Chapter 5
Enter the Virtual Forest: Exploring the Benefits of Forest Therapy in a Digital World

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ABSTRACT

One of the many challenges of this urbanization is significantly reflected in the distribution of urban green spaces, which may still not meet the needs of all inhabitants and preclude the many benefits that urban green spaces bring to mental health. From this perspective, Shinrin-Yoku emerged a traditional Japanese practice known as forest therapy (FT) or forest bathing (FB), as a natural health treatment. Using virtual reality, in addition, makes it possible to reproduce scenarios or environments that, in certain contexts, it would be almost impossible to recreate in real life. Thus, VR can provide opportunities and allow many more people to benefit from the best therapies and positive outcomes. It's important to note that the research on this union is still in its early stages, however, exploring this field represents, in many ways, a unique opportunity for healthcare, and would reach a wider population, providing the best possible therapy for everyone who could benefit from it.

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INTRODUCTION

Depending on circumstances, preferences, or even needs, people may live alone or in groups throughout their lives. However, as social creatures, they usually have the predisposition to seek out social relationships, which leads to forming bonds, grouping partners, integrating into communities, or even developing them. This is how societies are created, whether rural or urban (Szabo, 2018).

As a result, urbanization has seen unprecedented growth, with an estimated 55% of the world's population now living in cities, and this is expected to rise to 68.6% by 2050 (Csomós et al., 2020; Lee & Maheswaran, 2011). According to this growing trend, it is expected that by 2030 there will be around 41 megacities, each with a population of around 10 million, as a result of the creation and development of cities (Okkels et al., 2018; Szabo, 2018).

As a result of this increase in population density, (over)urbanization poses major challenges in terms of exacerbating social inequalities, limiting access to public services and relatively neglecting environmental issues, which together threaten the quality of life in cities, including the risk factor of mental health (Csomós et al., 2020; Okkels et al., 2018). One of the many challenges of this (over)urbanization is significantly reflected in the distribution of urban green spaces, which may still not meet the needs of all inhabitants. Such would manifest itself in inequitable services to the population regardless of socioeconomic status (Cheng et al., 2021).

Urban green spaces can provide multiple human health benefits by promoting increased physical activity (Bell et al., 2019; Chiabai et al., 2020), improving air quality (García de Jalón et al., 2019), reducing noise pollution (Vivanco-Hidalgo et al., 2019), and protecting against high temperatures and heavy rainfall (Li et al., 2019). In addition to physical health, urban green spaces contribute to the well-being and mental health of the population by increasing recreational activities (Foster et al., 2008), reducing stress and stimulating social contacts, and increasing social cohesion (García de Jalón et al., 2020b).

Recent studies suggest that urban green spaces provide significant improvements in residents' quality of life, including that residents of greener neighborhoods had significant improvements in mental health compared to residents of less green areas, such as a lower risk of depression symptoms, psychological distress, and sleep quality (Astell-Burt et al., 2013; Cheng et al., 2021; Gascon et al., 2015; Wood et al., 2017). According to current literature, proximity to green spaces not only has an effect on the above-mentioned factors, but also reduces the incidence of stroke, hypertension, dyslipidemia, asthma, and coronary heart disease (Barboza et al., 2021; Taylor et al., 2022; Twohig-Bennett & Jones, 2018).

Improving access to these spaces to promote healthy lifestyles also begins the search for physical and mental well-being associated with these spaces. Some studies on nature and mental health focus on woods, forests, scrubland, and gardens. However, in modern cities and towns, parks and open green spaces are among the most widely available forms of recreation. (Astell-Burt et al., 2013; García de Jalón et al., 2020a; Sugiyama et al., 2016; Wood et al., 2017).

Preference for each of the different environmental categories, such as vegetation and the size and connectivity of green spaces, is a topic that remains to be explored, but associations suggesting health benefits were more consistent in populations with more tree canopy as opposed to grassland (Nguyen et al., 2021). Even the inclusion of nature indoors has been shown to benefit health and well-being. For example, Ulrich's seminal study (Ulrich, 1984) demonstrated the benefits of views of nature on post-surgery recovery (Taylor et al., 2022).

