# SIMULATING PSYCHEDELIC THERAPY THROUGH MEDIATED REALITY

## BY

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# Abstract

Due to the illegality of psychedelic substances, and despite proven efficiency, people suffering from various psychiatric illnesses and disorders are unable to receive potentially life-changing psychedelic therapy. With the recent technological development of computer-mediated realities, designers and developers now have the opportunity to digitally recreate such treatments. Through practical application along with the review of literature and conferences, this study aims to analyse the potential of mediated realities to convincingly simulate psychedelic therapy.

Augmented reality (AR) and modulated realities (ModR) such as modified and diminished reality show insufficient evidence for practical use in simulated psychedelic therapy. Augmented virtuality (AV), mixed reality (MR), virtual reality (VR) and modulated virtuality (ModV) contain a range of characteristics fundamental to potentially simulating mind manifesting psychedelic therapy. However, mediated reality in general appears to be extraneous for practical use in mind loosening psychedelic therapy. Currently, virtual reality (VR) shows the greatest potential for healing, trauma release, personal growth and exploration of the psyche by simulating closed-eye psychedelic experiences through adding virtual information via an HMD.

Accordingly, the author of this study has proposed a proof of concept (POF) for a neurofeedback driven VR experience which simulates aspects of both mind loosening and mind manifesting psychotherapy. This POF is intended to simulate the transformation of phosphenes into complex geometric pattern based hallucinations. With further development in this field, one day people suffering from various mental conditions might be able to receive safe, accessible and legal forms of simulated psychedelic therapy.

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Andrew Hillstead

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# List of Abbreviations

AR . . . . . . . . Augmented Reality
AV . . . . . . . . Augmented Virtuality
EEG . . . . . . . Electroencephalogram
HMD . . . . . . Head Mounted Display
MMod . . . . Mixed Modulation
MR . . . . . . . Mixed Reality
ModR . . . . . Modulated Reality
ModV . . . . . Modulated Virtuality
RE . . . . . . . . Real Environment
VMod . . . . . Virtual Modulation
VR . . . . . . . . Virtual Reality

# 1

# 1 Introduction

Today we live in a world where even the terminally ill are denied access to the life changing treatment of psychedelic therapy, despite such treatment's proven success in treating associated psychiatric illnesses and disorders. Psychedelic therapy involves the use of psychedelic drugs such as LSD, psilocybin, DMT, mescaline and MDMA to primarily assist in psychotherapy (Masters & Houston, 2000; Grof, 2001). The practice assists patients in breaking through mental barriers that are at the root of their condition, thus greatly boosting the effectiveness of their therapeutic treatment. Before the international outlaw of psychedelic drugs in the mid-late 1960s over 2,000 papers were published in scientific journals that described positive therapeutic results from over 40,000 patients who took such drugs with few side-effects and a high level of safety (Masters & Houston, 1970; Sessa, 2005). Despite such positive results, allegedly due to the drug culture at the time, most psychedelic drugs were internationally outlawed and practically all research came to a halt ("The Medical History of Psychedelic Drugs", 2007; Sessa, 2012). Due to legislation and harsh penalties, few studies surrounding psychedelic therapy have been conducted since the early 1970s (Strassman, 2001).

Since the outlaw of psychedelics, the world has seen an exponential increase in technological development. In the past few years, augmented reality (AR), augmented virtuality (AV), mixed reality (MR), virtual reality (VR), modulated reality (ModR) and modulated virtuality (ModV) have become viable platforms to develop therapeutic applications. In fact, this year (2017) is expected to see the largest release of 'mediated reality' hardware and software yet (Merel, 2017; Rosedale, 2017). These realities, known as mediated realities, in some way or another all alter human perception through dynamic computer processing devices in a manner comparable to psychedelics (Starner et al., 1997; Mann, 2002; Huxley, 1954; Hofmann, 1979). These devices include handheld or head-mounted displays (HMD) such as a smartphone or an Oculus Rift virtual reality headset.

Much like psychedelic substances, mediated reality has shown potential to provide healing, trauma release, personal growth/development and other forms of treatment to people suffering from various mental conditions. Those mental conditions include post-traumatic stress disorder (PTSD), depression, chronic anxiety, eating disorders and body dysmorphia (Parsons & Rizzo, 2008; Gould, Holmes, Fantie, Luckenbaugh, Pine, Gould, & Zarate, 2007; Marco, Perpina & Botella, 2013). Mediated reality has even shown promising results in assisting in stroke rehabilitation and improving the social

skills of young adults with autism (Boian, Sharma, Han, Merians, Burdea, Adamovich & Poizner, 2002; Kandalaft, Didehbani, Krawczyk, Allen & Chapman, 2013). However, mediated reality is still in its early stages of development. Although there now exist technological capabilities that simulate various therapeutic practices, very little research has been conducted on specifically simulating psychedelic therapy. As a result, traditional methods of psychedelic therapy are still proven to treat a much wider range of psychiatric illness and disorders than therapeutic mediated reality applications (Sessa, 2012). This realisation presents exciting new possibilities to treat associated mental conditions with mediated reality psychedelic therapy.

As technology continues to advance at exponential rates, design practitioners and other creators will begin to integrate increasingly complex concepts and systems into potential therapeutic mediated reality applications. With new theories, game modes, mechanics, hardware and software continually evolving/being developed; design practitioners will have a greater range of tools and accessible knowledge to develop convincing psychedelic therapy simulations. The focus of this study is to analyse the potential of those mediated reality elements to convincingly simulate psychedelic therapy.

## 1.1 Thesis Structure

The above introduction has outlined the main contributions described in the body of this thesis. For coherent readability, the methodology section for the two parts of this thesis, namely the written thesis, and the creative output, will be discussed separately.

The theoretical research will be discussed first to provide the reader with a solid contextual understanding of the subject matter. The literature concerned with the practical application of design is discussed later in this thesis. Accordingly, the theoretical based research methods are discussed in Chapter 2, and the design-based methodology (Design Development) in Chapter 6.

Chapters 3 and 4 titled 'Mediated Reality' and 'Psychedelic Therapy' provide a theoretical framework/background within which the remainder of this study is based. This theoretical framework/background explores a variety of research which assists in demonstrating the plausibility that mediated reality may one day substitute or even aid in traditional methods of psychedelic therapy. Such exploration is utilised in this study to further understand, explain, challenge and extend existing knowledge surrounding mediated reality and psychedelic therapy, within the limits of critical bounding assumptions. Finally, these Chapters both briefly discuss a number of conferences and speaker events which I attended either in person or via live stream.

Chapter 5 (Design Precedents) begins by providing a historical overview of relevant design precedents, after which modern design precedents are discussed and analysed.

Chapter 6 (Design Development), as stated earlier, discusses the design development which assisted in coming to the final creative output(s). This Chapter analyses and discusses the initial works produced for this thesis; this includes works which were produced before this project and acted as a source of artistic direction. It also introduces supplementary works which were completed throughout the duration of this project, two of which were completed at Hackathons. Finally, this Chapter discusses the methods that I used to create my final creative outputs.

Chapter 7 (Analysis) analyses and interprets the findings of this study. It describes the potential of each type of mediated reality to simulate psychedelic therapy.

Chapter 8 (Creative Output) discusses the creative output(s) produced as a result of this thesis. This includes a proof of concept, two videos and an online portfolio website.

Chapter 9 (Discussion) discusses the results of both the creative output and the content of the thesis as a whole. This section will also include the recommendations and challenges of future prototypes.

Chapter 10 is the conclusion.

Chapter 11 is a brief reflection of the work that I have conducted over the past year. It finishes by summarising and concluding the study.

Chapter 12 provides the references used throughout this study.

# 2

# 2 Research Methods

Extensive collaboration within academia is crucial to producing a diverse variety of works which relate to the body of knowledge surrounding psychedelia. Masters & Houston (2000) warn that much of the work surrounding psychedelics will need to be exploratory. Therefore any limitations must be arbitrarily imposed, particularly in the creative fields. Masters & Houston explain that given the range and diversity of the psychedelic experience, the creation of a comprehensive body of knowledge will require multidisciplinary contributions if it is not to be warped and stunted. Such works, experiments and collaborations will help to determine the best research designs, data-collection methods and selection of subjects for future research. The success of future mediated reality psychedelic therapy prototypes depends on collaboration between disciplines. In exchange for collaborative contributions, people from all disciplines will be able to nurture, guide and celebrate the success of future prototypes.

Because the variables surrounding the psychedelic experience are so vast and the techniques required to simulate such experiences are so complex, both qualitative and quantitative research methods would aid in investigating the research problem. However, based on Masters & Houston's authoritative analysis of psychedelia related methodology in creative fields, this study has used primarily qualitative research methods. As Masters & Houston suggest, given the range and diversity of the psychedelic experience and considering the lack of knowledge surrounding mediated reality related psychedelia, and, also given my field of study (design), it is logical to chiefly use qualitative research methods to provide future researchers with a broad exploratory framework to work from.

Based on the research methods suggested by Masters & Houston combined with the research methods used by the authoritative sources cited, this study will predominantly use case studies and grounded theory. Eisenhardt (1989) describes a case study as an in-depth analysis of an individual unit stressing developmental factors in relation to the environment. Strauss and Corbin (1997) describe grounded theory as a systematic generation of theory derived from systematic research. Grounded theory is a set of rigorous research procedures which lead to the development of conceptual categories. These primary sources include Hofmann (1979), Leary (1994), Mann (2002), Masters & Houston (2002), Milgram et al. (1995) and Sessa (2012). Using these authoritative scholars as examples, I too have utilised case studies and grounded theory as an effective method of helping to understand the

potential mediated reality has in simulating psychedelic therapy. Such methods have been utilised throughout this study in a comprehensive and holistic way. That is that through case studies and grounded theory I have been able to analyse the relationship between mediated reality and psychedelia as a complex system, which is intimately interconnected through non-linearity.

The type of grounded theory used in this study shares many similarities to structural-functional theory, a theoretical perspective used in sociology which draws connections between seemingly solitary variables into a complex whole. An example of such a relationship is observing how virtuality (AR, AV, MR, VR) and the psychedelic experience can both augment a user's vision and in turn promote healing or other types of treatment. The relationships discussed in this study have been carefully interpreted and disclosed by sourcing and analysing corpus data from authors who use both or either qualitative or quantitative research methods. By reviewing, analysing and comparing existing literature and design precedents (corpus data) relevant to the design problem it is possible to make assumptions as to the capacity in which mediated reality psychedelic therapy simulations could be developed in the future.

As well as utilising case studies and grounded theory, this study also analyses the content discussed at various conferences which I attended about simulating psychedelic therapy. To keep up to date with the continually changing environment of mediated reality, and to hear about recent discoveries in the way of psychedelia, attending such conferences is vital, especially considering the qualitative nature of this study.

The type of research I am using throughout this study can be considered both basic (pure) and applied research. Applied research refers to research used to help understand real world problems and to solve them, whereas basic research refers to research used to further develop general knowledge (Kowalczyk, n.d.). While this research uses both methods, it leans towards the use of basic research. This is because the intention of my research is to expand the general knowledge of simulating psychedelic therapy through mediated reality using analysis, yet at the same time this research seeks to improve the understanding of how to develop such a proof of concept. The result of this study primarily seeks to provide universal principles surrounding mediated reality psychedelic therapy simulations, while at the same time attempting to provide an actual solution by creating a proof of concept.

# 3

# 3 Mediated Reality

Computer-mediated reality, or mediated reality for short (assuming that the reality is mediated via computer processing unless stated otherwise), similarly known by other names such as 'extended reality' (Gownder et al., 2016), means to add, subtract or manipulate human perception. To be precise, the term 'mediated reality' was defined by one of the godfathers of wearable technology, Steve Mann, as a "general framework for artificial modification of human perception by way of devices for augmenting, deliberately diminishing, and more generally, for otherwise altering sensory input." Such devices include dynamic computer processing devices such as handheld or head-mounted displays. Mediated reality is an umbrella term which collectively groups together realities such as AR, AV, MR, VR and also ModR and ModV. These realities will be explained later in this Chapter.

The need for me to give this presentation about mediated reality stems from a problem which I encountered early in my Master's studies. I found that in both academia and popular culture there seemed to be no consistent term which collectively describes all of these different realities. Milgram and Kishino developed a framework to describe these realities in 1994, and Mann added a few important additions to this framework in 2002 including the actual term mediated reality. However, this was 15 years ago, long before our recent technological advances in the way of mediated reality. While Mann's contribution to Milgram and Kishino's framework is critical to understanding the concept as a whole, there are a few holes in his proposed framework, which is unfortunate, because Mann's framework is still widely considered the most authoritative and accurate representation of mediated realities to date. The purpose of this video is to provide a more accurate analysis of the mediated reality framework. Therefore, the framework which is presented in this video expands on the fundamental ideas and principles which were originally proposed by Mann, Milgram, Kishino and a few others.

To understand mediated reality, we must first begin with Milgram & Kishino's 'Reality - Virtuality Continuum', as seen below in Figure 3.1. The 'Reality, Virtuality Continuum' can be understood as a continuous scale ranging from the completely real on the left to the completely virtual on the right.
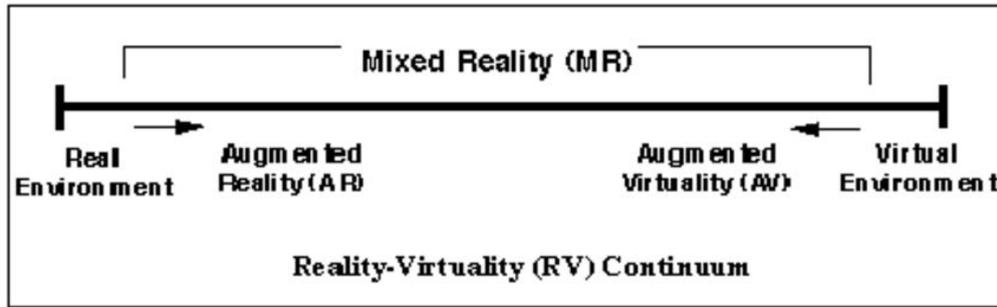
*Figure 3.1 – Reality – Virtuality Continuum (Milgram & Kishino, 1994)*

## 3.1 Real Environment

The completely real is what we all know and understand as reality. In mediated reality, reality is referred to as the 'real environment' (Milgram & Kishino, 1995).

## 3.2 Virtual Reality

Virtual reality, on the other end of the continuum, is a completely artificial, computer-generated environment (Milgram & Kishino, 1995; Brooks, 1999). This emulation typically requires the use of a VR HMD, such as Oculus Rift or HTC Vive, to fully immerse the user.

## 3.3 Augmented Reality

The first reality on the continuum after the real environment is augmented reality (AR). AR can be understood as primarily the real environment with some additional virtual information added to the user's view. The augmenting information may consist of virtual geometric objects or non-geometric information placed into the environment. Milgram, Takemura, Utsumi and Kishino (1995) state that there are two primary categories of AR titled 'See-Through' and 'Monitor-Based' AR.

'Monitor based' AR, as defined by Milgram et al. (1995), refers to non-HMD or "window-on-the-world display systems where computer generated images are either analogically or digitally overlaid onto live or stored video image." An example of a monitor based AR device is a smartphone with AR capabilities. The software development company named Niantic utilises these capabilities in a popular free-to-play, location-based AR game called 'Pokemon Go'. Released on July 6, 2016 ("Pokémon GO Available in Twenty-Six New Countries," 2016), players can use their smartphone's GPS capability to locate, capture, battle, and train virtual creatures, called Pokémon. These virtual creatures appear on the screen as if they were in the same real-world location as the player ("City Scout Magazine Podcast," n.d.). While it is important to understand that monitor based AR exists, this category will not be further explored in this study.

However, the second category of AR known by the term 'see-through' AR will be explored in this study. Two variations of see-through AR known by the terms 'optical see-through and 'video see-through' exist.

Optical see-through AR refers to head-mounted systems which combine computer-generated imagery with a "through the glasses" image of the real world. Milgram et al. (1995) characterise this category of displays as partly transmissive optical combiners which when placed in front of the user's eyes enables the user to see the reflection of virtuality projected on small displays in their viewable pathway. One of the most notable examples of an optical see-through device is the Google Glass that shows information in a smartphone-like hands-free format (Albanesius, 2012). The Google Glass prototype was released to the public on May 15, 2014. However, production was quickly cancelled on the 15th of January 2015 ("Here's your chance to get Google Glass," 2014) allegedly due to criticism in areas concerning privacy, safety considerations and terms of use ("Controversy grows over Google's Glass project," 2013).

The second variation of see-through AR known by the term 'video see-through' AR refers to HMD devices capable of presenting live video feeds to the user from cameras that capture the view of the real world. The video images of the real world are then combined with the computer-generated images of the virtual world, to create AR images that can be displayed on a traditional (non-see-through) HMD (Kanbara et al., 2000). The Vuzix WRAP 1200DXAR Glasses (2017) which are currently in the development stage (as of 21/02/2017) are a notable example of a Video See-Through AR device.

## 3.4 Augmented Virtuality

Next on the continuum after AR is augmented virtuality (AV). As opposed to AR which refers to reality augmented by graphics, Milgram and Kishino (1994) define AV as graphics augmented, or emulated, by reality. AV describes all the cases where aspects of the real environment are inserted into a computer-generated environment. To help differentiate between AR and AV, in 1995, Milgram et al., composed a set of questions:

- Is the environment being observed principally real, with added computer generated enhancements?
- Is the surrounding environment principally virtual, but augmented through the use of enhancements from the real world?

If the first question is answered in the affirmative, then the reality can be assumed to be principally AR. Alternatively, if the second question is answered in the affirmative, the reality can be assumed as principally AV. The case defined by the second question serves as a working definition of what Milgram et al. term as 'Augmented Virtuality'.

A visual example of AV would be to insert live video feed into a virtual environment. An olfactory example would be to direct a smell towards a user when they are exposed to an associated virtual object in a virtual environment. A haptic example would be to turn on an air conditioning system when the user is exposed to a hot or cold virtual environment. While the term AV is rarely used nowadays, AV and MR are often used as synonyms in popular culture.

## 3.5 Mixed Reality

Mixed Reality (MR) is a term which refers to all realities between the real environment and virtual reality. Therefore, it includes AR, AV, as well as any combination of these. It is the merging of real and virtual worlds to produce new environments and visualisations where physical and digital objects co-exist and interact in real time.

A notable example of an MR device is the head-mounted Microsoft HoloLens which was released as a development edition on March 30, 2016 ("Microsoft announces global expansion for HoloLens," 2016). Although marketed as MR, by definition this device could also fall under the optical see through category of AR.

