INTERACTIVE AUDIO DEVELOPMENT FOR GENERAL WELL-BEING

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Table of Contents

1. Introduction

Over the last century, particularly through recent decades, the advancement and development into technology has taken place at a significant rate [1]. The rapid pace of progression has produced increasingly intelligent and useful technological solutions in every area of day-to-day life. As a result, there exists a need for conducting research into the resulting impact of these innovations, considering how they may have affected factors such as interpersonal relationships, productivity, and general mental health/well-being.

When considering the scope of this project, it can be best represented as the intersection point between three primary areas of research and development (figure 1):

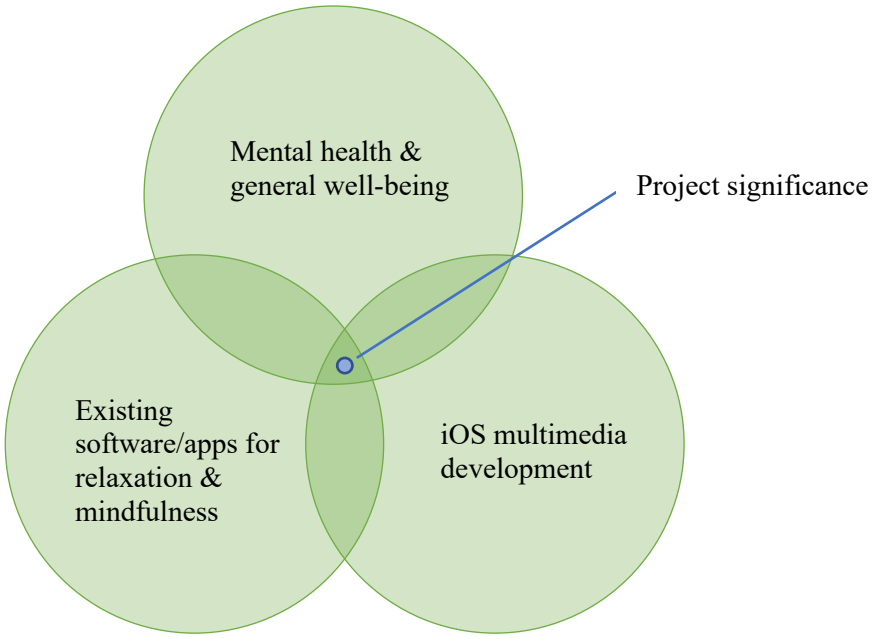

Figure 1 – A Venn diagram showing the three primary fields of interest as inspiration for the project of interest.

This report introduces existing work from the fields of interest shown above, demonstrating the inspiration for the project and its significance by providing context of what current solutions are available, any success they have had, and where there lies room for improvement and further development. The exact intention of this project is then explained, alongside a list of measurable objectives to track project progress. Additionally, a plan is introduced which shows the methods and systems used to monitor development, before finally summarising the work described in this paper.

2. Background Reading/Project Context

To better understand the context for this project, it is first necessary to recognise the existing work in the relevant fields of research and development mentioned above as the inspiration and motivation for the project's development. This section outlines some of the leading research into mental health over recent years, particularly looking at the consequences of the COVID-19 pandemic on mental well-being and investigating the relationship between general mental health and technology use. It then proceeds to describe some of the leading technological solutions for improving mental health and relaxation, highlighting potential key features which account for the success and value of currently available technology.

2.1. Mental Health Over Recent Years

One significant area of investigation and research which relates to this project is that of mental health and general well-being. Studies show that, despite life expectancy being at its highest to date, mental illness has skyrocketed in recent years, with 5 of the 10 leading causes of disability worldwide now being mental-related issues [2]. While physiological illnesses which are more common in less affluent countries, the contribution of mental disorders is larger in wealthier countries (23% compared to the 11% found in low- and middle-income countries). Other research has outlined more specific struggles such as anxiety – notably, one 2015 study found that 33.7% of people are affected by anxiety disorder during their lifetime [3], with the most common disorders being specific phobias and social anxiety disorder.

When considering how mental health impacts the well-being of an individual, one group that has arguably seen the most rapid increase of mental health struggles over recent years is younger people, with an NHS survey discovering that the proportion of under-16s experiencing any mental disorder has risen from 11.4% to 13.6% between 1999 and 2017 [4]. The study went on to cover the transition into adulthood, with a rate of 16.9% in 17–19-year-olds [5]. Emotional issues were outlined as the only category which showed significant change over time, with behavioural disorders, hyperactivity, and other less common disorders remaining similar in prevalence for the 5–15-year-old age group since 1999.

