disciplines.

Keywords cyber performance, distance performance, music industry, training, education, online repository

Introduction

The music industry has been heavily impacted by the COVID-19 pandemic, with traditional live performances being disrupted or altogether canceled. In response, many artists and organizations have turned to digital platforms and new forms of cyber and distance performances to continue reaching audiences and generating revenue. The MUSense project was initiated to identify and collect innovative models and practices related to these new performance forms, and to provide training and education to music students, teachers, technicians, and staff on how to create and participate in these performances. However, our literature research showed that theater companies and dance troupes have also turned to digital platforms and new forms of cyber and distance performances in response to the pandemic, and could benefit from the knowledge and resources developed through the MUSense project [1-19]. Additionally, new media art forms that involve interactive technology and online components, such as virtual reality installations or digital performance art, could also draw on the insights and tools generated by MUSense [1, 13, 14, 19-25]. Hence in this paper we explore the possibility to expand the scope of the project to include a wider range of performance and new media art, as the MUSense team could help to facilitate the creation and dissemination of innovative and engaging content for audiences around the world.



Project Design & Early Findings

The MUSense project is designed to address this need by identifying and collecting innovative models and practices related to cyber and distance music performances, and by providing training and education to music students, teachers, technicians, and staff on these new models. It is important at this point to see how the main project goals are addressed.

Identifying and studying international models and best practices in innovative forms of cyber and distance performances is implemented through a variety of research methods, such as literature reviews, online surveys, and interviews with experts in the field. To streamline this process, the team focuses on specific aspects of cyber and distance performances, such as technology platforms, audience engagement strategies, or revenue models, and use key informant interviews or case studies to delve deeper into these areas. There are a variety of international models, approaches and best practices in innovative forms of cyber and distance performances that have emerged in recent years in response to the COVID-19 pandemic and other factors that have disrupted traditional live performances.

Some examples traced within our literature review include:

- Live streaming concerts and performances on platforms such as YouTube, Facebook Live, and Twitch, which allow artists to reach audiences remotely and generate revenue through ticket sales, donations, or merchandise [26-33].
- Using virtual reality or augmented reality technology to create immersive, interactive experiences for audiences, such as virtual reality concerts or installations [34-48].
- Utilizing social media and other online platforms to engage with audiences and create a sense of community, such as through Q&A sessions, behind-the-scenes content, or interactive challenges [49-59].
- Developing interactive or personalized experiences for audiences, such as choose-your-own-adventure style performances or personalized playlists [60, 61].
- Utilizing artificial intelligence or machine learning to create interactive or adaptive performances, such as music generated by algorithms or interactive installations that respond to audience input [62-78].
- Leveraging the power of collective action or activism through performances that are centered around social or political issues, or that involve audience participation in advocacy efforts [79-89].

These are just a few examples of the many innovative research approaches and best practices that are being developed and tested in the world of cyber and distance performances. It is important to note that these models and best practices are constantly evolving and may vary depending on the specific needs and goals of different performers and audiences. Tracing the most innovative models and curriculum development in IT and cyber practices within music performing events is a process that the team implements using a combination of online searches and direct outreach to identify relevant programs and initiatives. The team then analyzes the content and structure of these programs to identify common themes and best practices, and use this information to inform the development of new curricula or training materials.



In their majority they include the following functions or follow the aspects summarized below:

- Developing curricula that focus on the technical skills needed to create and participate in cyber and distance performances, such as skills in audio and video production, live streaming, virtual reality, and interactive technologies [1, 90-99].

- Providing training in the business and entrepreneurial aspects of cyber and distance performances, such as how to generate revenue through online platforms, how to market and promote performances, and how to negotiate

contracts and licensing agreements [100-106].

- Teaching students about the creative and artistic possibilities of cyber and distance performances, including how to create engaging and immersive experiences for audiences, how to use technology to enhance performance, and how to develop new forms of performance that take advantage of the unique capabilities of online platforms [10, 11, 107-120].

- Incorporating experiential learning and hands-on projects into curricula, such as creating live streams or virtual reality performances as part of a class or workshop.

- Developing curricula that focus on the social and cultural aspects of cyber and distance performances, including how to build community and engagement online, how to navigate issues of accessibility and inclusion, and how to consider the ethical and social implications of these performances.

Interestingly there is a gap in the literature at the last two points that proves that MUSense will fill a significant gap in the literature. Creating an online repository in the form of an open platform to organize and share the results of these efforts with higher education institutions and other stakeholders the team uses a content management system (CMS) to house and manage the content is the suggested solution. To make the repository as user-friendly and accessible as possible, the team has considered using a responsive design, clear navigation, and search functionality. In addition, one of the innovations at this point is that technologies and the teaching/learning content are kept separate and are connected internally within individual case studies. This organization provides future users with the flexibility to pick-and-mix technologies with new media to create new case studies when designing a course.

Providing training and teaching activities targeted at music students, teachers, technicians, and staff, is a valuable tool that enables them to build their capacity to create new skills in the relationship between public and music performances. This is commonly implemented through a variety of methods, such as workshops, webinars, and online courses. To ensure the effectiveness and efficiency of these activities, the team uses learning objectives, assessments, and feedback mechanisms to measure the impact of the training and identify areas for improvement.

Development of comprehensive guidelines on new models and best practices in cyber and distance music performances the team uses the information and insights gathered through the other project activities to create a document that outlines key considerations and recommendations for creating and participating in these types of performances. By making the guidelines as useful and relevant as possible, the team can involve a diverse group of stakeholders in the development process, such as artists, educators, technicians, and industry professionals.



Describing the Proposed Project Expansion Strategy

In order to extend the MUSense project from the music industry to the wider world of performance we have developed a strategy featuring a few key steps that can be broken down into the following subtasks:

1. Identify the specific performance disciplines or domains you want to include in the project:

- Research the challenges and opportunities faced by these disciplines in the virtual performance world. This might involve reviewing literature or conducting online searches to gather information on the current state of the field and the issues that are most pressing for these disciplines.
- Consult with experts in the new disciplines or domains to understand their needs and interests. This might involve conducting interviews or focus groups with practitioners, educators, or industry professionals to get their input on the types of resources and support that would be most useful to them.

2. Assess the resources and expertise required to expand the scope of the project:

- Identify any gaps in your team's current skills or knowledge that need to be addressed in order to effectively support the new disciplines or domains. This might involve reviewing the expertise of your team members and identifying any areas where additional training or hiring is needed.
- Determine how to fill these gaps in resources or expertise. This might involve seeking out external training opportunities or hiring new team members with the necessary skills.

3. Develop a plan for how to incorporate the new disciplines or domains into the project:

- Adapt existing project activities, such as the online repository or training programs, to be more inclusive of the new disciplines or domains. This might involve modifying the content or format of these activities to better fit the needs of these fields, or developing new resources specifically tailored to these areas.
- Develop new activities or resources as needed to support the new disciplines or domains. This might involve creating new training programs, research studies, or online resources to address the unique needs and challenges of these fields.

4. Communicate the expansion of the project to relevant stakeholders:

- Update your project website and other promotional materials to reflect the expansion of the project to the new disciplines or domains. This might involve adding information about the new activities and resources being offered, as well as any changes to the project's scope or focus.
- Hold informational meetings or webinars to introduce the project to stakeholders in the new disciplines or domains. This might involve presenting an overview of the project and its goals, as well as discussing the specific resources and support that will be available to these stakeholders.

5. Implement the expansion of the project:

- Follow the plan and timeline you have developed for incorporating the new disciplines or domains into the project. This might involve conducting research and analysis, creating new resources or training programs, and engaging with stakeholders in the new fields.



- Monitor progress and make any necessary adjustments to the plan as you go. This might involve tracking key indicators of success, such as the usage or impact of new resources, or soliciting feedback from stakeholders on the value and relevance of the project to their needs.

6. Monitor and evaluate the effectiveness of the expanded project:

- Use tools such as assessments, surveys, and feedback mechanisms to track progress and identify areas for improvement. This might involve collecting data on the usage and impact of the new resources and activities, as well as soliciting feedback from stakeholders on the value and relevance of the project to their needs.

- Use the results of this monitoring and evaluation to inform any necessary adjustments to the project plan or activities, in order to ensure the project is meeting its goals and meeting the needs of stakeholders in the new disciplines or domains.

Conclusion

The MUSense project is an important initiative that aims to support the growth and development of innovative models and practices in cyber and distance music performances. By conducting research, providing education and training, and creating an online repository or open platform, the project will help to build the knowledge and skills of music students, teachers, technicians, and staff, and to promote the use of these new technologies and practices in education and professional settings. Extending the MUSENSE project from the music industry to the wider world of performance presents an exciting opportunity to broaden the impact and reach of the project, and to support the adaptation and innovation of a wider range of disciplines and domains in the virtual performance world. By following a structured process that involves identifying the new disciplines or domains to be included, assessing the resources and expertise needed, developing a plan for incorporation, communicating the expansion to stakeholders, implementing the plan, and monitoring and evaluating the effectiveness of the project, the MUSENSE team can successfully extend the project to the wider world of performance and contribute to the ongoing evolution and success of these fields.