The 'Reality - Virtuality Continuum' therefore includes all realities which augment (or add to) the real environment - this virtual addition to reality can be understood as virtuality (as seen in Figure 3.2 below). However, this poses the question, "how would realities which subtract from the real environment be represented on the Reality - Virtuality Continuum?"
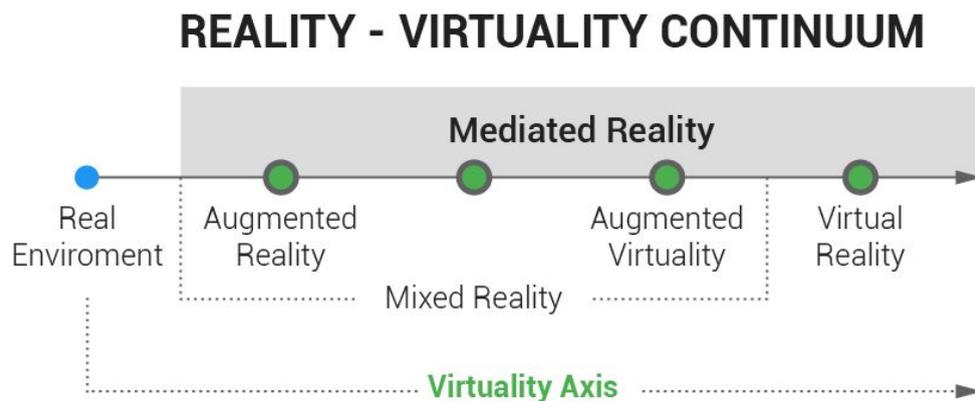


*Figure 3.2 – Reality - Virtuality Continuum (derived from Milgram & Kishino, 1994).*

## 3.6 Modulated Reality

Perhaps the least well-known, least understood and least developed category of realities in the mediated reality framework is modulated reality. The meaning of the word modulated, or modularity can change somewhat depending on the context and

area of study. However, in the context of mediated reality, it refers to objects or aspects of the real environment that are modified or deliberately diminished through the use of computer processing. Often this occurs through the process of removing or separating objects or aspects of the real environment and then recombining them to diminish or modify the user's perception of reality. Modularity, or modulated reality in the most general sense, is the direct opposite of virtuality (as seen below in Figure 3.3).
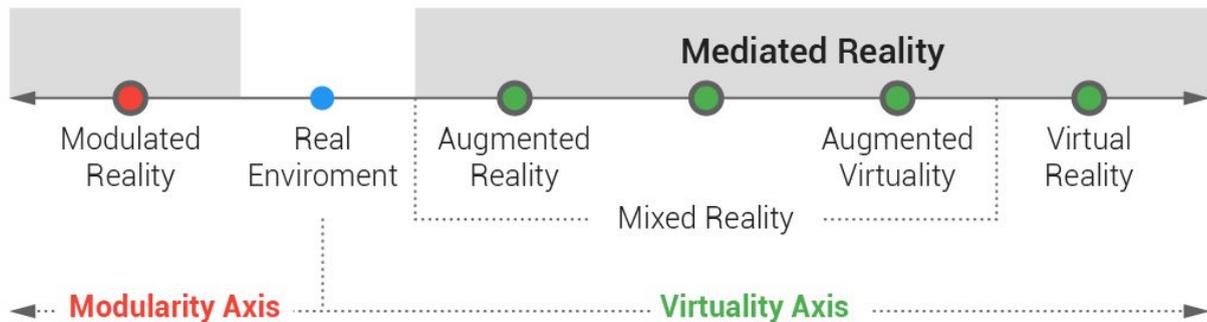


*Figure 3.3 – Modularity - Virtuality Continuum*

## 3.7 Modulated Virtuality

Placing modularity on the continuum horizontal to virtuality works in a theoretical sense providing that realities on the modularity axis can not be combined with realities on the virtuality axis. However, this is not the case. To denote realities which include aspects of both modularity and virtuality we must alter this continuum so that the modularity axis is placed vertically (as seen below in Figure 3.4). The continuum can now be referred to as taxonomy. When placed vertically, a new type of reality is introduced, this reality could be a combination of most forms of modularity and most forms of virtuality. This new type of reality is therefore called 'Modulated Virtuality' (ModV).
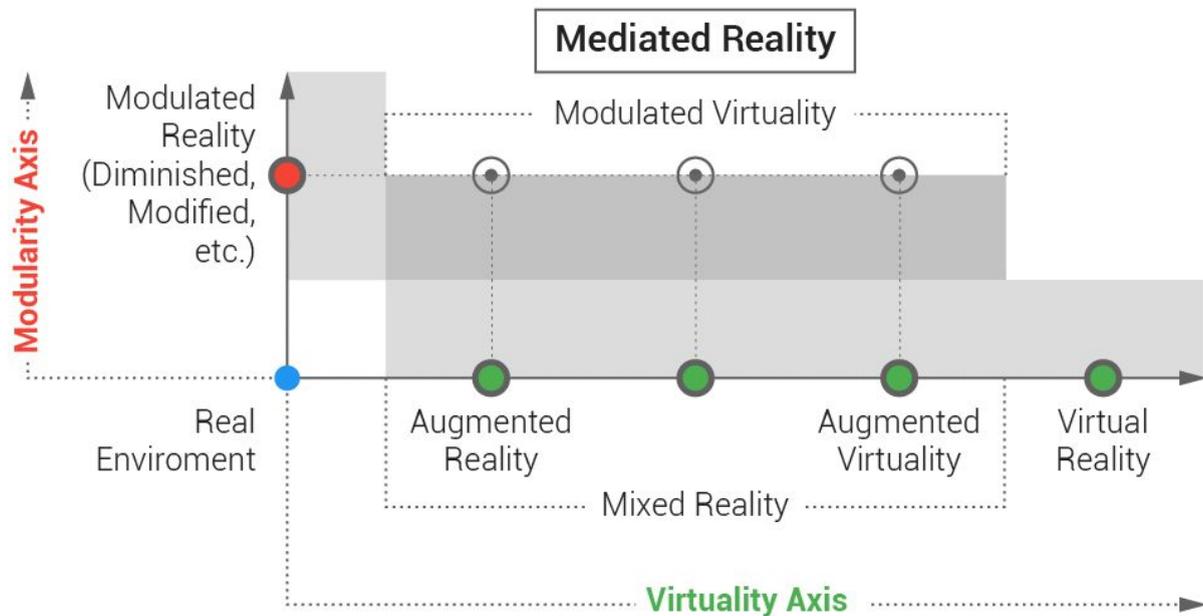
*Figure 3.4 – Mediated Reality Taxonomy – Condensed*

There is one exception when combining modularity and virtuality. In a theoretical sense, it is not possible for virtual reality to include aspects of ModR and vice versa. This is because ModR is defined as diminishing or modifying the real environment. Since VR is defined as being a fully virtual environment with no aspects of the real environment, if one wanted to merge VR and ModR, they would first have to reduce or take away some aspects of VR. Therefore, what they would actually be doing is merging AV with ModR.

The same principle applies to cases of ModR that are so severely modulated that they no longer include any aspects of the real environment. This is simply because, if virtuality were added to this version of severely modulated reality, it would no longer qualify as ModR. Instead, it would be considered VR.

So one could argue, that when a virtual reality headset is turned off, the user experiences a state of severe ModR, whereas when the headset is turned on, the user experiences a state of VR.


## 3.8 Taxonomy of Mediated Reality

To get a better visual understanding of this concept, we can expand our two-dimensional plane of virtuality and modularity to include modified and diminished reality (as seen below in Figure 3.5).

Here we can see that severely modulated reality, and VR can not interact with their perpendicular counterparts. We can also see that modified reality and diminished reality are types of realities within modulated reality, in a similar way to how AR and AV are realities within MR.
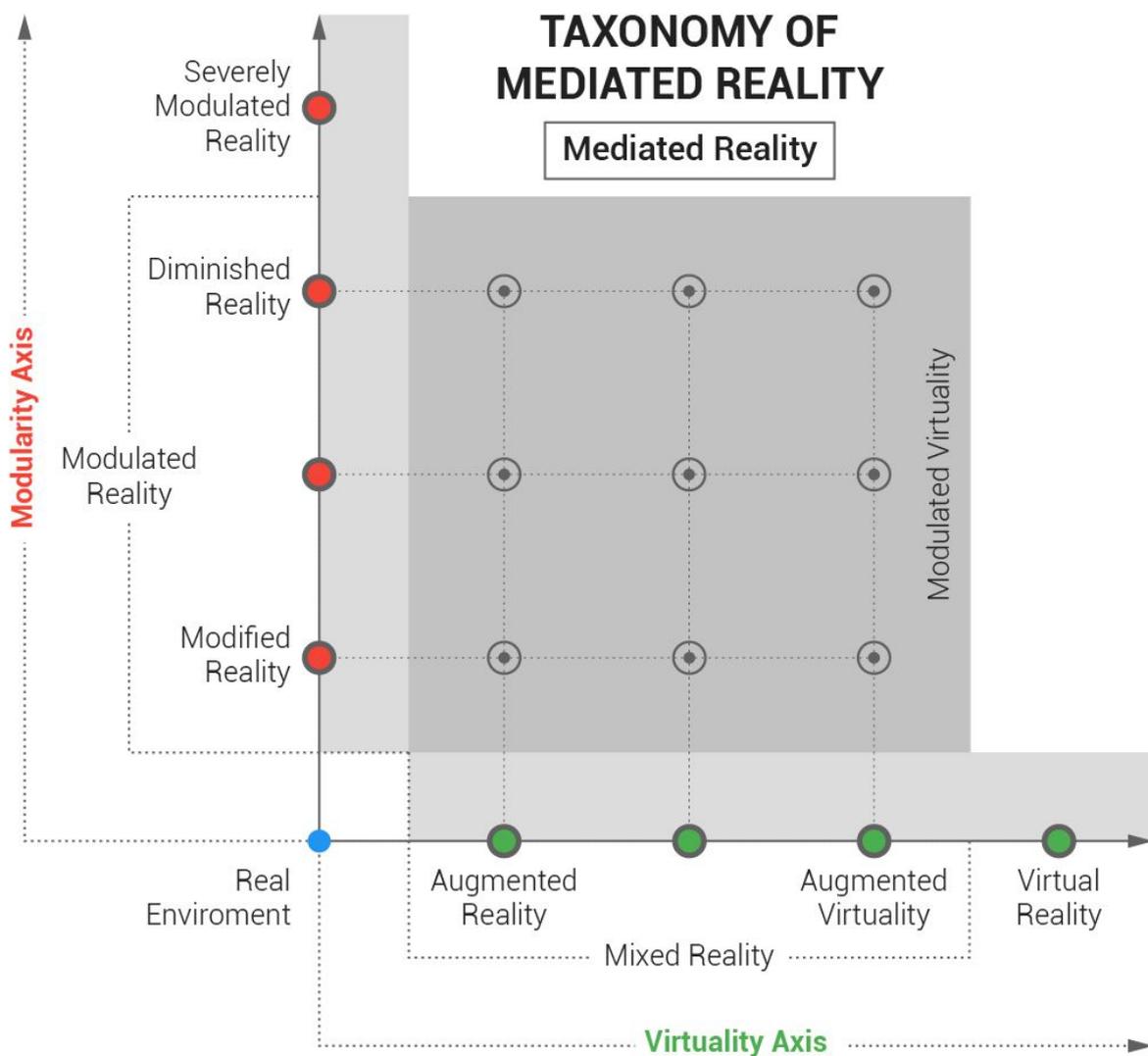


*Figure 3.5 – Mediated Reality Taxonomy*
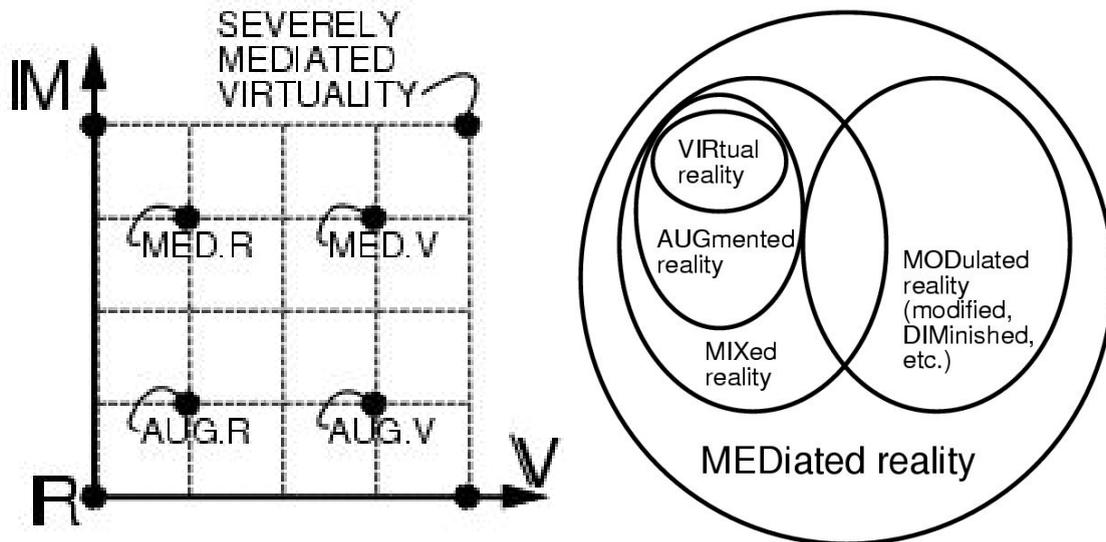
*Figure 3.6 - (at left) Taxonomy of Reality, Virtuality, Mediality (Mann, 2002)*
*Figure 3.7 - (at right) Venn Diagram Illustrating Mediated Reality (Mann, 2002)*

I will now discuss the changes which I have made in the 'Taxonomy of Mediated Reality' from Mann's 'Taxonomy of Reality, Virtuality, Mediality' (as seen above in Figure 3.6). Firstly, we can see that I have changed Mann's mediality axis (denoted by the letter 'M') to the modulated reality axis. It seems impractical and confusing to use a synonym of mediated for an axis which should describe modularity. It also seems strange that Mann even makes the visual implication that modularity should have its axis in his 'Venn Diagram Illustrating Mediated Reality' (as seen above in Figure 3.7). After changing the name of this axis and how the graph is arranged, it becomes much clearer as to how realities within the mediated reality framework sit in relation to one another.

## 3.9 Hierarchy of Mediated Reality

Mann's Venn diagram more accurately represents mediated reality than his 'Taxonomy of Reality, Virtuality, Mediality'. However, it still lacks a few important details. These details include the representation of where the real environment sits in relation to mediated reality. Mann also neglected AV and ModV. Accordingly, I have developed a Venn diagram to more accurately represent our current understanding of mediated reality.
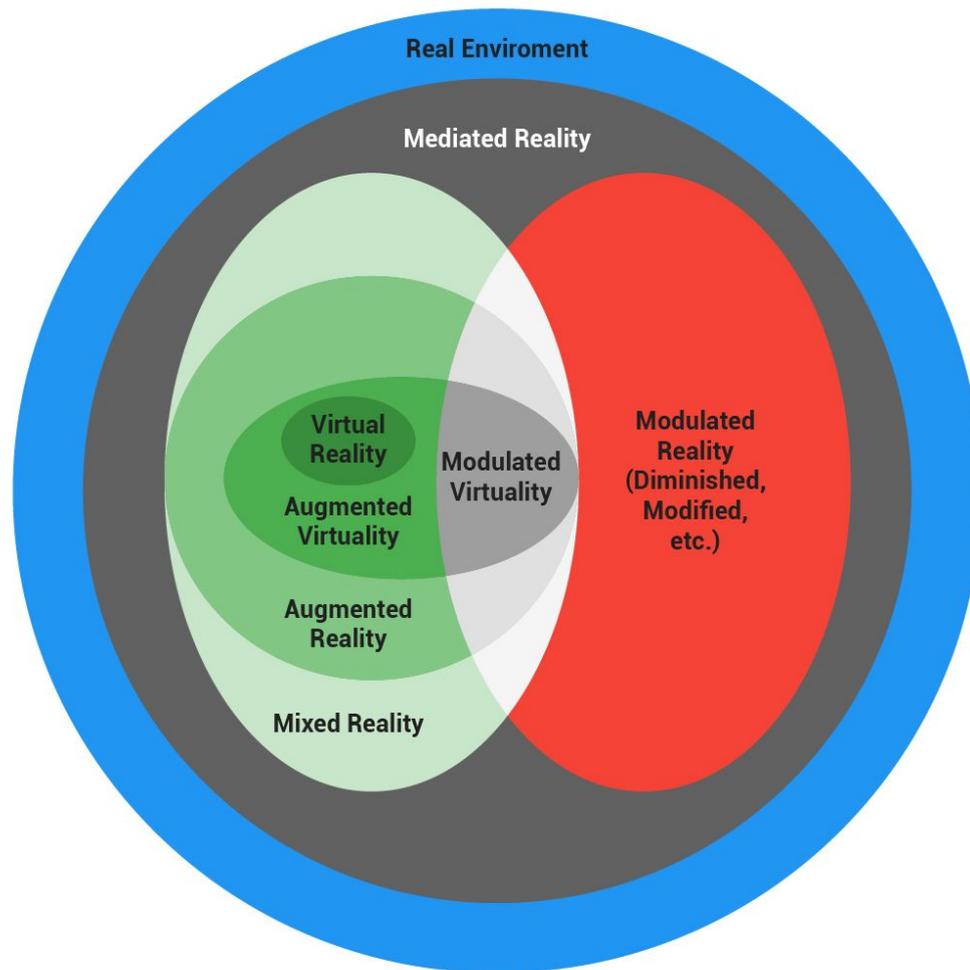
*Figure 3.8 – Venn Diagram Illustrating Mediated Reality (divided from Mann, 2002)*

## 3.10 Visualisation of Mediated Reality



**ModR, Severely Modulated: Modulated Reality**
Severely modulated environment with no aspects of real environment

**ModR, Diminished: Modulated Reality**
Real environment with some aspects deliberately diminished.

**ModR, Modified: Modulated Reality**
Real environment with some aspects modified.

**ModV: Modulated Virtuality**
A combination of both virtuality and modularity

**RE: Real Environment**
Full real environment with no aspects of mediated reality.

**AR: Augmented Reality**
Primarily real environment with some aspects of virtuality.

**AV: Augmented Virtuality**
Primarily virtual environment with some aspects of the real environment.

**VR: Virtual Reality**
Full virtual environment with no aspects of real environment.

*Figure 3.9 - Mediated Realities*

Starting at the bottom left and covering the virtuality axis is the full real environment with no aspects of either virtuality or modularity. Then there is augmented reality which is primarily the real environment with some aspects of virtuality. Next, is augmented virtuality which is primarily the virtual environment with some aspects of the real environment. Last, on the virtuality axis, is virtual reality which is the full virtual environment with no aspects of the real environment.

Mixed reality denotes both augmented reality, augmented virtuality or any combination of these.

First on the modularity axis is modified reality which is primarily the real environment with some aspects modified. Next, comes diminished reality which is primarily the real environment with some aspects deliberately diminished. Lastly, on the modularity axis, is severely modulated reality which is a severely modulated environment with no aspects of the real environment.

Modulated reality denotes modified reality, diminished reality, or any combination of these.

Finally, there is modulated virtuality which is a combination of both virtuality and modularity.

