|  |
| --- |
| Nottingham Trent University |
| Project Planning Document |
| Final Year Project | COMP20151/52 |

|  |
| --- |
| Hassaan Naveed | N0898071 |



Contents

[Introduction 2](#_Toc86769291)

[Depression 2](#_Toc86769292)

[Mental Health and COVID-19 2](#_Toc86769293)

[Virtual Treatments 2](#_Toc86769294)

[Affective State 3](#_Toc86769295)

[Aims and Objectives 4](#_Toc86769296)

[Aims 4](#_Toc86769297)

[Objectives 4](#_Toc86769298)

[Tasks and Deliverables 5](#_Toc86769299)

[Tasks 5](#_Toc86769300)

[Expected Outcomes 5](#_Toc86769301)

[Scope 5](#_Toc86769302)

[Milestones 5](#_Toc86769303)

[Gantt Chart 6](#_Toc86769304)

[Resources 7](#_Toc86769305)

[Resources 7](#_Toc86769306)

[Sources of Information 7](#_Toc86769307)

[Risk Analysis 8](#_Toc86769308)

[LSEPI 9](#_Toc86769309)

[Legal Issues 9](#_Toc86769310)

[Social Issues 9](#_Toc86769311)

[Ethical Issues 9](#_Toc86769312)

[Professional Issues 9](#_Toc86769313)

[References 10](#_Toc86769314)

# Introduction

## Depression

Depression is a major, increasingly common, mental illness, that can severely, negatively effect an individual’s quality of life (Malhi & Mann, 2018). Depression can have many different causes, ranging from environmental, to biological, and a combination of both. A variety of different models exist to explain the causes of depression, for example the Stress-Diathesis model suggests an external, environmental stressor is needed to trigger depression, however the required severity of the external stressor is dependant on their level of genetic predisposition (Colodro-Conde, et al., 2018).

Depression can manifest in a variety of ways, both psychological and physiological. The DSM-5 lists the two primary symptoms of depression as having a depressed, low mood and a diminished or loss of interest and pleasure in most activities (American Psychiatric Association, 2013). Other symptoms can include significant weight and appetite changes, fatigue and reduction of physical movement, loss of concentration, anxiety, and feelings of worthlessness and recurrent suicidal ideation. An individual must be experiencing 5 or more symptoms within a two week period to be classified as clinically depressed (American Psychiatric Association, 2013).

The recorded cases of clinical depression have been steadily rising over the years, with an increase of approximately 13.47% recorded cases worldwide between 1990 and 2019 (Institute of Health Metrics Evaluation, 2021). The WHO reports that an estimated 5% of adults globally suffer from depression (World Health Organisation, 2021).

## Mental Health and COVID-19

The recent COVID-19 pandemic has had a large impact on mental health around the world. Many measures taken to reduce the impact of the pandemic, such as self-isolation, quarantining, lockdowns, and working from home have interrupted people’s usual, everyday activities and routines (Kumar & Nayar, 2020).

There has been a large increase in loneliness and feelings of uncertainty and dread, in addition to many stressors ranging from financial to loss of life, that can have a large impact on people’s mental health, and lead to depressive symptoms and episodes (Pfefferbaum & North, 2020). In addition, the increased tension and workload on health workers can easily lead to stress and depression (Zhang, et al., 2020). From a study conducted in China between January and February 2020, 54% of respondants rated a moderate to severe psychological impact from the COVID-19 outbreak . 29% reported moderate to severe anxiety symptoms, and 17% reported moderate to severe depressive symptoms (Cullen, et al., 2020).

In addition to the pandemic directly leading to the worsening of people’s mental health, it has also caused an increased amount of stress and demand on health services (Willan, et al., 2020). This has lead to many hospitals and care facilities being unable to offer adequate, timely mental health services to those already suffering from mental health issues (Auerbach & Miller, 2020).

## Virtual Treatments

Virtual methods of management and treatment for a wide range of conditions have been steadily adopted over the years, and this has only been accelerated due to the COVID-19 pandemic, when in-person methods were more difficult to access and provide (Wosik, et al., 2020).

The most prevelant of these technologies is Virtual Reality. Virtual Reality headsets have been in use for treating a wide range of psychological issues for many years (Valmaggia, et al., 2016). The immersive properties of VR headsets have the capabilities of producing more authentic emotions in individuals than what could be produced from a video recording or game (Quesnel & Riecke, 2018), while allowing for a much more cost effective and easier method of placing individuals within certain scenario’s . The most notable use of VR in psychological treatment is exposure therapy for phobias and anxiety disorders (Maples-Keller, et al., 2017). It can be much more convenient to place an individual within a virtual environment containing a specific stimulus, than to attempt to place the participant in a real life environment. VR also has the advantages of having a greater degree of control (Parsons & Rizzo, 2008). The virtual environment can be changed, adapted, or stopped quickly, and therefore poses much less risk to an individual than a physical environment.