References

1. Webb, A. and J. Layton, Digital Skills for Performance: a framework for assessing current and future digital skills needs in the performing arts sector. *Arts and the Market*, 2022.
2. O'Hare, M., Cross-platform Play: A Hybrid Pedagogy for Devised College Theatre. *Theatre Topics*, 2022. 32(2): p. 83-95.
3. Kjus, Y., H.S. Spilker, and H. Kiberg, Liveness online in deadly times: How artists explored the expressive potential of live-streamed concerts at the face of COVID-19 in Norway. *First Monday*, 2022.
4. Karaosmanoglu, G., et al., Can Drama Lessons Be Given Online? Perspectives of Drama Teachers during the COVID-19. *International Online Journal of education and Teaching*, 2022. 9(3): p. 1249-1272.
5. Gallagher, K., N. Cardwell, and M.D. Tripathi, Losing and Finding Community in Drama: A Methodology-in-Motion for Pandemic Times. *LEARNING Landscapes*, 2022. 15(1): p. 159-172.
6. d'Hoop, A. and J. Pols, 'The game is on!'Eventness at a distance at a livestream concert during lockdown. *Ethnography*, 2022: p. 14661381221124502.
7. Brill, S., L. Gemini, and F. Giuliani, Theatre without theatres: Investigating access barriers to mediatized theatre and digital liveness during the covid-19 pandemic. *Poetics*, 2022: p. 101750.
8. Svich, C., *Toward a Future Theatre: Conversations during a Pandemic*. 2021: Bloomsbury Publishing.
9. Rehfuß, A., *ASSEMBLY IN ONLINE THEATRE Replacement and Renovation of Theatre as a Space of the Social for the Digital Assembly in Pandemic Times*. 2021.
10. McCauley, K., *Higher Education Dance, Drama and Performance Through Distance*



- Learning Beyond Times of Crisis. Emergency Remote Learning, Teaching and Leading: Global Perspectives, 2021: p. 81-101.
11. Li, Z., Creativity and opportunity: how COVID-19 fosters digital dance education. *Digital Creativity*, 2021. 32(3): p. 188-207.
12. Fuchs, B., *Theater of Lockdown: Digital and Distanced Performance in a Time of Pandemic*. 2021: Bloomsbury Publishing.
13. Conard, J.C., *A new proscenium: exploring interactive live performance in a socially distant digital world*. 2021.
14. Brusk, J. and H. Engström, *Marvinter: A case study of an inclusive transmedia storytelling production*. *Convergence*, 2021. 27(1): p. 103-123.
15. Benford, S., P. Mansfield, and J. Spence. *Producing Liveness: The Trials of Moving Folk Clubs Online During the Global Pandemic*. in *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 2021.
16. Aebischer, P., *Viral Shakespeare: Performance in the Time of Pandemic*. 2021: Cambridge University Press.
17. Timplalexi, E., *Theatre and Performance Go Massively Online During the COVID-19 Pandemic: Implications and Side Effects*. *Homo Virtualis*, 2020. 3(2): p. 43-54.
18. Stinton, N., *The surprising benefits of asynchronicity: Teaching music theatre online*. *Australian Voice*, 2020. 21: p. 31-38.
19. Bennett, N.P., *Telematic connections: sensing, feeling, being in space together*. *International Journal of Performance Arts and Digital Media*, 2020. 16(3): p. 245-268.
20. Mills, J.T., *The Gamification of Arts and Culture: The expanded narrative and the virtual space from digital media to COVID*. 2022.
21. Norton, K.E. and M.H. Kovacs, *Human and business success factors for transmedia design collaborations*. *Media Industries Journal*, 2017. 4(2).
22. Schwartzman, R., *Performing pandemic pedagogy*. *Communication Education*, 2020. 69(4): p. 502-517.
23. Gambarato, R.R., *Transmedia project design: Theoretical and analytical considerations*. *Baltic screen media review*, 2013(1): p. 80-100.
24. Agarwal, S., et al., *Unleashing the power of disruptive and emerging technologies amid COVID-19: A detailed review*. *arXiv preprint arXiv:2005.11507*, 2020.
25. Lee, L.-H., et al., *When creators meet the metaverse: A survey on computational arts*. *arXiv preprint arXiv:2111.13486*, 2021.
26. Thomas, M.D., *Digital performances*. *The Future of Live Music*, 2020: p. 83.
27. Thomas, M.D., *Digital performances Live-streaming music and the documentation of the creative process*. *The future of live music*, 2020: p. 83-96.
28. Green, B., et al., *How live is live?: COVID-19, live music, and online performances*, in *Remaking Culture and Music Spaces*. 2022, Routledge. p. 34-46.
29. Breese, J.L., M.A. Fox, and G. Vaidyanathan, *Live music performances and the internet of things*. *Issues in Information Systems*, 2020. 21(3).
30. Fox, M.A., J.L. Breese, and G. Vaidyanathan, *Live Music Performances and the Internet of Things*. 2019.
31. Haferkorn, J., B. Kavanagh, and S. Leak, *Livestreaming Music in the UK: Report for Musicians*. 2021.
32. Richards, P., *The Virtual Ticket: The Event Manager's Guide to Live Streaming Engaging Virtual Events*. 2020: StreamGeeks.
33. Sedillo, A., *We See You Guys Back on the Internet: Live Performance On and Off-Line*. 2017, University of Colorado at Boulder.
34. Díaz-Kommonen, L., et al. *360° video storytelling and virtual reality workshop*. in *Proceedings of the 2018 ACM International Conference on Interactive Experiences for TV and Online Video*. 2018.
35. Hu, R., et al., *Applying augmented reality (AR) technologies in theatrical performances in theme parks: A transcendent experience perspective*. *Tourism Management Perspectives*, 2021. 40: p. 100889.
36. Susi, M., *Dance and New Technologies: Exploring the artistic potential of technologies*. 2018.
37. Bauer, V. and T. Bouchara. *First steps towards augmented reality interactive electronic music production*. in *2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*. 2021. IEEE.
38. Rostami, A., C. Rossitto, and A. Waern. *Frictional realities: Enabling immersion in mixed-reality performances*. in *Proceedings of the 2018 ACM International Conference on Interactive Experiences for TV and Online Video*. 2018.
39. Birringer, J., *Immersive dance and virtual realities*. *Virtual Creativity*, 2017. 7(2): p. 103-119.
40. Clay, A., et al. *Integrating augmented reality to enhance expression, interaction & collaboration in live performances: A ballet dance case study*. in *2014 IEEE International Symposium on Mixed and Augmented Reality-Media, Art, Social Science, Humanities and*



Design (ISMAR-MASH'D). 2014. IEEE.

41. Nagele, A.N., et al., Interactive audio augmented reality in participatory performance. *Frontiers in Virtual Reality*, 2021. 1: p. 610320.

42. Wilson, H.R., New ways of seeing, feeling, being: intimate encounters in virtual reality performance. *International Journal of Performance Arts and Digital Media*, 2020. 16(2): p. 114-133.

43. Matthias, P., M. Billinghamurst, and Z. Siang See. This land AR: an Australian Music and Sound XR installation. in *The 17th International Conference on Virtual-Reality Continuum and its Applications in Industry*. 2019.

44. Jaller, C. and S. Serafin, Transitioning into states of immersion: transition design of mixed reality performances and cinematic virtual reality. *Digital Creativity*, 2020. 31(3): p. 213-222.

45. Scavarelli, A., A. Arya, and R.J. Teather, Virtual reality and augmented reality in social learning spaces: a literature review. *Virtual Reality*, 2021. 25(1): p. 257-277.

46. Serafin, S., et al., Virtual reality musical instruments: State of the art, design principles, and future directions. *Computer Music Journal*, 2016. 40(3): p. 22-40.

47. Young, G., N. O'Dwyer, and A. Smolic. A virtual reality volumetric music video: featuring new pagans. in *International Conference on New Interfaces for Musical Expression*. 2022. PubPub.

48. Baker, C. Virtual, artificial and mixed reality: new frontiers in performance. in *2017 23rd International Conference on Virtual System & Multimedia (VSMM)*. 2017. IEEE.

49. Allen, K.-A., et al., *An Academic's Guide to Social Media: Learn, Engage, and Belong*. 2022: Taylor & Francis.

50. Solis, B., *Engage: The complete guide for brands and businesses to build, cultivate, and measure success in the new web*. 2010: John Wiley & Sons.

51. Resmadi, I., From music industry to content industry: a story of Sun Eater Records. *Emerald Emerging Markets Case Studies*, 2022. 12(3): p. 1-42.

52. Gayeski, D., From Sage on the Stage to Host with the Most. *Higher Education Implications for Teaching and Learning During COVID-19*, 2022: p. 117.

53. Femenia-Serra, F., U. Gretzel, and A. Alzua-Sorzabal, Instagram travel influencers in# quarantine: Communicative practices and roles during COVID-19. *Tourism Management*, 2022. 89: p. 104454.

54. Wu, B. and B. Wu, *Metaverse: The World Reimagined*, in *Blockchain for Teens*. 2023, Springer. p. 267-313.

55. Schulte-Römer, N. and F. Gesing, Online, offline, hybrid: Methodological reflection on event ethnography in (post-) pandemic times. *Qualitative Research*, 2022: p. 14687941221110172.

56. Meisner, C. and A.M. Ledbetter, Participatory branding on social media: The affordances of live streaming for creative labor. *New Media & Society*, 2022. 24(5): p. 1179-1195.

57. Lin, L., *Playing in the Grey Area*, in *Convergent Chinese Television Industries*. 2022, Springer. p. 199-220.

58. Márkus, M.O., *Social media activism: an analysis of how climate activists use Instagram and encourage green behaviour among their followers*. 2022.

59. Carlton, J., *Using Data to Understand How Audiences Engage with Interactive Media*. 2022, University of Manchester.

60. Forbes, M. and K. Cantrell, Choose your own adventure: Vocal jazz improvisation, conceptual metaphor, and cognitive embodiment. *Musicae Scientiae*, 2021: p. 10298649211062730.

61. Collins, K., *Playing with sound: a theory of interacting with sound and music in video games*. 2013: MIT press.

62. Schacher, J.C. *Action and Perception in Interactive Sound Installations: An Ecological Approach*. in *NIME*. 2009. Citeseer.

63. Knotts, S. and N. Collins, AI-Lectronica: music AI in clubs and studio production, in *Handbook of Artificial Intelligence for Music*. 2021, Springer. p. 849-871.

64. Das, S., et al., Applications of artificial intelligence in machine learning: review and prospect. *International Journal of Computer Applications*, 2015. 115(9).

65. Caramiaux, B. and M. Donnarumma, Artificial intelligence in music and performance: a subjective art-research inquiry, in *Handbook of Artificial Intelligence for Music*. 2021, Springer. p. 75-95.

66. Hertzmann, A. Can computers create art? in *Arts*. 2018. MDPI.

67. Zhang, D., et al. Crowdlearn: A crowd-ai hybrid system for deep learning-based damage assessment applications. in *2019 IEEE 39th International Conference on Distributed Computing Systems (ICDCS)*. 2019. IEEE.