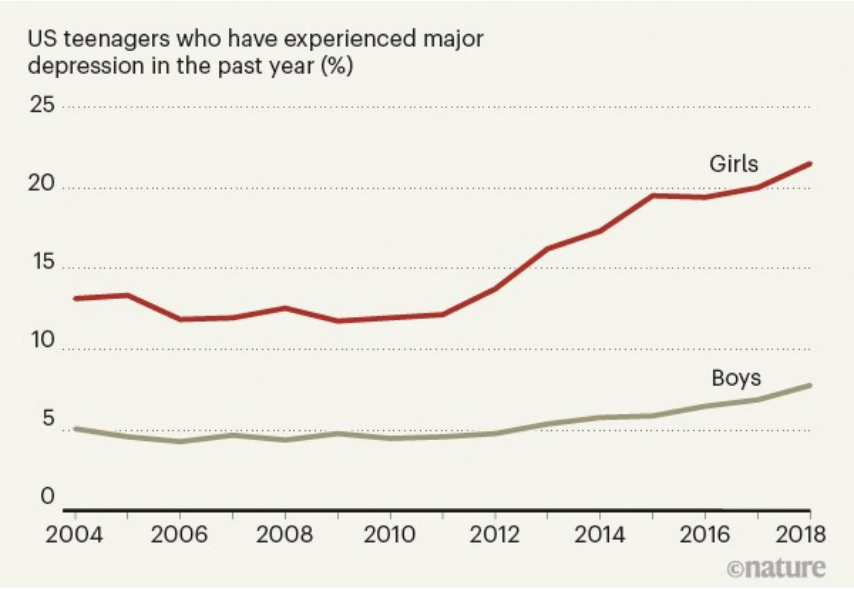

Figure 2 – Rates of depression among teenagers in the U.S. between 2004-2018. Produced by [6].

These trends have not only been found in the U.K., with evidence stating that in the U.S. rates of depression among teenagers has risen steadily since 2012 (figure 2).

Furthermore, the COVID-19 pandemic has only served to further intensify the struggle in the battle against mental health related issues. Restrictions in accessing public facilities used in day-to-day life has resulted in a more sedentary and isolated lifestyle for most, living from the confines of their own homes.

This has resulted in an increased concern for both individual and public safety, with the uncertainty of the virus adding additional pressure and frustration to everyday life.

With the average lifestyle forced into a more sedentary format, the convenience and consequently the use of technology has drastically increased, both for work and for leisure purposes. Preventative measures such as social distancing and wearing face coverings are necessary for slowing the spread of the virus, but as a result these measures increase isolation and a subsequent feeling of loneliness, causing a rise in levels of stress and anxiety [7]. This resulting stress can be a dangerous instigator for a myriad of different mental struggles ranging from decision making and impacts on mood to overall general well-being and happiness, particularly for those who are considered more susceptible to the virus due to a pre-existing health condition. Severe factors such as bereavement, separation, loss of income and fear are triggering mental health conditions or exacerbating existing ones [8]. Simultaneously, critical mental health services have been significantly disrupted due to the pandemic, with over 60% of patients reporting disruptions to mental health services for vulnerable people. The current state of the public's general well-being and the current absence of available support are critical factors for the desperate and urgent need for relief in any way possible, otherwise this struggle will inevitably worsen over time.

The specific causes of mental health and anxiety can sometimes be difficult to identify due to the wide range of potential reasons for a worsening mental illness or increased dissatisfaction with life quality. However, one specific pattern that has coincidentally neighboured the recent trends in general and overall well-being is the rapid uptake of technology and social media use. It therefore suggests that identifying correlations between use of technology and the state of general well-being could be a crucial component in explaining and defining user's current relationship with technology, as well as outlining concerns and consequently proposing ways to improve this multifaceted relationship.

Existing research already begins to uncover and reveal some of these trends, examining the correlation between overall well-being and technology use. It can be claimed that use of technology and social media is at an all-time high, with more than twice the number of teenagers in the U.K. using a smartphone for over 7 hours daily compared to those who's usage is 30 minutes or less. Correspondingly, heavy technology users were twice as likely to have low states of well-being (figure 3).

