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Written Report

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Berklee College of Music - Valencia Campus

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1. Introduction

This culminating experience was conceptually conceived at early stages of the masters program and there are many ways to describe it, due to its high level of complexity. It combines a number of hardware components, which will be described later, and an extensive software interaction system that ties everything together into an artistic form of an installation, with the intent to inspire curiosity about new technological implementations and their purpose. It was a personal challenge to develop a smart new way of using technology in a way that could have practical applications for the entertainment industry and even more so, to present it as true to its conception as possible. Especially after the many iterations it went through during the period of September 2016 to May 2017 at the Valencia Campus of the Berklee College of Music.

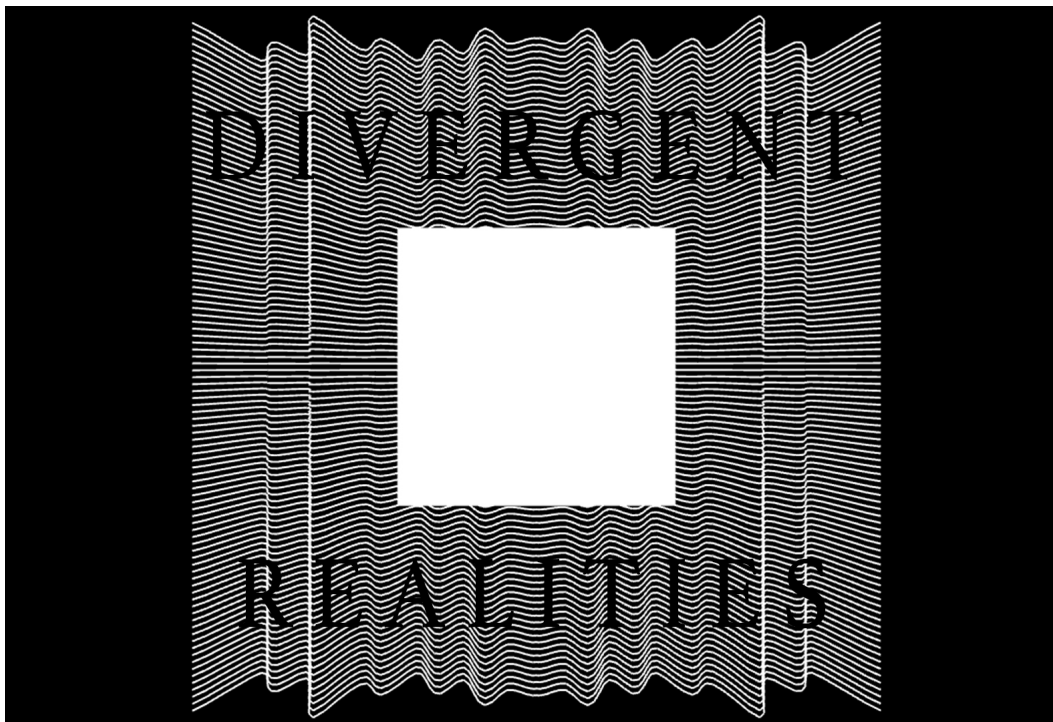


Figure 1: Promotional Artwork based on visual content of work, created on February 4, 2017, designed by author.

Yet, after much effort it took shape and was titled *Divergent Realities* to be presented at the Exhibition *Derivative Systems*, which is programmed to take place on June 11th 2017 in the venue for contemporary *la Rambleta*¹.

2. State of the Art

At its heart, this installation uses technology to explore new ways in which it can alter our perception of reality. The explorative work of the culminating experience was mainly inspired by acclaimed artists Ryoji Ikeda² and Julien Bayle³. They are both installation artists and performers based in France who develop highly conceptual work with technology at their core, while exploring themes like human perception and machine performance.

