



Making Time for Mindfulness

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ABSTRACT

Objective: Digital mental wellbeing interventions are increasingly being used by the general public as well as within clinical treatment. Among these, mindfulness and meditation programs delivered through mobile device applications are gaining popularity. However, little is known about how people use and experience such applications and what are the enabling factors and barriers to effective use. To address this gap, the study reported here sought to understand how users adopt and experience a popular mobile-based mindfulness intervention.

Methods: A qualitative semi-structured interview study was carried out with 16 participants aged 25 - 38 (M=32.5) using the commercially popular mindfulness application Headspace for 30 - 40 days. All participants were employed and living in a large UK city. The study design and interview schedule were informed by an autoethnography carried out by the first author for thirty days before the main study began. Results were interpreted in terms of the Reasoned Action Approach to understand behaviour change.

Results: The core concern of users was fitting the application into their busy lives. Use was also influenced by patterns in daily routines, on-going reflections about the consequences of using the app, perceived self-efficacy, emotion and mood states, personal relationships and social norms. Enabling factors for use included positive attitudes towards mindfulness and use of the app, realistic expectations and positive social influences. Barriers to use were found to be busy lifestyles, lack of routine, strong negative emotions and negative perceptions of mindfulness.

Conclusions: Mobile wellbeing interventions should be designed with consideration of people's beliefs, affective states and lifestyles, and should be flexible to meet the needs of different users. Designers should incorporate features in the design of applications that manage expectations about use and that support users to fit app use into a busy lifestyle. The Reasoned Action Approach was found to be a useful theory to inform future research and design of persuasive mental wellbeing technologies.

KEYWORDS

mindfulness; behaviour change; usability; user experience; situated use

INTRODUCTION

The penetration of ubiquitous technologies into every corner of our lives provides excellent opportunities for new forms of health and wellbeing interventions. [1] Among these technologies, mobile applications offer cost-effective methods of healthcare delivery. Mobile devices are carried with the user throughout the day, can connect to the internet and can deliver interventions using features such as push notifications, text based information and rich media content. These features make mobile devices particularly suitable for the delivery of mental wellbeing interventions.[2] Consequently, there is a growing market for consumer healthcare applications that deliver interventions such as stress reduction and anxiety management programs. If such technologies are to be effective vehicles for health behaviour change, then it is necessary to understand both how they are used in practice, what are the key features of experience, and what are the barriers and enablers of use. A deeper understanding of these issues will contribute to theoretical discussions about the design of e-health technologies and persuasive design (see, for example, [3, 4]). The study reported here investigated how people adopted one mental wellbeing app (Headspace, www.headspace.com), how they fitted use into their lives, and how they experienced use over time.

BACKGROUND

Mindfulness is a growing area in the field of e-mental health, within and outside clinical practice. Mindfulness is “a state of psychological freedom that occurs when attention remains quiet and limber, without attachment to any particular point of view”. [5] Many claims have been made for the efficacy of mindfulness for mental wellbeing. Advocates argue that increased mindfulness is correlated with greater self-control [6], objectivity [7], concentration [8], capacity to deal with stress [9] and empathy [10].

Kabat-Zinn [11] developed a mindfulness based stress reduction course that taught a series of techniques to cultivate mindfulness, such as attention focus exercises, body scans, breathing exercises and yoga-based exercises. The purpose of these exercises is to cultivate an awareness

of self: to learn to pay attention to the way the mind actually works, and to what is really going on in our bodies and in our emotional states.

Research has explored the effectiveness of mindfulness among clinical populations, reporting evidence that it can reduce symptoms of depression [12], anxiety [13] and severe mental illness [14], and improve the quality of life of people suffering with physical health conditions such as chronic pain and fibromyalgia.[4] In non-clinical populations, mindfulness programs have been associated with reductions in stress levels and increased wellbeing in the workplace among doctors [15] and office workers [16].

This strong empirical basis has contributed to mindfulness meditation becoming a growing trend in Europe and America.[17] Mobile application developers are exploring how to deliver mindfulness through mobile phones and other mobile digital devices. Plaza et al. [18] found 50 different mobile-based mindfulness apps available for Android, IOS and Windows devices, including Calm.com, Buddify, the Meditation App and Headspace.

Headspace

Headspace is a commercially successful web-based application that delivers mindfulness and meditation related content. In August 2014, Headspace had around 523,000 users in the UK and around 1.3 million users worldwide. [19] The app was chosen for the current study because it is among the most downloaded mindfulness apps; controlled experimental studies have reported benefits of use (as described below); and the app developers were supportive of our study.

Headspace delivers a course of guided mindfulness meditations, using both audio and video files. These guided meditations are voiced by Headspace founder Andy Puddicombe, a former Buddhist monk. Content can be downloaded through the company's website or via a mobile application, available on both Android and Apple iOS platforms. The full content comprises 365 different guided meditations. Users are encouraged to complete a meditation each day. Progress through the course can be viewed on a timeline that appears on the home screen (Figure 1). Much of the program follows a linear pathway of daily meditations. Tapping the play button on the timeline begins the next meditation in the series. This opens the meditation interface (Figure 2), which consists of a simple timer and a play button to begin the guided meditation. Users begin with a course of ten, 10-minute, daily meditations to learn the basics. These daily meditations increase to fifteen and then twenty minutes. After the completion of a thirty-day foundation course, the user is given access to advanced content related to health, relationships and performance (Figure 3). In the study reported here, participants engaged with the foundation course.