68. Schacher, J.C. and D. Bisig. Face to Face-Performers and Algorithms in Mutual Dependency. in *Proceedings of the International Conference on Live-Interfaces ICLI*, Brighton, UK. 2016.

69. Jeon, M., et al., From rituals to magic: Interactive art and HCI of the past, present, and future. *International Journal of Human-Computer Studies*, 2019. 131: p. 108-119.



70. Mosqueira-Rey, E., et al., Human-in-the-loop machine learning: a state of the art. *Artificial Intelligence Review*, 2022: p. 1-50.
71. Mathewson, K.W., Humour-in-the-loop: Improvised Theatre with Interactive Machine Learning Systems. 2019.
72. Mathewson, K.W. and P. Mirowski. Improvised theatre alongside artificial intelligences. in *Thirteenth Artificial Intelligence and Interactive Digital Entertainment Conference*. 2017.
73. Turchet, L., et al., Internet of musical things: Vision and challenges. *IEEE Access*, 2018. 6: p. 61994-62017.
74. Pasquier, P., et al., An introduction to musical metacreation. *Computers in Entertainment (CIE)*, 2017. 14(2): p. 1-14.
75. Dahlstedt, P., Musicking with Algorithms: Thoughts on Artificial Intelligence, Creativity, and Agency, in *Handbook of Artificial Intelligence for Music*. 2021, Springer. p. 873-914.
76. Pizzo, A., Performing/Watching Artificial Intelligence on Stage. *Skenè. Journal of Theatre and Drama Studies*, 2021. 7(1).
77. Yang, Y., Piano performance and music automatic notation algorithm teaching system based on artificial intelligence. *Mobile Information Systems*, 2021. 2021.
78. Scurto, H., B. Caramiaux, and F. Bevilacqua. Prototyping machine learning through diffractive art practice. in *Designing Interactive Systems Conference 2021*. 2021.
79. Bennett, W.L., The personalization of politics: Political identity, social media, and changing patterns of participation. *The annals of the American academy of political and social science*, 2012. 644(1): p. 20-39.
80. Bennett, W.L. and A. Segerberg, The logic of connective action: Digital media and the personalization of contentious politics, in *Handbook of digital politics*. 2015, Edward Elgar Publishing. p. 169-198.
81. Domingues, S., Art, Emotion, and Resistance, in *Teaching Women's and Gender Studies*. 2023, Routledge. p. 61-98.
82. Edwards, B. and J.D. McCarthy, Resources and social movement mobilization. *The Blackwell companion to social movements*, 2004: p. 116-152.
83. Jenkins, H., "Cultural acupuncture": Fan activism and the Harry Potter alliance, in *Popular media cultures*. 2015, Springer. p. 206-229.
84. Keck, M.E. and K. Sikkink, *Activists beyond borders: Advocacy networks in international politics*. 1998: Cornell University Press.
85. Lee, C.W. and E.L. Lingo, The "got art?" paradox: Questioning the value of art in collective action. *Poetics*, 2011. 39(4): p. 316-335.
86. Montgomery, A.W., P.A. Dacin, and M.T. Dacin, Collective social entrepreneurship: Collaboratively shaping social good. *Journal of business ethics*, 2012. 111(3): p. 375-388.
87. Obregón, R. and T. Tufte, Communication, social movements, and collective action: Toward a new research agenda in communication for development and social change. *Journal of Communication*, 2017. 67(5): p. 635-645.
88. Vromen, A., Digital citizenship and political engagement, in *Digital citizenship and political engagement*. 2017, Springer. p. 9-49.
89. Zajak, S., N. Egels Zandén, and N. Piper, Networks of labour activism: Collective action across Asia and beyond. An introduction to the debate. *Development and Change*, 2017. 48(5): p. 899-921.
90. Madariaga, L., et al., Offline and online user experience of gamified robotics for introducing computational thinking: Comparing engagement, game mechanics and coding motivation. *Computers & Education*, 2023. 193: p. 104664.
91. Sangtani, R.B., et al., Digital Innovations in Education, in *Technology Training for Educators From Past to Present*. 2022, IGI Global. p. 218-238.
92. Petrey, J.A., *Musical Realities: Virtual and Augmented Reality Applications in Music Performance and Education*. 2022, University of Miami.
93. Matthew, U.O., et al., Educational Technology Adaptation & Implication for Media Technology Adoption in the Period of COVID-19. *Journal of Trends in Computer Science and Smart Technology*, 2022. 4(4): p. 226-245.
94. Kumar, A., Gamification in training with next generation AI-virtual reality, animation design and immersive technology. *Journal of Experimental & Theoretical Artificial Intelligence*, 2022: p. 1-14.
95. Kommers, P., Virtual Reality for Learning, in *Sources for a Better Education*. 2022, Springer. p. 383-400.
96. Koh, K., O. Chapman, and L. Lam, An Integration of Virtual Reality Into the Design of Authentic Assessments for STEM Learning, in *Handbook of Research on Transformative and Innovative Pedagogies in Education*. 2022, IGI Global. p. 18-35.
97. Jagatheesaperumal, S.K., et al., Advancing Education Through Extended Reality and Internet of Everything Enabled Metaverses: Applications, Challenges, and Open Issues. *arXiv preprint*



arXiv:2207.01512, 2022.

98. Ilyas, M., Teaching Writing Skills during the Pandemic: Impact of Online Teaching in Material Development and Teaching Strategies. *Eurasian Journal of Educational Research*, 2022. 99(99): p. 135-156.
99. Herbert, N., et al. Why Embedding Indigenous Cultural Awareness in ICT Curriculum is an Imperative. in *Australasian Computing Education Conference*. 2022.
100. Shaheer, N.A. and S. Li, The CAGE around cyberspace? How digital innovations internationalize in a virtual world. *Journal of Business Venturing*, 2020. 35(1): p. 105892.
101. Hollands, R.G., Will the real smart city please stand up?: Intelligent, progressive or entrepreneurial?, in *The Routledge companion to smart cities*. 2020, Routledge. p. 179-199.
102. Bartleet, B.-L., et al., Building sustainable portfolio careers in music: insights and implications for higher education. *Music Education Research*, 2019. 21(3): p. 282-294.
103. Watson IV, G.F., et al., International market entry strategies: Relational, digital, and hybrid approaches. *Journal of International Marketing*, 2018. 26(1): p. 30-60.
104. Rogers, J., *The death and life of the music industry in the digital age*. 2013: A&C Black.
105. Preston, P. and J. Rogers, *Social networks, legal innovations and the "new" music industry*. info, 2011.
106. Kuratko, D.F., *Entrepreneurship education: Emerging trends and challenges for the 21st century*. White Paper, US Association of Small Business Education, 2003. 22(2003): p. 124-136.
107. Lewis, W.W. and S. Bartley, *Experiential Theatres: An Introduction*, in *Experiential Theatres*. 2023, Routledge. p. 1-22.
108. Kergel, D., *Postmodern Cyberspace*, in *Digital Cultures*. 2023, Springer. p. 35-121.
109. Giannini, J., 'Musical Personae'2.0. YouTube and Music: Online Culture and Everyday Life, 2023: p. 41.
110. Barrett, G.D., *Experimenting the Human: Art, Music, and the Contemporary Posthuman*. 2023: University of Chicago Press.
111. Mills, R., *Tele-Improvisation: Intercultural Interaction in the Online Global Music Jam Session*. 2019: Springer.
112. Crawford, R., Rethinking teaching and learning pedagogy for education in the twenty-first century: blended learning in music education. *Music Education Research*, 2017. 19(2): p. 195-213.
113. Ubik, S., et al., Cyber performances, technical and artistic collaboration across continents. *Future Generation Computer Systems*, 2016. 54: p. 306-312.
114. Crawford, R., Evolving technologies require educational policy change: Music education for the 21st century. *Australasian Journal of Educational Technology*, 2013. 29(5).
115. Wilks, J., A. Cutcher, and S. Wilks, Digital technology in the visual arts classroom: An [un] easy partnership. *Studies in Art Education*, 2012. 54(1): p. 54-65.
116. Kruse, N.B. and K.K. Veblen, Music teaching and learning online: Considering YouTube instructional videos. *Journal of Music, Technology & Education*, 2012. 5(1): p. 77-87.
117. Davis, S., Liveness, mediation and immediacy-innovative technology use in process and performance. *Research in Drama Education: The Journal of Applied Theatre and Performance*, 2012. 17(4): p. 501-516.
118. Parrish, M., Technology in dance education, in *International handbook of research in arts education*. 2007, Springer. p. 1381-1397.
119. Boyd, G., A theory of distance education for the cyberspace era, in *Theoretical principles of distance education*. 2005, Routledge. p. 234-253.
120. Shneiderman, B., *Relate-Create-Donate: a teaching/learning philosophy for the cyber-generation*. *Computers & education*, 1998. 31(1): p. 25-39.



7. New Technologies and the Pandemic

When we started working on this project, we immediately thought it was very interesting and ambitious. First because we are music composer and interested in these topics. Furthermore, the project is ambitious because there are many goals and the path to reach them can change day after day. When we met for the kick-off the chatbot ChatGPT was not that popular yet. So today there is a new user-friendly way to interact with AI.

This accessible technology will affect music creation and enjoyment of music. AI can be used in performances and in music creation. So we think the possibilities of interaction and blending between art and technology will be further expanded.

This is what we asked to Chatsonic (a conversational AI chatbot) some day ago.

Question

What about musical remote performances? What are the main problems in remote musical performance?

Answer

Remote musical performances are a recent innovation in the age of Covid-19, bringing a unique set of challenges compared to traditional performances.

The most obvious issue is the lack of physical presence between musicians, which can lead to a disconnect in the performance. This can be particularly pronounced in genres such as jazz and other improvisational music, where musicians rely heavily on the energy of each other to create great performances.

The technical aspects of remote performances also present their range of issues. Internet connections need to be stable and of sufficient speed for audio and video to be streamed without lag, resulting in a poor experience for the performer and the listener. Additionally, there is the issue of latency, or the time it takes for the audio and video signals to travel between the two locations. Without proper synchronization, this can cause numerous issues and make the performance sound out of time.