Since modulated reality and mixed reality are terms used to collectively describe sub-realities, one can use their imagination to decide what these realities would look like based on this visual representation.

# 4

# 4 Psychedelic Therapy

While scientists have a much better grasp on the inner workings of psychedelics now than they have ever had in the past, there remains a significant number of mysteries regarding psychedelics and the mind. The topic of psychedelic therapy, much like psychedelic substances, is profoundly broad. The following framework does its best to cover most areas of psychedelia I deem relevant to simulating psychedelic therapy through mediated reality, within the scope of this study. This Chapter will cover a variety of areas ranging from the medical history of psychedelics through to 'bad trips'.

## 4.1 A Brief Medical History

The medical history of psychedelics can be split into three timescales representing important lengths of time crucial to understanding the current context of psychedelic drugs in the present-day. The first timescale began at the time when humans began to consume psilocybin mushrooms thousands of years ago. The exact stage in history when humans began to consume such psychedelic substances is highly debated in academia. However, a theory proposed by Terence McKenna argues that psilocybin mushrooms were part of early humans' diet during their transformation from Homo erectus to the species Homo sapiens. The Stoned Ape Theory dates back to what can only be perceived as 'prehistory' and states that a significant proportion of human evolution came as a result of the ingestion of psilocybin cubensis mushrooms. The Theory argues that this new addition to the species diet played a key role in altering human behaviour, perception, and social order, thus giving humans an evolutionary advantage leading them to the development of spoken language. While this theory is highly controversial and attested in academia, fossil evidence suggests that civilizations began using psychedelics for various spiritual and often therapeutic purposes over 10,000 years ago ("The Medical History of Psychedelic Drugs", 2007) This evidence highlights the significance that psychedelics have had in influencing many cultures over the past thousands of years.

The arrival of Spanish Catholic missionary priests into the New World in the 16th century led to the discovery of the Mayan, Aztec and other indigenous civilisations that had been using naturally occurring psychedelic substances such as peyote, morning glory seeds, psilocybin mushrooms, and ayahuasca as part of religious or healing ceremonies. It was later discovered that various cultures from all around the

world, including ancient Greek and Pre-Aryan cultures, had utilised the positive and transformative properties that these substances hold (Grinspoon & Bakalar, 1979. These civilisations recognised that these substances could be used in a solemn and sacred context, often putting them at the centre of their spiritual life.

Various developments in the field of psychedelia were made between the 16th and 20th century including the isolation and identification of mescaline by A. Heffter in 1897, and its synthesis by E. Spath in 1919. However, it was not until the early - mid 20th century that the first important timescale ended.

The second timescale began on November 16, 1938, when Albert Hofmann, a Swiss chemist who was working at Sandoz Pharmaceuticals, attempted to create a stimulant when he synthesised lysergic acid diethylamide (LSD) instead (Hofmann, 1979). The substance affected the behavioural patterns in test animals. However, it was not the circulatory system stimulant that Sandoz had hoped for. Hofmann set LSD aside for five years, yet upon revisiting the substance, he seemed to have accidentally absorbed a small dose through his fingertips and experienced a profound shift in consciousness. After further research, Hofmann (1979) concluded the drug would be ideal for psychotherapeutic use. Soon after Sandoz began to send free doses of LSD and other psychedelics to various clinics and universities across the world for further research. The same spiritual and healing practices which ancient civilisations had used for thousands of years were rediscovered and began to be reinvented in the West. Over the next 15 years, more than 40,000 patients were administered psychedelic drugs alongside therapy with few side-effects and a high level of safety (Masters & Houston, 1970) These were the years known in academia as the 'golden age' where researchers made groundbreaking discoveries in neurochemistry and psychiatry. Before psychedelic drugs became illegal and consequently stigmatised, they appeared to be well respected in the scientific and academic community.

By the 1960s, there was widespread use of psychedelics within the American hippie counterculture. Users began to experiment with such substances for recreational use. The veritable publicity and hysteria surrounding psychedelia climaxed in the years 1964 to 1966, not only with regard to enthusiastic claims about the wondrous effects of psychedelics by drug fanatics and hippies, but also to increasing reports of recreational users incurring accidents, mental breakdowns, criminal acts, murders, suicide and "horror trips" under the influence of such drugs (Hofmann, 1979). This widespread use of psychedelics soon caught the attention of American federal and state governments. By the late 1960s, the hysteria surrounding psychedelia had come to an end as the majority of psychedelic substances were made illegal in most parts of the world. Despite its early promising results, practically all psychedelic research came to a halt, and Sandoz (the original manufacturer of LSD) ceased to continue distribution of psychedelics.

In 1976, years after the outlaw of practically all psychedelic substances, Californian chemist, Alexander Shulgin, who was working at Dow Pharmaceuticals discovered MDMA's effects after synthesising a batch and testing 120 milligrammes on himself

(Pearce, 2014). Much like LSD, MDMA was distributed to therapists across America and showed substantial therapeutic benefits. Before long MDMA was picked up by drug culture and thereafter quickly made illegal throughout the world ("The Medical History of Psychedelic Drugs", 2007).

The third timescale ranges from around the time psychedelics were made illegal up until the present day. This timescale depicts the denial of appropriate and desired treatment to individuals suffering from a variety of disorders and illnesses. It depicts a time when perhaps one of the most profound and least understood substances on earth was banned from being further researched due to its unsubstantiated illegality (discussed later in this Chapter). However, it also depicts an important time in history of learning and understanding. Luckily, for the interest of suffering patients, science, society, and the pursuit of knowledge in general, in recent years authorities around the world have begun to loosen regulation surrounding psychedelics. Despite still having to clear some hurdles, researchers are gradually being granted increased access to psychedelics for clinical purposes such as psychedelic therapy (Sessa, 2005). It appears that this time scale of global illegality may soon be coming to an end as academia and science continue to suggest promising results regarding psychedelics. We are now entering the timescale which academics describe to be the 'psychedelic renaissance' (Sessa, 2012; "The Medical History of Psychedelic Drugs", 2007).

The psychedelic renaissance may provide the opportunity for academics to examine entirely new depths of consciousness. According to Timothy Leary et al. (1966), psychedelic substances may well be the most important step in the evolution of the human species. As Leary once proclaimed, "PC is the LSD of the 1990s" (Leary, Burroughs, Horowitz & Marshall, 1994). The internet and mediated reality has already profoundly expanded the minds of people over the past few decades by exposing them to readily available information about almost anything imaginable. One can only imagine the possibilities that combining the effects of psychedelics with mediated reality may have on the constantly evolving human consciousness. With the help of academics such as Masters, Houston, Huxley, Leary, McKenna, Sessa et al., psychedelics may soon be available for legal research, thus presenting entirely new opportunities to document associated substances and therapeutic practice for a greater understanding of their potential for simulation.

## 4.2 Terminology

The collective term hallucinogen includes within it, substances which are not used in psychedelic therapy. However, the term should be understood as a variety of substances or compounds that induce hallucinations, perceptual anomalies, substantial subjective changes in thoughts, emotion, and consciousness (Lyvers, 2013). Each type of hallucinogen is quite different from the other and can be grouped

into three major categories: psychedelics, dissociatives, and deliriants (Johnston, 2015).

Contrary to the phrase 'psychedelic therapy', such therapy also includes the use of dissociative drugs as well as psychedelic drugs. Therefore, when the term psychedelic is used in reference to psychedelic therapy, it should be understood that it also includes within it the use of certain dissociative drugs.

The class of hallucinogens known as deliriants are not used in psychedelic therapy and therefore will not be discussed in this study. To avoid confusion, some common forms of deliriants are atropine, scopolamine (Hyoscine) and diphenhydramine (Benadryl).

The term 'psychedelic' meaning mind-manifesting, coined by Humphry Osmond in 1956, should be understood as a change in a mental state characterised by a profound change in sensory perception, thought and feeling (Psychedelic, n.d.). The term psychedelic is also a blanket term for many chemical compounds, all of which alter cognition and perception (NIDA, 2015). The 'National Institute on Drug Abuse' (2015) states that some of the most prominent effects of psychedelics occur in the prefrontal cortex; an area of the brain associated with mood, cognition, and perception, as well as other regions important in regulating arousal and physiological responses to stress and panic.

## 4.3 Overview

Psychedelic therapy refers to the therapeutic practice of utilising the revelatory and profound mystical properties of psychedelic substances in a context of healing, trauma release, personal growth/development and general exploration of the psyche. Psychedelic therapy consists of administering patients with specific doses of psychedelic substances as a form of mediation in dissolving and alleviating psychiatric illnesses and disorders at the root of their condition, as opposed to conventional psychiatric medication which is generally used to cover or mask such issues (Krupitsky & Grinenko, 1997). Masters & Houston state that psychedelic therapy can aid in the following areas: creative processes and problem solving, philosophy, levels and dimensions of consciousness, neural and sensory reduction, regulation of pain, enhancement of pleasure (including sexual pleasure), expanded awareness of self and world, exploration of myth and religion, self-knowledge and personal growth.

The practice of psychedelic therapy assists patients to break through mental blockages deep in the roots of their condition, consequently boosting the effectiveness of their treatment. Psychedelic therapy utilises psychedelic substances to activate parts of the brain (such as the amygdala) which store emotional memories, often traumatic or significant ones, such as a death of a family member. Activating these parts of the brain helps to override existing neural connections as well as to create new ones. The healing process does not erase those traumatic or significant

memories. Instead, it provides the patient with a new perspective and encourages closure.

Various studies spanning over the past 60 to 70 years have shown incredible results in treating various psychological/psychiatric illnesses and disorders with psychedelic therapy. Such conditions include but are not limited to: obsessive-compulsive disorder (OCD), chronic anxiety, depression, post-traumatic stress disorder (PTSD), substance addictions, habitual criminality, sexual deviation and violent tendencies. A study by Yensen and Dryer (1999) treated 17 dying patients with LSD using psychedelic therapy. One-third of those patients improved "dramatically" by the criteria of reduced tension, depression, pain, and fear of death, one-third improved "moderately", and one-third were unchanged. Yensen and Dryer's study and others similar to it (Mangini, 1998) are evidence that psychedelic therapy can be used to treat those suffering from terminal illness. Many of these successful treatment cases involve patients who had not found relief in traditional treatment programs, particularly pharmaceutical drug related programs (Masters & Houston, 2000). Within the context of psychedelic therapy, the psychedelics themselves are not seen as miracle cures in and of themselves. Rather, they assist in enhancing the patient's therapeutic process, thus encouraging profound breakthrough experiences.

Grinspoon and Bakalar (1966) reviewed a number of journals presenting evidence that drugs such as LSD and 3,4-methylenedioxymethamphetamine (MDMA) can be used to enhance the psychotherapeutic process. The case material found illustrates that the use of such drugs can facilitate the production of insights, memories, and fantasies as well as enhance the therapeutic process by encouraging self-disclosure, prompting trust and improving interpersonal connections. Unlike LSD, MDMA has been suggested to provide patients with therapeutic effects without associated perceptual changes, emotional unpredictability, and other occasional adverse reactions. The majority of literature which Grinspoon and Bakalar reviewed argue that research in the therapeutic potential of psychedelics should not be legally restricted because of fear that the drugs might be subject to illicit abuse.

A patient of psychedelic therapy cannot reasonably set expectations on how their psychedelic treatment will unfold. Every psychedelic experience is completely unique regarding subjectivity. In other words, a patient who undergoes psychedelic therapy will never have the same trip twice. The specific experience that the user undergoes relates more to the user rather than the drug induced. This is a result of set, setting, expectations, as well as other complex variables relating to the brain. With the assistance of psychotherapy and consideration of potential variables which may cause acute or adverse reactions, the outcome of any psychedelic trip is determined by the user alone ("NIDA", 2015; Masters and Houston, 2000).

**Types of Psychedelic Therapy**

Much like the broader practice of psychotherapy, there are many different methods of practising psychedelic-assisted therapy. In some cases, therapists provide the patient

with periodic low to moderate doses of psychedelics and perform therapeutic sessions with them during their "trip" as part of ongoing psychoanalytical therapy. This form of psychedelic-assisted treatment is called psycholytic psychotherapy (Sessa, 2005), which in this study I will refer to as mind loosening therapy to save confusion. Performing mind loosening therapy allows the therapist to be present and interact with the patient in real time as they are navigating the powerful but not-quite-overwhelming revelations of their psychedelic journey in an effort to facilitate and explore any repressed material.

More commonly, psychedelic ('mind manifesting') psychotherapy involves a one-time (or very few times) strong dose of a psychedelic drug to a patient in an overnight visit to a specialised clinic with therapy sessions given before and after the experience (Sessa, 2005). During their overnight visit, the patient is typically provided with a comfortable setting with relaxing music while support staff stand by to help them if necessary. The support from the staff is generally non-directive (meaning that the pace, direction, and termination of therapy are at the client's discretion; the therapist acts as a facilitator) towards the experience other than to provide safety and comfort (Rogers, 1945). The focus of this style of psychedelic therapy is to facilitate a transformative experience for the patient, which may then be explored and used in preceding therapy sessions. Intention setting beforehand and integration and exploration of the meaning of the material that emerged afterwards is just as important as the experience itself (Grinspoon & Bakalar, 1979).

## 4.4 Psychedelic Substances

The category of psychedelic substances consists of three classes; cannabinoids, serotonergics and empathogens (entactogens).

Cannabinoids are a class of diverse chemical compounds that act on cannabinoid receptors in cells that alter neurotransmitter release in the brain. The drug contains the psychedelic compound called delta-9-tetrahydrocannabinol (THC). Cannabinoids will not be included in this study as they are not used in psychedelic therapy and do not rate high enough on Timothy Leary's 5 levels of consciousness, (explored later this Chapter) (Johnston, 2015).

The term serotonergic is derived from the compound's activity in agonising specific serotonin receptor (5-HT2A) in the brain (Passie, 2008; Nichols, 2004; Schindler, 2012; Lee, 2012, as cited in "NIDA", 2015). Serotonergic associated cognitive effects include severe fundamental alterations of perception including synesthesia, visual and auditory hallucinations, and unusual thought patterns or emotional responses (Johnston, 2015).

The most common and well known serotonergic psychedelic substances which are used in psychedelic therapy are as follows (in alphabetical order):

- 2C-B.
- Lysergic acid diethylamide (LSD)

- Mescaline
- N,N-Dimethyltryptamine (known as DMT and/or ayahuasca)
- Psilocybin (the psychedelic compound in hallucinogenic mushrooms)

The term empathogen is derived from its predominant cognitive effect - an increased feeling of empathy. Similar to serotonergics, this class of psychedelics works by releasing serotonin in the brain which produces cognitive effects such as heightened feelings of love, openness, euphoria, and overall enhancement of sensory experiences. The most popular empathogen is 3,4-methylenedioxymethamphetamine, known as MDMA, which is often used in psychedelic therapy for its therapeutic effects alongside psychotherapy (Johnston, 2015).

### Dissociatives

Dissociatives are a class of hallucinogen, which distorts a user's perceptions of sight and sound through the reduction or blocking of signals to the conscious mind from other parts of the brain. They are unique from other drugs because they produce hallucinogenic effects such as sensory deprivation, dissociation and dream-like trances. Dissociatives often have depressant effects and can produce states such as sedation, respiratory depression, anaesthesia, and also cognitive and memory impairment and amnesia (Krupitsky & Grinenko, 1997).

The most common and well known dissociative substances which are used in psychedelic therapy are ketamine and ibogaine (Winkelman, 2014; Krupitsky & Grinenko, 1997).

## 4.5 Dangers

If conducted correctly, acute, adverse or unpleasant experiences are uncommon in psychedelic therapy due to assisted psychotherapy before and after the 'trip'. However, despite the high level of safety precautions associated with psychedelic therapy, like any drug, there are some dangers associated with psychedelic substances. The purpose of this section is to acknowledge and appreciate that such dangers exist even in therapist assisted psychedelic therapy and that if convincingly simulated, associated dangers may also emerge in mediated reality.

Although there have been two recorded fatal cases of recreational LSD users taking extraordinarily high doses of psychedelics, (in some cases 30,000 times the recommended dose), studies show that the chance of fatality due to the psychedelic drug is extremely rare. In fact, psychedelics have a much lower fatality rate and general risk of harm than many other common pharmaceutical drugs that are prescribed to patients which share associated mental conditions to those treatable with psychedelic therapy. Suicides, crime and other issues, much like most other drugs, arise from the unfortunate yet extreme cases of misuse. Usually, this occurs in unsuitable recreational settings where users who are psychologically unprepared

knowingly take dubious doses of drugs, which are usually sourced from unregulated black markets.

In the past, studies implying the dangers of psychedelic substances have been fraught with methodological shortcomings, inconclusive evidence and a political agenda (Sessa, 2012). In recent years since the prohibition of psychedelics, significant new evidence has emerged providing a more accurate analysis of the dangers surrounding psychedelics. A report from the University of Cambridge ("The Medical History of Psychedelic Drugs", 2007) has synthesised the most authoritative literature and research surrounding psychedelics. This report provides a substantial, impartial summary of the medical history of psychedelic substances including the prohibition of psychedelics right up to the recent years of which the author calls the psychedelic revival. The report compares the risks known to be associated with psychedelic substances at the time of prohibition in the mid to late 1960s with those known now. The findings of this study, and many other like it (Sessa, 2012, Masters and Houston 2000), indicate that the majority of concerning reports regarding psychedelic substances from the 1960s and 1970s have in recent years been proven false or as misleading scientific evidence. For example, cases of chromosome damage and the correlation between mental illness and psychedelics have recently been disproven. (Hofmann 1979; Cohen 1965, as cited in "The Medical History of Psychedelic Drugs", 2007). This new evidence suggests that psychedelic substances are not as dangerous as once suspected.

**Bad Trips**

Despite immense and highly regulated precautions, there is always an unlikely chance that the user may experience a 'bad trip' (NIDA, 2015). Patients who experience a bad trip can be subject to thoughts of terror and nightmarish feelings of anxiety and despair with fears of losing control, insanity, or death. In the context of psychedelic therapy, bad trips are not necessarily detrimental to the treatment of the patient. Instead, similar to psychotherapy, acute, adverse or unpleasant reactions usually assist in bringing the core of the patient's issue to the surface. Thus, this allows the therapist to assist the patient in understanding and overcoming their psychiatric illness or disorder whatever that may be. If treated with respect and understanding, under the context of psychedelic therapy, bad trips can act as part of the healing process (Krupitsky & Grinenko, 1997).

## 4.6 Legislation

Regarding legislation, the New Zealand Misuse of Drugs Act 1975 (the Act) states that all of the drugs described in the previous Chapter are restricted or unapproved to use for clinical or research purposes unless an exemption has been made. Because of these restrictions, any practice of psychedelic therapy is also prohibited by law. This state of illegality is similar in most countries around the world. Although, most of the research which is being conducted surrounding psychedelics is/has taken place in the United States.

