Exploring the use of Virtual Reality to enhance rapid decompression from occupational stress during short wellness breaks for content moderators

Ruth Spence
University of Middlesex
Natalie Campbell
njc42@bath.ac.uk

University of Bath
Tom Woofenden
University of Bath
Jeffrey Marco
University of Middlesex

Research Article

Keywords: content moderation, virtual reality, trait anxiety, occupational stress

Posted Date: January 2nd, 2025

DOI: https://doi.org/10.21203/rs.3.rs-5684444/v1

Additional Declarations: Competing interest reported. Financial interests: Ruth Spence and Jeffrey de Marco have received research support from the company included in this research, acting as independent research consultants. Natalie Campbell is an employee of the company included in this research, receives a salary and holds restricted stock units. Tom Woofenden is a part-time intern at the company included in this research, employed via a third party recruitment company.

Title

Exploring the use of Virtual Reality to enhance rapid decompression from occupational stress during short wellness breaks for content moderators.

Authors

Ruth Spence; Department of Psychology; University of Middlesex, UK

Natalie Campbell; Department of Psychology; University of Bath, UK

Tom Woofenden; Department of Psychology; University of Bath, UK

Jeffrey De Marco; Department of Psychology; University of Middlesex, UK

Corresponding Author

Natalie Campbell; Department of Psychology; University of Bath, UK

Email: njc42@bath.ac.uk

ORCiD: 0000-0003-3859-6607

Abstract

Virtual reality (VR) has the potential to be a popular stress management tool in workplaces, however its efficacy has yet to be tested on content moderators (CMs). This study used an experimental design where CMs were randomly assigned to either: 1) VR, 2) non-screen activity or 3) control condition for a six-week period. Adherence data regarding a further four-week period was also collected and focus groups were conducted. The results demonstrated no significant differences in trait anxiety or occupational stress between baseline and follow-up for the three conditions. However, consistent with previous studies state-based stress and mood showed improvements after engaging with the activities. Specifically, participants in the VR condition showed reductions in state stress, whilst all conditions showed increases in state mood. The adherence data showed continued use of VR and non-screen activities for some CMs after the six-week experimental period finished and a focus group highlighted the logistical challenge of utilising VR setup within the allotted time. The results suggest VR may be a useful intervention for some types of occupational stress, if used during brief break times, it needs to be embedded within a logistical process that alleviates time pressure.

Keywords: content moderation; virtual reality; trait anxiety; occupational stress

1. Introduction

The emergence of the metaverse has resulted in an increased interest amongst occupational health researchers for the utility of this technology to improve the physical, mental, and emotional wellbeing of the workforce (Ud Din & Almogren, 2023). Metaverse wellness refers to using virtual reality (VR) technology to improve physical and mental health. Amongst other applications, this technology has already been used for community building, relaxation using meditation and mindfulness programmes, increasing physical activity with the availability of virtual exercise classes and improved mental health through virtual therapy sessions (Bansal et al., 2022). The focus is on finding ways to make the virtual world as good for wellbeing as the real world. Through its use of virtual environments, avatars, and social connections, the metaverse has the potential to offer new opportunities for people to improve their wellbeing and connect with others in meaningful, immersive, and accessible ways. The possibilities of integrating metaverse wellness into modern life are vast, with continuous investments being made in the domain of simulation and allied technologies, with a projected worth of $5 trillion (McKinsey, 2022). Recently, human-computer interaction (HCI) researchers, designers, and technologists have started focusing on technological advances, including VR, as a potential source of subjective wellbeing and positive support in their users' lives. This has led to the emergence of fields such as "Positive Technology" and "Positive Computing" (Riva et al., 2012; Gaggioli et al., 2017), which aim to develop technology designed to foster wellbeing in individuals and groups. Cogent evidence is now available pertaining to the implications of VR in both clinical and organisational fields, and it is emerging as a successful intervention for dealing with a range of psychological problems, including but not limited to, stress, anxiety, depression, phobias, and nociceptive disorders (Baghaei et al., 2021; Freitas et al., 2021; Pourmand et al., 2018).

The current study is the first to explore the effectiveness of VR for reducing anxiety and occupational stress in content moderators (CMs). The study used an experimental design where CMs were randomly assigned to either VR, non-screen activity or control conditions for a six-week period. Participants took part in their activity three times per week whilst onsite for 15-minutes during their break. Trait-based anxiety and occupational stress were measured at baseline and at six weeks, and state-based mood and stress were measured at the beginning and end of each break. In addition, information was gathered regarding whether the CMs continued to engage in their assigned activity after the pilot completed and focus groups were conducted with people in each condition to explore their

views regarding their assigned activity. Results showed trait anxiety and occupational stress did not reduce across the study period and the condition*time interactions were not significant. However, there were significant main effects for both trait anxiety and occupational stress, with the non-screen condition scoring significantly lower on trait anxiety at follow up than the other two conditions and scoring lower than the VR condition on occupational stress. The focus groups suggested possible confounding factors such as the time pressure of setting up and packing down the VR equipment during their allotted break. This and the small sample numbers may explain the lack of significant results.

1.1 Background

To date, there have been no studies that investigate the use of virtual reality (VR) as an intervention for stress relief in content moderators, despite evidence suggesting its potential to facilitate rapid decompression in high-stress professions. This gap is significant given the growing evidence of the stressful nature of content moderation (Roberts, 2019; Spence et al., 2024; Steiger et al., 2021). Work related stress is a leading cause of common mental and physical health problems (Health and Safety Executive, 2022). Work stress also leads to absenteeism, with lost workdays and 'presenteeism', where workers are present, but workplace productivity is reduced (Prater & Smith, 2011). Stress management interventions can be used as a breaktime activity during the working day to promote recovery or restore depleted resources (Tetrick & Winslow, 2015). Breaks that involve preferred activities and those taken earlier in the shift help resource recovery (e.g., energy, motivation, concentration), increasing job satisfaction and decreasing emotional exhaustion and somatic symptoms (Hunter & Wu, 2015). In a work context, job-stress recovery during breaktimes has been shown to increase positive mood and energy, and reduce stress (Sonnentag et al., 2017). Research focused on the restorative effects of various break activities has found exercise and contact with nature amongst the most effective (Korpela & Kinnunnen, 2010; Sonnentag et al., 2022).