Finally, there is the issue of audience engagement. Without the physical presence of other performers and the audience, it can be difficult to create an energy and atmosphere that is conducive to a satisfying performance. Overall, remote musical performances can be a great way to connect with an audience, but it comes with their own set of challenges that need to be accounted for to ensure an enjoyable experience for all.

The answer focuses on the problems born during the pandemic situation, the performance problems for musicians who don't perform in the flesh, which becomes something to watch and listen to. The chatbot restricts the field only to some musical genres but this may depend on the available dataset. The answer also highlights an objective problem: the speed and stability of the broadband connection.

This AI also poses the problem of audience involvement, and maybe this is something a human beings should not overlook.

Today there are already several studies on remote performances, interaction with modern technologies, on involvement of AI and robotics, and on new ways of interaction with the audience.

Bown, O. (2021). Sociocultural and Design Perspectives on AI-Based Music Production: Why Do We Make Music and What Changes if AI Makes It for Us? In: Miranda, E. R. (eds), Handbook of Artificial Intelligence for Music, Springer, Cham.
https://doi.org/10.1007/978-3-030-72116-9_1



Abstract

The recent advance in artificial intelligence (AI) technologies that can generate musical material. Caramiaux, B., Donnarumma, M. (2021). Artificial Intelligence in Music and Performance: A Subjective Art-Research Inquiry. In: Miranda, E. R. (eds), Handbook of Artificial Intelligence for Music, Springer, Cham. https://doi.org/10.1007/978-3-030-72116-9_4

Abstract

In many contemporary societies, the pervasiveness of technology is constantly expanding. From communication to social networks, digital health, and welfare services, every aspect of social life in industrialized societies is being captured by technology with the objective of human enhancement, optimized services or automated management. Among these technologies, Machine Learning (ML) and the broader field of Artificial Intelligence (AI) received considerable attention in the past decades. Cope, D. (2022). AI Music. In: Clancy, M. (eds), Artificial Intelligence and Music Ecosystem, Routledge - Focal Press. <https://doi.org/10.4324/9780429356797>

Abstract

Meaning, in the context of this chapter, will be defined as the use, purpose, or significance of something. This definition will provide us with the fundamentals of musical 'meanings.' In this chapter, therefore, we will investigate many ways in which music can affect and influence listeners, thus allowing for communicating more meaningfully the composer's and performer's intents to an audience. Current neuroscience research suggests that emotion and logic derived from the same origins in the human brain. Interestingly, artificial intelligence and computers have nearly synonymous meanings these days, though certainly they have their differences. For example, counting intervals in melodies between two works by different composers can cause complexities that the analysis of only one would not suffice. For example, Igor Stravinsky is well-known for his appropriations, mostly from Russian folk melodies, and for stating blatantly that 'good composers borrow and great composers steal.' How can music have meaning, then, when each individual hears in that music different meanings and different to the point of no one having the same experience? As we shall see, music is the joy of feeling and thinking in unique ways that differ between the rest of the world's population and ourselves.

Hageback, N. (2021), AI for Creativity, Routledge - Focal Press. <https://doi.org/10.1201/9781003194941>

Abstract

What is computational creativity? Can AI learn to be creative? One of the human mind's most valuable features is the capacity to formulate creative thoughts, an ability that through quantum leap innovations has propelled us to the current digital age. However, creative breakthroughs are easier said than done. Appearing less frequently and more sporadically than desired, it seems that we have not yet fully cracked the creative code. But with the rapid advances in artificial intelligence which have come to provide ever-closer proximity with the cognitive faculties of mankind, can this emerging technology improve our creative capabilities? What will that look like and will it be the missing link in the man-machine-machinigma? AI for Creativity provides a fascinating look at what is currently emerging in the very cutting-edge area of artificial intelligence and the tools being developed to enable computational creativity that holds the propensity to dramatically change our lives. Moffat D. (2021). AI Music Mixing Systems. In: Miranda, E. R. (eds), Handbook of Artificial Intelligence for Music, Springer, Cham. https://doi.org/10.1007/978-3-030-72116-9_13

Abstract

Mixing music, or music production, is the process of combining a series of different musical tracks, while applying a range of audio processing to blend the tracks in a pleasant and aesthetically pleasing way. Music mixing practices require the pleasant combination of all aspects of a musical piece, using a set of engineering tools to do so.

Sounds and music during the pandemic

The transmission of the audio stream has already been tested for several years. There was a need for music professionals to be able to work remotely, or for online collaboration. For example, VST Connect by Steinberg:

VST Connect is a complete remote recording solution that lets you collaborate with any musician with an Internet connection and a computer, anywhere on the planet. Data encryption, multi-track recording, live video chat, audio stream protection, and MIDI support make geographical distance irrelevant to studio workflows. <https://www.steinberg.net/nuendo/features/>



This kind of software is useful only for transmitting audio streams and for the functions of a DAW (Digital Audio Workstation). It is not useful for performance. The pandemic has accelerated the development of remote-performance software. Three years ago remote performance software was nothing new but if we look at the Wikipedia page "Comparison of Remote Music Performance Software" (https://en.wikipedia.org/wiki/Comparison_of_Remote_Music_Performance_Software), we can read that many of the software programs were created or updated from 2020 onwards: Koord (<https://koord.live>) and FAIRPLAY (<https://farplay.io>) were updated in 2023. This means that during the pandemic restrictions, the need to be able to play together remotely increased exponentially, so more and more performing software was and is increasingly needed. These are linked to three software for remote performing.

ELK

<https://www.elk.live/>

<https://www.youtube.com/watch?v=7OkJrbP9nuM>

https://www.youtube.com/watch?v=_RZN1LME330

<https://www.youtube.com/watch?v=7yXipkhdj5w> (In this video we can listen to Roberto Prosseda and Alessandra Ammara playing 250 km away, like being in the same room)

<https://www.youtube.com/watch?v=sbZ2J-kuijl>

<https://www.youtube.com/watch?v=m9WBOKA4gsE>

<https://www.wired.com/review/elk-live-bridge/>

SONOBUS

<https://sonobus.net/>

<https://www.youtube.com/watch?v=Z1qxi80GjRA>

<https://www.youtube.com/watch?v=t62ovECJmYk>

<https://www.youtube.com/watch?v=wV-hqHtt8Y>

<https://ubunlog.com/it/sonobus-aplicacion-transmision-de-audio-en-red/>

<https://itsfoss.com/sonobus/>

mu5ic

<https://www.mu5ic.app/>

<https://www.youtube.com/watch?v=xb6PpV2MVM4>

<https://www.youtube.com/watch?v=Pe4jH6ui8R0>

Mu5ic is an Italian app for distance music performance that can operate with extremely low latency and an affordable price.

It runs on Mac and Windows operating systems on computers and iPhones/iPad. It doesn't run on Android devices at the moment due to the poor audio implementation of Android.

Mu5ic is in the beta testing stage and it needs:

- 1) a fast 5G internet speed connection;
- 2) a LAN/ethernet cable (No WiFi);
- 3) a dedicated dongle that can be purchased for 10 euros.

PROS:

- ultra-low latency;
- great sound stability (no jitter, no sound artifacts, no sound interruption);
- affordable price;
- no monthly payment plans (you only pay the dongle);
- simple to use;
- multiplatform (MAC, WIN, iOS)

CONS:

- only mono (no stereo)
- no panning
- no video support
- no fx (reverb, eq, compressor etc)
- no high-quality sound (the sound is very compressed)

This is the link we saw during the last multiplier event.

<https://youtu.be/wozIAS7y1D0>



- Distance Music Performance Showcase
- Milan – Palermo: 1.468,72 km
- very good performance, no latency, no jitter or audio artifacts
- Piano Keyboard, Davide Campione (Palermo)
- Drums Keyboard, Giuseppe Vasapolli (Milan)

All these apps appear to meet the demands of musicians that want to perform remotely:

- Musicians can play together over the internet live, having the illusion that the other musicians are in the same room. Some of the applications work well within a maximum distance, and with a fixed number of connections
- Removing barriers to performance through the internet and fixing connection problems of other platforms (Social networks or video call software are not suitable for the purpose).
- Using low latency peer-to-peer audio between devices on the Internet or a local area network. In some cases there's no encryption for the data communication.
- Musicians can play at home, so the members of a band don't need to move. The pandemic has increased this need.
- Using a tablet or smartphone. A computer is not always mandatory. Apps are often easy to use.
- Some of the apps are open source, can be multiplatform (Mac, Windows, Linux, iOS, Android), or have a plugin for a DAW integration.

The pandemic also stimulated research into artistic practices, listening habits, new ways of audience involvement, and innovative art forms.

Some festivals moved to the internet. Googling we can find a recent locution: Virtual Concert Hall.

Youtube has various virtual concert halls. They were the solution to keep playing in front of the audience, but a different audience that is not in the same hall as the musicians. This pandemic period habit is continuing to break down distances.

The broadcast of a streaming concert was already a habit before COVID. During the pandemic restriction the, streaming of a concert was a contingent need that today is a new way for a concert. Furthermore, forms of performance have been tested involving a few people, favoring distancing or involving an avatar.

Books/papers/research about Sounds, Music, and Pandemic

Befera L. (2022). Staging and Conception of Alexander Schubert's Virtual Reality Video Game Genesis. In: Agamennone, M. et al (eds) Sounds of the Pandemic, Focal Press.

Abstract

Alexander Schubert's most recent artistic research involves a renewed consideration of digital and human realities, merging them through interactive media and virtual environments. Genesis (2020) is a participative installation designed as a web-based video game. Home gamers control four avatars impersonated by real-life human performers living in an empty industrial hall in Hamburg over seven days. The chapter investigates its conception and staging, which occurred during the emergence of the COVID-19 pandemic. Being held by online users and involving a restricted number of people within the performance hall, Genesis was one of the few events confirmed for the 2019–2020 Elbphilharmonie season. The field study of the preliminary stages and the author's testimony outline a working schedule affected by staff restrictions and technical issues. Still, the performance stuck to the original concept, regardless of the emerging constraints: Schubert's approach encompasses the digital mediation of community instances, fitting perfectly with gamers' and avatars' isolation. To this extent, the analysis of internal dynamics related to extraordinary circumstances becomes the litmus test to show already emerging processes. Institutional, social, and aesthetic needs converge in the informatics' mediation, and the performative virtual space enlightens the intermedia transition as a cultural artifact.