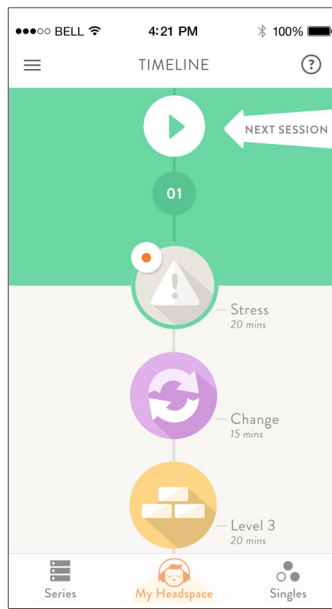


Fig 1: Timeline

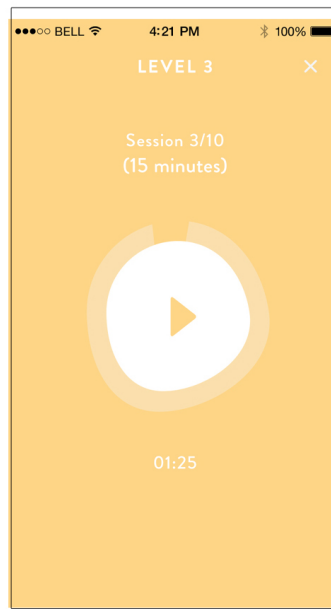


Fig 2: Meditation Interface

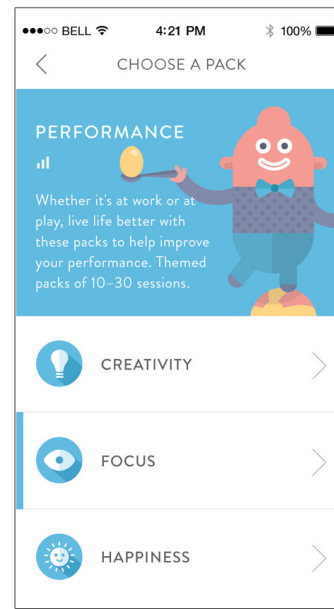


Fig 3: Performance Pack

Previous Research into Mindfulness E-Mental Health Interventions

A number of quantitative studies have demonstrated the efficacy of mindfulness technology interventions among clinical populations. For example, randomised control trials have been carried out by Glück & Maercker [20], Cavanagh et al. [21] and Boettcher et al. [22] to test the effectiveness of online mindfulness based interventions. In these studies, participants with clinical symptoms of depression and anxiety followed programs of daily mindfulness exercises delivered via the Internet to desktop computers in their homes. The interventions were associated with significantly decreased symptoms of perceived stress, depression, anxiety and insomnia when compared with a control group.

Headspace has been identified as the highest-scoring mindfulness app on the Mobile Application Rating Scale (MARS) rating scale [23], and has been shown to be beneficial in controlled trials. Howells et al (2014) conducted a randomised controlled trial with 121 'happiness seekers', 57 of whom used Headspace over a period of ten days (64 participants were in a control condition). Their study showed statistically significant changes in positive affect and reduced depressive symptoms. Bostock & Steptoe [16] carried out a controlled trial of the Headspace app with 238 workers from two large UK companies. The intervention was associated with increased subjective ratings of well-being and reductions in job strain in comparison with a wait-list control group. There was also a non-significant trend for lower blood pressure after eight weeks. However, neither of these studies investigated user behaviour or the user experience of the application.

Few qualitative studies have been conducted into mobile-based mindfulness interventions, so very little has been written about the user experience of these applications. Morris et al. [25] report a series of case studies for a mobile application that delivered mood tracking and thought

control exercises. They found that participants quickly understood and internalized the principles of mindfulness, which they were able to apply to difficult situations in their lives. However, the study only reports outcomes that are clinically relevant and therefore provides little insight about the user experience. Boggs et al. [26] conducted an interview-based qualitative study of an online intervention designed to deliver mindfulness based cognitive therapy (MBCT) to depressed patients. Participants reported that they wanted greater flexibility of content to make it easier to fit the intervention into their lives, more personal contact with clinicians and access to content through their mobile devices. The intervention was not available on mobile devices and this was a highly structured clinical intervention for patients with depression, so findings may not generalize to a non-clinical population or to a commercial application such as Headspace.

Chittaro and Vianello [27] conducted a 4-week evaluation of an interactive app developed by their own team (AEON) that focused on “de-centering”. Their focus was on the degree to which participants developed mindfulness practices; for participants who completed the trial (2.2% of those who started), there was also a qualitative questionnaire; responses to this were largely very positive, but there is no corresponding data for participants who dropped out for any reason, and the data does not focus on user experience or how participants fitted use of the app into their lives.

The previous study that is closest in approach to that reported here is a one-month field trial of a mobile app called Oiva reported by Ahtinen et al. [28] 15 people, all employed at a university, participated in their study. The focus of the study was on usage, user acceptance and perceived usefulness of the app. A mixed methods approach was taken, using quantitative measures with in-depth interviews. The focus of the interviews was on acceptability and perceived usefulness of the app. The main barrier to use was found to be busyness; several participants also reported forgetting to use it unless they had built use into their daily routine. Benefits of using the app were found to include reduced stress and the learning of new exercises that could be built into daily life. In the discussion, we compare our findings to those of Ahtinen et al. [28]

The Reasoned Action Approach

Hekler et al. [29] argue that macro theories of behaviour developed within the mainstream psychology community can provide useful conceptual frameworks to guide the evaluation of health and wellbeing behaviour change technologies. For instance, Grimes & Grinter [30] used the stages of change theory from the Transtheoretical Model [31] to structure their analysis of interview data when assessing a diet change game. Similarly, Hsu and Blandford [32] drew from the cost – reward construct of Decision Theory to analyse interviews of people trying to lose weight.

RAA is the latest in a family of theories of human behaviour developed by Fishbein and Ajzen.[33] Earlier versions of this approach include the Theory of Reasoned Action (TRA) [34] and the Theory of Planned Behaviour (TPB) [35]. RAA describes how environmental factors, skills and abilities affect the likelihood of intentions becoming actions. The three primary conditions are *intention to act*, *ability to perform the action* and *suitable environmental conditions to act*. Intention to act is, in turn, predicted by *attitude and beliefs about the behaviour*, *belief in one’s ability to perform the behaviour* (self-efficacy), and the *influence of social norms* upon the actor. Beliefs about behaviour include both beliefs about what the outcome of a behaviour will be, and whether the outcome is of value to the person. Perceived

behaviour control, or self-efficacy, is the extent to which a person believes that they are capable of carrying out a required behaviour. Social norms are the subjective interpretations and reflections upon social attitudes. This can include norms inherited from significant others as well as the wider culture.

The Reasoned Action Approach (RAA [33]) was chosen as a conceptual framework to guide data gathering and analysis in this study because it synthesises research on thought processes that contribute to behaviour change. As described below, the RAA was adopted when it became clear that themes emerging from the user interviews corresponded closely with the model.

OBJECTIVES

In order to develop effective mental wellbeing technologies and improve current interventions for behaviour change, it is essential to understand the relationship between users and the technology. This involves understanding complex psychological phenomena and behaviours occurring over time, to deliver design recommendations for future development of such technologies. As noted above, although studies have demonstrated the effectiveness of mindfulness and meditation delivered through technology, little qualitative work has been done to gain insight into the user experience of these interventions. Therefore, there is little understanding of the enablers and barriers to effective use of mobile mindfulness interventions, which might inform the design of future interventions.

In order to understand the user experience of one mindfulness app, Headspace, autoethnography and semi-structured interviews were used. These reflexive and in-depth research methods are effective ways to understand user experience over an extended period of time. Data was initially analysed inductively (as described below) and subsequently interpreted in terms of the Reasoned Action Approach.[33]

PREPARATORY STUDY: AUTOETHNOGRAPHY

Autoethnography is a research method where the researcher becomes a participant in order to enter into an empathic relationship with users. For instance, O’Kane et al. [36] present an autoethnography of using a wrist blood pressure monitor over a three month period to better understand the experience of using a device to help manage a long-term health condition. Krizek [37] argues that researchers must recognise that autoethnography provides a limited, subjective insight into the user experience. As a consequence, the findings may not generalise to another person or context. The purpose of this autoethnography was to inform the design of the main study and to provide early insights to be explored during subsequent interviews.