VR and immersive interactive technologies can employ simulated multisensory environments with interactive elements to promote workplace wellbeing and 4isualiz workplace conditions (Barton et al., 2020; Rajguru et al., 2020; Riches & Smith, 2022). Based on the theory that interacting with pleasant stimuli can help create beneficial emotional states, immersive environments may assist with alleviating stress in a similar way to more traditional mental imagery or 4isualization exercises (Riches et al., 2021). Such immersive technologies have potential to be cost-effective and time-efficient tools that are

engaging, promote wellbeing, and can be used during work breaks to simulate the sense of 'mental detachment' without individuals needing to physically leave their working location (Liberatore & Wagner, 2021; Sona et al., 2019; Vaquero-Blasco et al., 2021). Many VR technologies require minimal space, deployment costs, and maintenance, making them particularly viable and convenient (Vaquero-Blasco et al., 2021). Equally, VR does not depend on the individual's imaginative capabilities in the same way as mental imagery (Villani et al., 2012). A recent scoping review concluded VR has potential as a stress management tool in workplaces (Naylor et al., 2020), with studies reporting that it is a popular wellbeing tool amongst employees (Barton et al., 2020**;** Maarsingh et al., 2019; Naylor et al., 2019; Rockstroh et al., 2019). VR research has investigated the restorative effects of "virtual nature", and the convenience and immersive nature of VR may lend itself to emotionally challenging working environments, such as content moderation, in which there is a lack of time to engage in stress management or access natural environments during the working day (Horan et al., 2023).

Studies investigating the effects of immersive technologies on workplace wellbeing are scarce, with a review by Riches et al., (2023) finding 17 studies, which mostly involved brief, single sessions of immersive VR. The results tended to show VR reduces employee work stress (Maarsingh et al., 2019; Nijland et al., 2021; Thompson, 2021; Vaquero-Blasco et al., 2021**;** Wang et al., 2019) and negative mood (Adhyaru & Kemp, 2021; Leung, Shi, & Huang, 2023) with increases in relaxation (Adhyaru & Kemp, 2021; Anderson et al., 2017), restoration (Chung et al., 2018; Karacan et al., 2021; Mattila et al., 2020) and buffers against subsequent stressors (Blum et al., 2019), with some evidence that natural scenes are better at improving relaxation and that preferred scenes can decrease negative affect (Andersen et al., 2017). This is the case for self-report, as well as more objective measures of stress, including heart rate variability and salivary cortisol concentration, which show reductions (Annerstedt et al., 2013; Ho et al., 2023; Wang et al., 2019). There is also evidence that VR enhanced therapeutic treatment is better able than cognitive behavioural therapy to reduce perceived stress and trait anxiety, and improve the use of emotional support in high-stress occupations like nursing (Gaggioli et al., 2014) and military medical personnel (Stetz et al., 2011).

However, when VR is compared with other similar methods, such as 2D videos, many studies find that improvements experienced are not significantly different (Ahmaniemi et al., 2017; Naylor et al., 2019; Pretsch et al., 2020; Rockstroh et al., 2019), although VR may be more distracting from work (Ahmaniemi et al., 2017) and be associated with higher user acceptability and experience (Michinov et

al., 2024). One large study conducted in a real-world office found that 'immersive calming' and 'immersive stimulating' VR nature scenes increased positive affect and decreased negative affect significantly when compared to 2D calming and stimulating nature scenes with the sense of 'being away' mediating the relationship between immersion and affect (Karacan et al., 2021). Others have similarly found that VR increases feelings of immersion when compared to 2D screens (Liszio et al., 2018) and immersion enhances the restorative effects of VR nature scenes (de Kort et al., 2006). It appears that the degree of 'experienced presence', in this case the feeling of being in the nature scene, is associated with feelings of connectedness with nature, which in turn increases subjective wellbeing (Yeo et al., 2020). Most studies indicated that nature-based virtual stimuli reduced stress and improved wellbeing in the short-term, both in terms of self-report and physiological measures such as heart rate variability or skin conductance. It appears experiencing nature-based immersive technologies may be an effective way to improve physical and emotional wellbeing (White et al., 2018). However, most studies focused on short-term effectiveness and limited, brief interventions such as the immediate effects after one session, meaning that it was not possible to draw conclusions about longer-term impacts of these technologies. Additionally, only a small minority of studies tested interventions in naturalistic workplace settings and most studies used nature-based scenes. The few studies that did implement VR in workplaces, and over more than one session, did however find positive results (Ahmaniemi et al., 2017; Maarsingh et al., 2019). This suggests results can be maintained over time, but longer-term data in real workplace environments is needed.

In the present study we seek to expand on the current VR literature in several ways. First, there is currently no research examining the effectiveness of VR in content moderators. Second, few studies have explored the effects of VR over multiple sessions, in real workplace settings or directly compared its effectiveness to other stress management interventions. By addressing these gaps, this study seeks to contextualise the results more effectively, determining whether VR can reduce occupational stress in a novel occupational group, and provide more robust evidence for its utility and longer-term effects in a practical real-world work environment.

2. Methods

2.1 Participants

Participants were 38 CMs that worked at a large social media platform in the UK. 14 participants were

assigned to the VR condition, 11 to the non-screen condition and 13 to the control condition. There were 37 (97.4%) respondents who completed the State-Trait Anxiety Inventory Trait version and occupational stress measure at baseline, and 32 (84.2%) who completed them at follow up. Two participants left their job during the study and a one was ill for five weeks. There were 29 (76.3%) participants who completed the adherence survey, 11 from the VR condition, 8 from the non-screen condition and 10 from the control condition. All participants worked on the same queues to control for the potential confounding effect from the variation in viewed content.

2.2 Procedure

The research was conducted in collaboration with the company and took place during the work time. Potential participants were invited to attend a presentation where the study was explained by the research team and an in-house wellbeing specialist. Taking part was voluntary and participants were free to withdraw at any point, 13 (25.5%) CMs opted out of involvement and all withdrawals occurred before the study began. Those who remained were randomly assigned to one of three conditions: 1) VR, a condition under which participants engaged in a 'Daily Calm' meditation – a customizable guided mindfulness program available from TRIPP software installed on the virtual reality headsets. 2) Non-screen-based activity, where participants could choose a non-screen-based activity of their choice (e.g., mindfulness colouring, reading, puzzles, listening to music), or 3) a control condition where participants could continue with their usual choice of break activity. They were required to undertake their activity three times per week whilst onsite for 15-minutes during their break.