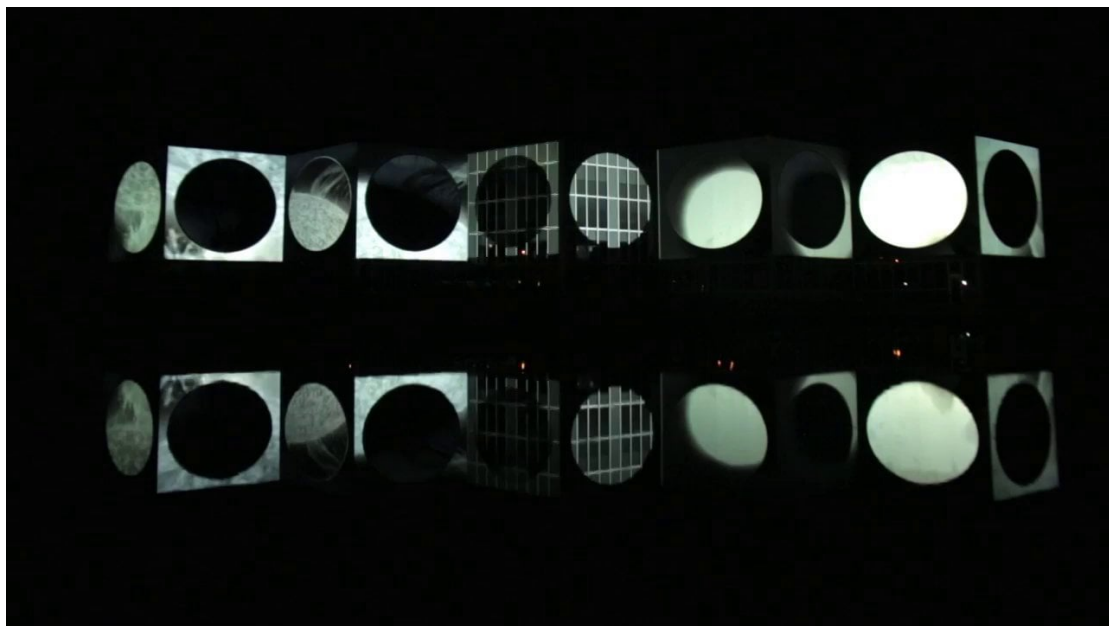


Figure 2: Ryoji Ikeda, “The Radar” Installation. Taken from Ikedas’ website. Copyright by Ryoji Ikeda.

¹ La Rambleta Website, “Què és la Rambleta”, accessed May 24, 2017,

<http://www.larambleta.com/que-es-la-rambleta>

² Ryoji Ikeda Website, “*Biography*”, accessed February 13, 2017, www.ryojiikeda.com/biography

³ Julien Bayle Website, “*Biography*”, accessed February 13, 2017, www.julienbayle.net/bio/

Installation Art often gets confused or associated with conceptual art because it can be traced back to the works of the same person: Marcel Duchamp⁴, who is an icon of conceptual art. However, as conceptual as an installation may be, it is usually an arrangement of objects and space. This allows the space to become an important part of the piece itself, unlike other art forms and viewers are invited to step inside for a unique experience⁵. This has allowed installation art to remain flexible and innovative over the years in terms of style and execution. “Installation art ranges from the very simple to the very complex. It can be gallery based, computer-based, electronic-based, web-based – the possibilities are limitless and depend entirely upon the artist’s concepts and aims.”⁶ This flexibility in style and concept presented excellent conditions for the work in progress. Having complete control over the space and environment in which it is exhibited is something that turned out to be more important than anticipated.

Another important aspect of the work is that everything it contains as far as audiovisual content, except for few audio samples, is digitally generated. Digital Art is a relatively new form that starts with Georg Neuss in 1965 when he presented

⁴ Encyclopedia of Art, “*Installation Art*”, accessed February 13, 2017, <http://www.visual-arts-cork.com/installation-art>

⁵ Ibid.