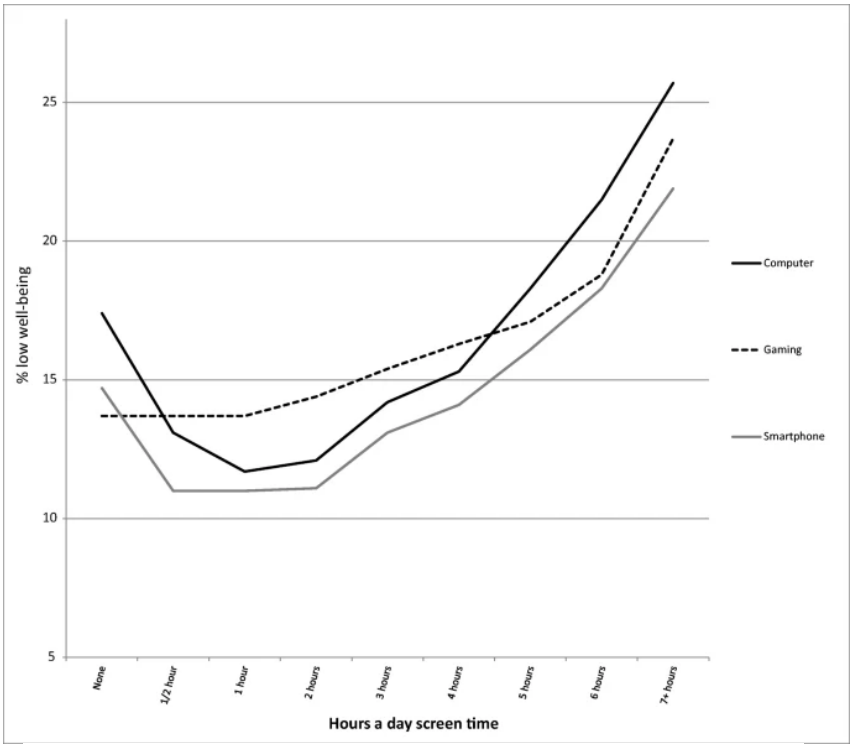

Figure 3 – Percent of adolescents low in psychological well-being by hours a day of computer, gaming, or smartphone use. Produced by [9].

Similar trends are also present in U.S. datasets, with a 70% difference in the number with at least one suicide risk factor among those using electronic devices more than 5 hours a day compared

to those whose use is less than an hour, and more than twice as many unhappy adolescents in the heavier usage group [9].

However, despite these indications, evidence is not entirely conclusive in claiming technology use as the sole perpetrator for this increase in lower well-being and mental health difficulties [10][11]. Especially over recent years, it has become progressively more challenging to be able to pinpoint causes of stress, anxiety, and poor well-being, through the plethora of limitations and difficulties introduced by the COVID-19 pandemic [12].

2.2. Technology for Relaxation

It is clear to see that the use of technology and social media is becoming increasingly popular. This creates the problem of managing mental health and general well-being appropriately in order to counteract the consequences of the increasing amount of time spent using technology, so that a sustainable and healthy relationship with technology use can be maintained. As described above, whilst these two trends are becoming progressively noticeable, there is some uncertainty in being able to decisively connect the patterns and behaviours between the two trends due to the wide number of potential causes for fluctuations in mental health and well-being. Nevertheless, it remains clear that there is a growing issue in terms of both use of social media and technology, and the overall state of mental health and well-being.

Various gadgets and devices have been created to bring different ways to relax and de-stress. Some notable mentions in this category of stress-relief gadgets include physical guided meditation devices such as the *Core* meditation trainer, which when held uses ECG sensors to send small periodic vibrations to guide breathing and focus, or the *Muse* meditation headband, which tracks brain activity in real time and plays a corresponding background sound reflecting the current level of activity in the brain [13]. More simple devices aim to provide a sense of calm and relaxation, such as Bluetooth speaker pillows and passive sound devices like the *Zwitscherbox* – a small motion-sensitive sound player that outputs soothing nature sounds when a user is walking past. Whilst these devices provide some potential for rest and relaxation, they do not offer much of a sense of accountability or motivation over prolonged use and are not always conducive to a busy lifestyle. Furthermore, gadgets like these are often very specific and sometimes expensive, making them more unlikely to appeal to a wider target audience as a useful application for providing a sense of calm and relaxation. As a result, despite the benefits offered, they have not seen tremendous success as a method of improving mental health and overall well-being.