There were two main phases of the research. Firstly, the testing phase involved participants actively being encouraged to take part in their activity. This is the phase when occupational health measurements were recorded. The second phase was the adherence phase, where participants could choose whether to take part in their activity and had the option of choosing other activities. This was so data on adherence could be collected, identifying whether participants changed how they spent their breaks once the research conditions ended. At the end of the adherence phase, focus groups were conducted with participants in each of the conditions to gather views on their assigned activity.

Data regarding trait-based anxiety and occupational stress was collected at baseline and six weeks using the State-Trait Anxiety Inventory Trait scale and four occupational stress questions. State-based stress and mood was assessed three times a week for six weeks, at the beginning and end of each

wellness break using self-report ratings. Adherence was measured using three self-report questions issued four weeks after the testing period had finished (week 10). Focus groups took place after the adherence period (weeks 11 and 12) (See Figure 1 for the study procedure). Participants were given an ID code so anxiety and occupational stress responses could be compared across time. Stress and mood were recorded at the condition level, i.e., participants reported which condition they were in but did not give an individual ID code.

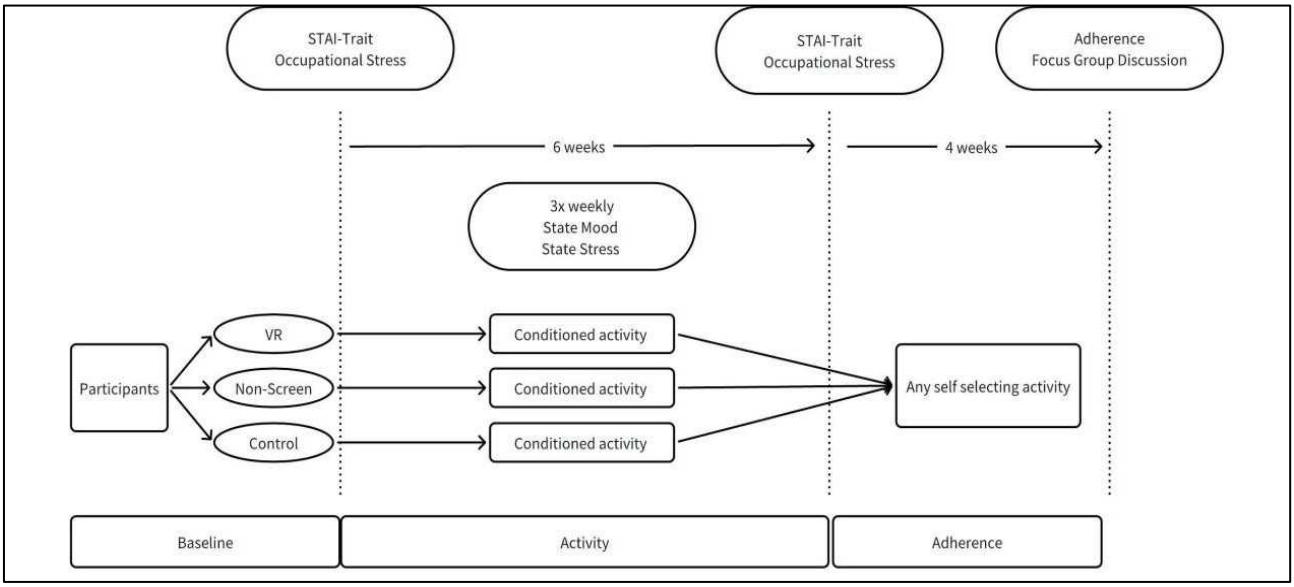

Figure 1: Study procedure

[Descriptive Caption: Figure 1: Study Procedure]

The diagram depicts the study procedure in three main phases: baseline, activity, and adherence.

1. **Baseline Phase:**

   Participants are recruited and grouped into three conditions: VR (virtual reality), non-screen, and control. Baseline measures include assessments of STAI-Trait occupational stress.

2. **Activity Phase (6 weeks):**

   Participants in all three conditions engage in "conditioned activities" specific to their group. During this phase, participants complete three weekly measures of state mood and state stress.

3. **Adherence Phase (4 weeks):**

   Participants transition to engaging in any self-selected activity of their choice. Final assessments include STAI-Trait occupational stress and participation in focus group discussions about adherence.

The flowchart uses arrows to indicate progression between phases and across conditions, emphasizing the

structure and timeline of the study.

2.3 Measures

State-Trait Anxiety Inventory Trait Version (STAI-T; Spielberger et al., 1970)

The STAI-T is a 20-item measure of trait anxiety. Items are scored using a 4-point Likert scale that range from 1 '*Not at all'* to 4 '*Very much'*, which were then summed. Scores on the STAI-T range from a possible 20-80, with higher scores suggesting higher trait anxiety. Scores between 20-37 suggest no or low anxiety, scores of 38-44 indicate moderate anxiety, and scores over 45 suggest high anxiety. The scale showed good reliability at both pre (α = .95) and post (α = .93) measurement.

2.4 Occupational Stress

This was measured through four self-report questions "*My work is stressful"*, "*Thinking about work makes me feel tense, worried or unhappy*", "*I regularly feel under a lot of pressure*" and "*Overall, I believe my work has a negative effect on my physical and mental health*". Each question was scored from 1 "*Strongly Disagree"* to 5 "*Strongly Agree"* and summed for a total occupational stress score. The total could range from 4 to 20, with higher scores denoting greater stress.

2.5 State Mood and Stress

Participants were asked to complete two questions at the beginning of their break "*What is your mood right now?"* and "*How stressed are you right now?".* Both questions were answered on a scale from 1-10 with a lower score indicating lower mood or greater stress. They were also asked to answer, "*What is your mood after the activity?"* and *"How stressed are you after the activity?"* on the same 1–10- point scale at the end of their break.

2.6 Adherence

Participants were asked "*Have you continued to regularly do the activity you were assigned for the study during your break*?" and given the option of responding 'yes' or 'no'. If they answered yes, they were asked "*Why have you continued the assigned activity?*", whilst if they responded no, they were asked "*Why have you not continued with the assigned activity?*". Lastly, all participants were asked "*In the last 4 weeks, have you tried any new and/or different activities during your break?*" apart from the activity

they were undertaking in experimental conditions 1 or 2.

2.7 Focus Groups

The participants from each condition were invited to take part in a focus group which lasted approximately 30 minutes. Questions focused on what they had done during their break, whether it was useful and why; as well as if there were other options they would have preferred. The discussions were recorded, and notes were taken. The recordings were used to identify themes across and within each condition.