⁶ Encyclopedia of Art, “*Installation Art*”, accessed February 13, 2017, <http://www.visual-arts-cork.com/installation-art>

“Schotter”, a computer generated image which was considered “the latest type of contemporary art – a sort of ultimate postmodernism.”⁷

To best call upon the attention of our sight, the visual content is inspired by and somewhat a tribute to some principals of the Gestalt psychology. Among many things, the theory of psychology describes a cognitive process, which demonstrates how our mind fills in the gap when presented with fragments. Based on past experiences, the mind does its best to find patterns, reconstruct the presented pieces and make sense of a whole.⁸ This ability allows us to associate an unfamiliar audiovisual experience with past experiences, incepting the question about technology within our daily lives.

Altered Reality is not a new technology in the sense of hardware, but it is a unique approach to a combination of existing tools in order to create new kind of experiences with less resources. It was inspired by the idea of bringing augmented reality into the toolbox of live performers. Virtual Reality is the most immersive technology, but it alienates the user from his environment. Reality augmentation seemed more fitting to the original idea. However, it is still in development and even the prototypes are somewhat expensive, like Google Glass⁹ or the Microsoft HoloLens¹⁰.

⁷ Encyclopedia of Art, “*Computer Art*”, accessed February 13, 2017, <http://www.visual-arts-cork.com/computer-art>

⁸ Koffka, Kurt “Principles of Gestalt Psychology” (United Kingdom: Psychology Press, 1999)

⁹ Techradar, “*Google Glass Review*”, accessed May 29, 2017, <http://www.techradar.com/reviews/gadgets/google-glass-1152283/review>

3. Project Description

Divergent Realities is a composition of technology presented as an audiovisual installation within a dark room and featuring customized hardware with a built in application that offers an altered perspective on reality.

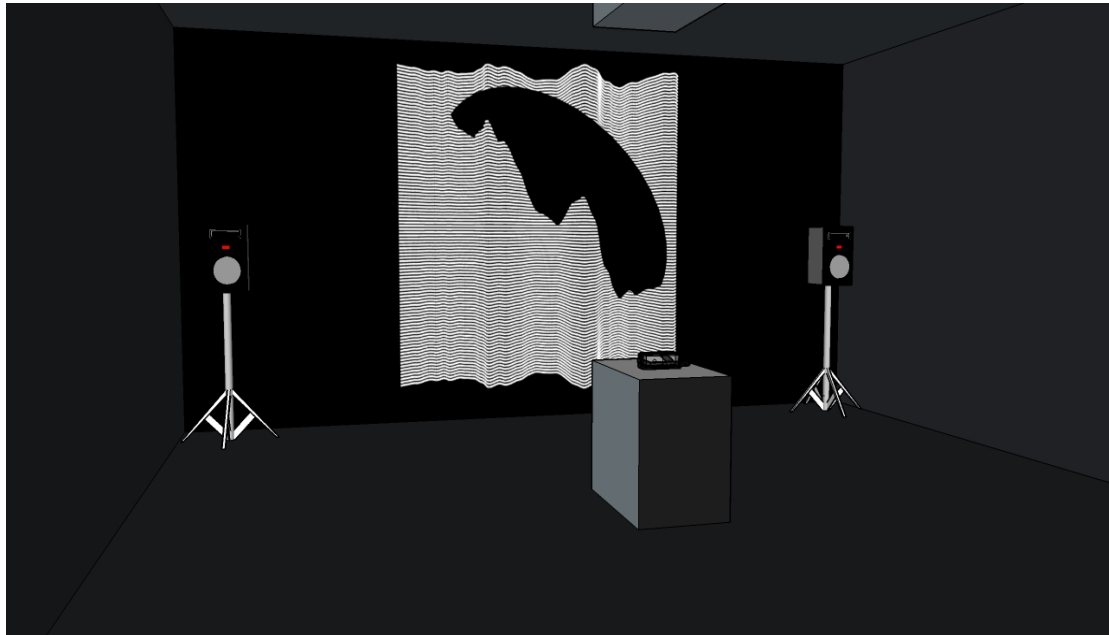


Figure 3: Divergent Reality Setup. Screen capture from SketchUp February 18, 2017, designed by author.