One option to help restore some balance to the relationship between technology consumption and mental health could be to reduce screen time and prioritise time spent away from technology, but with social media and marketing strategies focused on attracting more user attention, combined with the additional difficulties introduced by the COVID-19 pandemic such as remote working, this is becoming significantly more challenging to do. Therefore, an alternative (and perhaps, given the circumstances, a more successful) method is to develop technologies and solutions that can be incorporated within the devices used in day-to-day life, providing a sense of stability to an otherwise addictive and potentially dangerous relationship.

Over recent years, phone usage has increased dramatically, with 6,378 billion smartphone users worldwide in 2021 compared to 3,668 billion in 2014 [14], and the average daily phone

use rising from 2.5 hours in 2016 up to almost 4 hours daily in 2021 [15]. One instigator of this increased phone usage is the substantial uprise in the development of mobile apps. Apps have become more popular due to their convenience of use, regular updates, and sense of achievement provided through use. These benefits resulted in a rise of app use compared to mobile websites, with mobile users now spending 88% of their time on mobile apps [16]. Recently, there has been a substantial uprise in the development of apps which aim to offer a work-life balance, focussing on ways to improve general well-being through mindfulness and meditation practices in a format that is easily accessible and portable, so that it can be utilised at the user's convenience. Today, a wide variety of available apps have been created with the sole purpose of providing a sense of relaxation, calmness, and sometimes even entertainment for the user, all with the intention of improving their mental state through distraction and mindfulness techniques [17].

Some notable releases in this category over the last decade include apps such as *Calm*, *Headspace: Meditation & Sleep*, and *Simple Habit*. These apps have been identified as successful and effective through user feedback and ratings [18].

2.2.1. Calm

The winner of Apple's "App of the Year" in 2017, *Calm* has been dubbed the "*World's Happiest App*", having collected over 100 million downloads with more than 1.5 million 5-star reviews across its distributed platforms since its original release date in 2012 [19]. The app holds the current number 1 slot for sleep, meditation, and relaxation. *Calm* offers flexibility through its use, with less structure and more freedom to select from a range of programs and exercises that help manage anxiety. Different modes such as *Sleep*, *Meditate*, *Music* and *More* provide a selection of different functions within the app for the user to choose freely between (figure 4):