According to the Act, cannabinoid drugs are generally classified as being a moderate (Class C) risk of harm, empathogens as being a high (Class B) risk of harm, and serotonergics as being a very high (Class A) risk of harm to people misusing them. Most dissociative drugs are considered either Class B or Class C under the Act. The level of risk of harm these drugs pose to people who misuse/abuse them correlates with the potency in which such substances alter the user's consciousness. Incidentally, the Act correlates to Gnosis and Nipo's 5 Levels of Psychedelic Experience (1996) (as discussed later in this Chapter) in a rather contradictory yet understandable manner. This correlation/contradiction arises as a result of psychedelic drugs promoting/evoking higher levels of healing, enlightenment, treatment and other such beneficial properties, yet are contemporaneously classed as posing a very high risk of harm to public health and safety.

## 4.7 The Psychedelic Experience

In order to simulate psychedelic therapy, the content of the psychedelic experience must first be understood. This Chapter provides a detailed description of the psychedelic experience. Later in this study, the provided description is used as a reference for simulating different types of mediated reality.

The effects of psychedelic substances typically commence within 20 to 90 minutes after ingestion and can last as long as 12 hours ("NIDA", 2015). While the effects of psychedelics are principally unpredictable on a case by case basis, clear distinctions can be drawn between the general effects of different substances. Leary (1966) states that such differences include: duration, stimulation, perception (scope of effect, aesthetics, colours, patterns, etc.) and consciousness (ego dissolution, expansiveness, cognition, continuity, etc.).

**The 5 Levels of Psychedelic Experience**

It is exceptionally difficult to accurately describe the precise hallucinations and other visual effects of psychedelics due to their subjectivity and mystical nature. Nevertheless, based on the Tibetan Book of the Dead, an ancient religious text that deals with the nature of reality and the mind, Leary et al. (1966) translated and attempted to describe the most distinct and common effects experienced while on psychedelics. Thirty years after Leary et al. 'The Psychedelic Experience' (1966) was released, based on their description of such effects, Gnosis and Nipo, (1996) in collaboration with an online community of Psychonauts, provided a partial overview of the ideas expressed in Leary's book and thereafter developed the '5 Levels of Psychedelic Experience'. These 5 Levels Of Psychedelic Experience act as an excellent reference to use in designing and envisioning any potentially mediated reality psychedelic therapy applications. This scale should be used as a model when referring to different intensities, modes, levels or any other systems of gameplay which a mediated reality psychedelic therapy application may include. The following

5 five levels are paraphrased from Gnosis and Nipo (1996). They include the primary ideas translated by Leary et al. (1966).

*Level 1:*

Cannabis, being the mildest of psychedelics, induces this state in moderate doses. This level produces a mild 'stoning' effect, with some visual enhancement (i.e. brighter colours, etc.). Some short term memory anomalies. Left/right brain communication changes causing music to sound 'wider.'

*Level 2:*

Achieved through high doses of cannabis or low doses of psychedelics. Bright colours, and visuals (i.e.,. things start to move and breath) some two-dimensional patterns become apparent upon shutting eyes. Confused or reminiscent thoughts. Change of short term memory leads to continual distractive thought patterns. Vast increase in creativity becomes apparent as the natural brain filter is bypassed.

*Level 3:*

Achieved through regular doses of psychedelics. Very obvious visuals, everything looking curved and/or warped. Patterns and kaleidoscopes seen on walls, faces, etc. Some mild hallucinations such as rivers flowing in wood grained or 'mother of pearl' surfaces. Closed-eye hallucinations become three dimensional. There is some confusing of the senses (i.e., seeing sounds as colours, etc.) Time distortions and `moments of eternity`. Movement at times becomes extremely difficult (too much effort required).

*Level 4:*

Achieved through strong doses of psychedelics. Strong hallucinations, i.e. objects morphing into other objects. Destruction or multiple splittings of the ego. (Things start talking to the user, or the user finds that they are feeling contradictory things simultaneously) Some loss of reality. Time becomes meaningless. The user experiences out of body experiences, astral travel and inconceivable blending of the senses known as synesthesia.

*Level 5:*

Total loss of visual connection with reality. The senses cease to function in the normal way. Total loss of ego. Merging with space, other objects or the universe. The loss of reality becomes so severe that it defies explanation. The earlier levels are relatively easy to explain in terms of measurable changes in perception and thought patterns. This level is different in that the actual universe within which things are normally perceived, ceases to exist!

**Sensory Alteration**

General changes in sensory perception which occur during a psychedelic experience, therefore, include perceptual hypersensitivity, synesthesia, euphoria, disorientation, alienation, insight and random impulses. They can also include profound changes in mood, thought, intuition, and even out of body experiences. Altered neurophysiological processing of environmental stimuli can cause changes in sensory perception. Such alteration includes changes in visual, auditory, gustatory (taste), olfactory (smell), haptic (touch), kinesthetic (posture and movement), vestibular (balance) and organic (the sensation from internal organs). Other physiological senses which are often affected by psychedelics include thermoception (temperature) and nociception (physiological pain). Perception based senses which are often affected by psychedelics include chronoception (the perception of time and how it is experienced), agency (the subjective feeling of having chosen a particular action) and familiarity (recognition memory).

Based on Gnosis and Nipo's 5 Levels Of Consciousness as well as the psychedelic experiences described in literature by many scholars such as Grinspoon and Bakalar (1979, 1986), Sessa (2012), Masters and Houston (1970, 2000), Hofmann (1979), Leary and Dass (1966) and Huxley (1954), the two most prominent changes in sensory perception which are most applicable to mediated reality, considering our current level of technological development (discussed further in Chapter 5) are visual and audible. For this reason, the following sections will focus on describing specifically these visual and audible sensory effects.

**Visual Alteration**

The visual alterations/effects of the psychedelic experience can be broken down into three distinct categories: general visuals which are hallucinations/visual alterations which can occur with both the eyes opened and with the eyes closed, predominantly open-eye visuals, and predominantly closed-eye visuals.

*General Visuals*

Possibly the most common type of hallucination which occurs with both the eyes opened and closed are RGB (red, green, blue) blips (Leary et al., 1966, as cited in Gnosis & Nipo, 1996). This type of hallucination usually occurs at the onset and involves the superimposition of RGB colours over everything and anything. Such blips are most prominent in darkness. Another open and closed-eye hallucination which is experienced in more intense experiences, often at level 4 and above, are the visions of guardians, guides or teaching spirits which aid the user through the full duration (to the most part) of their voyage into the unknown. Carlos Castaneda, an American author with a PhD in anthropology, mentions these guardians in a number of his books, specifically The Teachings of Don Juan (1968). Actual hallucinations which are indistinguishable from reality often occur with high level 4, and above trips with the eyes closed, however, it is rare that such hallucinations are experienced with the eyes

open. Occasionally, the user may even be transported into what they perceive as a literal Alice-in-Wonderland type alternate universe. Ironically, users of psychedelics have also reported feeling as if they were in computer simulated reality.

At extremely high levels of the psychedelic experience (level 5) users can experience encounters and even communicate with entities or intelligent life forms unknown and even unimaginable to the sober state of consciousness (Masters & Houston, 2000). These intelligent entities can take almost any conceivable form and often range from things out of fantasy novels such as elves and even shapeless, but conscious, masses of hyperspace protoplasm. Entities are sometimes known to guide the user to specific places in alternate realities to communicate an important message. The most profound effect of psychedelics at a high level 5 can be experienced with the eyes closed and occasionally with the eyes open. This experience entails what Gnosis and Nipo (1996) describe as being the clear light of reality. This experience includes nirvana, ego loss, enlightenment and the ultimate truth of the universe. These so-called level 5 experiences are exceedingly rare, even for experienced psychonauts.

*Predominantly Open-Eye Visuals*

The second stage of RGB blips can be described as a 'pixelization' effect where the user perceives a mesh or web-like distortion to be superimposed over their vision (Leary et al., 1966, as cited in Gnosis & Nipo, 1996). This effect, like all other psychedelic visual effects described in this paragraph, is only experienced with the eyes open. Similar to pixelization are redshifts where the user's vision is superimposed with a red tinge, almost as if they have red tinted glasses on. A common effect which can be seen as early as a level 2 psychedelic experience are tracers. Tracers can be understood as moving objects that contrast sharply with their background leaving colourful trails.

Another very common effect at medium to high doses is the perception that everything around the user is 'breathing'. This effect entails an object or environment pulsing in and out, bubbling, shifting, splitting into multiple layers and in more intense experiences even morphing into something entirely unrecognisable. The direct corollary of the breathing effect is the melting effect where objects appear to distort, drip or wriggle as if they were melting plastic. In higher level psychedelic experiences (level 4 and above) the user can experience a kind of x-ray vision. In some cases, users can see beneath the skin of other individuals, allowing them to see a network of blood vessels or even energy flowing through their body (Castaneda, 1968).

*Predominantly Closed-Eye Visuals*

Closed-eye hallucinations are a distinct form of hallucination experienced while under the influence of psychedelic substances. Closed-eye hallucinations are known to accentuate the phenomenon of phosphene (the experience of seeing light without light entering the eye). When the eyes are closed, this phenomenon can be perceived by normal (sober) individuals as starlight objects and colours.

While under the influence of psychedelics, phosphenes can transform into complex formed patterns, objects and structures (Ditman et al., 1969, Huxley, 1954, as cited in Segal, 1971). Geometric patterns can take the form of a Mandelbrot, spirals, wave interference patterns, etc. Gnosis and Nipo (1996) state that the unifying feature of these patterns is the recurrence of primary colours and their general fractal nature. In lower doses, such patterns are usually observed as two-dimensional. However, at a higher dose, they become 3D. Leary (1966) calls this effect "The Internal Flow of Archetypal Processes". Unlike geometric patterns, objects seen with the eyes closed are amorphous, generally dim shaped and usually interconnected to the emotions which the user experiences at the time. Leary refers to this effect of visualising a feeling as "The Fire-Flow of Internal Unity". Traditional patterns or structures in the form of closed-eye hallucinations often contain imagery relating to ancient cultures which were known to connect with psychedelic substances on a spiritual or healing level. In most instances, users continue to see such hallucinations/visuals when they open their eyes in a darkened space. However, upon emitting light into that space, the optical phenomena along with any phosphenes hallucinations become extremely faint or disappears altogether (Pahnke & Richards, 1966, as cited in Segal 1971).

**Auditory Alteration**

Very little information regarding psychedelic associated changes in auditory perception are available from either academic, or psychonaut inspired sources. Taking into account the information which is available regarding this area, however, one can only assume that the lack of information is due to the area being considered either inconsequential in the broader scope of psychedelia, or so obvious that an explanation is unnecessary. Despite this, various authoritative scholars in the field of psychedelia such as Timothy Leary (1966), Masters & Houston (1970 & 2000), Hofmann (1979) and even Huxley (1954) briefly skim over this area throughout their literature. They suggest that at lower levels of the psychedelic experience, users may perceive distinct sound much clearer and may begin to add sentimental value to them.

At higher doses, users may perceive sound as being warped, distorted and may even begin to echo. As stated earlier, often psychedelic induced changes in auditory perception are interlinked with visual changes, this is known as synesthesia. Hofmann (1979) recounts that in his first ever psychedelic experience with LSD, "it was particularly remarkable how every acoustic perception, such as the sound of a door handle or a passing automobile, became transformed into optical perceptions. Every sound generated a vividly changing image, with its own consistent form and colour. " As well as experiencing synesthesia, users can experience a range of hallucinated sounds ranging from deep rumbling to high pitched crumbling. In some cases, users may even experience paracusia, otherwise known as auditory hallucinations, a form of hallucination that involves perceiving complex sounds without auditory stimulus.

A common form of paracusia involves hearing voices, an effect which is closely associated with various psychotic disorders. Somewhat ironically, while there is limited information available regarding psychedelic induced auditory hallucinations, there is an abundance of artists, musicians and sound designers who attempt to emulate such sounds through processes such as binaural beats and the broad genre of psychedelic music. This type of sound is discussed more in depth in Chapter 5.7.

# 5

# 5 Design Precedents

This Chapter will provide a historical timeline of various art, design and mediated reality precedents which I perceive as being influential references for potentially mediated reality psychedelic therapy simulations.

## 5.1 Pioneering Precedents

One of the earliest and most influential examples of non-computer modulated reality is George Stratton's eyeglasses which deliberately diminishes the perception of reality through special non-graphical, optical lenses. The glasses invert images both upside-down and left-right which essentially act as an inverting telescope with unity magnification in each lens. Strutton, who was an experimentalist in psychology, conducted multiple experiments with the glasses, one of which consisted of wearing the glasses for days on end. The result included out of body experiences as well as a disconnect between vision and touch, thus making him feel as if his body was not where his touch and proprioceptive feeling told him it was. Such feelings would be considered psychedelic by Masters & Houston's (2001) definitions and examples of psychedelic experiences.

Another notable design precedent extends all the way back to the early pioneering of utilising light and sound to alter brainwave frequencies. William Grey Walter experimented with electroencephalogram (EEG) equipment and electronic strobe lights to produce trance-like states of profound relaxation and vivid imagery. This experimentation with light and sound, described in The Living Brain (1963), would later influence a variety of works that seek to invoke deep relaxation and visual stimulation, many of which continue to be deployed (Budzynsk, 1991; Harriman, 2014). One of the first notable developments in light and sound which was directly influenced by Grey Walter's 'The Living Brain' was the Dreammachine by Gysin, Burroughs and Sommerville (Cashdin, 1961), as seen in Figure 5.1 below. The Dreammachine is a stroboscopic flicker device that when the eyes are closed, produces visual stimuli similar to that of psychedelic substances. While the Dreammachine does not utilise an EEG, its use of flickering stroboscopic light is known to evoke deep relaxation (Budzynsk, 1991).

*Figure 5.1 – Dream Machine (at left) (Mike Smith Studio, 1998)*
Figure 5.2 – The Joshua Light Show (at right) (1967)

Around the same time as the Dreammachine was developed (in the early 1960s), researchers, performers, painters, writers, religious scholars, philosophers and individuals alike began to experiment and find profound benefits of such substances, henceforth giving birth to psychedelic art, music and other psychedelic genres of modern culture. The introduction of psychedelic drugs to the mainstream culture had reportedly granted these individuals profound insights into the creative process, influencing their work in unconventional ways (Hofmann, 1979). The 'Joshua Light Show' (Magrino, White, Schwarzbach, Nelson, Dreiwitz, Shoesmith, 1967), as seen in Figure 5.2 above, were a group of art pioneers who unlike Grey Walters, Gysin, Burroughs and Sommerville, used psychedelic substances as a partial source of inspiration. The group created liquid light shows and used them as lighting backdrops for various famous psychedelic live band performances. Their work is one of the earliest examples of collaboration between artists and musicians with the intention of enhancing a user's psychedelic experience through technology.

Generally, psychedelic works such as the Joshua Light Show, or Dreammachine are not created during the psychedelic experience, rather they are produced afterwards with the experience being the source of inspiration. This is usually due to the profound effects of psychedelics impeding the artist's psychological ability to produce a work (Hofmann, 1979).

A year after the Joshua Light Show took off, Jack Schwarz developed the Integrating Stimulating Intensity Stroboscope, otherwise known as 'ISIS' (1968) (as seen in Figure 5.3 above). This device essentially combined Grey Walter's experiments with Gysin, Burroughs and Sommerville Dreammachine to create the next notable development in light and sound. The ISIS is considered the first ever prototype of a mind machine (Mind Machine, n/d.), an analog mediated reality device which uses pulsing rhythmic sound, flashing lights, and biofeedback to alter the user's brainwave frequency and evoke deep relaxation (Budzynsk, 1991).

In the same year as the development of ISIS (1968) was the first recorded development of digital mediated reality. In 1968, an American computer scientist, Internet pioneer, widely regarded as the "father of computer graphics", named Ivan Sutherland and his student Bob Sproull, created what is widely considered to be the first virtual reality head-mounted display (HMD) experience. This experience, called the 'Sword of Damocles', as seen above in Figure 5.4, generated primitive computer graphic wireframes of rooms and objects.

## 5.2 AR/AV/MR Precedents

Created by London-based designer, Keiichi Matsuda (Winston, 2016), Hyper Reality is a short film presenting a provocative futuristic scenario where AR and AV have merged into an intense MR simulation of a city saturated in digital media. This short film explores Matsuda's concept for a future which shares many similarities to, and in a sense visualises Neil Stephenson's "Metaverse" (Stephenson, 1992) where MR has been integrated into everyday life with the help of ubiquitous computing. In Hyper Reality, the protagonist's vision is filled with optical see-through projection-based AR that consists of a graphical layer of content intended to mediate the perceived environment. This layer projects a variety of content and interactive virtual interfaces including games, search engines, other internet services and functions as well as adverts. The film evokes thought and discussion regarding the future of technology, especially in relation to technological utopia and dystopia. "Our physical and virtual realities are becoming increasingly intertwined," said Matsuda. "Technologies such as VR, AR, wearables, and the Internet of things are pointing to a world where technology will envelop every aspect of our lives", (Winston, 2016). Although this short film only visualises a conceivable concept and does not actually represent any product, there are in fact many AR HMDs which are expected to have similar capabilities in the next few years. Such HMDs would allow users to experience psychedelic content mediated in front of their eyes in a similar way visualised in Matsuda's Hyper Reality.



*Figure 5.5 – Hyper Reality (Matsuda, 2016)*

As of current, there appears to be limited development of AR/AV/MR in treating psychological disorders and other conditions. However, according to both Baus & Bouchard (2014) and Giglioli, Pallavicini, Pedroli, Serino, Riva & (2015) AR seems like it could be a promising and useful tool for intervention in the treatment of specific phobias. The potential for AR to act as any means of psychological therapy seems to be less than that of VR. This is simply because the level of immersion involved in VR is comparatively higher than AR, allowing the user to face their issue directly. However, that is not to discredit AR's potential in psychological treatment. In the treatment of psychological disorders, AR has shown preliminary evidence to be a useful tool due to its adaptability to the patient's needs (Baus & Bouchard, 2014; Giglioli, Pallavicini, Pedroli, Serino, Riva, 2015). To date, AR has been used in many

fields, such as medicine, entertainment, maintenance, architecture, education, and cognitive and motor rehabilitation but very few studies and applications of AR exist in clinical psychology (Azuma, Baillot, Behringer, Feiner, Julier, Macintyre, 2001).

## 5.3 VR Precedents

Modern design practitioners can use mediated reality to expand on traditional psychedelic visual and digital design methods to create experiences which are capable of immersing the user into altered states of consciousness. Roger Essig's psychedelic VR experience (2015), as seen below in Figures 5.6 & 5.7, uses VR in an attempt to recreate past DMT (N, N-dimethyltryptamine) experiences. Similarly, Matteo Zamagni (2015) uses VR technology to create fractal and geometric psychedelic experiences. To create such experiences, Zamagini uses a software called Mandelbulb 3D, a free software application created for 3D fractal imaging.