Any information about this Schubert's work at the URL <http://www.alexanderschubert.net/works/Genesis.php>

Project Description (from the URL above)

Genesis is a virtual real-life computer game. It is an experiment, in which the audience can participate online for over a week, creating a real place, a true community, and a physical world according to their ideas. Participants can log in worldwide for free via the website and control a human avatar via an audio-video interface in a remote industrial hall. Genesis is a social simulation that unites in itself, ideology and, criticism. In this completely open setting, all its social components are in flux and can transform into one another.



Bratus A., Caliandro A., Caruso F., Ceravolo F. A., Garda M. (2022). Musical Performance during and after the COVID-19 Pandemic. In: Agamennone, M. et al (eds), *Sounds of the Pandemic*, Focal Press.

Abstract

All of the dimensions related to music performance have experienced deep transformations, crises, and reinventions during the COVID-19 pandemic. The scope of our interdisciplinary research team – including musicologists, ethnomusicologists, sociologists, and popular music scholars – is to map different ways of attributing meaning to the actions related to any form of organized sound production. The act of music-making was, since then, digitally remembered, represented, reimagined, relocated, and remediated in a variety of forms. At the same time, the performance of music – especially since it became impossible, as its practical organization seems incompatible with any effective form of physical distancing – has become an ideal referent and an arena. All of the identitarian stances related to music as a form of personal and collective self-recognition and construction of cultural values confront themselves around the (now impossible) act of performing live. These dynamics will be observed through the lens of several case studies related to traditional religious rituals, operatic performance scourses about live clubs and the circulation of musical performances through social media. We will discuss how much they reflect our current understanding of the cultural activities generally referred to as music production and consumption, and how much they foreshadow future developments in these sectors.

Hamilton C. et al (2022). Reconceiving spatiality and value in the live music industries in response to COVID-19. In: Berkers, P. et al (eds), *Remaking Culture and Music Spaces*, Routledge.

Abstract

The COVID-19 pandemic in the UK was predominantly framed as an economic crisis, one in which the economic systems through which revenue is derived from products and practices for many sectors had been abruptly closed off. Using Lefebvre's dialectics of spatiality as a theoretical lens, this chapter argues that for the UK live music and festivals industries, this period should also be understood as a crisis of spatiality. Whilst the transformative potential of this unique pause for the music industry has not yet been fully or consistently rerealized, the reframing of the crisis through these terms offers a means to both identify and understand this potentiality. To analyze the limitations of official responses to the pandemic, and the potential of small-scale experiments by industry professionals, we apply Lefebvre's model of conceived, perceived, and lived space. And in drawing upon two ongoing research projects in Scotland and the Midlands, this chapter argues that transformation requires a nuanced and critical engagement with the conceived aspects of live music spaces.

Thorley M. (2022). The Pandemic as a Catalyst for Remotivity in Music. In: Agamennone, M. et al (eds), *Sounds of the Pandemic*, Focal Press.

Abstract

The coronavirus pandemic of 2020 caused a sudden shift towards music collaboration, interaction, and delivery using the internet. This was evident from the activities of composers, performers, music producers, choirs, and orchestras, often working in lockdown. Whilst the technology necessary for such work had been around for some time, it was the sudden and enforced isolation that caused music practitioners to find creative new ways to reach clients and audiences. Whilst new approaches and results emerged, not all were effective, and so many questions relating to the capability necessary for remote working in music emerged. This chapter proposes emotivity as the unique combination of technical, creative, and interpersonal expertise for such remote working. It begins by examining the historical response of musicians to adversity, as well as the foundations for remote working which exist in music practice. It then looks at the specifics of the coronavirus pandemic for music practitioners and the new approaches and models which emerged. Following on from this, it summarises the necessary knowledge, background, situation, skills, and behaviors for practicing emotivity in music.

Martins P. G., Castilho L. C. (2022). Learning Music Theory Through Musical Theatre During a Pandemic. In: Raposo, D., Neves, J., Silva, R., Correia Castilho, L., Dias R. (eds), *Advances in Design, Music and Arts II*. EIMAD 2022. ed., Springer, Cham.
https://doi.org/10.1007/978-3-031-09659-4_49

Abstract

This research focuses on the application of Musical Theatre in the subject of Music Theory, in specialized Music Education.

The issue to be explored is related to the development of new creative approaches in Music Theory Education, showing how Musical Theatre, through song, movement, and performance, can contribute, as a pedagogic resource, to the implementation of strategies to promote musical, conceptual, attitudinal and motivation skills in musical learning.

The methodology applied was action research, taking a first-grade Music Theory class as the target population with



five students, aged between ten and twelve years, at the Castelo Branco Regional Conservatory (CRCB), Proença-a-Nova branch, during the 2019/2020 school year, and lasted 10 sessions. Surveys through questionnaires (applied at the beginning and end of the research), reflective summaries of classes, and observation grids were used as research instruments.

According to the evidence presented in the course of the study, the strategies adopted reveal a significant improvement in students' musical skills and knowledge, despite the limitations caused by Covid-19, positively contributing to their motivation and interest in the exploitation of musical content. In this sense, we conclude that the results obtained throughout the study reveal that the practical application of Musical Theatre in Music Theory classes can be a very significant pedagogical resource, substantially improving knowledge acquisition, interest, and motivation for musical learning.

Cyber and digital performance new practices

Links and connections between instrumental performance and technology development in a very wide field: instrument and fixed media; instrument and live electronics; instrument and motion capture whose data can control any other performative medium (images, video projection, laser lights, animation, and so on).

Books/papers/research on Cyber and digital performance new practices

Baumann, F. (2023). Embodied Interface Performance with Gestural Systems. In: Embodied Human-Computer Interaction in Vocal Music Performance. Springer Series on Cultural Computing. Springer, Cham.
https://doi.org/10.1007/978-3-031-17985-3_4

Abstract

This chapter outlines a dynamic framework for creating meaningful interactions between the embodied voice and the disembodied voice through gestural systems. Based on the practices of contemporary vocal art, I will discuss the sensor instrument as a prop, object, and body extension and show how the sensor's functions or affordances influence mapping strategies. I will show how the composed mapping of functional and communicative gestures together with a software's logic defines a creative virtual instrument design framework. For this study, the embodied practice is presented as a dynamic system with seven co-players, a visual metaphor with seven limbs that create meaning in their interactions. To clarify this, I introduce each of these co-players separately. I present a way of understanding the creation of meaning in embodied human-computer interaction as a stream of attention with shifting perspectives. This mapping framework will be useful not only for musicians, composers, and creative practitioners wishing to develop an understanding of the specifics of embodied human-computer interaction in vocal music performance but also for human-robotic researchers, voice-model and artificial machine-intelligence researchers seeking to develop a more systematic and targeted focus for exploring embodied interaction approaches in gestural systems.

Cosentino, S., Takanishi, A. (2021). Human-Robot Musical Interaction. In: Miranda, E. R. (eds), Handbook of Artificial Intelligence for Music, Springer, Cham.
https://doi.org/10.1007/978-3-030-72116-9_28

Abstract

Music is a form of art, and art is communication, the expression of self: the interaction between artists and their surrounding is a critical part of the artistic process. Artists perform in what we can call the performance space, an environment in which there is usually an audience and often other performers. To give engaging and powerful performances, artists need to not only master artistic techniques but also effectively interact with the audience and fellow performers at various levels of communication. They need to convey an emotional message to the audience, and technical signals to synchronize with their fellow performers. At the same time, they need to look out for and acknowledge technical signals from the other performers and sense the audience's emotional state a feedback to adjust their performance. In the scope of musical performance, most of these interactions are in the form of silent ancillary gestures to avoid auditory interference: both technical signaling and emotional gestures must blend in seamlessly and harmonically within the performance. Moreover, due to physical motion constraints related to instrument playing, these gestures are limited to posture changes, gazing, and facial expressions. In this chapter, we discuss the communication challenges that a robot faces during a live performance and some of the technical design choices that enable the robot to overcome such challenges and perform at the same level as human performers.

Kirke, A., Miranda, E. R. (2021). Performance Creativity in Computer Systems for Expressive Performance of Music. In: Miranda, E. R. (eds), Handbook of Artificial Intelligence for Music, Springer, Cham.
https://doi.org/10.1007/978-3-030-72116-9_19



Abstract

This chapter presents a detailed example of expressive music performance that focuses on performance creativity.

Mazzola, G. et al (2020). *New Concepts of Musical Instruments*. In: *The Future of Music*, Springer, Cham. https://doi.org/10.1007/978-3-030-39709-8_7

Abstract

As we create a means to cogitate the future of music composition, we need to consider the relationship between the composer and the medium in which music is performed. The concept of the development of musical instruments finds its foundation in the need for musicians to create sounds in ways that require more than one's own physical body. Currently, we organize musical instruments in a system based on the production modality of sound. We distinguish acoustic instruments, which mechanically generate sounds, from electroacoustic instruments which create sounds by electromagnetic devices. With the groundwork of instruments being steadily refined, the focus on the development of musical instruments can generally be accomplished by two strategies. The first is the expansive realization of an instrument, i.e., the improvement of the versatility of an existing instrument. The second is the creative realization of a new instrument, which has been the primary focus of development for the majority of the music.