2.8 Analysis

Descriptive statistics were used to calculate baseline and follow-up scores using all available data, and to describe adherence results. For participants that had data available at baseline and follow-up, repeated measures ANOVAs were conducted to explore differences in the STAI-T and occupational stress across the conditions and to investigate whether there was an interaction between condition and time. A two-way ANOVA was conducted to detect differences in state mood and stress across each of the conditions before and after the study activity. A qualitative assessment of the effectiveness of each condition was conducted through focus groups and key themes for each condition were identified through thematic analysis.

2.9 Ethical Approval

Ethical approval for this study was provided by the University of Middlesex, UK. In addition, the study was also approved by the Research Review legal panel within the social media company, and followed the standard operating procedure for conducting compliant and ethical research in-house.

3. Results

3.1 Trait Anxiety

The average STAI-T score at baseline was 43.19 (SD = 12.35; range:20-72) and the average at follow up was 42.25 (SD = 10.45; range: 22-61). When only those who had data at both times were included (N = 31) the mean at baseline was 40.26 and mean at follow up was 41.27, which was not a significant change (Mean Difference: 1.01, $p = .44$). At follow up, the percentage of those scoring in the high trait anxiety

range had fallen from 45.9% to 40.6% and those in the moderate range had increased from 21.6% to 28.1%. However, a McNemar-Bowker test indicated these differences were not significant (p =.350).

The ANOVA indicated a significant main effect for condition (F = 4.94, p = .015). Participants in the non-screen condition was significantly less anxious than those in the VR condition (Mean Difference: 12.40, p = .02) and the control condition (Mean Difference: 11.46, p = .039). The mean differences between conditions were not significant at baseline (F = 2.87, p = .073) but they were at follow up (F = 6.43, p = .005). At follow up, participants in the non-screen condition scored significantly lower than the VR condition (Mean Difference: 13.79, p = .008) and the control condition (Mean Difference: 12.90, p = .015). However, the interaction effect was not significant (F = .47, p = .63), indicating the changes in trait anxiety over time did not significantly differ by condition.

Table 1: Mean Trait Anxiety Scores by Condition at Baseline and Follow Up

Condition	**N**	**M (SD)**	**Baseline M (SD)**	**Follow Up M (SD)**	**Mean Difference**
VR	12	45.21 (10.02)	44.25 (10.96)	46.17 (9.37)	1.92
Non-Screen	8	32.81 (7.75)	33.25 (7.91)	32.38 (8.11)	.88
Control	11	44.27 (10.66)	43.27 (12.13)	45.27 (9.46)	2.00
All conditions	31	41.68 (10.94)	41.06 (11.39)	42.29 (10.62)	-1.23

3.2 Occupational Stress

At baseline, the mean occupational stress score was 12.21 (SE = .75; range: 4-20). At follow up, the mean occupational stress score was 12.04 (SE = .71; range: 4-19). This was not significantly different (F = .10, p = .76). A repeated ANOVA was conducted for occupational stress. There was a significant main effect for condition (F = 3.54, p = .043), demonstrating participants in the non-screen condition scored significantly lower than those in the VR condition (p = .039). Participants in the VR condition and control condition showed a decrease in occupational stress over the study period, whereas participants in the non-screen condition demonstrated an increase, although none of these differences were significant (see Table 2). There was no significant interaction effect between condition and time (F = .13, p = .88)

and the condition differences at baseline and follow up were not significant. Therefore, changes in occupational stress over time did not significantly differ by condition.

Table 2: Mean Occupational Stress Scores by Condition at Baseline and Follow Up

Condition	**N**	**M (SD)**	**Baseline M (SD)**	**Follow Up M (SD)**	**Mean Difference**
VR	12	14.29 (3.21)	14.33 (3.58)	14.25 (2.96)	.08
Non-Screen	8	9.81 (4.48)	9.75 (4.03)	9.88 (5.17)	.13
Control	11	12.27 (4.10)	12.55 (4.63)	12.00 (3.69)	.55
All conditions	31	12.42 (4.21)	12.52 (4.36)	12.32 (4.13)	.20

3.3 State mood and stress

State mood and stress were recorded during the activity phase, self-report measures were taken before and after each session in the VR (before: 74, after: 63), non-screen (before: 81, after: 78) and control conditions (before: 58, after: 54). Results from the two-way ANOVA outlined a significant main effect for condition ($F = 6.63$, $p = .001$) and for time ($F = 9.58$, $p = .002$) but no significant interaction effect ($F = 0.52$, $p = .59$). Participants in the control condition scored significantly lower on stress than the VR condition (Mean difference: 1.09, $p < .009$). The main effect for time showed that overall stress decreased after the activity (Mean difference: 0.72, $p = .002$) and within condition pairwise comparisons demonstrated this improvement was significant for the VR condition (see Table 3).

Table 3: Mean State Stress by Condition Before and After Activity

Condition	**M (SD)**	**Before Activity M (SD)**	**After Activity M (SD)**	**Mean Difference**
VR	4.34 (2.31)	4.81 (2.35)	3.87 (2.16)	-0.94*
Non-Screen	3.77 (2.67)	3.98 (2.24)	3.56 (3.05)	-0.41
Control	3.25 (1.98)	3.67 (2.17)	2.83 (1.67)	-0.83
All conditions	3.84 (2.41)	4.18 (2.30)	3.46 (2.47)	-0.72**

Note: $^{**}p < .01$, $^{*}p < .05$

Another two-way ANOVA for mood showed there were significant differences by condition (F = 17.59, $p < .001$) and significant differences in mood before and after the activity (F = 39.21, $p < .001$) but the interaction was not significant (F = 0.87, $p = .42$). The main effect for condition demonstrated participants in the non-screen condition had significantly higher mood ratings than those in the VR condition (Mean difference: 1.03, $p < .001$) and control condition (Mean difference: 1.02, $p < .001$). The main effect for time showed that mood improved after the activity (Mean difference: 1.07, $p < .001$) and within condition pairwise comparisons demonstrated this was the case for all three conditions (see Table 4).