The purpose of both experiences is to put the user into trance-like, mesmerising states through the use of full 360 degree visual immersion. Furthermore, both designers integrate Google DeepDream (2015) into their work to find and enhance patterns from their project renders. This algorithmic procedure creates a dreamlike hallucinogenic appearance through deliberately over-processed images similar to the visualisations described by subjects from Geyer and Vollenweider's (2008) serotonin research. These hallucinogenic visualisations include perceptual disturbances such as blurred vision, partial seeing and hypersensitivity to light as well as visual illusions, tactile hallucinations and loss of depth perception known as binocular vision. While both Essig and Zamagni successfully capture the essence of hallucinogenic visualisations and have overcome fundamental VR challenges, neither attempt to incorporate other important sensorial stimulus such as binaural audio. Using biofeedback to determine the outcome of both the binaural audio and the visualisations could increase the user's level of altered consciousness in mediated reality.
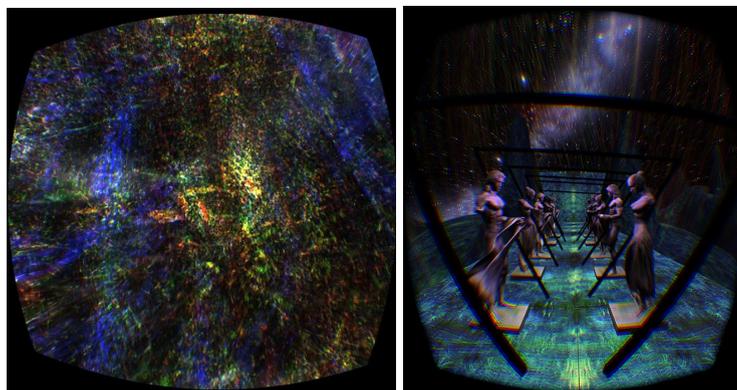


*Figure 5.6 - Roger Essig VR (Image 1) (Essig, 2015)*
*Figure 5.7 - Roger Essig VR (Image 2) (Essig, 2015)*

*Figure 5.8 – Nature Abstraction (Zamagini, 2015)*

VR can provide the opportunity to experience the effects of psychedelic substances and altered states of consciousness through full 360 degree visual immersion. Marks and Blagojevic (2015) explore five major design challenges associated with the use of immersive technologies in exercise games. In particular, motion sickness, motion tracking, health and safety, player perspective and physical feedback latency were studied. These challenges affect potential immersion within VR games and experiences which may otherwise be overlooked.  As a result of recognising current challenges, the researchers successfully overcame all of their major challenges. They state that their work on the game and user experience was predicted to lead to improvements but would also generate a whole new range of challenges. Overcoming such challenges is crucial to the development of all VR experiences and games to maintain cohesive immersion and to keep the user focused and engaged. It is likely that the development of a mediated reality psychedelic therapy experience would entail similar challenges.

Unlike AR and MR therapy, VR has already shown promising results in treating a range of psychological disorders and other conditions. Bravemind VR exposure therapy was created at the University of Southern California Institute for Creative Technologies and is aimed at providing relief from post-traumatic stress (Rizo, Hartholt, 2005). This is achieved through a clinician guiding the patient through a VR simulation of a traumatic memory or experience via an audible interface. As well as visual stimulation, a VR exposure therapy simulation can also include 3D audio, vibrations, smells and other sensory inputs. Therapy sessions are customised on a case by case basis however generally consist of multiple sessions per week over a period of weeks or months.  It is currently funded at over 60 locations including veterans health hospitals, military bases, universities. This type of VR therapy has demonstrated significant results in treating post-traumatic stress disorder. The Bravemind therapy has recently been used to treat various other mental conditions such as anxiety and phobias. Research for VR exposure therapy is ongoing.

The Bravemind VR exposure therapy simulation has been proven to treat various mental conditions which have also been proven to be treatable by psychedelic therapy. The goal of both VR exposure therapy and psychedelic therapy is to assist in the healing process, often of traumatic experiences. For Bravemind patients, this process of healing is provided by re-entering and overcoming a simulation of their

experience. Usually, this is in a war-related scenario. VR psychedelic therapy could work similarly by assimilating a patient into and exposing them to an unfamiliar or uncomfortable environment to help them overcome any inherent fears they have as well as the fears associated with psychedelics. Such associated fears are mainly loss of mind or control.



*Figure 5.9 - Bravemind (Parsons & Rizzo, 2008)*

## 5.4 ModR (Modified) Precedents

Created by Los Angeles based interdisciplinary artist, Eric Parren (2012), the Synesthesia Glasses, as seen below in Figure 5.10, are an experimental modulated/modified reality sensory manipulation tool that allows the wearer to experience what synesthesia might feel like. Users of psychedelics have reported experiencing synesthesia, a phenomenon which Cytowic (1993) theorises newborn children also experience before their senses are fully developed. The phenomenon of synesthesia can be understood as a neurological experience in which stimulation of one sensory or cognitive pathway leads to automatic, involuntary experiences in a second sensory or cognitive pathway (Cytowic, 1993). By cross-feeding the sonic and visual senses, using AR technology, Paren's glasses create a hallucinatory experience. When wearing the glasses, the surrounding environment evolves, sounds appear as disruptions of the visual space, and movements trigger change sin the sonic sphere. Users of psychedelics have reported experiencing synesthesia, a phenomenon which Cytowic (1993) theorises newborn children also experience before their senses are fully developed. These glasses provide significant insight into the kind of technology and direction required to simulate the psychedelic effect of synesthesia through modulated reality, specifically modified reality.

*Figure 5.10 - Synesthesia Glasses (Paren, 2012)*

If developed further, these glasses or glasses similar to these may have the potential to also include the synesthesia of other senses. This cross stimulation of senses could include but are not limited to: kinesthetic (the sense of posture and movement), vestibular (the sense of balance) and organic (the sensation from internal organs) with visual and audible senses. This development of synesthesia into the experience could, therefore, entail an altered sense of visual and audible movement, balance and internal sensations such as sickness due to the confusion/mixture of senses. While probably not desirable nor applicable to therapeutic application, this sense of sickness could mirror the experience of nausea one feels after ingesting particular psychedelic drugs such as mescaline and ayahuasca.

Despite the exciting potential that this type of glasses has, with our current level of technological development, the Synesthesia Glasses are limited to focus only on the merging of audio and visual senses. Unfortunately, they do not cover the whole range of effects that psychedelics have to offer. Full sensorial immersion of the effects experienced while on psychedelics would involve the integration of all the senses discussed in Chapter 4.7 (The Psychedelic Experience). The next phase of iteration for an experience such as the Synesthesia Glasses could be to integrate other traditional senses such as gustatory, olfactory and cutaneous into the experience. Furthermore, non-traditional senses listed under Sensory Alteration in Chapter 4.7, could also show potential in simulating synesthesia or a psychedelic experience if integrated into the experience.

A potentially mediated reality psychedelic therapy simulation could begin to create a sense of synesthesia by mixing and altering different sensorial inputs such as those described above. A case of synesthesia which is often experienced when on psychedelics is the sense of tasting colours. Several studies have already begun to simulate the sensation of taste in virtual reality (Ranasinghe, & Do, 2016; Niijima, & Ogawa, 2016). By using eye-tracking technology such as the eye tracking upgrade kit, HTC Vive, or the Fove virtual reality HMD to recognise when the user is looking at a certain colour, a specific taste could be administered to the patient. Similarly, blowing cold air at the user when they see a colour blue or altering the user's sense of sound depending on what the user touches could induce similar effects of synesthesia. A

study by Hülsmann, Fröhlich, Mattar, & Wachsmuth (2014) integrated wind and warmth into virtual reality and as a result improved the user's presence as well as task performance for certain challenges. Furthermore, studies have shown the benefits of utilising haptic feedback in therapy related virtual reality applications (Fucentese, Rahm, Wieser, Spillmann, Harders, & Koch 2015; Small, Stone, Pilsbury, Bowden, & Bion, 2015). Combining these complex systems of simulated synesthesia with other exploratory concepts discussed throughout this study including those visualised in Hyper Reality would increase the overall credibility and validity of the experience.

These innovations have shown promising results and have sparked interests in the area. However, while the development of these effects would bring us significantly closer to simulating a psychedelic experience, the potential for them to aid in the therapeutic process of simulated psychedelic therapy is questionable. Currently, none of these effects have shown any evidence of proving therapeutic benefits, thus, at this point, the potential for glasses like these to simulate psychedelics is unsubstantial.

## 5.5 ModR (Diminished) Precedents
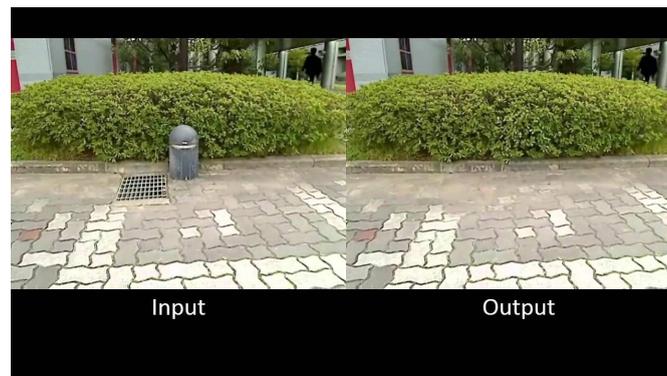


*Figure 5.11 – Diminished Reality (Broll,Herling, 2010)*

Researchers at the Technical University of Ilmenau in Germany (Broll, & Herling, 2010) have developed a diminished reality software that can delete an object from live, full-motion video. The software first reduces the object's resolution, removes the image, improves the remaining result (similar how the smudge tool in Photoshop works), then incrementally increases the resolution, improving the result, until the original resolution is restored.

It then repeats that procedure for each frame of the video captured in real time, delivering the final image in 40 milliseconds. The user can remove a desired object by drawing a lasso around it. Perhaps the next step in this technology is to replace the diminished object with a virtual object. As far as my research delves, this technology has not yet been implemented into an HMD.

Much like modified reality, there is an insufficient amount of evidence suggesting that this kind of technology has potential in simulated psychedelic therapy. Perhaps diminished reality could be used to simulate high level 5 psychedelic experiences where the user loses all sense of reality. However, more research must be done on diminished reality before being assessed. To my knowledge, there is yet to be developed any type of modulated reality therapy application.

## 5.6 Therapeutic Precedents

**Ajna Light**

The Ajna Light was developed by Harriman (2014) to help people explore the inner workings of their mind. The Light functions through the use of high power LED lights flickering at specific frequencies to transition the user's brainwaves. This stimulates the pineal gland in the brain to assist the user to access altered states of consciousness. Users who have experienced the Light have described various benefits such as clarity of mind and emotions, reduced states of anxiety and stress, greater creativity and connection with reality, and even out of body and astral projection experiences. This system is similar to light and sound methods used by Grey Walters (1963), Gysin, Burroughs and Sommerville (1960). The Light is acclaimed for its quality in that it does not alter the user's brain chemistry thus in contrast to Ayahuasca or LSD, there are no short-term side effects such as nausea. Aspects in which the way the Light functions and its capability to induce a user into deep relaxation could be used in mediated reality.



*Figure 5.12 - Ajna Light (Harriman, 2014)*

**Shakti Mat**

The Shakti Acupuncture Mat ("Shaki", 2017) is a mat on which a user can use to achieve relaxation to ease stress, tension and muscle discomfort. The user lies on durable plastic spikes for a deep acupressure effect. Incorporating this mat into a

psychedelic therapy mediated reality simulation either before, during or after the session could increase the overall effectiveness of the therapeutic process.

## 5.7 Audible Precedents

Altered sound perception and hyper-acoustic sensitivity are sensorial effects experienced while under the influence of psychedelic drugs (Geyer & Vollenweider, 2008). Binaural audio, specifically binaural beats, can provide access to altered sound perception including a wide variety of altered state experiences similar to that of psychedelic drugs. This is made possible by channelling a person's brain frequencies in conjunction with visual stimulation. Binaural audio works by reproducing sound the way human ears hear it. A binaural beat takes this technique a step further by adding auditory illusion which is the sound perceived when two different pure-tone sine waves, both with frequencies lower than 1500 Hz, with less than a 40 Hz difference between them, are presented to a listener dichotically (one through each ear). When listening to a binaural recording through headphones, a distinct and genuine 360 degree sound is perceived (What is binaural audio? n.d.).

Atwaters (1997) recorded electrical signals from subjects' brains with an electroencephalograph (EEG) while they were listening to binaural beats. He concluded that individuals could use an environment of stimulation such as restricted visualisations to achieve altered states of consciousness. Likewise, Vesely and Clemens (2010) examined the effects of binaural beats; they found that different brain wave frequencies are associated with different levels of consciousness and that binaural beats can alter the electrochemical environment of the brain allowing the user to have unique altered consciousness experiences.

Both studies revealed that when binaural beats are set at the correct frequency while in a suitable environment, a person can access altered states. Subsequently, if the binaural frequency is changed, then the person's state of consciousness would change

respectively. Binaural beats, as well as other audible binaural experiences, can be created using software such as 3Dception® (2016) for Unity® software (2016), a cross-platform audio plugin. Alternatively, recordings can be made using a special microphone that simulates a human head. 'Virtual Barber Shop - 3D Sound' (2008) uses such microphones to create an experience which when heard with headphones and with closed eyes is both immersive and remarkably believable. While binaural audio may not actually be heard while throughout the psychedelic experience, it could be a good alternative for a simulation to help get people into a therapeutic-altered state.

Relaxing music can also affect people's cognitive processes and can be effective in reducing the negative effects of stress (Guo, Ren, Wang, & Zhu, 2015). A lower pulse and heart rate, lower blood pressure, and decreased levels of stress hormones may enable a patient to openly be induced into an altered state of consciousness without the barrier of fear or stress. Thus, relaxing music could be valuably integrated into psychedelic therapy.

## 5.8 Biofeedback Precedents

Mediated reality technology has the capability to adapt and change its visual projection based on the user's brainwave activity and even their emotions by utilising biofeedback data. Biofeedback is the process of gaining greater awareness of internal bodily functions normally beyond conscious control, usually with the purpose of being able to manipulate them at will. Neurofeedback is a form of biofeedback in which subjects respond to a display of their own brainwaves, or other electrical activity of the nervous system This awareness of electrical activity is achieved through employing sensitive instruments which measure and display physical or mental processes (What is Biofeedback? n.d.).

Wiederhold and Riva (2009) used a biosensor worn around the wrist to access biofeedback that directly affects the user's VR experience. Through mind exercises, users learnt to control sensorial reaction parameters. Feedback provided by the virtual environment allowed the user to gauge his or her success. The researchers successfully used this method to determine the effectiveness of anxiety reduction. Nevermind (2015) is a non-virtual reality adventure thriller game which incorporates this concept of manipulating a game environment based on biofeedback. However, unlike Wiederhold and Riva's experiment, Nevermind's goal is to provoke the user's anxiety and fear rather than to reduce it. The game takes advantage of the user's instinctive and subconscious biological reactions through a standard webcam and/or supported heart rate sensor. As the user becomes more frightened, the game becomes more terrifying. Both Wiederhold & Riva and Nevermind's works help to fill the gap in knowledge surrounding biometrics and mediated reality. However, neither attempt to emulate the effects of psychedelic substances.

The concept of altering a user's gameplay based on their instinctive and subconscious biological reactions strongly relates to research involved with psychedelia. Masters &

Houston's (2000) research suggests that the cognitive effects of psychedelic substances are largely influenced by the user's predominant emotional response. For example, if the user is experiencing an emotion such as joy, then the psychedelic response could entail comforting or delightful feelings, sensory effects and hallucinogenic visualisations, while emotional responses such as anxiety may provoke menacing or hostile effects.

**Neurofeedback**

As of 2017, there have been some major advancements in the way of EEG integration with mediated reality devices. An installation/application named 'Conductar' takes Nevermind's gameplay techniques and combines it with the suggestions from Masters and Houston's research to utilise their user's predominant emotional response in an immersive, psychedelic, audio-visual AR experience. Layered on the city of Asheville, North Carolina, 'Conductar' invites participants to control a city with their brainwaves through an EEG. The application developed by Odd Division ("Conductar", 2014) allows users to walk the city as their smartphones become both an instrument to compose a generative soundscape and a window into a world that dynamically changes audio-visually with their brain's neurological reaction. The developers describe the application as a collective experience which allows an infinite amount of participants to actively compose live generative audio and visuals and also passively watch and listen to what others create.

To achieve this project the Odd Division team utilised an EEG called the 'Mindwave Mobile' from the company Neurosky who specialise in consumer grade EEG biometric devices. The Mindwave Mobile is specifically designed to evaluate the electrical activity in the brain. The device has plug-in integration with the game engine Unity, thus allowing developers to create PC, Android and iOS applications. This EEG has already been used to develop hundreds of applications including Conductar.

The Mindwave Mobile works by reporting a value on a scale of 1-100. 1 representing intense agitation or distraction, and 100 representing intense calmness or concentration. After being integrated into Unity, the value representing its respective level of calmness or concentration could be visualised in mediated reality. An example of this could be when the biometric value representing the user's respective cognitive state changes, the virtual environment within mediated reality would also change accordingly.

MIT Technology Review (Metz, 2017) have revealed that Boston-based technology start-up company 'Neurable' have developed brain-sensing technology capable of analysing a user's EEG data to trigger in-game actions and therefore determine the AR or VR gameplay experience based on the user's biofeedback. The current version pairs the start-up's custom built EEG with the commercial-ready HTC Vive HMD. Neurable is not planning to build its own hardware. Instead, they plan to offer software toolkits for game development and is optimistic that companies will begin to manufacture HMDs with integrated sensors to support its technology in the next several years.

Once such technology becomes readily available on the consumer market it will become significantly more appealing for consumers to invest in such a product, thus providing more of an incentive for people to invest their time, money and creativity into it. Currently, there is a lack of research and funding surrounding the integration of EEG with AR and VR. Therefore, it will still be a few years before consumers would be able to experience a neurofeedback driven mediated reality simulation. Nevertheless, in the meantime, this method of using real-time neurofeedback data to generate unique, user-specific experiences could prove advantageous to a number of fields. Designers, developers and directors could all utilise this knowledge to develop more immersive and experiential games, films and mediated reality experiences.

## 5.9 Conferences

**Augmented World Expo**

31 May 2017 - 2 June 2017 (Santa Clara, USA)

Augmented World Expo (AWE) is the world's largest conference and vendor exhibition for professionals focused on making the world more interactive—featuring technologies such as AR, VR, wearable computing, smart glasses, gesture and sensor devices, and the Internet of Things. I watched sections of this conference via live stream. Perhaps one of the most relevant and interesting talks was by Jesse Schell, CEO of Schell Games. In this talk, Schell made AR related predictions for the next decade. Schell illustrated various key principles of human psychology that can help to predict the future of simulating psychedelic therapy by 2025. The future of mediated reality technologies will be cableless, mobile headsets, and this may allow greater accessibility to psychedelic mediated reality treatment programs. The technological development of such hardware will also entail exponentially increased specs, thus increasing immersion and making therapeutic experiences more convincing. Lastly, Schell also covers topics such as AR field of view, a topic which I discuss in Chapter 6.3 (Hackathon).