Wanderley, M. M. (2022). *Motion Capture of Music Performances*. In: McPherson G. E. (eds), *The Oxford Handbook of Music Performance, Volume 2*, OUP. <https://doi.org/10.1093/oxfordhb/9780190058869.013.30>

Abstract

Motion capture (mocap)—the recording of three-dimensional movement using high-accuracy systems—has become a standard research tool in the analysis of music performances in the last two decades. A variety of systems is currently available, ranging from optical, multi-camera (passive and/or active) infra-red systems and inertial systems (using orientation sensors) to electromagnetic trackers providing six-degrees-of-freedom (DoF) measurement per marker/sensor. Recent advances in technology have made many of these systems more affordable, allowing access to a large research community. Music-related mocap applications include the tracking movements of solo or group, beginner, or expert performers and instruments for teaching performance skills, comparing movement strategies across performers, generating movement synthesis parameters in animation, and use in real-time music interaction. This chapter introduces the basic concepts behind motion capture, reviews the most common mocap technologies used in the study of music performance, and presents several examples of research, pedagogy, and artistic uses. Mocap of single acoustic instrument performances is reviewed, including violin, cello, piano, clarinet, timpani, and acoustic guitar, as well as examples of mocap of multiple instruments. Finally, we discuss the limitations of mocap and possible solutions to overcome them.

In 2016 and 2017 in Palermo, we created something that we can define as a performance in which the audience has a different role than usual (a new practice). A concert in which the audience can influence the evolution of the performance thanks to an app that sends information to a robot.

The press have sometimes referred to the robot as a conductor. It is a misleading interpretation that creates misunderstandings. The robot was just the interface between the audience and the orchestra. The name of the project is I.C.A.R.O.

I.C.A.R.O. (Interactive Computer Architecture for Robot and Orchestra) is an interactive show and research project with an interdisciplinary approach to music, emotions and artificial intelligence. A smartphone application allows the audience to interact with the show which involves accordingly.

The research was born as a collaboration among the Conservatoire, the University, and the Fine Arts Academy.

Here is a short video of the concert

<https://youtu.be/9-kNaqqLBAo>

This is the link to the paper of the project https://www.researchgate.net/publication/318234408_Conveying_Audience_Emotions_Through_Humanoid_Robot_Gestures_to_an_Orchestra_During_a_Live_Musical_Exhibition

Press review

<https://www.unipa.it/Robotics-Lab-Progetto-di-ricerca-Unipa---Conservatorio/>

<https://www.comune.palermo.it/palermo-informa-dettaglio.php?tp=1&id=11731>

<https://conservatori.eu/covegno-rami-e-progetti-di-ricerca-al-conservatorio-di-palermo/>

https://www.adnkronos.com/musica-a-palermo-concerto-interattivo-diretto-da-un-robot_3oWCpz6EYQzDRigEodIfCo



Books/papers/research about Music and Network

Mazzola, G. et al (2020). Musical Distribution Channels: New Networks. In: The Future of Music. Springer, Cham.

https://doi.org/10.1007/978-3-030-39709-8_8

Abstract

The distribution of music is an essential component of its social relevance. It is a core factor of the music's socially relevant shape, in particular when given the direction of a quasi-simultaneous network resonance. In this chapter, we examine the earlier stages of distribution, review the development of a musicaplatformsrm, and discuss the implications of a global network.

Rohrhuber J. (2017). Network Music. In: Collins N., d'Esquivan J. M. (eds), The Cambridge Companion to Electronic Music, Cambridge University Press
(from the first page)

With the proliferation of transport infrastructure in sixteenth-century England, the term network appeared. From then on, its use spread to the most varied fields, so that it now occupies various significant nodes in our thinking - it has become a way to understand the world. Network music can be situated somewhere between a conceptual and the more technical meaning of the term. It covers a broad range from collaborative composition environments to sound installations and improvised music ensembles. Within today's computer music, networks play an important role. Be it laptop ensembles that use the local ethernet to exchange hidden musical messages, composition tools for searching online sound databases, or shared environments for musical improvisation on the internet, the communicative and social aspects of music making are reflected in the computer instrument. The history of the computer is closely linked with the history of telecommunication so it is not surprising that network music has been evolving together with computer music. Nevertheless, as we will see, network music goes beyond the technical needs of communication - it investigates the implications of networking in a much broader sense.

Books/papers/research on Digital shift, VR, AR, and Metaverse

Filimowicz, M. (2022), (eds), Designing Interactions for Music and Sound, Routledge - Focal Press

Book description

Designing Interactions for Music and Sound presents multidisciplinary research and case studies in electronic music production, dance-composer collaboration, AI tools for live performance, multimedia works, installations in public spaces, locative media, AR/VR/MR/XR, and health.

As the follow-on volume to Foundations in Sound Design for Interactive Media, the authors cover key practices, technologies, and concepts such as: classifications, design guidelines, and taxonomies of programs, interfaces, sensors, spatialization, and other means for enhancing musical expressivity; controllers, i.e. the techniques of non-musician performers of electronic music who utilize MIDI, OSC and wireless technologies to manipulate sound in real time; artificial intelligence tools used in live club music; soundscape poetics and research-creation based on audio walks, environmental attunement, and embodied listening; new sound design techniques for VR/AR/MR/XR that express virtual human motion; and the use of interactive sound in health contexts, such as designing sonic interfaces for users with dementia.

Collectively, the chapters illustrate the robustness and variety of contemporary interactive sound design research, creativity, and its many applied contexts for students, teachers, researcher,s and practitioners.



8. Musesense and the 2030 Agenda

Comparative study on the 2030 Agenda prerequisites and the aims of the MUSENSE Project
MUSENSE is an Erasmus+ KA220 Cooperation partnership in higher education project which has started on 1st January 2022 and will end on 31st December 2024.

MUSense is a collaborative project among five HEIs and one International Association from five countries; Italy, Turkey, Belgium, Sweden, and Greece for establishing innovative practices in teaching and training activities targeted at music, teachers, staff, and students of HEIs. MUSense will approach digital technologies not just as a simple additional communication system but will highlight how and in which way the introduction of technology transforms the music experience and the traditional aesthetic. MUSense, therefore, is planning to create in music HE actors (students, teachers, staff, governance) a unique mindset revolution able to knowingly act on the normal chain of art expression that has been around for centuries. Teachers, staff, and students will rethink their active position in engaging the “remote” general public as part of their curricula and artistic performance, radically changing the relation skills-performance-audience. In MUSense, the dynamic and enduring interaction between skills and cyber performance becomes the crucial future of the new digital creative and didactic model.

The MUSENSE Project will focus on the circle of new skills- training- digitally framed performances, in line with the European Digital Strategy 2021, the Declaration of cooperation on advancing the digitisation of cultural heritage (2019), and with priorities 4, 8, 9 and 17 of the Sustainable Development Goals of the EU approach to sustainable development Agenda 2030. The relationship between the priorities and the project aims will be explained below.

Agenda 2030

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. It also seeks to strengthen universal peace in larger freedom. Eradicating poverty in all its forms and dimensions is the greatest global challenge and an indispensable requirement for sustainable development. All countries and all stakeholders, acting in collaborative partnership, will implement this plan.



26 <https://sdgs.un.org/goals>



The 17 SDGs and 169 targets demonstrate the scale and ambition of the new Universal Agenda. They seek to build on the Millennium Development Goals and complete what they did not achieve. They seek to realize the human rights of all and to achieve gender equality and empowerment of all women and girls. They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social, and environment. The goals and targets will stimulate action in areas of critical importance for humanity and the planet. The creativity, know-how, technology and financial resources from all of society are necessary to achieve the SDGs in every context.

People: We are determined to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfill their potential in dignity and equality and a healthy environment.

Planet: We are determined to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources, and taking urgent action on climate change, so that it can support the needs of the present and future generations.

Prosperity: We are determined to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social, and technological progress occurs in harmony with nature.

Peace: We are determined to foster peaceful, just, and inclusive societies that are free from fear and violence. There can be no sustainable development without peace and no peace without sustainable development.

Partnership: We are determined to mobilize the means required to implement this Agenda through a revitalized Global Partnership for Sustainable Development, based on a spirit of strengthened global solidarity, focussed in particular on the needs of the poorest and most vulnerable and with the participation of all countries, all stakeholders, and all people. (UN 2022c)

There is not one right way to structure 17 SDGs, because of the interlinkages and integrated nature of SDGs. One way to structure the interaction of SDGs is called “wedding cake”. In its structure the SDGs are arranged according to the theme’s biosphere, society, and economy.

- The ground-level biosphere contains goals 6, 13, 14, and 5.
- The second level of society contains goals 1, 2, 3, 4, 5, 7, 11, and 16.
- The third level economy contains goals 8, 9, 10, and 12.
- On top of the cake is goal 17. (Stockholm Resilience Centre 2020.)

SDGs

The global indicators are providing a framework for the SDGs and targets of the Agenda 2030 for Sustainable Development. The Global indicator framework was developed by the Inter-Agency and Expert Group on SDG Indicators and agreed upon in the session of UNs Statistical Commission in March 2017. The indicator framework was later adopted by the General Assembly and is contained in the Resolution adopted by the General Assembly on Work of the Statistical Commission and about the Agenda 2030 for Sustainable Development. 17 SDGs and related ones with the MUSENSE Project can be found below.

- No Poverty

With a projected global poverty rate of 7% in 2030, the equivalent of 598,394,116 people, this UN goal aims to end the poverty of all kinds.

SDG Goal 1 objectives include but are not limited to ending extreme poverty (those living on 1.25 dollars per day), reducing half the population living in poverty implementing protection systems, ensuring equal rights to economic resources and basic services, reducing poverty-related vulnerability to climate change-induced extreme weather events, mobilize resources in developing countries, and create pro-poor and gender-sensitive policy frameworks by 2030.

- Zero Hunger

End hunger, achieve food security and improved nutrition, and promote sustainable agriculture:

As of 2020, 2.37 billion people are without food or unable to eat a healthy balanced diet, hence the goal of zero hunger.

“Zero Hunger” sets out to end hunger, achieve food security, improve nutrition, and promote sustainable



agriculture. The global pandemic has only worsened global hunger, seeing as many as 161 million additional people will experience hunger as a result. Regarding women, 1/3 of those at a reproductive age experience Anaemia due to nutritional deficiencies.

SDG Goal 2 objectives include but are not limited to: ending hunger, ending all forms of malnutrition, doubling agricultural productivity and the income of small-scale food production bringing resilience to agricultural practices found sustainable food production systems maintain genetic food diversity.