In summary, the urbanization trend of the twenty-first century poses an increasing challenge to mental health. Epidemiological studies have shown that mental health problems often accumulate in urban

areas compared to rural areas. Possible causes are linked to the social and physical urban environment (Krabbendam et al., 2021). Thus, the search for the promotion of mental well-being represents a form of prevention in relation to mental illness, which is characterized as one of the main causes of disability worldwide (Wood et al., 2017).

Therefore, urban densification increases the exposure to light, smell, noise, and vibrotactile factors that underlie each urban dweller. This set of factors, even if the exposure is relatively low, will lead to an increased risk of adverse effects after exposure in different dwellings. (Pedersen, 2015). Compared to rural areas, studies also show that this set of factors is associated with a higher risk of developing serious mental illness. (Gruebner et al., 2017).

With the continuous growth of the urbanization process, a deficit of accessibility to nature will happen, which is a phenomenon of disruption of the relationship between man and nature (Fisher et al., 2021). In this context, with the increase in health awareness, people are again considering the relationship between human development and the natural environment, the importance of the carrying capacity of natural ecosystems, and the search for health in nature (Chen et al., 2023; Zhang et al., 2020).

This is why nature therapy is an effective way to reduce risk factors and has been scientifically proven to provide relaxation through exposure to the natural stimulation of forests, urban greenery, plants, and natural woods. It is empirically known that exposure to natural stimuli induces a state of hyper-awareness and hyperactivity of the parasympathetic nervous system, which allows us to relax (Song et al., 2016). Given the current information and relaxation effects, there is an urgent need for the creation and accessibility of green spaces (Siah et al., 2022; Song et al., 2017). Reconnecting with woodland is increasingly recognized as an effective way to address mental health issues, promoting mental and physical health (Kim & Shin, 2021; Song et al., 2017; Tsunetsugu et al., 2010).

FOREST THERAPY

From this perspective, it emerged *Shinrin-Yoku* a traditional Japanese practice that came to light around 1982 and is known as Forest Therapy (FT) or Forest Bathing (FB), coming to the forefront of Mindfulness-Based Practice Methods as a natural health treatment (Zhang et al., 2022). This consists of consciously immersing oneself in nature, using all five senses (Hansen et al., 2017; Yi et al., 2022a).

Moreover, the term ‘forest therapy’, which refers to the medically proven health benefits of exposure to the forest environment, was later coined from the term ‘forest bathing’, defined as being in a forest environment to restore psychological and physiological balance and absorb its atmosphere (Kim & Shin, 2021; Song et al., 2016).

Forests offer environmental elements that bring comfort to humans, such as beautiful scenery, clean air, sunlight, sound, phytoncides, and negative ions (Park et al., 2022). Numerous studies have proven the effectiveness of FT in improving health, including reducing stress, improving mood, increasing immune function, and lowering blood pressure (Yi et al., 2022a).

To do this, the person or group moves to forests to participate in treatment activities that connect them with the landscape through sound, smell, touch, sight, and sometimes even tasting (Park et al., 2022). In addition, the most preferred forest environments were identified as lakeside woodland, open pine forest, and rocky outcrops with small scattered trees, characterized by openness, light, and good views. This could be because they are environments that are not demanding, quiet, and stimulate different senses (Sonntag-Öström et al., 2015).

FT is usually divided into two types, one of which involves walking or experiencing the forest on one's own without a guide, and the other accompanied by a trained guide. The experience of self-guidance brings benefits that are not typically associated with therapy in the presence of a guide. We can relate these benefits to the opportunity for introspection, self-reflection, and thinking about the inner self. With regard to individual visits to forests without a guide, a considerable amount of research has demonstrated the effects of walking or looking at the forest alone in relieving stress and inducing psychological and physical relaxation (J. Lee et al., 2011; Park et al., 2011; C. Song et al., 2019; Sonntag-Öström et al., 2015; Tsunetsugu et al., 2013). Park et al. (2011), as an example, demonstrated that walks and forest viewing can improve one's emotional state and lead to psychological relaxation.

On the other hand, the guided group is more susceptible to changing emotions and social interaction, providing positive emotional changes, and promoting social bonds through interaction with others. Whereby, various studies have reported the positive effects of both methods (Kim & Shin, 2021).