It relies on a complex system of software interaction, reactivity and generative elements within a loosely structured audiovisual composition that is being screened onto the main wall of the room. It sets the theme with playful perspective teasing visuals. The Headset, which provides the altered reality, is placed in the center of the room, in front of the projection. The physical distribution in space suggests a place for technology. It is set to be in the forefront of the work, allowing the user to easily detect its presence and relevance to the piece. The Altered Reality experience

¹⁰ Techradar, “Hands on: Microsoft HoloLens review”, accessed May 29, 2017,

<http://www.techradar.com/reviews/wearables/microsoft-hololens-1281834/review>

emphasizes technology as a tool that allows the user to have a divergent experience to what would otherwise be a traditional one, thereby catalyzing curiosity about its purpose and influence on our perception of reality.

The system that runs the installation was composed with a specific combination of software and hardware, due to limited resources. On the other hand, they are all accessible or already part of our daily rituals, which makes it a more accessible technology and easier to replace while prototyping. The Altered Reality Headset, as an example, is a custom designed App for iOS which runs on an iPhone inside a stereoscopic VR Headset. There are many free Apps available for iOS and Android, but their functionality is limited and are not fully functional or reactive to sound. Both being a requirement for the App, making it clear that it had to be a custom designed App that would seamlessly stream a camera input while twisting or distorting the image according to cues received over network from the main Ableton Live Set.

At the center of the installation is a MacBook Pro running that very complex Ableton Live Set with customized Max for Live plug ins and its own private network. It operates as the main engine of the installation and includes many features in order to enhance the experience. It makes use of the Arrangement View with an active loop to give it a super structure of thirteen minutes, while simultaneously using the Clip View on individual channels for Random Follow Actions. By including these generative elements, the soundtrack becomes less predictable. One may argue that technology acquires more character, which seemed fitting to underline the role of technology in this piece.

That same Ableton Live Set triggers the visual content, which is a string of scenes designed in OpenGL, based on audio reactive objects that phase in and out of each other by using layer priorities and alpha values. This was inspired by the concepts of Gestalt psychology, a philosophy the berlin school of experimental psychology¹¹. It is run by a custom designed Max for Live plugin that sends and receives data and audio in order to maximize the amount of reactive pathways, while keeping them subtle. For example, the grid of lines and shapes in the visual environment receives a direct audio signal from an auxiliary bus inside Ableton Live and turns that digital audio information into a matrix. The values of which get rendered onto the lines and shapes for movement that is representative of the music in real time.