Method

The first author used the Headspace application on his personal smartphone for a thirty-day period during which he carried out eighteen daily meditations. Throughout the autoethnography, data was collected through the application ‘Day Journal’, which was accessed at any point throughout the day. A short description of the experience of using Headspace was made, along with any other reflections that occurred at the time. Thematic analysis [38] was conducted on the diary entries to draw out major themes. This allowed the author to build up a compositional picture of his experience of use, including the sensations, emotions and interpretative reflections of the experience of use.

Results

The first author had initially set out to use the app on a daily basis. However, as the study continued, patterns of use became irregular and were characterised by periods of consecutive daily use followed by a number of days without use. A number of questions emerged at this stage including, ‘Why does my use of the app follow this particular pattern? What is the difference between days when I have used it and days when I have not used it?’

These questions generated a series of observations about the role played by certain factors in how the app was used. These factors included beliefs about effects of use, the role of the study itself, the disruptive effects of busy routines and the quality of emotional experiences before, during and after using the application.

A key theme that emerged through the study period concerned routine and priority. Diary entries indicate there was an ongoing struggle about the extent to which the application should be prioritised over other uses of time. Another theme that emerged concerned the consequences of using the application. Every diary entry contained an evaluative statement about the experience. These evaluations usually comprised emotional, affective qualities. These ranged from positive: *“The world feels softer and more pleasant and my mind is just still”*, to more negative evaluations: *“Troubled meditation. Couldn’t really concentrate as I was worrying about things”*. Even when there was no clear consequence of using the application, there was still an evaluation, based on expectations.

A third theme that emerged was the importance of context of use. Despite the fact that meditation is highly introspective, the diary entries indicate the importance of context of use, such as time and location. The final theme that emerged from the autoethnography focussed on the application design itself and the experience of using a mobile device during mindfulness sessions.

These four themes informed the generation of an initial interview schedule for the main study exit interviews, as described in more detail below.

SEMI-STRUCTURED INTERVIEW STUDY METHODS

A semi-structured interview study was carried out to explore the user experience of Headspace. Three-month download codes were donated by Headspace to give participants full access to the content. Participants downloaded the application onto their smartphones and signed up for their free three-month period of use. They were asked to use the application in a self-directed way. Semi-structured interviews were conducted prior to the trial period to explore expectations and intentions. An exit interview was conducted thirty to forty days after initial download to assess and explore the user experience, as described below. The relationship of this study to the themes of the special issue are summarised in Tables 1 and 2.

The Intent	To facilitate mindfulness meditation
Persuader	The key persuader is the developer and distributor of Headspace (Andy Puddicombe), but ‘ownership’ of the change is with the participant who is choosing to use the app (or not).

Intended Outcome/Change	Effective engagement with mindfulness practices in daily life, primarily through ongoing use of the app. However this engagement also includes developing mindfulness practices to use outside app use.
Designer Bias	The designer has developed the app based on his own beliefs about the efficacy of mindfulness practices based on those of Kabat-Zinn.
The Event	A daily ten to fifteen minute guided meditation delivered through an audio file, accessed through the user timeline. Every three to four days there are short videos to supplement the audio content.
Use Context	Participants had a stated desire to engage with mindfulness practices.
User Context	Participants were all adults, in full-time work, fitting mindfulness practices into their daily lives.
Technology Context	The app is available and was used by participants on both the IOS and Android platform.
The Strategy	Daily guided meditations designed to walk the user through a meditation.
Message	Daily meditations are supplemented with teaching about the benefits, principles and techniques of mindfulness meditation.
Route	The content is primarily a direct message type. However, information is provided and principles are explained that encourage the user to reflect on their experience.

Table 1. Persuasion Context addressed in this study.

Primary task support	Reduction, tunneling and rehearsal: These methods are used in the introduction and delivery of the guided meditations. Self monitoring: This is encouraged through continuous self reflection during the meditations.
Computer-human dialogue support	A timeline style interface for users to access audio and video content.
Credibility support	Trustworthiness, expertise, authority: It is mentioned in the marketing of the application and in the content itself that Andy Puddicombe is a former Buddhist monk. Third party endorsements: During sign up, users read quotes from journalists and celebrities. Surface credibility: The quality of the design of the app supports the notion of credibility.
Social support	Social comparison, normative influence, social facilitation, cooperation, competition: The app has a built in buddy feature, allowing users to team up with others. However, no participant reported using this feature.

Table 2. Persuasive software features addressed in this study.

Participants

Sixteen participants were recruited, five males and eleven females. The age range of participants was 25-38 with a mean age of 32.5 years. All participants had been living in London, United Kingdom for at least a year. Participants were recruited by sending an email about the study through social networks and via email. This email explained that the purpose of the study was to explore the personal experiences of people using the Headspace app with the intention to uncover insights that will improve the design of similar technologies. Since we wished to focus on the

experiences of busy people who had some routine to their lives, the email invitation stated inclusion criteria: participants should be between 25 and 40 years old and in full-time work. Potential participants had to be interested in using an app to help them meditate and practice mindfulness with no prior experience of using Headspace. The reward for taking part in the study would be a three-month subscription to the application. The study was approved by the departmental Ethics Committee (ref. UCLIC/1213/015). Each participant gave informed consent and understood that they could leave the study at any time.

Materials

The Headspace application was downloaded from the Android Play or Apple iOS Application store onto each participant's mobile smartphone. The application was accessed on these mobile devices. Participants also had to access the Headspace website via a desktop computer or laptop to sign up.

Procedure

An initial semi structured interview was conducted with participants before they began using the application. The interview sought to explore current mobile habits, prior experience of mindfulness and meditation, as well as expectations and intentions of use. Questions were designed to avoid influencing perceptions of the application. This interview lasted 10-15 minutes.

Immediately following the initial interview, an instruction email was sent detailing how to sign up and download the application. The email explained that they would be contacted in approximately one month to arrange a follow-up interview to discuss their experience of the app. All participants responded to the email within twenty-four hours.

During the autoethnography, it had become clear that the study itself could have an effect on how participants used and experienced the application, so participants were asked to use the application in an entirely self-directed way. Participants were informed during recruitment that the purpose of the study was to investigate real usage. Therefore, if they tried the app and decided they did not want to continue using it, this by itself would provide valuable insights. Secondly, contact with participants was kept to a minimum throughout the trial period to minimise influence on usage. Participants were asked to use the app in a self-directed way, and were not asked to keep a diary, in order to maximise ecological validity.