Table 4: Mean State Mood by Condition Before and After Activity

Condition	**M (SD)**	**Before Activity M (SD)**	**After Activity M (SD)**	**Mean Difference**
VR	6.35 (1.85)	5.93 (1.94)	6.76 (1.64)	.83*
Non-Screen	7.38 (1.81)	6.70 (1.72)	8.05 (1.65)	1.35**
Control	6.36 (1.66)	5.84 (1.74)	6.87 (1.40)	1.03*
All conditions	6.73 (1.85)	6.20 (1.84)	7.31 (1.69)	1.11**

Note: $^{**}p < .001$, $^{*}p < .01$

3.4 Adherence

Over a third (n = 4, 36.4%) of participants from the VR condition continued using VR during the adherence phase. However, two of these reported doing so to help with the study, including someone who continued to use it despite it making them feel nauseous. Of the 7 (63.6%) participants who did not continue using VR, two were not in the office due to holiday or sick leave, two reported not having enough time and the remaining three reported not enjoying it for various reasons including 'boring' and making their eyes hurt. Similarly, over a third (n = 3, 37.5%) of participants from the non-screen condition continued with their activities during the adherence phase. Similar to the VR condition, one person reported doing so because of the study, the other two appeared to find non-screen activities positive, and continued to be away from technology or to explore the effect on their wellbeing. Of the 5

(62.5%) who did not continue, it appeared they mostly went back to their own previous recreational activities, and one reported wanting to spend their break socialising with colleagues. Most of the control condition (80%) continued with their usual activities. Of the two that did not, one reported going outside to take advantage of good weather.

Nine individuals said they had tried a new activity during the adherence period, 1 from the control condition, 3 from the non-screen condition and 5 from the VR condition. Mostly, activities were non- screen activities: three mentioned walking, three mentioned drawing/writing and games, one referred to meditation and one mentioned using colouring books. There was one person who said they looked at their phone.

3.5 Focus Groups

There were common themes across the three groups; wellness was commonly associated with activities like talking to others, going outside, and being away from screens. Many participants tried to engage in activities with colleagues during breaks when their schedules aligned. This social aspect enhanced the enjoyment and effectiveness of breaks for these participants.

"I prefer to talk with people because usually we spend like most of our time watching the video and there is a lack of communication, so for me it's helpful" CM1, non-screen condition

Despite these positive associations, breaks could also be associated with some unforeseen challenges. One significant issue was the feeling of increased pressure when taking breaks, or having shifts scheduled in regardless of how the moderator was feeling when their break began. Similar to other industries where shift work is common (e.g. retail, hospitality, service workers etc.) participants reported feelings of stress related to clock watching; needing to ensure they rejoined their moderation queue punctually to ensure a peer could then begin their break (Kim & Jang, 2022, Wendsche et al., 2022). This meant that instead of being a time to relax, breaks could become another source of stress because participants were focused on how long remained on their break before their return to work or were taking breaks when they did not feel they needed it.

Participants in the VR and non-screen conditions particularly appreciated having a prescribed activity. Knowing they had a specific activity to look forward to made them more likely to fully engage

with their breaks rather than using that period to work on metrics or remain logged on. Even if the activity was not one they would have chosen themselves, the structure provided by a prescribed activity made break time more appealing and effective. Participants in the VR and non-screen conditions wanted activities that would provide relaxation in a quiet and comfortable environment. They both expressed a preference for something akin to guided meditation. Certainly, in the VR condition meditation, breathwork, and nature scenes were the most visited options, as they provided a calming and immersive experience.

"the box breathing thing is actually really good and it really helps with resetting the central nervous system. And it's something that I've been doing in my personal life as well, so just the rhythm of the breathing. Maybe if it was accompanied by a nice nature scene. Perfect." CM3, VR condition

Nevertheless, some participants reported the VR led to nausea or mild motion sickness and another critical limitation identified was the logistical challenge of utilizing the VR setup within the allotted time, which involved setting up and then packing up the VR equipment and added to the time pressure felt by CMs. This in and of itself became a source of stress, and the time constraints made it difficult for some to fully disconnect and relax.

"If it was a clean like oh, get in, put the headset on, great, fine. But then if it was like fumbling round with the keys or like trying to find where the keys are, find the right thing then you're just sitting there being like I don't actually, this is going a little bit too slow now because I need to actually be back at my desk in like two minutes and I don't know how long this has got" CM3, VR condition

4. Discussion

This study is the first to evaluate the use of VR for stress reduction in content moderators. Additionally, it assessed the effects of VR compared to two other conditions over a longer period of 6 weeks and in a naturalistic work setting. The results demonstrated that anxiety and occupational stress were not reduced under the VR condition, although there were also no reductions under the non-screen condition. However, the use of VR was associated with a reduction in state stress and an improvement in mood when ratings were compared from immediately before and after use. This is consistent with previous research where

the effects of VR are studied over a single application and found to reduce anxiety and improve mood (Leung, Shi, & Huang, 2023; Nijland et al., 2021).

Trait anxiety is a consistent part of someone's way of thinking or personality (Elwood et al., 2011). Whereas state anxiety reflects the temporary reactions which occur in response to a stressful situation (Leal et al., 2017). It is possible the short bursts of relaxation available to the moderators during their breaks was not enough to change more ingrained anxiety despite influencing more transient stress states. Additionally, the scores on the STAI-T indicated those in the VR condition scored in the high anxiety range. It is possible VR would be more effective for those scoring in the milder anxiety ranges. Similarly, the occupational stress questions e.g., '*I regularly feel under a lot of pressure'* may be more associated with stress linked to organisational factors, such as achieving key performance metrics, that individual-level based techniques alone may not be able to alleviate (Giga et al., 2011). Short term self-reported mood improved after using VR, wellbeing is relatively independent of mental health symptoms like anxiety (Weich et al., 2011), demonstrating the potential for VR to have beneficial effects beyond stress reduction. Future research should examine the longitudinal effects of VR on different types of anxiety, as well as more positive effects on mood and wellbeing.

The adherence results showed that over a third of participants continued to use VR. Unlike in previous studies where participants were very enthusiastic about VR, these participants expressed reservations, such as wanting a break from screens or describing the experience as tedious. The adherence data showed a general preference for non-screen activities. This population has a more screen-based job than previous samples used in studies of VR, which include medical personnel (Gaggioli et al., 2014; Stetz et al., 2011) and so may be more open to non-screen options. Alternatively, it might be that over repeated sessions the novelty of VR wears off and some of the excitement found in previous studies is an artifice of the single use methodology often employed.