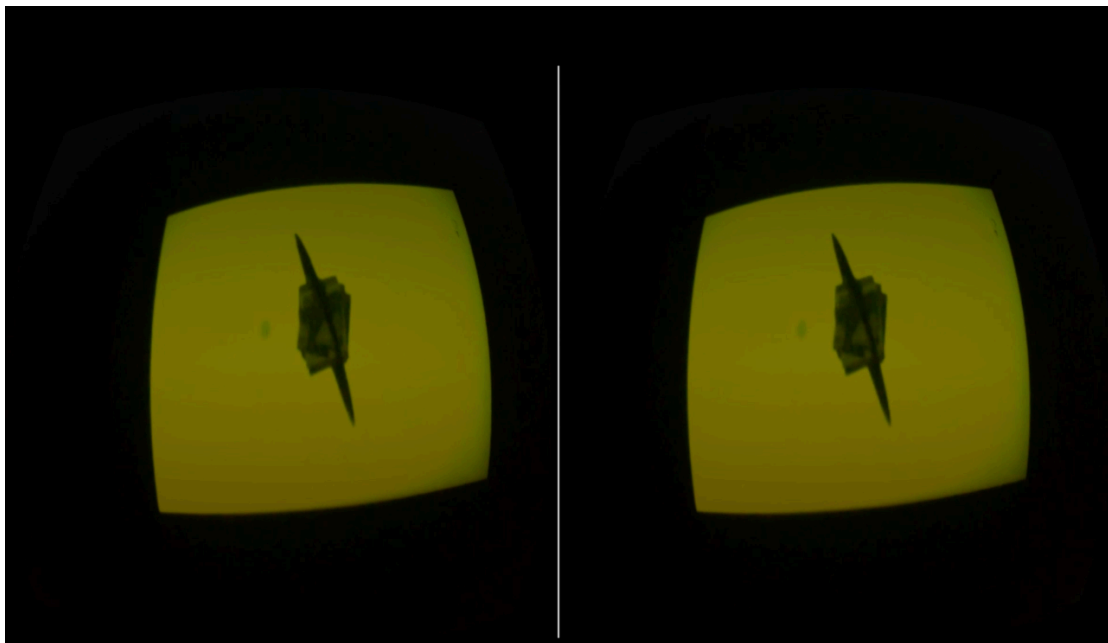


Figure 4: Screen capture from the stereoscopic Divergent Reality Application, May 20, 2017.

Another perceivable software reactivity is the Divergent Reality Plugin reads the alpha values of the visual render. It constantly calculates it as a median value, which then scaled and routed from Max into Ableton to control the Cutoff Frequency of the

¹¹ Ibid., Koffka.

High Cut Filter on a soft pad. It creates a direct relationship between amount of white pixels and amount of audible harmonics of the pad. However, the pad modulates on its own, increasing and decreasing in presence. This simulates an organic flow between two components of the piece.

While some elements of the piece are very obvious, like the dual experience, it is important to mention that the reason for subtlety is due to the installations inquisitive nature towards the human perception of reality and its evolving relationship with technology. The human sense of perception is what should be stimulated, in as many degrees as possible, to awaken curiosity and ask the relevant questions.

The following image might help better illustrate how all the software used for the development of Divergent Realities is connected in process and real-time to offer a unique experience:

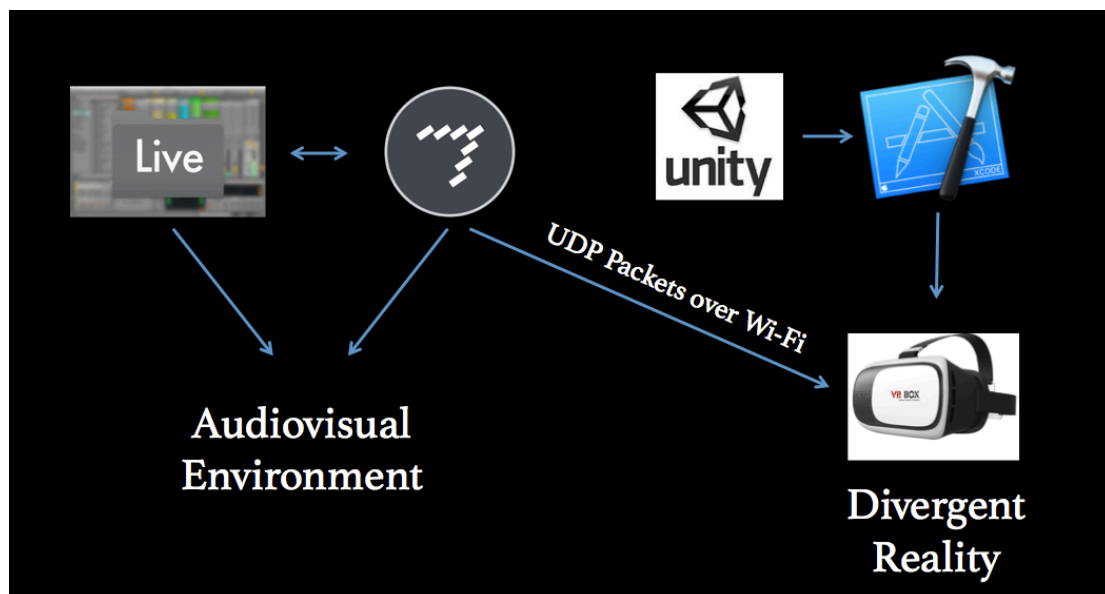


Figure 5: Divergent Realities software layout. April 12, 2017, graphics by author.