Exit Interviews

Semi Structured exit interviews were conducted within thirty to forty days of initial download. Each lasted 15-30 minutes. Interviews began with a discussion of patterns of use before moving on to an exploration of the participant's personal reflections about why they had used the app in that way. Guiding questions in the later stages of the interview were informed by the themes of the autoethnography as outlined above.

After the first few interviews were completed, it became clear that there was a lot of variability in user experience between participants. Consequently, subsequent interviews became more open and participant-directed. Towards the end of each interview, further questions were raised that related to specific themes or the concepts underpinning the Reasoned Action Approach that had

not yet been discussed. This had the benefit of allowing the participant to initially discuss their experience freely, before being engaged in discussions that were of theoretical interest to the authors.

Data Analysis

A key aim of the current study was to use theoretical reflection to deepen insights into the phenomena under observation. Furniss et al. [39] argue that 'extant theory can be a source of creativity and insight'. However, the danger in applying theory in the research process is that it can restrict data gathering and analysis because the researcher selectively attends to data that confirms their theories.[29] Consequently, the approach developed in this research project was to initially engage with the empirical world using inductive methods, followed by a process of theoretical reflection.

Data analysis was informed by Grounded Theory coding methods.[40] However, there were a number of divergences from Grounded Theory. Firstly, participants were recruited at the beginning of the study to reflect a population of urban professionals, so theoretical sampling was not used in this study. A second divergence was that theoretical reflection was used in the later stages of data analysis to enrich the understanding of the interviews.

Data analysis proceeded through three stages. In stage one, interviews were transcribed and analysed immediately using a method of open coding, without theoretical reflection. This allowed for the identification of concepts from the interview transcripts.

In stage two, themes and concepts that had been identified during stage one were fed back into subsequent analysis to seek verification and to explore their validity. This enabled the formation of key categories. At this stage, a clear core concern of users emerged from the interviews, namely to what extent and how to fit app use into their lives. A further process of axial coding sought to find the causal conditions, context and intervening conditions that affect this core concern. Towards the end of the interview process, an affinity diagram of concepts was created to express the themes, concepts and relationships that were identified both from the data itself and from early theoretical reflections.

In stage three, the emerging phenomena were interpreted in terms of the Reasoned Action Approach.[33] Each category was considered in the context of the theory. The theory offered insights into the core concern of the users and illuminated many aspects of their experiences. However, as discussed below, other themes (such as participants' emotional experiences and their responses to the voice of the narrator) are not directly addressed by the theory.

The following section presents the results of stages 1 and 2 of this process. Care was taken to avoid shoehorning the results into the theoretical model at this stage as it was important to let the data speak for itself before interpretation within the RAA model. The findings are related to the Reasoned Action Approach in the discussion section below.

RESULTS

Most participants began the study with the intention to use the app on a regular basis. However, four participants came to the conclusion within three uses that they did not want to use the app. This was explored in their exit interviews and their reasons are presented below.

In presenting the findings, we begin by summarising the reported patterns of use. In subsequent sections, we present the core theme of fitting use of the app into everyday life, followed by other factors that shaped the experience, namely: the role of context (time and location) of use, routines and busy lifestyles, the influence of other people, the changing roles of intentions and self-disappointment, the perceived consequences of using the app, the changing role of expectations, the role played by emotions and mood, and the particular experiences of using the app on a mobile smartphone device.

Barriers to effective use included difficulty in finding time, negative expectations about mindfulness, negative experiences of using the app, uncomfortable emotions, disappointment at self for not using the app more and a sense that the app 'was not right for the person'. Enabling factors included the development of routines, finding a time or place to conduct a meditation, positive expectations about usage, simplicity of design of the app and the personal way in which the content was delivered.

All participants' names have been changed to maintain confidentiality.

Frequency and Patterns of Use

Six participants reported using the app between one and three times. Four of these six reported that they had tried the application with an open and inquisitive mind but had decided after a couple of tries that the app would not suit them. Two other users tried the app three times but reported that throughout the month, their motivation had not reached high enough levels to facilitate routine use. One suggested this was mainly due to her busy lifestyle and social issues. Another had only used the app on two occasions: both times when he felt stressed and turned to the app to help him deal with this.

Six participants reported using the app between five and ten times. Of these six participants, all reported that they had struggled to fit the app into their busy lifestyles and had often turned to competing activities. All reported an intention to use the app more than they had; five users expressed disappointment with themselves that they had not developed more regular habits of use. Among these users, there were four reports of using the app for several consecutive days followed by a run of days with no use.

Two participants had used the app between eleven and twenty times. These users were naïve to meditation before the study, but both expressed a high level of motivation at the outset. They reported beneficial effects from using the app but both felt some disappointment with themselves that they had not developed a daily routine.

The final two participants had used the app between twenty and thirty times. These users were both prior (although not highly experienced) meditators who had included the app into their regular meditation practices.

There was a wide variety of usage patterns throughout the day. Ten participants reported little uniformity in their usage patterns. The remaining six users reported that they used the app more regularly at one particular time of the day. Among these six were four of the most regular meditators. Two participants reported using the app during the night to help them with sleep. Seven participants expressed a dislike for using the app either first thing in the morning or last

thing at night, due to tiredness. Conversely, four participants reported that these times were the best times to use the app, as they would not be distracted.

Context of use

Location and environment were important themes for users. Participants reported large differences in experience when using the app in different contexts. Most app usage occurred at home, in a place where they would not be distracted, somewhere safe, quiet and comfortable; usually in their bedroom. Three participants found quiet places in their workplace to use the app. However, most reported a struggle to find somewhere where they could use the app. Four participants reported using the app on public transport. This proved to be less successful than when using it in an environment with less stimulation. However, there were beneficial effects, especially on longer journeys.

Busy lives and Routines

A central concern for users was how to fit their use of the app into their busy city lifestyles. Participants explained that their busy lives were a significant factor in limiting their app usage. One participant perceived that it was not simply having a busy life that stopped her using it – it was the psychological effect that this had on her.

“I think that when I feel that I have to do too many things, I feel that I cannot fit the space to do it. If it’s just 10 minutes then I feel that I can do this. But if it’s 20, then I’m thinking about it too much.” Julie

As well as being able to concentrate for the required time, participants also expressed a belief that they could only use the app regularly if they had a routine. One participant had initially expressed a strong intention to use the app. However, there was a two-week period without use in the middle of the 30-day period. When asked why this was, she answered,

“Because of the fact that I haven’t had any kind of routine in my life.” Katie

Many participants expressed a strong belief that once a routine was started, it would generate a momentum which would motivate them to use the app. One participant reflected on a run of days when she used the app every day. Rather than taking personal responsibility for this pattern, she attributed it to the fact that she had ‘got into a routine’.