*Figure 5.14 - Jesse Schell Talks At AWE6 (Schell, 2017)*

**Te Papa Talks: Virtual Realities**

17 Mar 2017 (Wellington, New Zealand)

From art to education, filmmaking to architecture, VR and AR are changing the way people explore what matters to them. This conference, organised by Te Papa and Victoria University hosted four renowned VR enthusiasts.

Lynette Wallworth spoke about the power of immersive storytelling, an area crucial to any mediated reality experience. Whether that story is told verbally or through visually, every good virtual reality application should guide their user through a unique and engaging experience.

Mike Jones took this area a step further and spoke about writing for VR. The content of this talk relates strongly to any form of guided meditation that a mediated reality psychedelic therapy simulation may include.

Sutu, an Australian author, illustrator, and interactive designer spoke about art in the age of immersive technologies. In many ways, the art in which Sutu produces are three-dimensional virtual reality iterations of my own pen on paper works (as seen in Chapter 6.1).

Kat Lintott spoke about working with the New Zealand VR/AR/MR community to ensure that content is produced on a global scale for a global audience. Lintott spoke about making and encouraging content that adds to society, providing viewers who are coming out of these experiences with the feeling of empowerment to be part of the real world too. Much of this talk resonates with simulating psychedelic therapy. Part of such therapy is to give back to society and to give whoever uses such experiences the feeling of empowerment.

After the speaker events, the conference provided guests with a variety of AR and VR demos. These demos helped to visualise the possibilities of such technology.



*Figure 5.15 - Te Papa Talks (Te Papa 2017)*

**Antipodes: Creativity in France and New Zealand**

19 Sep 2016 - 23 Sep 2016 (Wellington, New Zealand)

While this symposium was not directed at mediated reality technologies, there were multiple speakers over this three-day event who spoke about the power of VR content. The symposium focused on exploring aspects of the broad rubric of creativity as the propellor of, and opportunity of coping with increased societal and technological changes.

**Ethnopharmacologic Search for Psychoactive Drugs II: 50 Years of Research**

The 'Ethnopharmacologic Search for Psychoactive Drugs II: 50 Years of Research' (ESPD50) held on the 6th -8th June 2017 marks the 50th anniversary of the landmark 1967 symposium that was held in San Francisco, California. Ironically, the United States government including the Department of Health, Education and Welfare, and the National Institute of Mental Health, funded the symposium. The result of the original symposium was the book, 'Ethnopharmacologic Search for Psychoactive Drugs' which was later discontinued allegedly due to the government's budget. However, in the past 50 years since the original symposium, there have been various significant discoveries surrounding psychedelics. The intention of the ESPD50 was to discuss and document such discoveries. The speakers ranged from some of the leading experts in pharmacology, chemistry, botany, neuroscience, and many other fields that can be related to psychedelics and the study of the mind. Watching the ESPD50 via live-stream on Facebook was an excellent final addition to this study. The ESPD50 is evidence that academic and scientific interest in psychedelics is increasing. Greater interest thus provides hope for patients suffering from various associated treatable illnesses and disorders because within the near future they may be able to receive the treatment required.



*Figure 5.16 – Ethnopharmacologic Search for Psychoactive Drugs II: 50 Years of Research (ESPD50, 2017)*

# 6

# 6 Design Development

## 6.1 Preliminary Work

This section titled 'Initial Work' will analyse, interpret and evaluate my own personal creative works which influenced this study.  In doing so, this will contextualise the creative development/evolution of myself and my works in relation to the general themes which are focused on throughout this study; psychedelia and mediated reality. This exploration and contextualization will allow the reader to visually understand the perspective in which I have directed this study and the art style in which I envision potential mediated reality psychedelic therapy to take.

**NCEA Level 2 Drawing Portfolio**

This psychedelic A1 x2 sized drawing portfolio was created in 2011 as part of the New Zealand NCEA Level 2 drawing curriculum and received the grade 'excellence'. The source of inspiration for this portfolio was a series of altered state of consciousness experiences which had taken place before and during the four months spent developing it. The portfolio begins by using traditional black pigment ink on paper drawing methods and later evolves into an iterative series of coloured felt tip and collaged works.



*Figure 6.1 – NCEA Level 2 Drawing Portfolio*

**Benediction**

See the animation at; https://www.youtube.com/edit?o=U&video_id=XIV4vPcxgQ0

This short psychedelic animation was collaboratively produced in under three weeks with a classmate, Sebastian Paz during the same time I was working on this thesis. An emphasis was placed on experimentation and pushing the boundaries of the status quo in digital media design. The animation features a central protagonist who is caught in a psychedelic world where the lines between reality have become distorted. This animation was completed at the same time as working on my master's thesis and indeed explores a variety of concepts and techniques which could be integrated into mediated reality. Such techniques include 3D modelling, animation, motion capture, rendering and sound design. The software used in this animation include Maya, Motionbuilder, After Effects and a variety of plugins. This project was completed at an early stage of this study and therefore relates strongly to psychedelia, however, lacks relevance to psychotherapy. This animation was an important part of the design process which taught me a variety of technical skills required to produce a mediated reality simulation.

Unlike NCEA portfolio, this animation was meticulously planned. It would have been particularly difficult to produce unplanned content such as this while working in a team, especially considering the complexities of such a task. The design process of creating an animation includes significantly more steps than drawing, many of which change each year with technical developments. The making of this animation inspired me to take a more methodological approach to creativity in this project.



*Figure 6.2 – Benediction*

## 6.2 Exploration

**The Psychotomimetic Beyond**

This (slightly bigger than) A0 size drawing, as seen below in Figure 6.3 (The Psychotomimetic Beyond), uses the combination of black pigment ink and coloured felt pens. It was  was produced at the start of this Master's Thesis with the aim of visualising the aesthetic of a potential mediated reality prototype. Much like the NCEA portfolio, my source of inspiration for this huge drawing was a series of altered state of consciousness experiences which had also taken place before and during the four months spent developing it. A work like this is started by simply putting the pen on the papers and drawing random lines and shapes. After a while, much like the psychedelic experience, patterns begin to emerge and the artwork gradually increases in complexity. This drawing was not planned in advance; meaning that the art/design elements and principles within the works were for the most part spontaneous. The link between constantly changing spontaneous content is achieved by merging art/design elements such as line, texture and space to achieve consistent art/design principles.    This method of drawing allowed me to rapidly generate and visualise ideas related to psychedelia in a creative manner.

Spontaneous drawing methods, otherwise known as doodling, have some correlation to the spontaneous effects of psychedelic substances. The users of psychedelic substances often experience spontaneous psychological effects causing sudden inclination of thought and hallucinations (Masters & Houston, 2000). By comparing my own methods of drawing and computer orientated design, I have found  that working systematically rather than spontaneously towards a mediated reality psychedelic therapy simulation may yield the best results. Simultaneously, the content of such an experience could entail various functions which appear to the user as being spontaneous by basing them on the user's biofeedback or other user-centered parameters including GPS, etc. User-centered design in which usability goals, user characteristics, environment and functions are given extensive attention at each stage of the design process would be important to validate any assumptions made in this study.

Based on Roger Essig (2015) and Matteo Zamagni (2015) work I began experimenting with Google Deep Dream. By utilising the Deep Dream neural network to find and enhance patterns in 'The Psychotomimetic Beyond' (as seen above) via algorithmic pareidolia I was able to create a dream-like hallucinogenic appearance in the deliberately over-processed images. The image shown below in Figure 6.4 (Google Deep Dream Render) is just one of the many renders produced as part of this stage of iteration.
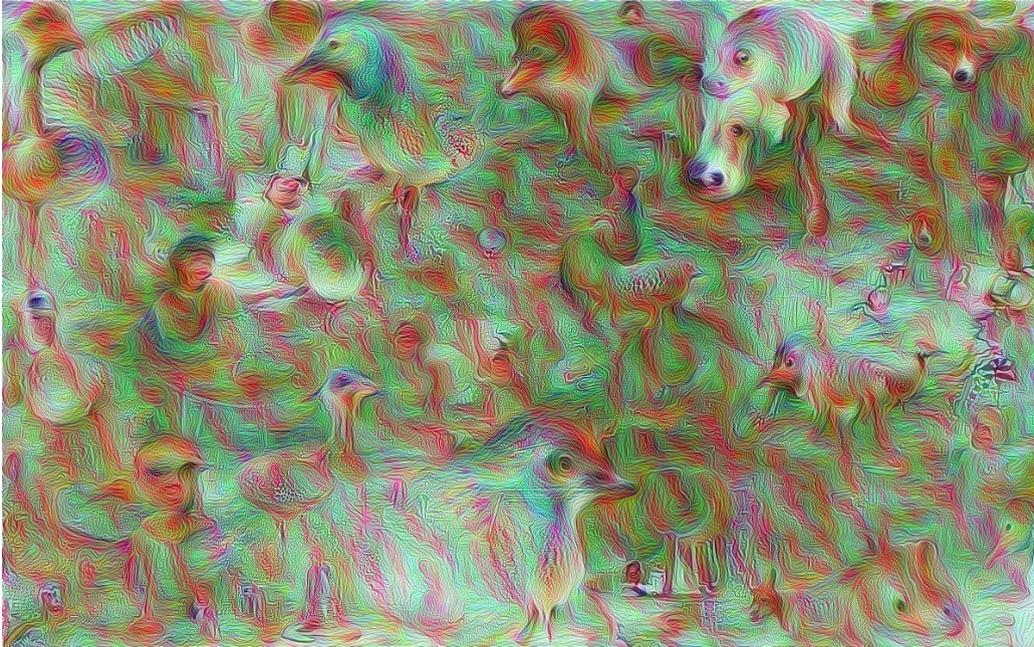
*Figure 6.4 - Google Deep Dream Render*

While both Roger and Matteo used Deep Dream in their works, neither of them was able to fluidly integrate the neural network into their VR experiences. Currently, as far as my understanding of the network extends and from the research gathered, it would be extremely difficult to integrate into a VR experience. Furthermore, the neural network does not render in real time and therefore I can not see how it would be would be used in AR. Even if it were to be used in AR, its use in therapy seem doubtful.

After moving on from Google Deep Dream I began exploring 360 degree video for use in VR. A variety of software was used during this phase of the design process such as Maya, Mandelbulb 3D and After Effects. Maya plug-ins such as Mental Ray and Domemaster 3D were used for rendering 360 degree stereoscopic images. A considerable amount of research into psychedelic art and design which was produced through digital technology was conducted. This led me to discover Mandelbulb 3D, a software capable of effectively rendering fractal imagery. Incidentally, Matteo (2015) also used Mandelbulb 3D in his work 'Nature Abstraction'. Essentially, fractals are never-ending, infinitely complex patterns that are self-similar across different scales. Geometrically, fractals exist in between our familiar dimensions. Fractal patterns are extremely familiar because nature is filled with them. For instance, they exist within trees, rivers, coastlines, mountains, clouds, seashells, and hurricanes, etc. They are also commonly seen throughout psychedelic experiences in the form of hallucinations and are at the forefront of human curiosity. They are created by repeating a simple process in an ongoing feedback loop. Driven by recursion, fractals are images of dynamic systems – the pictures of chaos.

After creating a series of 360 degree fractal animations, as seen below (Figure 6.5 & 6.6) I realised that while these fractals were brilliant in form, they did not accurately represent the psychedelic experience, let along psychedelic therapy. Furthermore, I

wanted to do some experimentation with an EEG headset. Such experimentation would not be possible using 360 degree video due to it being pre-rendered.
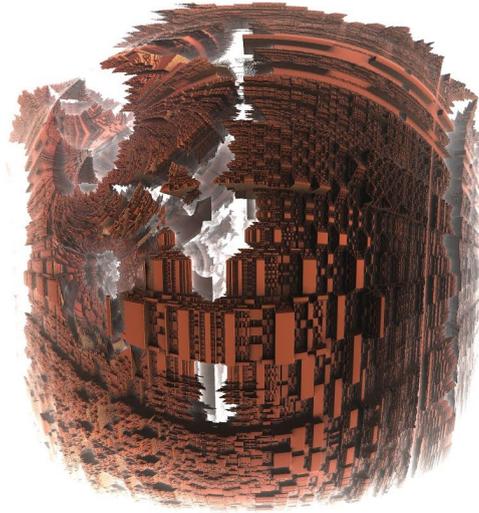
*Figure 6.5 – Mandelbulb 3D Render (Image 1)*
*Figure 6.6 – Mandelbulb 3D Render (Image 2)*

## 6.3 Hackathon

To get a better understanding of mediated reality in general and to get some practical hands-on experience with the equipment, I attended two 48 hour Hackathons. The people met and skills learnt throughout these Hackathons have been assets to my overall understanding of mediated reality in practical application.

**Project Eden**

On Friday the 17th of March, 2017, I attended New Zealand's first ever MR Hackathon. As a member of team 'Eden', we developed an educational AR/MR application with the Microsoft Hololens designed to teach children about ecology, specifically ecosystem dynamics. This branch of ecology deals with the processes of soil formation, nutrient cycling, energy flow, and productivity of plant growth.

While ecology is completely unrelated to this study, the practical application involved with the Eden project yielded some crucial insights into the potential of simulating psychedelic therapy through AR. The Microsoft Hololens proved to be an impressive feat in technological development and shows enormous potential in various therapies. However, the potential to simulate psychedelic therapy seems limited. The field of view on the Hololens does not extend across the user's field of view. Therefore the overall level of immersion is small in comparison to its VR counterparts (Oculus and HTC Vice etc.). According to multiple credible companies involved with mediated reality, there is yet to be released an AR headset with comparable technical specifications which completely covers the user's field of view.
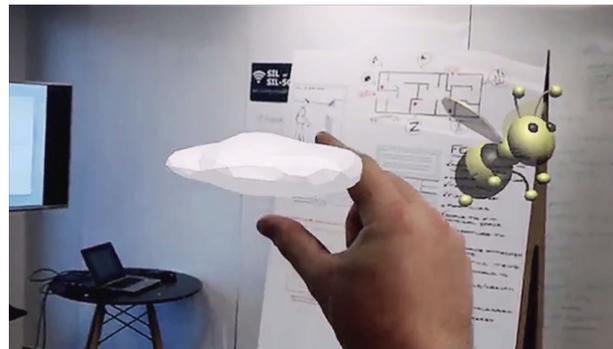


*Figure 6.7 - Project Eden (at left)*
*Figure 6.8 - Team Eden (at right)*

**Project VEXT**

Based off of Carlin, Hoffman & Weghorst's (1997) 'Virtual reality and tactile augmentation in the treatment of spider phobia', the aim of this 48-hour Hackathon project was to add neurofeedback technology to virtual reality exposure therapy for

the phobia of spiders. The biggest challenge we, Team VEXT (Virtual Reality Exposure Therapy), had to overcome was the limitations of the EEG devices. At first, we attempted to develop with the Neurosky Mindwave Mobile (the same EEG as the Odd Division team used in Conductar, as discussed previously in Chapter 5.8. However, unfortunately, the developer support for this product was extremely poorly documented and outdated. Due to tight time restraints, we decided to stop developing with the Mindwave Mobile and instead began to develop with the Emotiv Insight. The Insight had far better developer support than the Mindwave Mobile and within a day of development, we had the EEG integrated and running with the game engine Unity 3D.

The final experience prototype began with an outline of what the user should expect to experience as well as how the EEG will work in relation to the prototype. This outline was set in a white void and was narrated by a woman who walked towards the user. When the player was ready, they would press the main button on the controller to begin. The user was then virtually transported into a room where spiders would crawl in through cracks in the roof. Within a minute or so, the room was filled with spiders. To make these spiders disappear, the user would have to think of a calming thought such as a flowing river. As the users level of relaxation increased, the spiders would slowly disappear. The concept of the spiders disappearing represented the user overcoming their phobia.

Many of the ideas and principles explored throughout this project could be integrated into a mediated reality psychedelic therapy experience. For example, a simulation of a bad trip which is resolved in a similar way to the VEXT project could even help a patient overcome their psychiatric illnesses or disorders. This type of therapy could be called mediated reality psychedelic exposure therapy. The EEG could also be used to determine the intensity of the user's visualisations.

It should be noted that it would be possible to achieve similar results using the Neurosky, however, advanced programming skills would be required.

*Figure 6.9 – Project VEXT (at left)*
*Figure 6.10 – Team VEXT (at right)*

# 7

# 7 Analysis

HMDs are the optimal devices for simulating such effects due to the graphical content being overlaid in front of the user's eyes. For that reason, this Chapter will only analyse the potential of mediated reality to simulate psychedelic therapy through HMD.

As described in Chapter 4.3, mind manifesting therapy is usually conducted with an eye mask over the patient's face. The aim of this type of therapy would be to promote transcendental, ecstatic, religious or mystical peak experiences. As traditional methods of mind manifesting therapy generally entail the patient spending most of the 'trip' lying down with eyeshades, virtual reality would be the best option for simulation. Consequently, this precludes any reality type whose fundamental characteristics are predominantly based around the real environment. Therefore, AR and ModRs such as diminished and modified reality show very limited potential, and should be avoided when simulating mind manifesting therapy. Conversely, the hallucinations experienced in mind loosening therapy are generally extremely mild, if any occur at all. This is due to mind loosening therapy usually being conducted with MDMA. When taken at low doses, MDMA generally does not invoke visual anomalies. Therefore, the overall potential for AR, diminished and modified reality to simulate psychedelic therapy is extremely limited, if there even is any potential at all. Despite apparent limited potential, the following three sections will provide a more in-depth analysis of each of these realities. This analysis will focus moreso on their potential to simulate the psychedelic experience rather than psychedelic therapy, as these realities have already demonstrated minimal evidence in their ineptitude to simulate psychedelic therapy.

**Augmented Reality**

While AR shows limited potential in simulating psychedelic therapy, it does show some potential to simulate psychedelic visual effects by adding virtual information to the users field of view. For example, open-eye effects such as tracers and x-ray effects (Chapter 4.7) could be simulated by using AR to overlay them in front of the user's perception of the real world. Due to the nature of a psychedelic experience taking up the entirety of the the user's field of view, monitor-based AR is not a feasible option to convincingly simulate the psychedelic experience.

Most, if not all optical see-through displays on the market have a limited field of view, thus optical see-through AR currently has limited potential for simulating the psychedelic experience. However, the field of view limitations of optical see-through are provisional. Furthermore, AR is limited to only adding or 'augmenting' virtual information. By definition, it is not able to modify the environment to the same degree as modified reality. Even once optical see-through technology develops to include a fully covered field of view, its potential in simulating the psychedelic experience is limited in comparison to other reality types..

Video see-through AR would be the most feasible form of AR to simulate the psychedelic experience as the user/patient observes the the world through a completely unique perspective (through the camera). From personal experience, the feeling of perceiving the world through a camera can cause feelings of disorientation, partial loss of ego and exhibit aspects of out of body experiences. These effects can be compared to the effects of psychedelic substances. Overall AR has limited potential to convincingly simulate both the psychedelic experience and psychedelic therapy due to its fundamental characteristics.