27 SDG Indicators – SDG Indicators (un.org)

- Good Health and Well-Being

Ensure healthy lives and promote well-being for all at all ages.

With a focus on increasing life expectancy and reducing common child and maternal diseases and killers, this goal targets ensuring healthy lives and promoting well-being for all ages. The global pandemic has only made health disparities more apparent, halting and even reducing life-expectancy progress.

SDG Goal 3 objectives include but are not limited to: reducing maternal mortality ending preventable newborn and child death, ending multiple disease epidemics, reducing premature mortality, preventing and treating substance abuse, halting traffic-related deaths and injuries, ensure universal health coverage and access, reduce pollution and contamination deaths.

The Covid pandemic has had severe impacts on mental health and well-being, with a disproportionate impact on young people and the economically vulnerable. A significant rise in depression, loneliness, anxiety and stress has also been a consequence of the spatial and social confinement of prolonged lockdowns. Online and real-world addictions also saw a rise as a consequence of this.

The development of online services and platforms as mitigating strategies for essential activities such as those of the education and culture fields, has opened new and exciting possibilities for knowledge dissemination and artistic creation but has also proven to not be a substitute for the live, face-to-face experiences.

Mindful of the importance of the social element in music performance as well as the risks for online seclusion, MUSense aims to create forms of cyber performance and distance learning which promote sociability and personal interaction, especially between performers and audiences, which are crucial for mental health and for a sense of true participation in social and cultural life.

- Quality Education

This goal ensures inclusive and equitable quality education and promotes lifelong learning for all. Sadly, COVID-19 reversed years of education gains, and many countries lack basic school infrastructure.

SDG Goal 4 objectives include but are not limited to: ensure free and quality primary and secondary education, give children access to early childhood development, ensure equal access for men and women to afford higher education choices, increase skills in youth, ensure gender equality, and promote sustainable development in education.

MUSENSE project will focus on the circle new skills- training- digitally framed performances, in line with the European digital Strategy 2021, the Declaration of cooperation on advancing digitization of cultural heritage (2019), and with priorities of the Sustainable Development Goals, that supports innovative quality education.

MUSENSE will;

- Build new curricula and best practices in digital technologies, virtual and augmented reality referring to music;
- Create innovative models in cyber and distance digital music performances;
- Prepare students to deliver pilot blended live and distance performances, involving an audience, despite the current health emergency, both in the presence and remotely, via IT
- Raise partners' capacity to change at the same time the training practices and the dissemination of art forms
- Create specific course modules to update skills, competencies and know-how, based on digital technologies also capitalizing on previous experiences and practices of former projects;



- Establishing international mobility of artists (international blended mobility, short training activities, and intensive projects) able to promote new learning attitudes;
- Strengthen sustainable future entrepreneurship opportunities through digital capacities.
The project will also support lifelong learning opportunities with open learning sources developed during the project. The training contents will be promoted by partners after the completion of MUSENSE to ensure sustainability and support lifelong learning.

- Gender Equality

Achieve gender equality and empower all women and girls.

SDG 5 targets to achieve gender equality and empower all women and girls. The percentage of women who work in national parliaments, local governments, and in managerial positions is still significantly less than that of men. Not to mention 1 in 3 women are subject to violence at least once since the age of 15, and child marriage is still highly present.

SDG Goal 5 objectives include but are not limited to end discrimination against women, eliminating all forms of violence against women, eliminate harmful practices, value unpaid care and domestic work, ensuring equal leadership opportunities, ensuring access to feminine health care, and ensuring equal rights.

According to the United Nations Sustainable Development Goals Report 2022, "The world is not on track to achieve gender equality by 2030, and the social and economic fallout from the pandemic has made the situation even bleaker."

Specifically, in the Tech and AI fields, women are underemployed and underrepresented. According to the World Economic Forum (2018), more than three-quarters (78%) of global professionals in these fields are men, while less than a quarter (22%) are women. Moreover, at a global level, women have less access to technology, fewer digital skills, reduced ownership of devices, and less presence on online platforms. Cyberharassment and bullying are also rampant problems.

Armed with this knowledge and the awareness of the online and cyber spaces as social and political arenas, MUSense is committed, especially in the design of its Learning, Teaching, and Training Activities, not only to achieve gender parity in its target groups but also to the development of models that promote gender equality and guarantee that the performing cyberspace can be a safe space of freedom of expression.

By strengthening key competencies, in particular innovative transdisciplinary skills in music and technology, in a way that takes the above into account, MUSense will make a contribution for the democratization of access to new technology and new performance mediums.

- Clean Water and Sanitation

Ensure availability and sustainable management of water and sanitation for all: The availability and sustainable management of water and sanitation ensure safe water for drinking, sanitation, and hygiene, yet 2.3 billion people live in water-stressed countries.

SDG Goal 6 objectives include but are not limited to: providing equal universal access to safe drinking water, sanitation, and hygiene, reduce water pollution, increase water-use efficiency, integrate water-re source management, and protect ecosystems dependent on water.

- Affordable and Clean Energy

Ensure access to affordable, reliable, sustainable and modern energy for all: Almost 800 million people lack access to electricity and 1/3 of the population uses dangerous cooking systems. This puts into perspective why this goal aims to ensure affordable, reliable, sustainable, and modern energy.

SDG Goal 7 objectives include but are not limited to: increase renewable energy use, improve energy use efficiency, enhance international cooperation regarding clean energy access, research, and technology, and to upgrade technology in developing countries for sustainable energy services.

- Decent Work and Economic Growth

Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.



Especially after the global pandemic, joblessness and unemployment are extremely prevalent, making this goal of promoting sustained, inclusive, and sustainable economic growth and productive employment and decent work ever more important.

SDG Goal 8 objectives include but are not limited to sustaining economic growth, increasing economic productivity, improving resource efficiency, achieving full and productive employment, increasing the working youth population, ending forced labor, protecting labor rights, promoting tourism, and granting access to financial institution access for all.

The activities of MUSense will be designed through a global analysis of the demands of the targeted groups coming from HEIs at the EU level and the global performing world. The project will design a model of cyber performance, skills, and best practices that music HEIs actors, music companies, creative industries' managers, future music graduates will need to be most competitive.

MUSense will develop new methodologies and technological solutions for distance and distributed performance models with digitally mediated access experiences. Among OCED policy recommendations, the promotion of "greater complementarities between culture and other policy sectors like Education, that can benefit from advances in cultural and creative sectors, particularly in the use of new digital tools that build on gaming technologies and new forms of cultural content." will be at the center of MUSense.

The approach to digital transformation will help empowering young musicians to tackle global challenges with core values in order to support their productive employment.

- Industry, Innovation and Infrastructure

Resilient infrastructure, inclusive and sustainable industrialization, and innovation is the objective of this sustainable development goal. Enhancing rural road connectivity, increasing research and development investment, and manufacturing high-tech products help stabilize infrastructure.

SDG Goal 9 objectives include but are not limited to: reliable infrastructure for all, sustainable industrialization, increased access to small-scale industries and enterprises in developing countries, rendering industries sustainable, and improving technology in all industries.

Innovation and technological progress are key to finding lasting solutions to both economic and environmental challenges. In terms of communications infrastructure, more than half of the world's population is now online and almost the entire world population lives in an area covered by a mobile network. In this sense, it is important to contribute to the digital development of music education which will facilitate access to resources independent of time and place.

Musense is an innovative project that aims at establishing innovative practices in teaching and training activities targeted at music, teachers, staff, and students of HEIs. The project will provide models, training, and pilot actions in a new paradigm within a digital and cyber music performance.

MUSense will fill a gap, forging HE Music Institutions to embrace the digital shift and "stimulating innovative learning and teaching practices" to sustain and achieve new innovative performance practices and leverage the digital media potential.

The action will innovatively bring together music, IT, communication disciplines, aesthetics, intellectual property, data protection, and entrepreneurship.

- Reduced Inequalities

This sustainable development goal focuses on reducing inequalities within and among countries. Income inequality, the refugee crises, and inequality indexes all show that certain areas and countries are highly more beneficial to live in than others. Living standards between countries are very unbalanced.

SDG Goal 10 objectives include but are not limited to income growth for the bottom 40 percent of the population at a higher than national average rate, social, economic, and political inclusion, appropriate legislation policies to reduce inequality, wage, and fiscal equality, better financial market and institution regulation, legitimate institutions that represent developing countries in global decisions, and safe migration.

- Sustainable Cities and Communities

This goal promotes making cities and human settlements safer, resilient, and sustainable through the use



of national urban policies, more access to public spaces, convenient public transportation, and the reduction of slums.

SDG Goal 11 objectives include but are not limited to: safe and affordable housing for all, safe and affordable transport for all, sustainable urbanization and human settlement planning, protect cultures around the world, protecting the poor and vulnerable from death by natural disasters, monitoring air quality and waste management to reduce negative city impact, and to provide green public space.

- Responsible Consumption and Production

Ensuring sustainable consumption and production patterns, as a goal, aims to reduce climate change and negative environmental impacts.

SDG Goal 12 objectives include but are not limited to: implementing a 10-year framework program for sustainable development and consumption, achieving sustainable management, having food waste, managing chemicals and waste in an environmentally responsible way, reducing waste, encouraging company sustainable practices, sustainable public procurement practices, and providing access to relevant sustainable development and harmony with nature information.

- Climate Action

Climate action is a goal involving the fight against climate change and its impacts. Rising greenhouse gas emissions, an average global temperature increase, and increased spending due to climate change are all negative results of climate change.

SDG Goal 13 objectives include but are not limited to: being prepared for climate-related disasters, integrating climate policies into national policies, and raising climate awareness.

- Life Below Water

The Life Below Water goal focuses on conserving and sustainably using our oceans, seas, and marine resources for sustainable development. We, as a population, rely heavily on our oceans for food, tourism, recreational activities, and global trade. 3 billion people rely on the ocean for their livelihood. However, our oceans are under severe threat. Over half of key marine biodiversity areas are unprotected, and dead zones, zones lacking oxygen to support marine life, are rising. It is thus imperative we protect our oceans better.