“I wasn’t more busy or less busy than any other time, I was just more aware that I wanted to do it and I was more motivated because I had got into a routine, I guess.” Mary

Once participants had established using Headspace as part of their regular routine, there was always a risk that this routine would be disturbed and they would find themselves a few days later having to re-establish this routine. One participant described this phenomenon as ‘peaks and troughs’:

“I found it kind of went in peaks and troughs. I would get into the routine of it for several nights a few nights and I would do it every day and then I would get out of it and there

would be a whole week where I wouldn't have used it and I'd be like 'dammit I want to use it more.' Mary

Nine participants expressed disappointment with themselves about not being able to use the app to the extent that they had intended. However, there was also a strong theme of the importance of self-directed use, with three participants stating that they specifically chose not to establish a routine, as they wanted to keep meditation as a leisure activity, rather than a work-like activity which they had to do.

"I guess at the moment, I need to feel that I want to do it, rather than that I have to do it, cause then I would probably give up. I think there is so much in my life that I have to do that I wouldn't want to make it scheduled, that I HAVE to do it, to fit it into all my other stuff that I HAVE to do." Rosie

A number of users spoke about how the app gave them 'permission' to take some time out of the day, to take a break from their routines, to switch off from constantly engaging with social media, emails, entertainment, socialising or work.

"I felt like I was being allowed to just have some time out and just think of nothing. And that was good." Rosie

Although the study had been designed to minimise the effects of the study itself on the user experience, five users reported being influenced by the fact that they were taking part in a study. In all cases, this effect was reported as being beneficial. Many expressed gratitude that they had been 'allowed' or encouraged to meditate by partaking in the study. One even jokingly asked that she be threatened to meditate more often.

"I intended to use it every day. Because I wanted the fact that I was doing the study to push me to do it every day." Georgina

"Can you threaten me?" Samantha

This led participants to reflect on their own intentions and how they were living up to their own expectations.

Intentions and Disappointment with self

Many participants reported that they had not used the application as much as they had wanted to. This often resulted in feelings of disappointment with self or guilt. One participant expressed this as a constant battle between thinking she needed to use the app and being distracted from using it. She began to chastise herself and suggest that she lacked self-discipline. She then pointed out that if there is a consequence to not using the app, a punishment, she is more likely to use it.

"I lack discipline. I let my routine slide a bit...If there is a negative consequence of not doing something if I don't do it, then I'm more likely to do it." Samantha

This participant had not expressed a strong intention to use it regularly during her initial interview, so her self-disappointment had emerged during the period of use. Other users also showed a change of intention during their times of use. For instance, during the initial interviews, one participant expressed an intention to use the app every day. However, this participant only used the app on five occasions throughout the trial. During the exit interview she explained that she would like to continue using the app but with very different intentions. There had clearly been a reduction in her belief that she was capable of meditating regularly:

"I don't think I would expect to do it every day now. I think I would be a bit more realistic. But I would want to try to do it. If I could try and do it...I mean it's only ten minutes, isn't it? If I could do it 4 or 5 times a week, I would be happy with that." Sally

However, two participants reported using the app more than they had initially intended. For instance, one participant began the study with little intention to use the app with any kind of regularity. She had merely expressed a vague desire to train herself to be more mindful. During this initial interview she also expressed a low self-belief in her capacity to meditate. However, during the exit interview, she expressed surprise at the amount of meditation that she had done. She also expressed surprise that she had actually enjoyed using the app.

"I quite enjoyed it, I really felt it was kind of like, it felt good to be doing it, instead of feeling weird, of feeling it was a waste of time. I thought this is quite nice." Rosie

Finally she expressed a strong increase in self-efficacy with regards to meditating. She attributed this change in self-efficacy to the way in which the app had taught her practically how to meditate.

Social context

As well as individual factors, participants reported that other people influenced their use of the app. One reported being influenced in both positive and negative ways by the opinions of friends. The opinions were of a conflicting nature: one narrative encouraged a cynical attitude towards mindfulness; the other encouraged embracing mindfulness. She had not yet made up her mind about these differing attitudes. This caused an inner tension or confusion:

"Like I said, my friends do it and I have friends who do yoga and stuff and they manage to fit it in every day and I often struggle to find the time." Georgina

"Yes I think half of my friends were kind of sceptical about it. Which kind of played into my scepticism..." Georgina

Another participant reported that she had been unsure what to make of the app but finally made up her mind after demonstrating the app to two colleagues who subsequently responded in the same way as her, reinforcing her opinion:

"I thought maybe it's just me. But I played it to two of the girls that I sit with and they said the exact same thing." Amanda

One participant explained that she had had a single conversation about the fact that she was using the app with a friend. Before the conversation, she had only experienced frustration and bewilderment with using the app. The friend's response fundamentally affected the way that she experienced and thought about the app from that moment onwards, informing the narrative by which she rationalized her continued use.

"I only spoke briefly about meditation with a friend of mine who does it. And he told me... I told him that I wasn't feeling any difference... and he told me that it's not an immediate thing and I need to train my brain to do it, but after I've done it for a while I'll find that I can even meditate when I'm doing the dishes." Sofia

A number of users reported that other people had enabled them to use the app. One of the most prolific users attributed almost all her motivation to the fact that her partner also meditates every day.

"My partner meditates. When I'm with him I meditate with him. He meditates twice a day. So doing it once a day is slacking. So I have an environmental factor that affects my behaviour." Jess

Perceived consequences of using the app

There was a wide variety of experiences, ranging from disappointment to visceral sensations of calm. Probably the most commonly mentioned effect was that participants emerged from using the app feeling calm and relaxed:

"Each time I did it, I felt better afterwards...at some times, real peace, at other times, slightly less agitated." Robert

A number of participants simply enjoyed the fact that using the app enabled them to access a different mind-set to normal life. They saw a value in simply being 'in the moment'. Accessing this alternative mind-set was in itself a reward, particularly as it allowed them to view their life from a different perspective.

"You know it's part of my job being a PA, I'm always looking at a calendar for December. I'm always 'ahead', 'ahead', 'ahead', all the time and so it was nice to feel, 'I'm right in the moment here'. When it says 'just listen to the sounds', I was thinking, 'I never just sit and listen to the seagulls above, or cars driving past.'" Rosie

Other participants reported that the positive consequence of using the app was that it was helping them learn about meditation and develop mindfulness practices during their day-to-day life, especially the practice of 'returning to the breath'.

"It actually did what I wanted it to do, which was to take me back to the basics of meditation." Jess

However, five participants reported that they experienced little or no positive effects from use. Two of those who were unable to report clear positive benefits of using the app stopped using it

altogether. The other participants rationalized their continued use by stating that they believed that there would be long term effects if they continued to use the app. Two of those stated that they felt it was wrong to look for a reward, as mindfulness was not about seeking rewards.