The focus groups highlighted the participants found social interactions and nature important for promoting wellbeing. Participants reported having activities prescribed to them motivated them to take breaks, and to use them more meaningfully. The use of guided meditation was mentioned by several content moderators and was an aspect of the VR experience that participants enjoyed. The recommendation, therefore, is that any organization with the responsibility for the wellbeing of trust and safety employees could benefit from having breaks that are both flexible in terms of timing, with a system in place that signals when they are due to return to work, and structured in terms of activities,

especially those that can be enjoyed with colleagues.

4.1 Limitations & Future Research

The participants took part voluntarily and work in a time pressured environment. This likely reduced their ability to contribute to research and highlights the difficulties of in situ research where individuals are not mandated or incentivized to take part. Therefore, the small sample size is a major limitation and impacted the ability to demonstrate significant change. Indeed, that the research was undertaken in a naturalistic setting is a strength and a limitation of the study. We cannot be certain to what extent the CMs adhered to the condition they were set and there is some evidence that there was crossover with one, possibly more, CMs reporting they used VR during their breaks when that was not their allocated condition. However, this approach helps ensure the ecological validity of research.

Developing the skill to rapidly decompress from occupational stress is essential and requires deliberate practice. Research suggests that a 10-minute break can help restore focus for cognitively demanding tasks (Steinborn & Huestegge, 2016), whereas a full psychological reset after work may require several hours (Sonnentag et al., 2022). In the context of virtual reality (VR) interventions, users might benefit from additional guidance on proactive decompression techniques rather than relying solely on the VR experience for stress relief. This study highlighted that with populations where the amount of break time allotted may be more limited, VR needs to be embedded within a practical and pragmatic logistical process to alleviate time pressure, allowing employees to maximize the benefits of their breaks without the added stress of managing the VR equipment. It is certainly possible the time pressure of setting up and packing down equipment might have obscured any benefits in the current study as this was frequently mentioned during the focus group. Short breaks, such as 10- or 15-minute sessions, may be most effective when focused on accessible, low-effort, hedonic activities—like listening to music—that promote relaxation without extensive training. In contrast, longer sessions could be reserved for engaging in eudaimonic practices, which support personal growth, professional development, and deeper meaning-making, including mastering rapid decompression techniques.

The concept of prescribed activities is particularly relevant in light of extensive research on structured gym classes, where individuals can engage in beneficial physical activity without needing to plan or consider each detail themselves. These classes provide participants with pre-determined exercises that they can trust to deliver health benefits. Similarly, feedback from participants in the study suggests

that some appreciated the prescriptiveness of the activities provided. This raises an important consideration for VR: by serving as a prescribed, structured activity, VR could become a habit-forming tool for CMs. This approach would allow CMs to experience the evidence-based benefits of VR without needing to be dedicated VR enthusiasts. It should be noted that the participants in the current study identified several potential routes for improved use of break time. One suggestion was to offer guided relaxation and meditation sessions in a quiet, comfortable setting, with optional nature-based visuals. This approach would cater to those seeking a more structured relaxation experience without needing to use screens. Another idea was to implement an automated notification system to signal the end of breaks. This would help participants avoid clock-watching and reduce their reliance on screens to keep track of time, allowing them to focus more fully on relaxation. Additionally, participants suggested coordinating breaks with colleagues. This would enable them to take their breaks alongside team members or peers from other teams, mitigating the solitary nature of their work and fostering a sense of community and support. Feedback from frontline workers is invaluable as they have the most in- depth understanding of their experiences. Therefore, it is suggested future research incorporate these ideas, for example VR could be used as part of group guided relaxation and automatically notify workers when their break is ending, this could then be compared against a non-screen version.

4.2 Conclusion

This paper is the first of its kind to demonstrate the potential use of VR for CMs, providing industry specific insight into the enablers and barriers of conducting wellbeing intervention pilots in situ. The current study demonstrated that VR did not significantly influence trait anxiety or occupational stress over a six-week period. However, consistent with previous studies, it reduced state-based stress and improved mood over the short-term suggesting that VR is effective in content moderators for reducing some types of stress and is associated with other benefits as well. The small sample numbers and the time pressure participants felt in the VR condition may help to have masked further significant associations. We recommend replicating this study with a larger sample size and a more targeted examination of break preferences and different indicators of wellbeing and stress. This approach would allow for a clearer assessment of whether different wellness conditions are more effective for groups with varying preferences—such as those who prefer solitude, physical activity, digital engagement, smoking breaks, or who have lower baseline wellbeing. Identifying specific groups that respond

particularly well to VR could inform more tailored VR-based interventions in workplace settings, ultimately enhancing the effectiveness of wellness programs across diverse employee needs.

5. Statements and Declarations

This research was funded by the stated social media company. One of the authors is an employee of the company, which played a role in the design of the study. However, data collection and analysis were conducted independently of the company by external academics. The manuscript was jointly written by the research team, ensuring impartiality and accuracy in the presentation of the findings.

6. References

Adhyaru, J.S., & Kemp, C. (2022). Virtual reality as a tool to promote wellbeing in the workplace. *Digital Health,* 8:205520762210844. https://doi.org/10.1177/20552076221084473

Ahmaniemi, T., Lindholm, H., Muller, K., & Taipalus, T. (2017, December). Virtual reality experience as a stress recovery solution in workplace. In *2017 IEEE life sciences conference (LSC)* (pp. 206- 209). IEEE. https://doi.org/10.1109/LSC.2017.8268179

Anderson, A. P., Mayer, M. D., Fellows, A. M., Cowan, D. R., Hegel, M. T., & Buckey, J. C. (2017). Relaxation with immersive natural scenes presented using virtual reality. *Aerospace Medicine and Human Performance*, 88(6), 520–526. https://doi.org/10.3357/AMHP.4747.2017

Annerstedt, M., Jönsson, P., Wallergård, M., Johansson, G., Karlson, B., Grahn, P., ... & Währborg, P. (2013). Inducing physiological stress recovery with sounds of nature in a virtual reality forest—Results from a pilot study. *Physiology & behavior*, *118*, 240-250. https://doi.org/10.1016/j.physbeh.2013.05.023

Baghaei, N., Chitale, V., Hlasnik, A., Stemmet, L., Liang, H.N., & Porter, R. (2021). Virtual Reality for Supporting the Treatment of Depression and Anxiety: Scoping Review. *JMIR Mental Health, 8*(9), e29681. https://doi.org/10.2196/29681