3. Innovative Aspects

The first innovative component considered innovative is the Altered Reality technology, which was specifically developed for this installation. It is easily confused with Augmented Reality, yet they differ greatly in purpose. Augmented Reality is mainly used to enhance our real world experience by adding that which cannot be picked up by our senses¹². Altered Reality on the other hand was developed to distort the users perception of reality. By altering the users view, reality is perceived differently and a new experience is acquired. This results in a duality between our natural perception and a divergent perception of reality through technology, which is paramount to the concept and purpose of this project.

So far, Virtual Reality has made use of cinematic and synchronized audiovisual experiences. It offers standard content in a groundbreaking format. However, they are still based on playback, which means that the content remains the same. Augmented Reality is real time, but it has not yet been developed for musical purposes. The Divergent Realities App, on the other hand, combines a number of structured effects and real-time information over network for unpredictable outcomes. A customized Sampler within the Ableton Live Set is tasked to trigger a random color change value, which is turned into a package and sent over its private network to the Divergent Reality App only for the current users experience. This links it directly to the installation and makes it a unique experience. It even has built in sounds that respond to visual cues only visible with the Headset.

¹² Mekni, Mehdi and Lemieux, André, “Augmented Reality: Applications, Challenges and Future Trends”, Applied Computational Science, pg. 207

Altered Reality is also innovative in the sense that, with further development, it can be a very accessible technology capable of competing with Augmented and Virtual Reality, requiring only a number of affordable gadgets. Most of which can be found in a common household. In this sense, one can argue that there is a methodical innovation in how existing technology is being used and combined in order to create an entirely new experience.

4. Challenges

Developing this project presented a number of challenges, both, expected and unexpected. The expected challenges were accounted for while developing the concept, while the unexpected challenges required some improvisation and compromise. It was also a personal challenge to develop a highly complex multimedia piece by expanding the available skillset.

It was expected to encounter many gaps of knowledge that were necessary to successfully complete the project. Programming skills, generating audiovisual content, network protocols and learning different methods of software interaction and generative processes had been accounted for and built into the original plan of action. It was also expected to spend a small budget and a great amount of time testing these new methods and skills to better portray the purpose and concept of the final work.

A somewhat unexpected challenge was working with a limited budget. New technology is always expensive at its early stages and still requires funding to further the development. So instead of using existing technology, the best option at hand was to develop a customized technology specifically for the projects purposes. However,

acquiring the skills to build it required more time than anticipated and help from peers was sought out to quickly solve the problems at hand. For example, the Divergent Reality App, which is built with scripting languages in Unity, was by far the biggest and most unexpected challenge. It required very customized scripts to receive data over network and react within Unity. With pieces of code, they were put together but were not yet responsive. The proper syntax for the scripting languages C# and JavaScript were confusing to learn in parallel, yet both were needed to complete this task. Until then the Unity Console managed to display the incoming data over network from the main Ableton Live Set correctly. However, unpacking and mapping that data within Unity seemed a lot more difficult than anticipated. By seeking out help and small collaborations, these issues were quickly set aside and the development could continue its course.

Around February, an artistic crisis came along and was an unexpected challenge to overcome. The first working prototype of the Divergent Reality App had been successful yet it had not turned out as expected. The concept had to be slightly redrafted and the project required further prototyping and research. Doubts of its potential and purpose had to be overcome and with hard work and dedication, the App was improved, the crisis resolved and a proper workflow resumed.

5. New Skills Acquired

Divergent Realities was conceptually conceived with no more than a background in Sound Engineering and Music Production, but Music Technology has always been a useful tool within reach of Producers and Musicians. This gave a foundation of knowledge to build the concept for the installation. Throughout its development it

became utterly clear that many new skills were required to execute this ambitious multi-disciplinary work. They were necessary to develop the concept, overcome the challenges and successfully troubleshoot any given problem while prototyping.