SDG Goal 14 objectives include but are not limited to: preventing marine pollution, protecting marine and coastal ecosystems, minimizing ocean acidification through impact reduction, protecting the fishing market, conserving marine and coastal areas, and overfishing control.

- Life on Land

Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss: This goal overall promotes the health of land life. It includes protecting, restoring, and promoting land ecosystems, and managing forests sustainably. Combatting desertification and halting and reversing land degradation and biodiversity loss. With many species under threat and ever-increasing biodiversity loss, we must take better care of land ecosystems.

SDG Goal 15 objectives include but are not limited to: ensuring freshwater ecosystem health, sustainable management of forests, ensuring mountain ecosystem health, preserving natural habitats, sharing benefits of genetic resource use, ending poaching and protected species trafficking, and integrating biodiversity values into national planning.

- Peace, Justice, and Strong Institutions

This goal involves reducing conflict, insecurity, and weak institutions utilizing the promotion of peace and inclusivity for sustainable development and justice for all.

SDG Goal 16 objectives include but are not limited to: reducing violence and death rates, ending all forms of violence against children, promoting law at national and international levels, reducing financial crime, reducing corruption, developing transparent institutions, developing country participation in global governance institutions, legal identity for all, and ensuring public access to information and freedom rights.



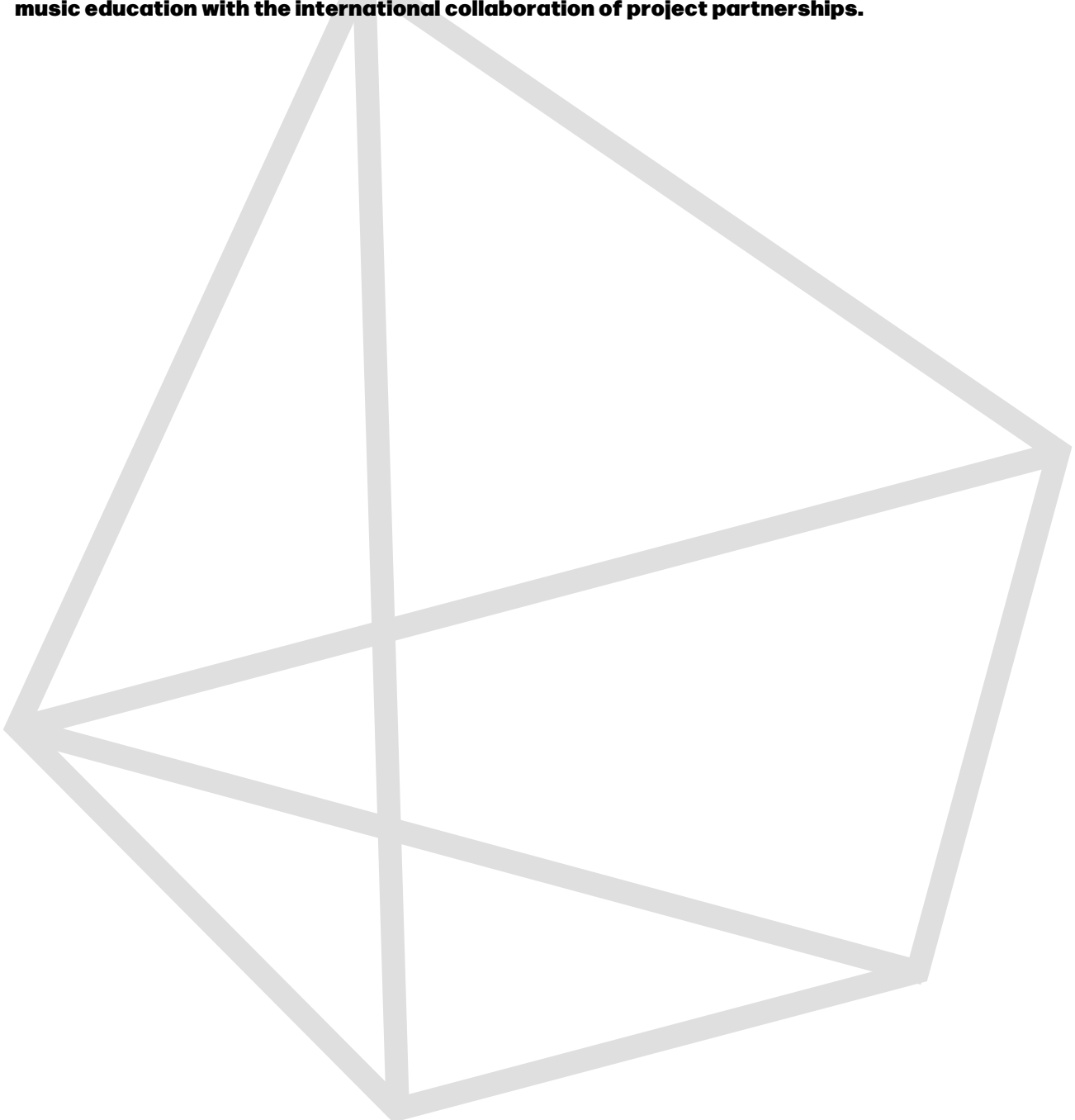
- Partnerships for the Goals

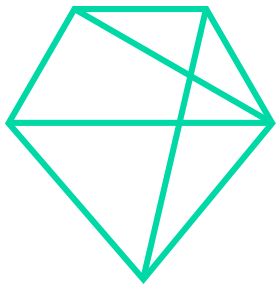
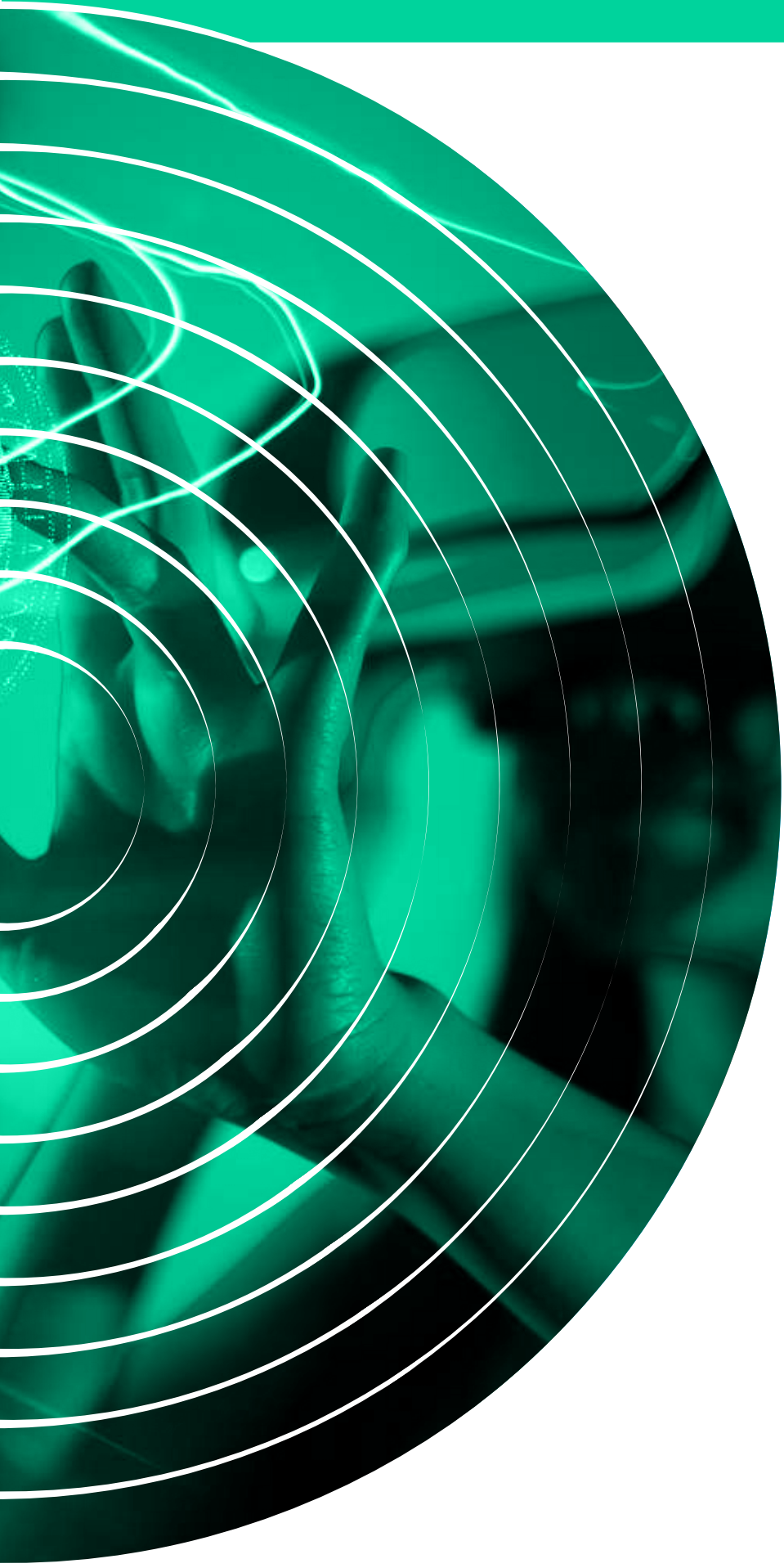
This last goal aims to help realize strong partnerships and global cooperation for the SDGs.

SDG Goal 17 objectives include but are not limited to: enhancing developing country international support, enhancing international cooperation, promote environmentally sound technologies, rule-based and equitable multilateral trading system, increase developing country exports, enhance global economic stability, and coherent sustainable development policy.

The SDGs can only be realized with strong global partnerships and cooperation. As mentioned by the UN, a successful development agenda requires inclusive partnerships – at the global, regional, national, and local levels – built upon principles and values, and a shared vision and shared goals placing people and the planet at the center.

MUSense is a collaborative project among five HEIs and one International Association from five different countries, which will develop practices in teaching and training to improve the quality of education in the related field. This way, the project will support the sustainable development of music education with the international collaboration of project partnerships.





The Museense Project