Bansal, G., Rajgopal, K., Chamola, V., Xiong, Z., & Niyato, D. (2022). Healthcare in Metaverse: A Survey on Current Metaverse Applications in Healthcare, *IEEE Access*, *10*, 119914-119946. https://doi.org/10.1109/ACCESS.2022.3219845

Barton, A. C., Sheen, J., & Byrne, L. K. (2020). Immediate Attention Enhancement and Restoration From Interactive and Immersive Technologies: A Scoping Review. *Frontiers in Psychology*, *11*,

2050. https://doi.org/10.3389/fpsyg.2020.02050

Blum, J., Rockstroh, C., & G€oritz, A. S. (2019). Heart rate variability biofeedback based on slow-paced breathing with immersive virtual reality nature scenery. *Frontiers in Psychology, 10*, 2172. https://doi.org/10.3389/fpsyg.2019.02172

Chung, K., Lee, D., & Park, J.Y. (2018). Involuntary attention restoration during exposure to mobile-based 360 virtual nature in healthy adults with different levels of restorative experience: Event-related potential study. *Journal of Medical Internet Research, 20*(11), e11152. https://doi.org/10.2196/11152

de Kort, Y., Meijnders, A. L., Sponselee, A. A. G., and Ijsselsteijn, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of Environmental Psychology, 26,* 309–320. https://doi.org/10.1016/j.jenvp.2006.09.001

Elwood, L. S., Wolitzky-Taylor, K., & Olatunji, B. O. (2011). Measurement of anxious traits: a contemporary review and synthesis. *Anxiety, Stress, & Coping*, *25*(6), 647–666. https://doi.org/10.1080/10615806.2011.582949

Freitas, J.R.S., Velosa, V.H.S., Abreu, L.T.N., Jardim, R.L., Santos, J.A.V., Peres, B., & Campos, P.F. (2021). Virtual Reality Exposure Treatment in Phobias: a Systematic Review. *Psychiatric Quarterly,* 92, 1685–1710. https://doi.org/10.1007/s11126-021-09935-6

Gaggioli, A., Pallavicini, F., Morganti, L., Serino, S., Scaratti, C., Briguglio, M., & Bernava, G. (2014). Experiential virtual scenarios with real-time monitoring (interreality) for the management of psychological stress: a block randomized controlled trial. *Journal of Medical Internet Research, 16*(7), e3235. https://doi.org/10.2196/jmir.3235

Gaggioli, A., Riva, G., Peters, D., & Calvo, R. A. (2017). Positive technology, computing, and design: shaping a future in which technology promotes psychological well-being. In J. Myounghoon (Ed.), *Emotions and affect in human factors and human-computer interaction* (pp. 477-502). Academic press. https://doi.org/10.1016/B978-0-12-801851-4.00018-5

Giga, S.I., Noblet, A.J., Faragher, B., & Cooper, C.L. (2011). The UK perspective: A review of research on organisational stress management interventions. *Australian Psychologist, 38*(2), 158-164. https://doi.org/10.1080/00050060310001707167

Health and Safety Executive. (2022). Work-related stress, anxiety or depression statistics in Great Britain. https://www.hse.gov.uk/statistics/causdis/stress.pdf

Ho, M.H., Wu, M.S. & Yen, H.Y. (2023). Effects of virtual reality natural experiences on factory workers' psychological and physiological stress. *Frontiers in Psychology*, *14*, 993143. https://doi.org/10.3389/fpsyg.2023.993143

Horan, K.A., Harrington, M.; LeNoble, C.A., Mosher, M., & Pring, T. (2023). Using Virtual Reality to Bring Restorative Environments to Employees: An Online Pilot Study. *International Journal of Environmental Research & Public Health, 20*, 5797. https://doi.org/10.3390/ijerph20105797

Hunter, E.M., & Wu, C. (2016). Give me a better break: Choosing workday break activities to maximize resource recovery. *Journal of Applied Psychology, 101*(2), 302. https://doi.org/10.1037/apl0000045

Karacan, B., Kombeiz, O., & Steidle, A. (2021). Powered by virtual realities: promoting emotional recovery through technology-based recovery interventions. *Ergonomics, 64*(10), 1351–1366. https://doi.org/10.1080/00140139.2021.1912399

Kim, M., & Jang, J. (2022). The effect of physical environment of the employee break room on psychological well-being through work engagement in the hospitality industry. *Journal of Human Resources in Hospitality & Tourism*, *21*(2), 175-196. https://doi.org/10.1080/15332845.2022.2031606

Korpela, K., & Kinnunen, U. (2010). How is leisure time interacting with nature related to the need for recovery from work demands? Testing multiple mediators. *Leisure Sciences*, *33*, 1–14. https://doi.org/10.1080/01490400.2011.533103

Leal, P.C., Goes, T.C., da Silva, L.C.F., & Teixeira-Silva, F. (2017). Trait vs. state anxiety in different threatening situations. *Trends in psychiatry and psychotherapy*, *39*(3), 147-157. https://doi.org/10.1590/2237-6089-2016-0044

Leung, X.Y., Shi, X., & Huang, X. (2023). How virtual reality generates daily negative mood spillover amongst frontline employees: A within-person field experiment. *Tourism Management, 95,* 104680. https://doi.org/10.1016/j.tourman.2022.104680

Liberatore, M. J., & Wagner, W. P. (2021). Virtual, mixed, and augmented reality: A systematic review for immersive systems research. *Virtual Reality, 25*(6), 1–27. https://doi.org/10.1007/s10055-020-00492-0

Liszio, S., Graf, L., and Masuch, M. (2018). The relaxing effect of virtual nature: immersive technology provides relief in acute stress situations. *Annual Review of Cybertherapy and Telemedicine,* 87– 93.