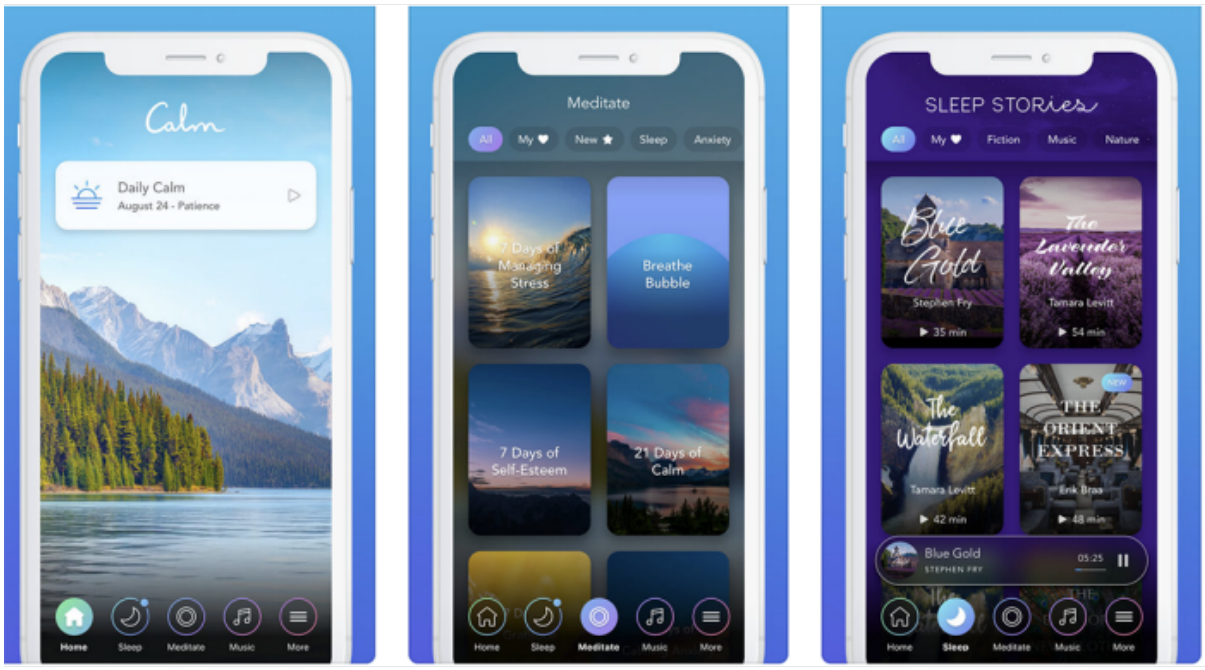

Figure 4 – Screenshots of the main interface of the app *Calm*. Produced by [20].

The main interface of *Calm* is simple and easy to use, with soothing and calming nature sounds to accompany a slowly moving nature-themed background. The user is not overwhelmed with different options, alerts, or subscription notifications, and can move between the different modalities of the app with ease. Deeper colours and rounded edges of panels containing different natural environments increase the sense of peace and relaxation felt through the app's use.

From personal experience, *Calm* is a beautiful and relaxing app to use. Even the opening screen itself inspires a sense of peace, with the simple words "take a deep breath" being the first interaction with the app. The animated nature environments with accompanying nature soundscapes create an instant sense of relief from the beginning of the app, and the main interface panel shifts between matching colour themes which blend between the soundscape and the app content. Soft and appropriate colour selection for different text and sections compliment the meditation and mindfulness options, which show aesthetic images of either the individual leading the practice or a pleasant nature environment. There is a consistent theme of nature integrated into the app's functionality, which really enhances its effectiveness in escaping and relaxing from the stresses of the outside world. Daily check ins are also included which allow the option to take a quick mental inventory, helping the user become more aware of their current mental state and providing opportunity to track changes over time. Inside the user's profile, statistics such as the number of mindful days and the total number of minutes and sessions is featured, along with the history of consecutive use to help inspire consistency and motivation to continue to use the app. Most options require access to the *Calm* subscription, which is moderately priced at £28.99 a year, but for the range of exercises and practices to choose from this seems trivial compared to the benefits the app offers. There is also a 7-day free trial for users to experience the entirety of the app before purchasing. It is clear to see from personal use why this app has achieved such success.

2.2.2. Headspace: Meditation & Sleep

Headspace (figure 5) is one of the most popular and well-known apps for meditation and mindfulness. Released in 2010, its sole mission is "*To improve the health and happiness of*