Expectations

Each of the above themes reveals the importance of user expectations, and the interplay between expectations and behaviour. These expectations were initially influenced by a variety of factors revealed in the initial interviews. These included beliefs and worldviews related to meditation, previous personal experiences of mindfulness, current social relationships such as partner and housemate meditation habits and attitudes, and popular cultural and media narratives of mindfulness. There was also an ongoing influence of expectations during the study, which was shown by the way use was affected by reflections about the app and about mindfulness during the period of the study. All users approached the app at least once during the study with an attitude that mindfulness could offer a quick fix to a problem they were experiencing. When they did not experience the immediate results that they were expecting, there was a loss of motivation. Those with more realistic expectations about mindfulness and a greater knowledge of the benefits and challenges of mindfulness practices were less likely to report this loss of motivation.

Emotions

Emotional experiences were reported to be an important aspect of the user experience and were reported by some to be a barrier to use. Twelve of the sixteen participants spoke about the role of emotions in their experience of using the app. Seven users specifically reported times when they turned to the app for help with difficult emotional situations. Nine users reflected on the way in which the app helped them to deal with their emotions, while three stated that emotions had little impact on their continued use. These sections of the interviews often revealed that the participant had internalized some of the teaching used in the app about mindfulness.

“Yes I was using it as a tool to step away from the emotions and not get too involved in it. It calmed me down and made me think and make me look at these emotions non-judgmentally.” Mary

Eight participants reported that difficult emotional feelings were a barrier to use, particularly when people were highly stressed or agitated. At these times, users reported frustration that they were unable to control their thoughts. Users frequently reported that the app was more difficult to use when stressed.

“If you’re feeling quite stressed or there’s tension in your body, probably using the app is going to be harder than if you’re already quite relaxed.” Craig

Three participants responded to these negative emotions by attempting to maintain a regular disciplined routine, regardless of how they were feeling. This was discussed by the two most experienced meditators, both of whom spoke of the importance of developing a discipline that transcended their moods.

Participants who reported the most intense emotional experiences during the previous month explained that when they were agitated, mindfulness was frustrating and did little for them. These

users advocated other behaviours during these times, which would enable them to escape or express their emotional turbulence, rather than become more aware of it. Most of these behaviours had an active quality to them, such as exercising or socialising. They were convinced that while there was a value to mindfulness practices in usual situations, at times of heightened emotion this was not what was needed.

"I think meditation really makes you notice what's going on for you and that's actually quite hard and I want to distract myself with TV or the internet cos that's much easier than sitting there for 10 minutes and noticing that I am maybe quite anxious or stressed." Sally

The context of the specific app design

When asked about design features, all participants commented that the app was well designed and that it had helped them to meditate. For more naïve meditators, the guided meditations had been particularly helpful to focus their meditations and learn about meditation.

"I do think that if I did not have the app I would not be able to do it at all. Because I would just completely get lost in my own thoughts and there would be nothing to bring me back." Sofia

However, more experienced meditators responded more critically. Two expressed frustration that they were forced to start at a beginner's level. Three users questioned whether the app was suitable for them, as it did not follow the particular style of meditation practice that they had used previously.

"I do kind of guided visualization, rather than a kind of 'empty your mind' meditation style. I approach it in a totally different kind of way. So I found the whole business of... listening to your breath and counting, counting to ten in circles, I found really frustrating." Jon

One participant thought deeper about designing technologies to facilitate meditation, suggesting that she might benefit from a tactile quality in meditation technology.

"You've got the different learning styles for people. I think if you can incorporate that sort of thing... Not everyone is auditory, not everyone is visual, not everyone is kinaesthetic...I'm tactile. I like to touch and smell and taste and all that. And having an online meditation seems a bit... for me, it wasn't a tactile type of thing." Samantha

Five participants made reference to small design features of the app that had presented problems. These were relatively insignificant problems that users were able to work around. However, they demonstrate that there are particular problems that need to be overcome when delivering meditation on a mobile device.

"When I started the session, there was a clock saying how much time there was left and it was kind of distracting me from the meditation because I couldn't help but look at how much time there was left. And also the colour is bright and orange. I couldn't ignore it." Jo

"He leaves long gaps and sometimes I'm worried that I have run out of battery on my phone." Jess

Headspace delivers its content through spoken guided meditations and video tutorials that are voiced by the founder, Andy Puddicombe. During the interviews, it became clear that users were not simply responding to abstract information or even to an impersonal detached voice. Rather, users were, to some extent, experiencing contact with a person. Users differed widely in their response to this. Thirteen users reported that they liked the voice guidance; they spoke positively about Andy, with five specifically referring to him as a guru character. Other responses were more ambiguous. One participant reported that he did not like being told by Andy that he had to meditate the next day and this put him off using the app. This particular participant had reported that he had been forced to meditate by his mother when he was a child. Three participants reported strong negative responses, suggesting that their dislike of the voice was their main reason for stopping using the app. E.g.:

"I didn't feel comfortable. And I thought maybe it's just me. I was talking to Kelly about it and she said 'I really like the voice'. And so I realized it was like a personal preference. Maybe I've had nightmares about someone with a similar voice or something. I don't know... I think it would've been really different if there was a different voice." Elisa

"I'm going to be honest and tell you that I hate it. I just can't bear Andy's voice. Perhaps his tone has caused some sort of abreaction in me." Sue

DISCUSSION

In this section, we re-visit the findings, relating them to the Reasoned Action Approach (RAA) to behaviour change. The study illuminates ways in which conditions affect users of the application, and how the design of the technology facilitates and prohibits mindfulness meditation practices; we therefore also discuss implications for design, and also limitations of our study.

Interpreting the findings in terms of RAA

As a descriptive model of behaviour, RAA provides empirically verified constructs with which behaviour can be analysed. The theory directs the researcher to reflect upon the attitudes of participants about the behaviour under investigation and the role of social norms and self-efficacy in shaping the patterns of use.

As summarized above, patterns of use varied across participants; the RAA predicts that much of this variance can be explained by different levels of intention, both at the beginning and throughout the study. Three participants described wanting to use the application occasionally, in a self-directed way, as a leisure activity, rather than as part of a routine. All other users attempted to establish a daily, or at least regular, routine of using the app. Although a small number of users came close to achieving this, none used the app every day. The majority of users who began the study with strong intentions struggled to establish a regular pattern of use. However, other users began the study with low intentions to use the app but went on to establish regular routines. Stated intention to act only provides a limited explanation of the variance in behaviour. One characteristic of the RAA is the low importance it gives to emotions and non-cognitive phenomena, and the high importance it gives to rational decisions. As discussed below in the

section on emotions, users do not always behave according to rational utility. In the following sections, we discuss the role that attitudes, self-efficacy and social norms played in intention to act, before discussing environmental factors, expectations, emotions and design features that affected behaviour and experience.