Maarsingh, B. M., Bos, J., Van Tuijn, C. F., & Renard, S. B. (2019). Changing stress mindset through Stressjam: a virtual reality game using biofeedback. *Games for Health Journal, 8*(5), 326–331.

https://doi.org/10.1089/g4h.2018.0145

Mattila, O., Korhonen, A., P€oyry, E., Hauru, K., Holopainen, J., & Parvinen, P. (2020). Restoration in a virtual reality forest environment. *Computers in Human Behavior, 107*, 106295. https://doi.org/10.1016/j.chb.2020.106295

McKinsey (Aug, 2022). *What is the Metaverse?* Retrieved from https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-the-metaverse

Michinov, E., Dodeler, V., Adam, H., & Michinov, N. (2024). Relaxing at work: does virtual reality work? An exploratory study among employees in their workplace. *Frontiers in Organizational Psychology*, *2*, 1441816. https://doi.org/10.3389/forgp.2024.1441816

Naylor, M., Morrison, B., Ridout, B., & Campbell, A. (2019). Augmented experiences: investigating the feasibility of virtual reality as part of a workplace wellbeing intervention. *Interacting with Computers, 31*(5), 507–523. https://doi.org/10.1093/iwc/iwz033

Naylor, M., Ridout, B., & Campbell, A. (2020). A scoping review identifying the need for quality research on the use of virtual reality in workplace settings for stress management. *Cyberpsychology, Behavior and Social Networking, 23*(8), 506–518. https://doi.org/10.1089/cyber.2019.0287

Nijland, J., Veling, W., Lestestuiver, B. P., & Van Driel, C. M. (2021). Virtual reality relaxation for reducing perceived stress of intensive care nurses during the COVID-19 pandemic. *Frontiers in Psychology, 12,* 706527. https://doi.org/10.3389/fpsyg.2021.706527

Pourmand, A., Davis, S., Marchak, A. *et al.* (2018). Virtual Reality as a Clinical Tool for Pain Management. *Current Pain Headache Reports, 22*(8), 53. https://doi.org/10.1007/s11916-018- 0708-2

Pretsch, J., Pretsch, E., Saretzki, J., Kraus, H., & Grossmann, G. (2020). Improving employee well-being by means of virtual reality – REALEX: An empirical case study. *European Journal of Economics and Business Studies, 6*(1), 95-105. https://doi.org/10.26417/519mvt88n

Rajguru, C., Obrist, M., & Memoli, G. (2020). Spatial soundscapes and virtual worlds: challenges and opportunities. *Frontiers in Psychology, 11*, 2714. https://doi.org/10.3389/fpsyg.2020.569056

Riches, S., Azevedo, L., Bird, L., Pisani, S., & Valmaggia, L. (2021). Virtual reality relaxation for the general population: a systematic review. *Social Psychiatry and Psychiatric Epidemiology, 56*(10), 1707–1727. https://doi.org/10.1007/s00127-021-02110-z

Riches, S., & Smith, H. (2022). Taking a break in the “new normal”: virtual reality relaxation for a stressed workforce. *Mental Health Review Journal, 27*(2), 133–136. https://doi.org/10.1108/MHRJ-06-2022-095

Riva, G., Baños, R. M., Botella, C., Wiederhold, B. K., & Gaggioli, A. (2012). Positive technology: using interactive technologies to promote positive functioning. *Cyberpsychology, Behavior, and Social Networking*, *15*(2), 69-77. https://doi.org/10.1089/cyber.2011.0139

Rockstroh, C., Blum, J., & G€oritz, A. S. (2019). Virtual reality in the application of heart rate variability biofeedback. I*nternational Journal of Human-Computer Studies, 130,* 209–220. https://doi.org/10.1016/j.ijhcs.2019.06.011

Sonnentag, S., Cheng, B.H., & Parker, S.L. (2022). Recovery from work: Advancing the field toward the future. *Annual Review of Organizational Psychology and Organizational Behavior, 9*, 33–60. https://doi.org/10.1146/annurev-orgpsych-012420-091355

Sonnentag, S., Venz, L., & Casper, A. (2017). Advances in recovery research: What have we learned? What should be done next? *Journal of Occupational Health and Psychology, 22*, 365–380. https://doi.org/10.1037/ocp0000079

Spence, R., Bifulco, A., Bradbury, P., Martellozzo, E. and DeMarco, J. (2024). Content moderator mental health, secondary trauma, and well-being: a cross-sectional study. Cyberpsychology, Behavior, and Social Networking. 27(2), 149-155. https://doi.org/10.1089/cyber.2023.0298

Spielberger, C.D., Gorsuch, R.L. and Lushene, R.E. (1970). *STAI Manual for the State-Trait Anxiety Inventory*. Consulting Psychologists Press, Palo Alto.

Steiger, M., Bharucha, T. J., Venkatagiri, S., Riedl, M. J., & Lease, M. (2021, May). The psychological well-being of content moderators: the emotional labor of commercial moderation and avenues for improving support. In *Proceedings of the 2021 CHI conference on human factors in computing systems* (pp. 1-14).

Steinborn, M. B., & Huestegge, L. (2016). A walk down the lane gives wings to your brain: Restorative benefits ofrest breaks on cognition and self-control. Applied Cognitive Psychology. 30(5), 795- 805. doi:10.1002/acp.3255

Tetrick, L. E., & Winslow, C. J. (2015). Workplace stress management interventions and health promotion. *Annual Review of Organizational psychology and Organizational Behaviour, 2*(1), 583–603. https://doi.org/10.1146/annurev-orgpsych-032414-111341

Thompson, A.H. (2021). A Holistic Approach to Employee Functioning: Assessing the Impact of a Virtual-Reality Mindfulness Intervention at Work. FIU Electronic Theses and Dissertations. 4704. https://digitalcommons.fiu.edu/etd/4704

Ud Din, I., & Almogren, A. (2023). Exploring the psychological effects of Metaverse on mental health and well-being. *Information Technology & Tourism*, *25*(3), 367-389.

Vaquero-Blasco, M. A., Perez-Valero, E., Morillas, C., & Lopez-Gordo, M. A. (2021). Virtual reality customized 360-degree experiences for stress relief. *Sensors, 21*(6), 2219. https://doi.org/10.3390/s21062219

Wang, X., Shi, Y., Zhang, B., & Chiang, Y. (2019). The influence of forest resting environments on stress using virtual reality. *International Journal of Environmental Research and Public Health, 16*(18), 3263. https://doi.org/10.3390/ijerph16183263

Wendsche, J., Paridon, H., & Blasche, G. (2022). Nurses' rest breaks and organizational leaving intentions. *Psychology, Health & Medicine*, *27*(8), 1782-1792. https://doi.org/10.1080/13548506.2021.1950784

White, M. P., Yeo, N. L., Vassiljev, P., Lundstedt, R., Wallergård, M., Albin, M., et al. (2018). A prescription for "nature" – the potential of using virtual nature in therapeutics. *Neuropsychiatric Disease and Treatment, 14,* 3001–3013. https://doi.org/10.2147/NDT.S179038