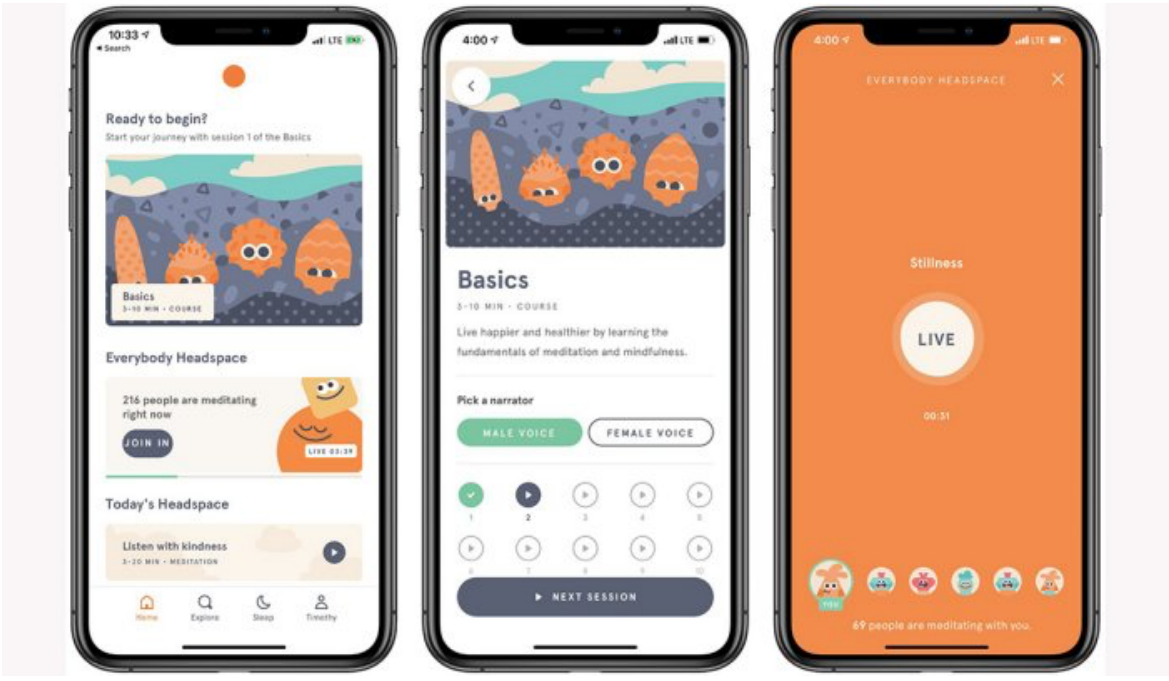

Figure 5 – Screenshots of the main interface of the app *Headspace: Meditation & Sleep*. Produced by [20].

the world". The company uses science-backed meditation and mindfulness tools to create habits for supporting mental health and general well-being. As a pioneer in guided mindfulness and meditation practices, it has been proven through use to reduce stress by as much as 14% over 10 days, alongside providing other benefits such as relaxing the mind, improving focus, and even enhancing quality of sleep [21]. The app has accumulated over 70 million followers in 190 countries worldwide, exceeding 600,000 reviews. The primary focus of *Headspace* in its functionality is using guided meditations, offering breathing exercises, sleep meditations, movement demonstrations, and wind-down practices. The app also dims the screen to encourage the mind to be present and focussed on the audio of the guided meditation.

Headspace appears to be an ideal candidate for those whose minds get lost in worry or overwhelm. Even from opening the app the user is welcomed with a slow visual animation encouraging the user to take a single mindful breath. Based on experience, the app is well organised and categorised into separate sections, each providing a range of different exercises and practices to select according to the amount of time they wish to spend. The whimsical, innocent characters with peaceful expressions are a nice added touch to personalise the theme and interface of *Headspace* and are featured throughout its content, being the avatars of the consistent animated theme that populates the display images of the various guided meditations an. A recent update has also added the *Today* panel, which outlines a small series of guided meditations recommended for different stages throughout the day. This is a smart way of inspiring consistency and providing a daily reset button in effect to return to the present moment. On the user's profile page, there is an outline of progress, showing interesting metrics such as total time meditated and number of sessions completed. One notable mention when exploring the app is that in its current version all exercises and practices require access to the paid subscription, which at the annual cost of £49.99 is quite a big commitment. There is, however, an option for a 7-day free trial for those considering subscribing who wish to experience the app first. Overall, the app is easy to use and neatly arranged, offering a variety of available and effective guided meditations based on the user's desire at any moment throughout the day.

2.2.3. Simple Habit

Simple Habit has taken a slightly different approach to achieving success in alleviating symptoms of stress and anxiety, focussing its design and functionality for more hectic and busier lifestyles, and subsequently earning the title of "*The best meditation app for busy people*" [22]. Winning the 2018 Google Play award for "Standout Well-being App" and an "App of the Day" award in 2019, the app is becoming increasingly popular across multiple platforms, making its mark in the category of health and general well-being. This app is designed to meet the needs of users who feel they have limited free time, prioritising short and simple 5-minute meditations for recentring, and gaining back a sense of control. *Simple Habit* has an extensive library of meditations, ranging from guided exercises for sleep and mindfulness to more active tutorial videos for movement (figure 6). Each meditation is specifically titled and well catalogued, making them easy to find and use.

Figure 6 – Screenshots of the main interface of the app *Simple Habit*. Produced by [23].

The use of *Simple Habit* is enjoyable and intuitive. Even from the sign in process, the app features slow moving and informal messages to help calm the user. The app uses information based on sex, age, and desired goal (such as increasing happiness or reducing anxiety) to create a personalised plan which matches the user's personal situation. Each guided meditation has the option to add a pre-set nature sound in the background if desired. A *For You* page is regularly updated with the user's current practice and recently explored content. The guided meditations featured on the app also include a comment section, where other users can describe and share their own experiences with a particular meditation or practice. The price tag attached to *Simple Habit* is more expensive than its competitors, demanding an £87.99 annual fee after an optional 7-day free trial. Some content is still available without subscribing to this premium service. A deep blue colour theme remains throughout the entire app's content, creating a smart and aesthetic design. There is also a tracking feature inside the user's profile which shows statistics like the current streak and total sessions explored, accompanied by any achievements unlocked by the user to provide a sense of achievement and accomplishment. One advantage of *Simple Habit* is that it can also be used offline, providing even more opportunity and convenience to be able to use the app and therefore gaining an advantage over its competitors who require an internet connection to operate. The app is well produced and offers a range of different features, all tailored to fit the user's particular situation or stare of mind.