The research into the possibilities of VR treatments for depression are lacking, in comparison to the uses of VR in interventions for phobias, anxiety, stress, and pain management. Meanwhile studies that have focused on VR as an intervention for depression have found promising results in the delivery of therapies such as CBT (Lidner, et al., 2019).

While there have been some studies measuring the effectiveness of Virtual Reality as a delivery of psychotherapies such as Cognitive Behavioural Therapy for depression, there is even less research into smaller scale, symptom management for people exhibiting symptoms of depression.

Due to some of the symptoms caused by depression, primarily low mood, loss of motivation, and fatigue, seeking out psychotherapy can be a daunting task, and due to the waiting times of mental health services, the procedure can take many months (Reichert & Jacobs, 2018). During this time, the ability to engage in low cost and low effort techniques for managing symptoms of depression can be extremely helpful for individuals’ day to day lives. Current suggested techniques include meditation and exercise, however the potential of VR to change a persons emotional state for depression has been untapped.

## Affective State

Affective State is a measure of an individuals emotional state. Virtual Reality can be used to alter an individuals affective state by presenting a series of different virtual environments, and recording an individuals emotional response to those environments . Many different measures can be used; self report methods such as psychometric questionnaires and interviews, or empirical measurements such as Electroencephelogram and Electrocardiogram readings (Holzwarth, et al., 2021).

It could be possible to place an individual suffering from depressive symptoms such as low mood in a Virtual Reality environment, in order to alter their affective state and induce positive emotions.

# Aims and Objectives

## Aims

The project aims to investigate the potential of using virtual reality to alter an individual who is exhibiting depressive symptom’s affective state, in order to identify the effectiveness of virtual reality as a tool for reducing and managing depressive symptoms.

## Objectives

* Establish the need for the project
* Review existing literature
* Carry out primary research
* Identify the main technologies to be used
* Identify the main experimental principles to be used
* Carry out an experiment
* Review the results
* Present findings

# Tasks and Deliverables

## Tasks

* Carry out background research into depression, affective state, and virtual reality
* Review existing research and identify areas of weakness
* Identify main properties of experiment and submit ethics approval
* Write context and new ideas chapters of report
* Research existing Virtual Reality experiences and games to be used
* Research any psychometric questionnaires to be used
* Gain familiarity with EEG headset
* Identify participant gathering techniques
* Identify experimental design to be used
* Develop experimental plan
* Write design chapter of report
* Gather participants and equipment
* Conduct experiment and gather results
* Write implementation chapter of report
* Analyse EEG and psychometric results and find level of statistical significance
* Write discussion and conclusion chapters of report
* Produce a presentation on findings

## Expected Outcomes

The expected outcomes of this project will be a set of findings from the experiment that may be statistically significant, that may be able to suggest that using VR to alter affective states could be a viable technique of depressive symptom management.

## Scope

The scope of the project includes the majority of the tasks that have been identified, and the primary tasks that are needed will be writing the report sections, conducting the experiment, analysing its results and presenting the findings.

The project will not involve developing any new 3D Virtual Reality environments, and instead will focus on reviewing the already existing environments available to the general public. This is due to time constraints, as it will be difficult to develop any effetive environments whilst trying to learn new technologies in order to develop those environments.

## Milestones

The primary milstones for this project will be gaining ethical approval, developing the experimental plan, conducting the experiment and analyising the results, and presenting the findings, along with writing each section of the main report.

# Chart, bar chart Description automatically generatedGantt Chart

This Gantt chart represents the distinct stages and milstones of the project, their subtasks, and the estimated amount of time each task will take. The project has been split into five distinct phases, Planning, Research, Design, Implementation, and Conclusion, relating to the main sections of the final report. A draft version of each section of the report will be completed within each stage, well as any other subtasks.