Sound was not going to be a matter of concern, so the focus had to be directed towards the skills that the project demanded, like generating visual content. This proved to be a long and difficult process, with a great deal of possibilities and new information that had to be processed quickly, but rewarded great results after understanding the workflow behind visual programming for OpenGL in Max. It offers a 3D environment in which objects can easily be generated, removed, physically warped and programmed to be reactive to incoming data, like a sound source or a stream of numbers. With the intent of stepping outside the comfort zone, it was not going to be sufficient to just generate audio reactive visual content. It required a clear compositional aspect with some generative components built in. Once the algorithm for the visual generating max Patch was written it had to be built into a prepared Ableton Live Set, which would eventually become the final Ableton Live Set, though it went through countless iterations before arriving at its final version.

Having technology at heart, the installation also required many skills from the Information Technology domain, like setting up networks and designing custom applications. This was probably the most challenging moment for the project and took a long time to overcome. Though with extensive research and external help, the needed skills for scripting the small programs and implementing them into Unity seemed effortless. The last step involved Xcode, the software with which the custom

scripts were assembled into a working Altered Reality Application were acquired and the issues resolved.

6. Future Ramifications

Further iterations are planned with intention of exploring the possibilities that were discovered while developing the Altered Reality technology. It is a simple combination of tools that may offer even more practical applications in the entertainment industry.

By having such an affordable technology at our hands, this project could be a next step of how live events are experienced. With the right equipment and investment, it can be tested and developed to support a large audience. It would require a team of technologists and musicians, but it could allow artists to have customized generative effects running through the App, which could be designed specifically for each song, yet unique each time, or however the artist envisions it. The user would always have a slightly different experience than the next, which makes the experience more interesting. And all they would need is a phone with the App and access to the events Wi-Fi. Cardboard Altered Reality Headsets could be designed for effortless transportation or offering them at events and at some point, user interaction could also be contemplated as a way for the users to engage with the experience and make it their own.

7. Conclusions

Augmented Reality is not an innovation in itself. It is, however, a novelty technology which is still in early stages of development with plenty room of improvement and for experimentation. Its current applications are more practical than artistic and most of them are still prototypes. Divergent Realities approaches this technology in order to use it within artistic fields. To develop artistic applications, as means to enhance our visual experience and make it reactive to sound and creating immersive environments.

Augmented Reality still has a long way to go before it becomes a good piece of technology that is accessible to the general public, even as a high-end quality gadget for entertainment. A part of the intent of this project was to make it more accessible by requiring only a phone and a cheap VR Headset. It has lots of potential and can be developed further in many ways. It is only a starting point for the future of immersive, reactive environments and a new terrain for artistic expression.

8. Footnotes & Citations

La Rambleta Website. “Què és la Rambleta.” Accessed May 24, 2017.

<http://www.larambleta.com/que-es-la-rambleta>

Ryoji Ikeda Website. “Biography.” Accessed February 13, 2017.

<http://www.ryojiikeda.com/biography>.

Julien Bayle Website. “Biography”. Accessed February 13, 2017.

<http://www.julienbayle.net/bio/>.

Encyclopedia of Art Website. “Installation Art”. Accessed February 13, 2017.

<http://www.visual-arts-cork.com/installation-art>.

Encyclopedia of Art Website. “Computer Art”. Accessed February 13, 2017.

<http://www.visual-arts-cork.com/computer-art>.

Koffka, Kurt. *Principles of Gestalt Psychology*. London: Psychology Press, 1999.

Techradar Website. “Google Glass Review”. Accessed May 29, 2017.

<http://www.techradar.com/reviews/gadgets/google-glass-1152283/review>.

Techradar Website. “Hands on: Microsoft HoloLens review”. Accessed May 29,

2017. <http://www.techradar.com/reviews/wearables/microsoft-hololens-1281834/review>.

Mekni, Mehdi and Lemieux, André, “Augmented Reality: Applications, Challenges and Future Trends,” in *Applied Computational Science*, edited by Azami Zaharim,

Kamaruzzaman Sopian, Kleanthis Psarris, Maurice Margenstern, 205-214. World Scientific and Engineering Academy and Society, 2014.