2.2.4. Apple and Mental Health

Apple products have a series of built-in solutions and tools dedicated to help cultivate a healthier relationship with their technology. Features such as setting app limits, which will warn users when they have used an allotted amount of time on an app, or allowing a user to set specific times during the day or night to silence all incoming notifications, all help to provide opportunity to create balance for how a user interacts with their software. Notably, Apple has incorporated several health-oriented options on the Apple Watch, all designed to help with general well-being and overall health. These solutions include features such as the

Mindfulness app (figure 7), which periodically notifies the user to spend 1-2 minutes taking short number of guided breaths [24]. Health notifications also regularly remind users of their progress in achieving pre-set daily goals for movement and activity, either congratulating or motivating the user based on their current progress throughout the day. Small reminders such as these help to keep the user engaged and active in achieving physical and mental goals – an equally important factor considering physiological state has a direct influence on mental well-being [25].

Figure 7 – A series of screenshots showing the operation of the *Mindfulness* app on the Apple Watch. Taken from [24].

From the research described previously, it can be said that the research and development into technological solutions that improve and enhance overall well-being is an increasingly significant area. The recent impact of the COVID-19 pandemic has increased the time spent using technology, creating the necessity to cultivate and maintain a healthy, balanced, and sustainable relationship with the software and hardware used daily. It is observable from the number of reviews and users of different apps that mobile apps for improving mindfulness, relaxation and overall well-being are considerably popular. As a result, these apps have been able to deliver on their promises, showing a measurable reduce in stress levels from brief and consistent use of the app over a two-week period [26].

Whilst there is already some success in existing apps for assisting with stress and anxiety, there is still more that can be explored through future work in this area. For instance, one noticeable limitation is that current apps such as those outlined above, whilst effective, all use a passive approach to achieve a sense of calm and relaxation, requiring no action from the user other than to select and play an audio or video of a guided meditation or practice. This may make it easy to zone out or get distracted while listening due to lack of engagement, preventing the user from getting the most from the practice and potentially still leaving them feeling restless and unsettled. Gadgets and toys such as fidget spinners and stress balls exist to physically provide an outlet for restless activity through physical interaction. This project aims to combine these two concepts to develop a more immersive and engaging form of stress relief whilst still providing a sense of calm and relaxation, and therefore potentially a more effective tool for improving mental health and overall well-being.

3. Project Aims

This project sets out to create an interactive audio-driven software solution which helps to alleviate signs of stress and anxiety, providing a relaxing and calming experience for the user. The final deliverable will be an iOS application using leading research and identifying key features of successful applications for mindfulness and mental health as inspiration behind its design and functionality.

4. Objectives

The final deliverable of the project can be broken down into the following objectives:

I. Produce a research document outlining the key features of leading successful applications for mental health and relaxation, using personal experience and existing reviews to highlight the specific features that appeal to users.
II. Research into iOS interface design and relevant audio frameworks, investigating how to achieve an interface that uses the successful features above whilst having an audio-driven focus.
III. Draft a visual prototype of the application with provisional descriptions and explanations of its key functionality and potential additional features.
IV. Design a skeleton version of the application in XCode.
V. Design a complete version of the application with full functionality in XCode, using any necessary audio frameworks where appropriate.
VI. Obtain user feedback for application, comparing it to existing apps it used as inspiration to get an initial response as to how successfully the app has been designed.
VII. Further expand on first model using feedback from VI to create an improved version of the application.

5. Intended Approach

The intended approach for the project is to expand on the current research and use personal experience to identify specifically what traits and features from existing applications in the field of health and wellness make successful apps so effective and appealing. These features will then be used as inspiration for researching into iOS interface design and audio frameworks, at which point potential features and components for the app's interface and functionality will be considered. After this research period, an initial draft of the app's design will be created, and then a skeleton version of the application will be implemented using this design. Once a basic model has been created, additional and more advanced features will be incorporated to improve the overall experience with the software. Then, the app will be evaluated through user feedback, comparing the experience with this model against other successful applications in the field to identify similarities and differences. This feedback will inspire future development to further enhance the capabilities and overall appeal of the app as a useful and viable product.