Attitudes and Beliefs

The RAA suggests that attitudes, beliefs and expectations predict intentions. The study revealed an interplay between users' expectations and their subsequent use of the app. Four users began the study with the belief that meditation would have little immediate effect and should be used for a longer period of time before beneficial effects were seen. All other users expected at least some immediate sensations of relaxation and mental calm. For most users, apart from the most experienced meditators, attitudes changed as a result of using the app.

Some users began the study with high expectations and were disappointed by their experiences, leading to a trailing off of use. Many of these users began the study with a belief that the app could offer a quick fix for stress and other mental phenomena. However, seven users reported that practising meditation had been difficult or frustrating when stressed or emotional. These negative experiences changed their attitude about mindfulness, so that four users came to the view that mindfulness was not what they needed on stressful occasions. Interviews revealed that while the app content was well designed for naïve and less experienced meditators, those with more experience often found it restrictive and inflexible. Two stopped using it because they felt it did not fit with their ideas about meditation. However, eleven users reported positive consequences to use. These included feelings of relaxation and calm, learning to meditate, and learning to be more mindful in life. These positive consequences functioned as rewards, increasing positive judgments of app use. Three users reported believing that, although they had not received any strong benefits from use, there would be rewards if they continued using the app for longer periods. This justified their continued use. More experienced meditators, or those who had read about mindfulness previously and therefore had more realistic and in-depth understanding of the purpose and outcomes of mindfulness practices, were better able to establish the patterns of use that they had originally intended.

Self-efficacy

The RAA suggests that self-efficacy predicts intention. There is a clear relationship between the struggles with routines and emotions reported in the interviews and expressed self-efficacy. Some users expressed surprise and frustration that they were not able to establish routine patterns of use: their self-efficacy had been challenged between the start and finish of the study. Others reported increased self-efficacy: they reported that using the app had taught them that they were able to meditate. This is likely to be the reason why users reported that routines generated a momentum. If the application is used for a number of days in a row, the self-efficacy of the user increases, as the evidence convinces them that they can set aside the time to use the application. This corresponds to the predictions of the RAA, which states that as self-efficacy increases, behaviour becomes more likely.

Social Norms

The RAA suggests that social norms predict intention to act. The interviews demonstrate a relationship between social norms and attitudes towards the behaviour, intentions to use, and

actual behaviour. This is particularly so when the social influence comes from those closest to the participant. However, social influence was commented upon by a minority of participants, so it may not play a strong role in mindfulness practice, which is a personal activity for which social judgments are of little relevance to many users. Indeed, a number of users denied that other people had had any influence on their use whatsoever.

Environment and Ability to Act

The RAA suggests that intention to act will only be translated into action if the user is able to perform the action and environmental conditions are suitable for performance. Environmental conditions included busy routines and distracting events but also included locations and environments. If the user had a very busy day, or lacked a formal routine, this would reduce the likelihood of using the app. If the user could not find somewhere quiet, without distraction, this decreased likelihood of using the app. Users attempted to manage these conditions by finding quiet spaces and quiet periods during the day when they could take time out to use the application.

The design features of the app could be conceived as 'environmental factors' that inhibit or facilitate the participant to carry out meditations. There were a number of minor issues with using the app on a mobile device that could potentially distract users during the exercises. These included receiving texts and emails during meditations and other factors discussed above.

Emotions

Within the RAA model, emotion is a small factor that plays a role through the way it influences behavioural beliefs, normative beliefs and control beliefs. However, the interviews reveal that emotion plays a substantial role in use patterns. Eight participants reported that emotions and mood were at times a powerful factor that completely stopped their intention to act from becoming an action. Seven participants reported that they used the app to help them deal with difficult emotions. These participants explained that using the app would enable them to achieve a greater objectivity about the cause of their emotional state. However, it was also reported that once agitation reached a certain threshold, meditation would become much more difficult. This could reduce their desire to use the app on future occasions. Four users also reported that emotional states acted as a distraction from their attempt to establish a healthy balanced routine. Those who reported the highest states of agitation reported that they turned to a more physical activity on these occasions, such as exercise or drinking alcohol.

One of the key aims of mindfulness meditation is to improve emotion regulation.[41] Studies such as Goldin & Gross [42] report significant reductions in anxiety and depression during mindfulness sessions, using both objective and subjective measures. It is therefore curious to reflect that many users in this study reported a sense of futility in their attempts to regulate strong emotions. As discussed above, those who approached the application with an expectation of experiencing a 'quick fix', may have been disappointed at not seeing immediate results. Many people use mobile phones to get a 'quick fix'; checking their messages and playing games while they are waiting or travelling. This 'fiddling' behavior is characteristic of anxiety regulation strategies. Mindfulness meditation does not offer this quick fix, or anxiety avoidance. Kabat-Zinn [11] suggests that mindfulness is a lengthy learning process of growth: mindfulness is

something that is cultivated over time. The process can only happen successfully by taking the time to experience and come to terms with difficult emotions, rather than avoiding them.

Finally, the interviews revealed a strong consequence of having a person at the forefront of content delivery. Seven participants expressed a growing connection to the person instructing the meditations. This personal connection was expressed especially by those participants who had used the application more regularly. However, conversely, three stopped using the app because they did not feel comfortable with the voice. The force with which this reaction was expressed by some users suggests a strong emotional component that is not well accounted for within RAA; this is an area for further investigation.

Design recommendations for mindfulness technologies

The Reasoned Action Approach provides a series of higher-level guidelines for the development of technologies to facilitate mindfulness practices. To effect behaviour change, the technology must facilitate high levels of intention. This can be achieved by managing beliefs about the outcome of mindfulness behaviours, managing and utilising the role of social norms, and increasing self-efficacy. The technology must also teach skills and facilitate environmental factors that increase the likelihood of intention becoming action.

As reported above, expectation and beliefs about the consequences of using the app were both an enabling factor and a barrier to use. These conclusions are broadly in agreement with the PSD model of Oinas-Kukkonen and Harjumaa [4], which states that adoption of a persuasive technology is dependent on high levels of perceived credibility and perceived persuasiveness. In particular, those with an accurate understanding of the benefits and practices of mindfulness were more likely to succeed in using the application as they intended over the period of the study. It is therefore important that designers of mindfulness applications seek to manage expectations and beliefs. Early content should provide a clear explanation about the benefits, consequences and proper use of mindfulness meditations. Particular attention should be directed towards ensuring that people do not approach the app simply as a 'quick fix' or distraction from certain mental states. The focus of this content should be directed towards enabling the user to contextualise and gain perspective on difficult mental states and gain an understanding of the potential struggles and benefits of use.