# Resources

## Resources

|  |  |
| --- | --- |
| Resource | Explanation |
| Laptop or Computer | A computing device will be required to set up virtual reality software, input EEG readings and analyze EEG data. |
| Oculus Quest 2 | A VR headset will be needed in order to place the participant in a virtual environment. The Oculus Quest 2 has capabilities of wireless VR, which will be useful to fit around an EEG headcap. |
| SteamVR or Oculus VR | SteamVR or OculusVR will be used, depending on the VR software chosen, as the platform to run said VR software |
| VR Software | VR software will be used to run either a 360 video, VR experience, or VR game during the experiment. |
| OpenBCI Headcap | The OpenBCI EEG Headcap will be used to collect EEG readings from the participants during the experiment. |
| EEGLab | EEGLab is a software that will enable processing of EEG readings. |
| PHQ-9 | The PHQ-9 is a questionnaire designed to assess depressive symptoms, and will be used during the experiment to assess whether a change has occurred in a participants depressive symptoms before and after. |

## Sources of Information

|  |  |
| --- | --- |
| Source | Explanation |
| Library | The NTU Library and Library OneSearch systems will be used to find relevant literature |
| Google Scholar | Google Scholar will be used to find relevant literature |
| JSTOR | JSTOR will be used to find relevant literature |
| NHS Website | The NHS website will be used to find information and resources on depression |
| WHO Website | The WHO website will be used to find information and resources on depression |
| Steam Store or Oculus Store | The Steam or Oculus stores will be used to acquire VR software for the experiment. |
| Supervisor | The supervisor will be able to giev advice and guidance about the topic area and the project. |
| BCS | The BCS offers various guidelines for professional and ethical procedures within computer science. |

# Risk Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Risk | Probability | Impact | Mitigation |
| Project does not acquire any voluntary participants | 2 | 5 | Ensure a backup plan is ready for acquiring participants. Expand the requirements of the participants to increase possible sample |
| Initial time estimates are inaccurate | 4 | 4 | Project progress will be kept under constant review, and the Gantt chart will be regularly updated to allow for deadlines to be met. |
| Technical failure of VR headset during experiment | 3 | 4 | Ensure rigorous testing of vr headset prior to experiment for all possible conditions. Ensure that rescheduling of the experiment is possible in case. |
| Technical failure of EEG cap during experiment | 3 | 4 | Ensure rigorous testing of EEG headcap prior to experiment for all possible conditions. Ensure that rescheduling of the experiment is possible in case. |
| Student absence results in project falling behind schedule | 2 | 3 | Ensure that such occurences are brought to the attention of the project supervisor and module leader. Review project deadlines and time estimates and submit NEC if required. |
| Supervisor is absent for a long period of time | 2 | 2 | Ensure constant and open communication between student and supervisor for notification of absences, ensure that other supervisors are able to give some guidance. |
| Unclear or unrealistic requirements and scope | 2 | 3 | Ensure all requirements are thoroughly reviewed and seek out support to ensure scope is attainable. Iterate requirements and scope if necessary, updating time schedules. |
| Insufficient background knowledge and research | 2 | 3 | Carry out extensive research early in the project and ensure records and notes are kept |
| Loss of data due to technical failure | 2 | 5 | Ensure a secure backup is available |
| Participants struggle to use VR headset | 3 | 4 | Allow time in experiment for participants to be oriented for using VR headset |
| Participants struggle to use VR Software | 3 | 4 | Allow time in experiment for participants to be oriented for using VR software |
| Unclear or unrealistic plan of the project | 2 | 4 | Ensure project plan is thorough and regularly reviewed. |
| Participant data is leaked due to security breach | 1 | 3 | Ensure all data is anonymised and stored securely. |

# LSEPI

## Legal Issues

The primary legal issue of this project is the Data Protection Act (Data Protection Act, 2018). The project will be collecting data on participants, and therefore this data will have to be stored in accordance to the DPA. This means any data collected on the perticipants must only be used faitly and lawfully, and only for the purposes that have been explicitly specified. The data should also be kept accurate and up to date, and should not be kept for longer than it is needed. The data should also be stored securley in a way that ensures protection against any unauthorised access. All data will also be anonymised and encrypted to protect the participants’ privacy, ensuring that their identity cannot be revealed in the event of a security breach.

## Social Issues

There are a variety of ethical implications for the project, the most important being privacy. Some companies such as Valve and Meta have been working on incorporating BCI into VR headsets directly, allowing for increased data collection of the users of VR headsets. This has implications on the issue of targeted advertising, as a company would theoretically be able to identify a users brain activation based on the content displayed on the VR headset. Additionally, incorporating low intensity and low effort management techniques into virtual reality could lead to increased social isolation, as people may want to be spending more time within the virtual world. Due to the idea that VR management techniques require less effort and motivation, users may be less motivated to seek other forms of help.

## Ethical Issues

Due to the nature of the project, there are some ethical implications to be considered. As the project will consist of an experiment on a sample of people, it is necessary for any health and safety measures to be taken, in order to prevent risks to people’s health during the experiment. For example, participants should be screened for photosensitive epilepsy, as well as any other conditions that may create risks when using a VR headset. Some participants may not be able to use the controllers due to motor impairments, and considerations should be made in advance. Due to the project requiring voluntary participants, unprecedented bias in gender or race may emerge, and these should be noted. All participants should also be fully broefed and made aware of what the experiment will entail, and give their informed consent. Participants should be able to withdraw at any time, and any data should be destroyed.