During this process, regular check ins will be undertaken to review progress and identify if there is a particular stage that has taken an unexpected amount of time, adjusting the plan as necessary.

6. Timetable

Below is an outline of a visual representation of how the work will be carried out for this project (figure 8):

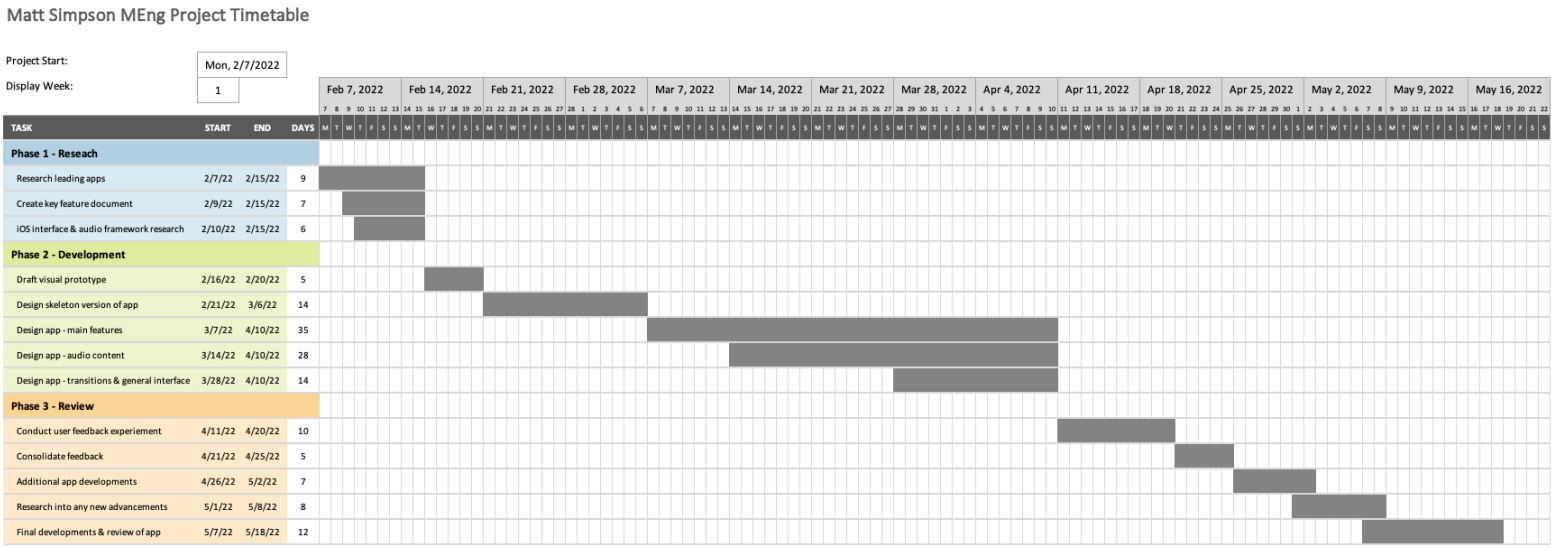

Figure 8 – A Gantt chart of the expected dates for completing consecutive project objectives.

Throughout the project, current progress will be compared to this initial plan, making adaptations and adjustments to the various stages as appropriate to ensure the objectives are achieved to a sufficient standard.

7. Conclusion/Summary

This report introduces the significance of the project as the intersection between three areas of research and development – mental health & general well-being, iOS multimedia development, and existing apps for relaxation & mindfulness. It highlights significant research into mental health over recent years, showing the average increase of lower states of well-being both through excessive use of technology and due to the resulting impact of the COVID-19 pandemic. Leading apps in the field of relaxation & mindfulness are explored, commenting on the key features from reviews and personal experience. Other solutions for technological solutions for improving mental health and general well-being are mentioned, before stating the aims and objectives for this project – to create an interactive audio-driven iOS application for relief of stress and anxiety. The intended approach is described, accompanied by a visual representation of the plan for work over the coming months.

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