**Modified Reality**

Modified reality shows potential to simulate some aspects of the psychedelic experience, however its overall potential seems extraneous in simulated psychedelic therapy application. However, overall it does show greater potential than AR for simulating the psychedelic experience. This is for two reasons. Firstly, unlike AR, all current computer modified reality HMDs use video see-through displays. Theoretically, with our level of mediated reality development, I do not think that it would be possible to modify the user's perception of reality using an optical see-through display, at least not in the context of simulating psychedelic therapy. Secondly, and more importantly, modified reality shows potential to convincingly simulate a wider range of psychedelic visual effects. The most convincing method to simulate open-eye effects such as pixelation, breathing and melting would be to distort them using modified reality. Much like AR, its potential for those effects to aid in the therapeutic process of undergoing simulated mind loosening therapy seems doubtful. The characteristics of modified reality do not relate to mind manifesting therapy.

**Diminished Reality**

Overall, diminished reality alone shows little to no potential in simulating psychedelic therapy or the psychedelic experience. Very little research has been conducted on diminished reality. As of yet, diminished reality has not been integrated into any HMD. However, even if diminished reality was integrated into an HMD, its characteristics seem extraneous to the psychedelic experience. At low to medium doses of psychedelics, the user does not experience any types of 'deliberately' diminished effects. While the user may experience some sense of visual diminishment, this exact diminishment does not relate to diminished reality. The

diminished experienced on psychedelics would relate moreso to modified reality. At high, to extremely high doses of psychedelics, the user may experience some effects similar to deliberate diminishment. These effects may include completely losing all perception of reality and also the universe as everything perceivable ceases to exist. While some aspects of these effects could be simulated through deliberately diminished reality, they would likely also require aspects of virtuality, thus meaning that modulated virtuality would be the prefered reality type.

### *Virtual Reality Prototype*

VR shows the greatest potential to simulate psychedelic therapy, specifically mind manifesting therapy. The most prominent characteristic that both VR and psychedelic therapy share is the use of removing visual stimuli from the users/patient's environment and then deliberately re-introducing it with the purpose of altering their perception of reality. In mind manifesting psychedelic therapy, this is achieved via inducing a strong dose of psychedelic substances while wearing an eye mask. In VR this is achieved through adding virtual information via an HMD. The possibilities of visual display is almost infinite in both VR and closed-eye psychedelic experiences. In VR these displays could be simulated through a game engine such as Unity or Unreal Engine. Closed-eye effects such as complex geometric patterns, three dimensional structures and visions, and even out of body experiences could be convincingly simulated through VR.

VR mind manifesting psychedelic therapy could take the traditional mind manifesting therapy approach where the clinician is non directive. Alternatively it could incorporate a similar system to that seen in the Bravemind therapy (Chapter 5.3) where the clinician guides the patient through their experience via an audible interface. This form of guidance would relate to mind loosening therapy. Combining elements of both mind loosening and mind manifesting psychedelic therapy may prove advantageous to future prototypes. Utilising clinician-guided treatment may be more suitable for some patients' needs, specifically patients suffering from forms of trauma.

Currently, VR shows the greatest potential for healing, trauma release, personal growth and exploration of psyche by simulating closed-eye psychedelic experiences. VR also proved most practical in simulating psychedelic therapy as it inherently exhibits characteristics advantageous to psychotherapeutic application and psychedelic simulation.

### **Augmented Virtuality**

AV shares many fundamental characteristics to that of virtual reality. The defining difference is that AV can incorporate aspects of the real environment into the virtual environment. Augmenting aspects of the real environment into the full virtual environment offers an entirely new range of opportunities to future development. Unfortunately, due to the scope of this study, a comprehensive overview of AV design

precedents was not provided, thus a thorough analysis AV can not be given. However, based on Gnosis and Nipo's (1996) 5 Levels of Psychedelic Experience and the three categories of visual alterations (Chapter 4.7), AV may have the potential to stimulate higher levels of the psychedelic experience including psychedelic effects such as out of body experiences, astral travel and merging with space or other objects or the universe. One example of how this could be achieved is through the use of Leap Motion hand tracking technology. Enabling the user to be able to see their own hands while in a completely unique, psychedelic virtual environment could increase overall levels of immersion..

## Mixed Reality

Mixed reality essentially incorporates and combines all possible psychedelic effects from both AR and AV. MR shares many similarities to open-eye psychedelic experience as both are essentially altering what the user is already seeing or hearing. Due to mind manifesting psychedelic therapy being practiced with closed eyes, many of MR's characteristics related to AR seem extraneous to therapeutic application. MR would allow the patient to experience the merging of real and virtual worlds to produce new environments and visualisations where physical and digital objects co-exist and interact in real time.

## Modulated Reality

As stated earlier, modulated reality shows limited potential to simulate psychedelic therapy due to its lack of practical use in both mind loosening and mind manifesting psychedelic therapy. Overall, some aspects of modulated reality such as modified reality show substantial potential to simulate the psychedelic experience while other aspects such as diminished reality show limited potential.  It appears that modulated reality would be more of a gimmick than anything else when it comes to simulating the psychedelic experience Besides from 'tripping people out' for a little while, the overall value of this type of reality in simulating psychedelic therapy seems doubtful. However, in saying that, there appears to be a market that this kind of experience would cater for. So, while modulated reality may not be useful in psychedelic therapy, it may have potential in entertainment.

## Modulated Virtuality

ModV could seamlessly combine the potential of every type of mediated reality. Mediated virtuality shows the most potential for patients to experience what Gnosis and Nipo (1996) describe as being the clear light of reality. This experience includes nirvana, ego loss, enlightenment and the ultimate truth of the universe. Unfortunately, however, to actually be able to develop this kind of experience would still require a considerable amount of technological development. Therefore, modulated virtuality has the greatest potential to simulate psychedelic therapy in the future, yet it may be some time before we can see there capabilities implemented.

# 8

# 8 Creative Output

The final creative output which I produced for this project consists of one short film and two supporting videos which can be viewed on an online portfolio at this url: http://simulating-psychedelic-therapy.surge.sh/. The short film can be considered the primary creative output for this study. However, the two supporting videos, website, A0 drawing 'The Psychotomimetic Beyond' and two Hackathons are all supplementary. The following Chapter will solely discuss the making of the short film. However, it should be briefly noted that the second video explains the mediated reality framework which I further developed from Mann's original framework (2002). And the third video summarises the most important findings from this study. These supporting videos do not require any further explanation.

**Creating A Short Film Rather Than A Prototype**

The short film which I have created demonstrates the potential capabilities of a psychedelic therapy simulation with our current level of technological development. The purpose of the short film is to demonstrate a potential proof of concept for simulating psychedelic therapy. This proposed proof of concept, called VRPT (short for 'Virtual Reality Psychedelic Therapy'), helps to verify that a mediated reality psychedelic therapy *can* be developed as well as exploring *how* it could be developed. The proposed proof of concept does not focus on usability, instead, it focuses on proving that the principle concept is viable. Hence why this study does not discuss user testing - that stage of development should be explored after this study once a framework is laid out. At later stages of development, user testing will be essential.

The decision to present this project/thesis in video format on an online portfolio seem germane to the topic of mediated reality and emerging technologies. As the amount of video content online continues to rise exponentially, people from both academia and popular culture will continue to turn to video platforms like Youtube for new and interesting sources of knowledge. With an estimated 300 hours of video content uploaded to its platform every minute, Youtube generates billions of views each day ("YouTube for Press", n.d.). The rise of YouTube and decline of traditional publishing (Mitchell & Rosenstiel, 2015) emphasises the societal shift from textual to visual information. A recent survey conducted by Kaltura indicates that around 80 percent of online participants agree that video conveys more powerful messages than written communication ("The 2014 State of Video in the Enterprise Report", 2014).

While the literature provided in this thesis will engage a niche group of intellects, the video which is produced as a result of this study will engage a much larger audience. This audience may include people who do not have the time or previous interested in this topic. The videos which I have produced will therefore help connect people who may show interest in the idea of simulating psychedelic therapy through mediated by utilising a more visceral platform of communication. For this study to truly help those who are suffering, it needs to have a broad reach. It needs to be hosted on a platform which is accessible to people around the world in an easily comprehensible format.

**Creating The Film**

The film can be broken down into three parts. The first part introduces psychedelic therapy and the VRPT simulation. The script for this part can be read below:

> Despite the stigma associated with psychedelic drugs and the so-called recreational drug culture, in reality, psychedelics have profound potential in psychotherapeutic application, and have long been utilised by indigenous cultures around the world for spiritual and personal growth.
>
> Ever since their assimilation into Western culture in the early 20th century, psychiatrists have researched potential application for psychotherapy, showing promising results. Unfortunately , reactionary legislation passed in the late 60's, to curb the drug counter-culture at the time, resulted in the international and indiscriminate ban of psychoactive substances, essentially halting research for decades.
>
> Imagine if everyone had access to legal forms of psychedelic therapy.
>
> What that could do for our mental health system.
>
> Unfortunately the road to legalisation is a long and tedious process. And for many people, treatment seems like a distant dream, too far out of reach.
>
> Yet through our technological advancements, a revolutionary form of virtual therapy is now emerging.
>
> This virtual reality experience is based around the simulation of phosphenes - the perception of visual patterns or noise despite no light entering the eye. This is a phenomenon that we all experience when we close our eyes.
> At low to medium doses of psychedelics, this phenomenon drastically changes.
>
> This virtual reality experience simulates the changes of the seemingly blotchy and mundane phenomenon as it begins to morph and transform into unique, stimulating arrays of complex geometric patterns and other alluring visual displays.
>
> As the user drifts further into relaxation, the experience  progressively increases visual stimuli with the aim of inducing an altered state of consciousness liable to produce therapeutic effects similar to those of psychedelic therapy.

The second part acts as the introduction to the actual VRPT simulation. The third part is a brief guided meditation to get the user relaxed and prepare them for the simulation. The scripts for these parts are covered in the next section.

The first part of the film was narrated by myself, and the second and third part were narrated by a female friend.

The Filming was shot on two separate occasions. The first occasion captured the city harbour on a sunny afternoon from Maupuia Park, Wellington, New Zealand. The second occasion showed a woman and her partner utilising the proposed prototype in the privacy of their own home.

All of the visual effects and post-production work were completed in After Effects, a digital visual effects, motion graphics, and compositing application developed by Adobe Systems.

**The Proposed Prototype**

It appears that there are countless methods in which psychedelic therapy could be simulated through mediated reality. The most viable and relevant effect to VR seemed to be the change of phosphenes to complex visual displays. VRPT is therefore based off of phenomenon of phosphenes - the perception of visual patterns or noise when the eyes are closed, despite no light entering the eye, .

VRPT should be built using Unity 3D and integrating the Emotiv Insight EEG. This combination of software/hardware were established to be feasible in Project VEXT (Chapter 6.3).

In the short film, VRPT begins with a brief introduction. In practical application, the patient would have already undergone at least one, if not multiple therapy sessions before entering VRPT. However, this introduction will reiterate the purpose of the experience for emphasis, clarity and to familiarise the patient with the VR environment. The following passage of text serves as a preliminary narrated introduction.

> *Welcome to VRPT. This is a phosphenes based simulated session of psychedelic therapy. You are embarking on the first of several sessions in a spiritual journey of self discovery. Throughout this process you will experience healing and the release of past traumas. Through exploration of the deep realms of your psyche, you will gain insight into your true being, and experience profound personal growth. What you take from this experience, from any experience, is completely upto you.*

Throughout this introduction, the patient experiences relaxing audio visual effects. The visuals could potentially take any number of different forms, however, in this proof of concept, the visuals consist of a small intelligent entity (which takes the form of a hazy light) hovering around the environment. This entity is the patient's 'guide' to the experience.

The music for this proof of concept was orchestrated and produced by a Wellington (New Zealand) based musician named Henry Boyle. This soft acoustic music assists in the relaxation process.

As the introduction finishes, the visuals (including the guide) begin to morph into an interpretation of phosphene. In practical application, this interpretation can be achieved by using an empty black void (an empty game engine environment) and simply adding randomised blotchy noise over time.

During this transition of the introduction visuals to the phosphenes visuals, the following guided meditation would be narrated.

> *Make yourself comfortable, sit back, relax, and stay centered. Take a deep breath in. Slowly exhale. Continue to breath slowly, deeply. Feel your breath move through the canals of your nose. Draw the breath down into your stomach. Feel the weight of your mind. Release the thoughts that are overly present and heavy. Visualise them floating away.*
>
> *When you feel you are ready to begin the session, close your eyes for five seconds. Upon opening them, your journey will begin.*

The process of the patient closing their eyes for a prolonged period of time acts as a simulated equivalent of a patient inducing a dose of a psychedelic substance in psychedelic therapy. In the VRPT simulation, the system would recognise the state of the patient's eyes, therefore, upon opening their eyes, the simulated drug would begin to take effect. This mechanic is made possible by utilising eye tracking technology such a the HTC Vive eye tracking upgrade kit or the Fove VR HMD. The purpose of this feature is to allow the user to control their breathing and relax their mind before proceeding. Just like psychedelic substances, the patient must be comfortable and content before proceeding into therapy.

As the VRPT simulation takes effect, the seemingly blotchy and mundane interpretation of phosphenes would begin to morph and transform into unique, stimulating arrays of complex geometric patterns and other alluring visual displays. As the user drifts further into relaxation, the experience would progressively increase visual stimuli based on the user's neurofeedback data. With high levels of relaxation, the visuals would morph into complex kaleidoscopic displays. When the user's level of relaxation drops, the visuals would regress back to phosphenes forms. The strength of the visual effects experienced in this simulation could be described as anywhere between level 1 -3 on Gnosis and Nipo's 5 Levels Of Psychedelic Experience (1996). The aim is to induce an altered state of consciousness liable to produce therapeutic effects similar to those of psychedelic therapy.

VRPT seeks to incorporate the nondirective therapy approach which is often seen in mind manifesting therapy whereas the support from the staff generally acts as a facilitator, providing safety and comfort when needed. For this reason, this proof of concept would maximise immersion by limiting interaction between the patient and the clinician throughout the actual simulation.

The brief introduction at the beginning of the psychedelic therapy virtual reality simulation is merely a form of guided meditation to assist the patient in the relaxation process - it is by no means a form of psychotherapy and is not intended to replace the clinician. This proof of concept, like psychedelic therapy, is intended to be conducted with therapy sessions before and after the experience to ensure patient safety and to maximise therapeutic potential.

VRPT would ideally be a treatment option for patients who require psychedelic therapy but who are unable to access it. For health and safety reasons, VRPT user testing should include people over the age of 18 and who do not have any preexisting conditions which may induce unpleasant or harmful side effects. Often experiences similar VRPT such as the Ajna Light or the Synesthesia Glasses warm the user that they may be at harm if they have pre-existing conditions relating to epilepsy. More extensive development and testing of the prototype will inform any future researchers of a more precise target audience including who can and who can not use this form of treatment.

**Duration**

The number of sessions required to treat a patient in VRPT would be prescribed by the clinician. In mind loosening therapy the patient generally undergoes a series of sessions over a number of weeks, as opposed to mind manifesting which generally entails one 'strong' session. Due to the 'strength' of the VRPT, it seems unlikely that a patient could receive successful treatment in one session. The Bravemind VR exposure therapy simulation (Chapter 5.3) is an excellent reference to use when assessing the required number of sessions per patient. In the Bravemind therapy programme, the users are examined on a case by case basis, and therapy usually consists of multiple sessions per week over a period of weeks or months. Based on the Bravemind therapy programme and on how mind loosening therapy is usually conducted, a patient may be expected to attend VRPT sessions multiple times a week for an extended period of time, perhaps a few weeks or months.

It is unreasonable at this stage of development to expect that a patient should undergo simulated psychedelic therapy for the equivalent duration of the psychedelic experience which generally lasts between 3-9 hours. VRPT should aim to be under 1 hour in length. However, the exact amount of time needed in VRPT should be decided after further research is conducted.

9

# 9 Discussion

The ways in which psychedelic therapy can be simulated may almost be a vast as the content of psychedelic therapy itself. Psychedelic therapy is the therapeutic practice which involves the use of psychedelic drugs such as 2C-B, DMT, Ibogaine, Ketamine, LSD, Psilocybin, MDMA and Mescaline to primarily assist in psychotherapy. There are many different methods of practising psychedelic-assisted therapy. The two primary treatment methods are psycholytic psychotherapy, otherwise known as mind loosening therapy, and psychedelic psychotherapy, known as mind manifesting therapy. In mind loosening therapy the therapist provides the patient with periodic low to moderate doses of psychedelics and perform therapeutic sessions with them during their "trip" as part of ongoing therapy. Mind manifesting therapy involves a one-time (or very few times) strong dose of a psychedelic drug to a patient in a specialized facility with therapy sessions given before and after the experience. The support from the staff is generally non-directive towards the experience other than to provide safety and comfort. In both types of therapy, the prescribed drug dose is agreed upon between the psychotherapist and the patient. Potentially mediated reality psychedelic therapy simulations should base their application around these primary therapy types. The creators of such applications will have to consider whether the goal is to treat the patient or person with one intense session or with multiple less intense sessions, or a mixture of both.

Timothy Leary's 5 levels Of Psychedelic Experience can be used as a framework for measuring and calibrating the strength/intensity of a mediated reality psychedelic therapy simulation on a level ranging from 1 -5. Level 1 represents the lowest possible level of psychedelic experience and generally entails mild visual and audible enhancement as well as a stoning effect. Level 5, on the other hand, represents the climax of altered consciousness. It can entail total loss of all connection with reality, total loss of ego, merging of time and space, and entails profound, indescribable experiences.

When comparing current design precedents and current technological capabilities to the descriptions of each level of psychedelic experience, it appears that there is potential for mediated reality in general to convincingly simulate a level 1 experience, possibly even a level 2 experience. Some sensory effects of level 3, 4 and 5 could be emulated, however, the general consciousness changing effects extend far beyond merely altering sensory perception. Currently, it appears that the only way to access these higher levels of psychedelic experience is through actual psychedelic

substances. The priority of future researchers should be to focus on conducting further research into convincingly simulating lower levels of the psychedelic experience.

Each type of mediated reality offers unique possibilities and, at the end of the day it depends on how the experience is  developed. However, my research indicates that at this time, with what we know and understand about both mediated reality and psychedelia, virtual reality has the most potential to simulate psychedelic therapy. The reason why there is not Psychological Therapy for augmented reality yet may not necessarily be because the technology is not available, but because there there is not as much need for it as there is for VR. The target of neither mind loosening psychotherapy or mind manifesting therapy is to experience trippy effects. The purpose is to open the mind and the heart and pave the path for healing and trauma release. It is to allow the psychedelic drug to expose the user to thoughts and experiences that they may not have otherwise been exposed to. In the context of therapy, it is more logical to have the patient lying down, relaxing, rather than walking around or looking at the ceiling.