In this study, many users reported that they found it difficult to fit use of the app into their busy schedules. A key problem to overcome in adoption of this technology is that successful meditation requires setting aside time during the day to practice. The PSD model states that unobtrusiveness is an important factor in whether an intention to use a persuasive technology becomes actual use (the behaviour-intention gap). Unobtrusiveness is a construct that describes how a persuasive technology fits with the user's environment and task flow.[4] However, the construct of unobtrusiveness has some limitations for a mindfulness application because meditation is meant to be a disruption from the tasks of everyday life. Those users who tried to fit the app into the task flows of their life, such as using the app while travelling on the train, reported less satisfying effects.

Fitting use into a busy schedule is a skill that can be learned. Therefore, a mindfulness application should teach new meditators how they can fit this practice into their busy lives. These messages can be delivered within the content of the application. For instance an introduction session could be delivered to users that teaches methods of setting aside time, and of

time management, such as alarm setting and implementation intention strategies. Persuasive technologies can use methods such as asking users to sign a contract of use, or using social networking features where goals, successes and failures are shared with other users. A number of users who wanted to establish regular routines reported that they would have preferred a more prominent scheduling, reminder or nudge facility. A benefit of a mobile device is that it offers the capacity to link the application with diaries, alarm clocks and other features that can assist the user to establish routines. Context aware technologies are fast improving in their capacity to sense our affective states, locations and other contexts. We can imagine a future where an application reminds us to meditate when we reach a certain affective state, when we are in a particular location, or during a period of time when the device sensors show decreased movement.

Eight users reported that when they experienced higher levels of emotional arousal, they found it more difficult to meditate or even reported that it became a negative experience. These users reported that it was easier to do something more active, as sitting still and focusing on themselves simply heightened their awareness of their anxiety. These experiences can be managed by guiding users to avoid 'quick fix' thinking about mindfulness, and to help them understand how mindfulness should be used as an emotion regulation strategy, as discussed above. In one of the original courses of mindfulness developed by Kabat-Zinn [11], yoga was incorporated; yoga enables a bodily, active articulation or expression of our internal states which often functions to diffuse internal emotional energies. Some users who reported needing something more active to help them deal with difficult emotional states might have found a solution in yoga. How yoga practices could be delivered through a mobile app, alongside the current meditations, is an interesting design problem.

A number of users reported that the study itself was an enabling factor. These users expressed gratitude that they were 'being given permission' to meditate. Users are enabled by an external figure, especially one to whom they may feel a sense of accountability. This might be a clinician in clinical services; in consumer applications, this may be a friend. Headspace has a 'buddy system' that can be used on the application. However, no participant used this feature and it was only mentioned by two participants during the exit interviews, so there may be room for improvements with this feature, to bring it to the forefront and to alert users to its potential value.

Hawkins et al. [43] found that technologies with high levels of interactivity were more successful at engaging users and changing behaviour. However, the user of Headspace has a passive role. For the first thirty days users are not able to choose which meditation they listen to and their interaction consists of pressing play and listening. This has the benefit of creating a simple and seamless user experience. However, this linear pathway can be off-putting or frustrating for those who are more experienced meditators. This ties in closely with the theme of the importance of self-directed learning and flexibility of use reported in other studies of e-mental health (e.g., [43]). Making the application more interactive would result in a more engaging experience. Thieme et al. [44] offer one possible solution of increasing interactivity through a more embodied style of technology aided meditation: they developed a meditation sphere for women in a secure psychiatric unit. This sphere changed colour in rhythm with the heart of the person who was holding the ball. The sphere was used as a meditation tool to help the user become more aware of their body.

A number of e-health technologies deliver mindfulness without any human presence in the technology, for example through written instructions followed by a timed meditation, or through a mood reflection application that asks users to enter their mood. However, Fogg [45] argues that technologies that use human presence, or play a role as a social actor, are able to deliver a richer, more engaging experience. This is clearly the case for Headspace, as reported by users. However, during the study, three users stopped using the app because they did not feel comfortable with the voice, even though they liked almost everything else about the app. One possible way of designing around this problem could be to enable users to choose from a selection of guides, both male and female, to take them through the program, so that they can find someone they feel comfortable with.

These design recommendations overlap with, but are not identical to, those of Ahtinen et al.[28] Their main recommendations are to:

- find a proper place and time for challenging content; this finding is strongly supported by our study.
- guide without restricting choice; this finding is supported by our study, particularly in the responses of the more experienced meditators.
- provide (active) exercises for everyday life; this is consistent with the finding that many participants found the lack of physical activity promoted by Headspace difficult to deal with if they were at all agitated.
- focus on intrinsic rather than extrinsic rewards; this did not emerge as a strong theme in our study.
- provide a flexible tool for self-reflection; again, this did not emerge as strong theme in our study, highlighting differences in findings caused by differences in study design and in the design of the mindfulness apps that were the focus of study.

Limitations

As becomes evident when comparing our findings with those of Ahtinen et al [28], the nature of Headspace (which focuses on meditation rather than physical activities) shaped participants' experiences significantly. The study design also influenced what data was gathered: data was gathered from participants at the beginning and end of the study. This had the benefit of not disrupting users during the study, ensuring higher levels of ecological validity. However, it also meant that experiences during the study were not sampled. Further, despite attempting to control for the effects of the study, it is clear from the interviews that some users were influenced by the study. In addition, the study only explores user experience of people beginning to use the app; the user experience is likely to change once the user develops their own practice and moves into the maintenance stage. Finally, all were busy, employed city-dwellers, and none had reported mental health problems.

CONCLUSION

In this study, the Reasoned Action Approach was found to be a valuable theoretical framework for analysing and understanding behaviour and experience.

To be truly effective, behaviour change technologies need to work with people's lifestyles, values and expectations. This research revealed that the primary concern of users of a mobile mindfulness application was fitting use of the application into their lives. User responses to this concern were influenced by a number of interrelated factors. These were the demands of their routines, the perceived consequences of using the application, beliefs about their ability to fit the app into their lives, the influence of other people and social norms, and quality of their mood and emotional states. The study also revealed factors that stop people from using the app from the beginning. These include issues with the design and delivery of the program, especially in terms of not being comfortable with program content or methods of delivery. Future research and design should explore the ways in which technologies can a) encourage people to reflect on how to make time and space for mindfulness; b) manage expectations about behavioural outcomes; c) increase the self-efficacy of users; and d) improve environmental conditions to make digital health interventions more usable and engaging.

ACKNOWLEDGMENTS

We are grateful to Dr David Cox and Headspace for their generosity in providing access to Headspace for participants, and to all participants for their time, energy and thoughtful input.

CONFLICT OF INTEREST STATEMENT

No conflicts of interest to declare.

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