## Professional Issues

Throughout the project, a certain level of professionalism and integrity must be upheld. The BCS Code of Conduct (BCS, 2021) will be closely followed, which outlines the key principles that an individual conducting work within the tech industry should uphold.

# References

American Psychiatric Association, 2013. *Diagnostic and Statistical Manual of Mental Disorders: DSM-5.* 5th ed. Washington D.C.: American Psychiatric Publishing.

Auerbach, J. & Miller, B. F., 2020. COVID-19 Exposes the Cracks in Our Already Fragile Mental Health System. *American Journal of Public Health,* 110(7), pp. 969-970.

BCS, 2021. *BCS Code of Conduct: BCS.* [Online]   
Available at: https://www.bcs.org/membership/become-a-member/bcs-code-of-conduct/  
[Accessed 02 11 2021].

Colodro-Conde, L. et al., 2018. A direct test of the diathesis-stress model for depression. *Molecular Psychiatry,* 23(7), pp. 1590-1596.

Cullen, W., ulati, G. & Kelly, B. D., 2020. Mental health in the COVID-19 pandemic. *QJM: An International Journal of Medicine,* 113(5), pp. 311-312.

Data Protection Act, 2018. *Data Protection Act 2018: Legislation.* [Online]   
Available at: https://www.legislation.gov.uk/ukpga/2018/12/contents/enacted  
[Accessed 02 11 2021].

Holzwarth, V. et al., 2021. Towards estimating affective states in Virtual Reality based on behavioral data. *Virtual Reality,* Volume 25, pp. 1139-1152.

Institute of Health Metrics Evaluation, 2021. *Global Health Data Exchange (GHDx).* [Online]   
Available at: http://ghdx.healthdata.org/gbd-results-tool?params=gbd-api-2019-permalink/d780dffbe8a381b25e1416884959e88b  
[Accessed 27 10 2021].

Kumar, A. & Nayar, K. R., 2020. COVID 19 and its mental health consequences. *Journal of Mental Health,* 30(1), pp. 1-2.

Lidner, P., Hamilton, W., Miloff, A. & Carlbring, P., 2019. How to Treat Depression With Low-Intensity Virtual Reality Interventions: Perspectives on Translating Cognitive Behavioral Techniques Into the Virtual Reality Modality and How to Make Anti-Depressive Use of Virtual Reality–Unique Experiences. *Frontiers in Psychiatry,* Volume 10.

Malhi, G. S. & Mann, J. J., 2018. Depression. *The Lancet,* 392(10161), pp. 2299-2312.

Maples-Keller, J. L., Bunnel, B. E., Kim, S.-J. & Rothbaum, B. O., 2017. The use of virtual reality technology in the treatment of anxiety and other psychiatric disorders. *Harvard Review of Psychiatry,* 25(3), pp. 103-113.

Parsons, T. D. & Rizzo, A. A., 2008. Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis. *Journal of Behavior Therapy and Experimental Psychiatry,* 39(5), pp. 250-261.

Pfefferbaum, B. & North, C. S., 2020. Mental Health and the COVID-19 Pandemic. *New England Journal of Medicine,* 383(6), pp. 510-512.

Quesnel, D. & Riecke, B. E., 2018. Are You Awed Yet? How Virtual Reality Gives Us Awe and Goose Bumps. *Frontiers in Psychology,* Volume 9.

Reichert, A. & Jacobs, R., 2018. The impact of waiting time on patient outcomes: Evidence from early intervention in psychosis services in England. *Health Economics,* 27(11), pp. 1772-1787.

Valmaggia, L. R., Latif, L., Kempton, M. J. & Rus-Calafell, M., 2016. Virtual reality in the psychological treatment for mental health problems: An systematic review of recent evidence. *Psychiatry Research,* Volume 236, pp. 189-195.

Willan, J., King, A. J., Jeffery, K. & Bienz, N., 2020. Challenges for NHS hospitals during covid-19 epidemic. *BMJ,* 386(8239), p. 368.

World Health Organisation, 2021. *Depression.* [Online]   
Available at: https://www.who.int/news-room/fact-sheets/detail/depression  
[Accessed 27 10 2021].

Wosik, J. et al., 2020. Telehealth transformation: COVID-19 and the rise of virtual care. *Journal of the American Medical Informatics Association,* 27(6), pp. 957-962.

Zhang, W. et al., 2020. Mental Health and Psychosocial Problems of Medical Health Workers during the COVID-19 Epidemic in China. *Psychotherapy and Psychosomatics,* 89(4), pp. 242-250.