## 9.1 Prototype Recommendations

This study suggests that there is a variety of methods available to developers and researchers to simulate psychedelic therapy, yet the methods discussed throughout this study are the ones that I perceived to be the most significant. Using the phenomenon of phosphenes as a basis for simulating psychedelic therapy is just one of many ways in which this kind of therapy could be simulated. Further research should be conducted on other possible technical elements and themes in order to recognise the extent to which realistic mediated reality experiences can alter a person's state of consciousness. In doing so, this may help to solidify potential requirements for a final design.

Designing and proposing a proof of concept has helped to demonstrate the functionality of a VR psychedelic therapy simulation.  Developing this proof of concept into a working prototype would allow further assessment of functionality and other elements which may need to be revised or discarded. Future prototypes should include a working and interactive model of the end product, communicating the design and navigation of the application. Such a prototype would include visualisations of how the experience will function, demonstrate user flows, and give a more refined idea of the design and layout.

Allowing the user to choose their preferred gender for narration could be implemented into future prototypes. This comes down to familiarity, personal preferences, and also extends to facilitating for people who have trauma or issues relating to a specific gender.

While binaural beats were not incorporated into VRPT, integrating them into future prototypes could prove advantageous. The ability to change the binaural beat depending on the user's neurofeedback could be an avenue worth exploring.

The risk of failure is possible, especially considering the high level of exploration and technical requirements. The technology in terms of VR psychedelic therapy is still relatively underdeveloped. However, it is important to remember that failure in such a field is important, especially for evaluating the likelihood of future success. As Thomas Edison once remarked, "we now know a thousand ways not to build a light bulb."

**Neurofeedback**

From personal experience, and from the experiences of my peers, I would recommend that the Emotiv EEG product range is used for the development of neurofeedback related experiences/games rather than the Neurosky products. This is due to Neurosky's disappointing developer support documentation. Both the Neurosky and the Emotiv EEG headsets have the potential to change the mediated reality experience based on the user's brainwave activity, and in the filming of the VRPT simulation, I used the Neurosky EEG. However, based on the experimentation and research which was conducted in the second Hackathon, I can conclude that the Emotiv EEG would be better to use for future prototypes. Both EEG's have the capability to monitor and register thought patterns. However, these changes need to be relatively significant. At the moment, EEG technology is still in its early stages of development and the data produced is rudimentary, to say the least. This prototype proves the capabilities that EEG technologies have in simulating the psychedelic experience. Neurofeedback technology is still in its early stages and is relatively undeveloped for use in games and experiences. The data that such technology provides is a crude representation of how the brain actually works. However, the only way to advance this kind of technology is to continue to facilitate its research and development. Similar technology represents the brain in such complex yet simple data sets. As EEG technology develops, its potential use in psychedelic therapy simulation will also increase particularly in terms of mediated reality integration. I therefore propose that potential proof of concepts should be built in either the game engines Unity or Unreal Engine, both of which have developer support for EEG technology. While it is contentious whether the data provided from the EEG actually relates to the psychedelic experience, the purpose of using the EEG in such a simulation is to recognise that in the near future the data will become more relevant.

**Clinical Use**

This study barely scratched the surface on how a psychedelic therapy simulation would be used by a therapist or clinician. Psychedelic therapy requires careful and thorough preparation - as might mediated reality psychedelic therapy. Thus, the way in which psychotherapy is conducted with the integration of technology would need to be discussed with a psychotherapist or other associated expert in the field.

Nevertheless, it could be conducted before or during sessions. The Bravemind therapy programme is the current leading programme in terms of VR psychological therapy and should therefore be used as a reference for future researchers. Nevertheless, further research may clarify whether mediated reality psychedelic therapy could be used independently or if supervision by a therapist/clinician is required. If this treatment option were available to people who could access it independently, this would encourage greater accessibility. However, safety concerns accompany that potential route. Situations of misuse of such treatment should be avoided as for the purpose of this study, the psychedelic therapy simulation is ultimately intended to be a form treatment, not a recreational activity.

**Interesting Avenues For Exploration**

Other forms of altered sensory perception as discussed in Chapter 4.7 (The Psychedelic Experience) which could be incorporated into a psychedelic therapy simulation include: gustatory, olfactory and haptic, kinesthetic, organic and thermoception. However, limited research surrounding these senses in relation to the psychedelic experience means that a thorough analysis cannot be presented in the scope of this study. There is a clear indication that such effects would help to simulate a more convincing mediated reality psychedelic therapy simulation.

The modern phenomenon of MMORPG has opened a gateway for development into more complex virtual worlds similar to Stephenson's concept the 'Metaverse' (1992). The next evolutionary step in virtual worlds may be the integration of AR technologies and games modes such as transreality gaming. Transreality gaming describes a type of gameplay that combines virtual world gameplay with physical, real-world experiences (Montola, 2005). Players of transreality gaming can move seamlessly through the unified game spaces which combine real and virtual elements. Fluidity between physical and virtual stages of gameplay is essential in order to manipulate the user's distinction between what is allegedly 'real' and what is virtual while playing.

Transreality gaming is also associated with technology and gaming modes such as big data feeds, reality mining, ubiquitous computing, geolocation, cyberware, gamification and effective gaming, all of which could potentially be integrated into a psychedelic mediated reality experience. Big data feeds are data sets which are so large or complex that traditional data processing application software is inadequate to deal with them. It is a mechanism which could be used to increase complexity and immersion in psychedelic mediated reality experiences by integrating systems capable of procedurally generating enormous amounts of content. Reality mining uses aspects of big data feeds to help collect and analyse digitally gathered environmental data pertaining to human social behaviour. Such technology is currently being used to identify predictable patterns of behaviour to build systems which allow for positive change in both individuals and in global communities (Eagle & Pentland, 2006). Alongside the use of ubiquitous computing, reality mining and big data feeds could be used anywhere and anytime to collect and identify data pertaining to patterns in

human behaviour. This data could then be used to provide a user with a unique mediated reality experience which correlates to their behavioural patterns, similar to how the effects of psychedelic substances directly correlate to the user's own personal history and behavioural characteristics (Sessa, 2012). There are clearly more variables involved in the psychedelic experience which need to be considered. However, using methods such as collecting the user's behavioural data in large feeds anywhere anytime could be a possible solution to develop a more refined and accurate psychedelic simulation in the future.

In the future, mediated reality games, simulations and experiences may become so developed/refined that a device has the resolution capability of rendering graphically enhanced content which is indistinguishable from the real world. As technology evolves, such devices will change form, presumably being made smaller and in more convenient forms. The once bulky and inconvenient mediated reality devices will likely evolve from HMD displays to cyberware, specifically cybernetic implants, which can be understood as hardware implanted into the human body. Recently, as of 2017, Sony has patented contacts that record the user's vision. This is perhaps the first step to implementing AR directly onto the user's eyes through cybernetic implant. The lens is capable of performing autofocus, exposure adjustment, and zooming (Starr, 2016). The Sony contact lens patent showcases the ability to calibrate the implanted camera with a user's blink as well as utilising electroluminescence display to playback recorded content. These lenses are expected to revolutionise daily life and bring us closer to living in AR. If this technology was used to simulate psychedelic experiences the possibilities could be endless. The question is how would all of these elements be incorporated into a therapeutic setting? The future of mediated reality looks promising for patients suffering from illnesses and disorders which are treatable with psychedelic therapy. Never before has humankind been able to simulate the effects of psychedelic substances to this level of complexity.

Optical corrective lenses (eye tracking) could also be used to conduct psychedelic therapy. The lenses register where the user's eyes are looking, and would be useful to determine where to place content as well as how to recognise when the eyes are open and shut. The registration could cause an experience to shift between types of reality, specifically between mixed and virtual reality. This way patients could dynamically experience the unique effects of both open and closed-eye hallucinations. This control over mediated reality would provide the ultimate level of immersion and would perhaps be the first step towards creating an experience where it is impossible for the user to distinguish between reality and mediated reality.

Additions such as the Shakti Mat could prove effective if integrated into psychedelic therapy. However, perhaps one of the most exciting types of non-conventional mediated realities would be to use the Ajna Light and sound machine with an isolation tank. This was mentioned in the Joe Rogan Podcast (Rogan, 2017) with Dennis McKenna, the same scholar in the field of psychedelics who organised the ESPD50. It seems as if scholars in the field of psychedelics such as Dennis McKenna, his brother Terence McKenna, Timothy Leary  and many other others have been

imagining simulated psychedelic experiences for over 60 years now. Finally, the dreams of these academics and patients alike will get the chance to embark on an adventure of technological psychedelic therapy development.

## 9.2 Methodology Recommendations

Future studies which use qualitative research methods would benefit from empirically analysing mediated reality psychedelic therapy simulations, thus employing deductive reasoning that uses existing qualities (this study) as a foundation for formulating a conclusive answer to the associated research problem.

Currently, there appears to be no existing study that compares the brain under the influence of psychedelics versus the brain in a mediated reality psychedelic therapy simulation. Comparing such scans could act as a basis for any future quantitative research that aims to design a hypothesis based on the theoretical framework and observations made /outlined in this study.

An example of a quantitative research method which may lead to more conclusive results could hypothetically compare the brain undergoing various forms of stimulation. This research may include human brain scans which show:

1. The unstimulated brain
2. The brain on psychedelics
3. The brain while experiencing different types of mediated reality
4. The brain while experiencing mediated reality psychedelic therapy.

This list of scans may help researchers to compare the brain while experiencing a psychedelic mediated reality simulation with both the unstimulated brain and the brain on psychedelics. In doing so, this may allow researchers to draw quantitative, close-ended conclusions and perhaps design a hypothesis based around whether mediated reality can objectively simulate the psychedelic experience. The scans of the brain experiencing various types of non-psychedelic mediated reality would act as a mediator to ensure that there is a sufficient difference between itself and the brain while experiencing mediated reality psychedelic therapy. This could determine the relationship between psychedelic influenced mediated reality, regular non-psychedelic mediated reality and psychedelic substances.

Systematically predefined in-depth interview questions would also help in the accumulation of evidence and information regarding the simulation of psychedelic experiences through mediated reality. In-depth casual or formal interviews may help to compile data on the opinions, perspectives and experiences from clinicians, developers and other experts in the field as well as from patients. Interviewing people with psychiatric conditions such as anxiety or depression may help with results in the future. Incorporating interviews into this study may produce findings that were not determined in advance, thus potentially receiving new insights into how a psychedelic mediated reality experience could most effectively be developed in the

future. Such findings may even be applicable beyond the immediate boundaries of this study.

## 9.3 Challenges

Many of the challenges associated with simulating psychedelic therapy through mediated reality extend beyond the scope of this project. Future researchers who intend to create psychedelic therapy applications may have to face such challenges. In April 2017, the Virtual Reality, Augmented Reality Association (VRARA) Digital Health Committee conducted an industry survey with a goal of understanding the current state of the VR/AR healthcare market. This survey has helped to identify challenges in adopting VR/AR healthcare solutions.

The survey compiled a list of common hurdles to innovation and adoption of VR/AR healthcare solutions. It asked respondents to rank these hurdles based on how significant each was to them, on a scale of 0 - 5 (5 being "very significant", 0 being "not at all significant."). Based on this survey, the following challenges to adoption of VR/AR for Healthcare are listed in order of significance.

1. Funding - 4/5
2. Technical Limitations - 3/5
3. Clinical Organisation - 3/5
4. Lack of VR/AR knowledge - 3/5
5. Lack of VR/AR research - 3/5
6. Cultural Obstacles/Competency - 2/5
7. Resistance to tech from end users - 2/5
8. Regulation/Insurance/Policy issues - 2/5
9. Market issues - 2/5
10. Interest in VR/AR in health care staff - 1/5
11. Concern about side effects - 1/5
12. Interest in VR/AR in patient population - 1/5

The challenges facing the adoption of VR/AR for healthcare, specifically for simulating psychedelic therapy extend far beyond the scope of this study, and therefore such challenges will not be described in detail. However, the challenges noted above will likely be very similar to the ones faced by future mediated reality psychedelic therapy applications for use in healthcare. As for specific technical challenges, these may include registration, visual tracking, motion/simulator sickness, HMD and hand-held technical limitations. Other potential dangers include misuse and addiction similar to either drug abuse or to videogame/technological abuse. For more information regarding such challenges/dangers, please refer to the 'ARVRA survey' (2017). The ARVRA are planning to conduct subsequent surveys in the near future which will expand on such challenges. Please also refer to Srivastava, Chaudhury & Das's 'Virtual reality applications in mental health: Challenges and perspectives' (2014) as well as North, M. M., & North, S. M., 'Virtual Reality Therapy for Treatment of Psychological Disorders' (2017).

## 9.4 Reflection

Using qualitative research methods has strengthened the validity of this study by helping to obtain a more realistic view of mediated reality psychedelic therapy in a way that cannot be understood or experienced in numerical data or statistical analysis. It has allowed me to describe and assess the current state of mediated reality, psychedelia and the combination of the two. Furthermore, it has allowed me to develop flexible ways to perform data collection, subsequent analysis, and interpretation of collected information. Quantitative research methods have strengthened my ability to produce results that may be helpful in pioneering new ways of understanding mediated reality psychedelic therapy simulation. As a result of such methods, it was possible to shift the focus of the research based on new insights.

In retrospect, there are a few aspects of this study which could have been changed/extended on to yield better results. Firstly, due to the large quantity of reality types, it was difficult to provide substantial evidence as to each type's potential to simulate the psychedelic experience. If the scope of this study was reduced, more design precedents could have been analysed for specific realities, thus perhaps producing more definitive results. Despite this, the extent of this study's scope proved to offer a compelling insight into such a new area of study. Secondly, at the beginning of this thesis, I had initially planned to develop a working prototype. Unfortunately, however, at some point throughout this study, I realised that I had to prioritise either developing a prototype or writing a substantial thesis. I chose the latter.

Lastly, because of the qualitative nature of this study, I ended up conducting a significant amount of research into research which was not directly related to the research question. For example, a decent portion of this study focused on the culture and context of psychedelic mediated reality. This research looked at the science fiction genre 'cyberpunk' and how it influenced the way society perceives future technologies. A large portion of this culture and context research discussed Neil Stephenson's concept of the Metaverse which he wrote about in the cyberpunk novel 'Snow Crash' (1992). The following content is an extract from that section of study which did not make it into this thesis. It serves as an excellent precursor to the recommendations section.

There is still a significant amount of research needed to be done in the area of simulating psychedelic therapy through mediated reality. Undoubtedly, by the time that this thesis/project has been presented there will have already been some significant new discoveries in this field. Due to the considerable scope of this thesis and to the nature of the study, there undeniably will have been many questions left unanswered. The following section seeks to recognise some of these questions and provide recommendations for future researchers.

Only once a prototype which incorporates both qualitative and quantitative research methods is developed can conclusive research verify the insights outlined in this

study and potentially help to formulate relevant hypotheses for more definitive investigation. Therefore, it must be stressed, that this study does not seek to draw any definite conclusions or results, rather it seeks to analyse and interpret relationships between variables.

# 10

## 10 Conclusion

This study focused on simulating psychedelic therapy through the development of a mediated reality framework originally proposed by Mann in 2002. Mediated reality can be understood as a theoretical framework/umbrella term for realities that alter human perception via dynamic computer processing devices. Through a series of case studies on various literature and design precedents, I was able to analyse the potential that each of these realities within the framework has in simulating psychedelic therapy.

This study found that Augmented reality (AR) and modulated realities (ModR) such as modified and diminished reality show insufficient evidence for practical use in simulated psychedelic therapy. Augmented virtuality (AV), mixed reality (MR), virtual reality (VR) and modulated virtuality (ModV) contain a range of characteristics fundamental to potentially simulating mind manifesting psychedelic therapy. Mediated reality, in general, appears to be extraneous for practical use in mind loosening psychedelic therapy. This is due to mind manifesting psychedelic therapy generally involving mild or even no changes in visual perception. Each type of mediated reality's potential to simulate psychedelic therapy is contingent based on associated technological development.

VR proved most practical in simulating psychedelic therapy as it inherently exhibits characteristics advantageous to psychotherapeutic application and psychedelic simulation. Currently, VR shows the greatest potential for healing, trauma release, personal growth and exploration of the psyche by simulating closed-eye psychedelic experiences. The most prominent characteristic that both VR and psychedelic therapy share is the use of removing visual stimuli from the users/patient's environment and then deliberately re-introducing it with the purpose of altering their perception of reality. In mind manifesting psychedelic therapy, this is achieved via inducing a strong dose of psychedelic substances while wearing an eye mask. In VR this is achieved through adding virtual information via an HMD.

Accordingly, the author of this study has proposed a proof of concept (POF) for a neurofeedback driven VR experience which simulates aspects of both mind loosening and mind manifesting psychotherapy. This POF is intended to simulate the transformation of phosphenes into complex geometric pattern based hallucinations.

With further development in this field, one day people suffering from various mental conditions might be able to receive safe, accessible and legal forms of simulated psychedelic therapy. Enabling those suffering from a range of emotional and mental conditions to receive potentially life changing treatment. Unfortunately, the road to legalising psychedelics for clinical use is a long and tedious process. Until a feasible alternative is available, people who require psychedelic therapy but are unable to access it due to illegality will continue to suffer. This is a crucial time in technological development to explore potential research avenues in mediated reality and begin developing and testing prototypes.

# 11

## 11 Author's Note

This project has been my life for the past year, and what an incredible year it has been. From four months of drawing a single artwork, attending conferences, video production, designing a proof of concept to the writing of this thesis, this invaluable year has opened all kinds of unexpected doors. Prior to writing this thesis, my literacy skills were elementary, to say the least. Being able to write coherently is something I had always desired after having severe reading and writing difficulties growing up. After countless hours, days and months of writing, re-writing, editing, searching for definitions, searching for synonyms, structuring, and everything else that accompanies the formulation of a Master's level thesis, for the first time in my life I feel as if I am a competent writer. And if there is one thing that I would take away from this programme, it would be the ability not only to write but also to write critically.

Reflecting on this project, more time spent building the actual proof of concept/prototype would have yielded more definitive results. Ideally, this proof of concept should have been at the stage of prototyping. However, in retrospect, I do not regret applying the majority of this past year to literature-based research.

Moving forwards, my aspirations are to continue working in the field of mediated reality. The elation I felt from finally finishing this project has led me to consider further studies at a doctoral level. However, for now, I can only speculate as to where I will find myself in the near future.

I would just like to take a moment to sincerely thank whoever has taken the time to read this thesis. I understand that this thesis was lengthy, and because of the qualitative nature of the research, at times it took all kinds of interesting and unexpected turns. Despite this, I hope you, the reader, embarked on digesting this thesis with content. I hope that after reading this thesis you have gained more knowledge about simulating psychedelic therapy through computer-mediated reality than you initially had. Thanks again. Over and out.

# 12

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# 13

# 13 Appendix

Creative output video 1: Demonstration of the VRPT proof of concept.

Creative output video 1: Presentation on mediated reality
Creative output video 1: Presentation summarising this study

Please see these videos at; http://simulating-psychedelic-therapy.surge.sh/