In general, it can be said that patients' and participants' moods were improved and, as their rehabilitation advanced, they began to look forward to foresting visits. Positive feelings, a sense of ease, peace, self-confidence, and self-esteem were easier to experience when they were alone in the forest (Sonntag-Öström et al., 2015). C. Song et al. (2019) also described that participants who walked in a forest had increased parasympathetic nervous activity and reduced sympathetic nervous activity and heart rate compared to walking in an urban context (Kim & Shin, 2021).

FOREST GUIDE CERTIFICATION

Depending on the region and the company that adopts it, this therapeutic approach can be carried out in different ways. The most eastern form of FT involves meditation and contemplation, with the goal of deeply connecting with the surrounding nature. In its more Western form, FT is based on scientific principles, and it can be guided by specialists from a variety of fields, such as psychologists and occupational therapists, who adjust the practices according to scientific principles of health and wellness. In Europe, guides seek to integrate tradition and science to create a unique, holistic experience that blends Eastern and Western elements.

One of the ways to become certified in Nature & Forest Therapy and to become a Certified Forest Therapy Guide, in a more Western vision, is to use one of the programs offered by the Association of Nature & Forest Therapy: Guides & Programs. The certification process consists of 3 main steps (Nature & Forest Therapy Guide Certification Online, 2021).

In Step 1, the theoretical component is passed between certified trainers and students through live remote calls over a period of 6 months. In parallel, the practical component is completed in the field through Nature Connection activities. At the end of the first 6 months, the student will be provisionally certified as a Certified Forest Therapy Guide.

In order to proceed to Step 2, the student must have completed at least Module 9 and the corresponding assignments given during Step 1. They must also be eligible for a 4-day in-person immersion. During this step, the student is accompanied by certified trainers on guided forest therapy walks. There is a time frame of 2 years to complete this level.

Step 3 refers specifically to the end of the student's training and the now permanent certification as an ANFT Certified Forest Therapy Guide. It is important to note, however, that in order to obtain the Forest Therapy Guide certificate, it is necessary to obtain a Wilderness First Aid (WFA) or Wilderness

First Responder (WFR) certificate, which can be obtained through an outside agency such as the National Outdoor Leadership School (NOLS), Recreational Equipment, Inc. (REI), and other organizations. It is usually earned in just 2 days of training.

One of the other methods, in a more European vision, is to become certified in Forest Therapy through the Forest Therapy Hub (FTHub). Here it is possible to obtain the certificate by completing the online course only, which consists of a 24-week program (220 hours), which equates to 30 to 60 minutes a day. It includes 16 online sessions and 18 group dynamics sessions of 1 hour each. It also includes 12 Forest Bathing Walks led by FTHub trainers, each lasting 2 hours (FTHub Certified Forest Therapy Practitioner Program, 2023).

In addition, it is possible, but not mandatory, to undertake face-to-face training in a 3-day immersive program with FTHub trainers. This program exists in several continents, such as in Europe (Portugal, Spain, Italy, France, Poland, Scotland, England, Slovenia, and Latvia), America (USA, Canada, Chile, and Argentina), and Asia (Hong Kong and India) (FTHub Certified Forest Therapy Practitioner Program, 2023). Again, one of the requirements to complete the course is WFA and Mental Health First Aid, the latter of which is already included in the program.

The objectives of the certification program are to create a growing network of professional forest therapy guides who consistently provide high quality, safe, and healthy experiences for clients; to enhance the confidence of physicians and other referral sources in the health care system; to contribute positively to public and policy makers' perceptions of *Shinrin-yoku*, forest therapy, and other forms of nature-based therapy and eco-therapy; to increase public awareness of the connective and healing power of nature; to help establish certified forest therapy trails, areas for mindful walking, and sensory opening activities on private and public lands; and to serve as an information and advocacy resource for nature-based therapy and eco-therapy; raise public awareness of the unifying and therapeutic power of nature; help to establish certified forest therapy trails, mindful walking areas, and sensory opening activities on private and public lands; be information and advocacy resources for forest therapy and nature connection; and be at the forefront of helping to shift our cultural relationship with forests by fostering deeper relationships and positive experiences with forested areas (Nature & Forest Therapy Guide Certification Online, 2021).

Once certified, guides are encouraged to deepen their skills and knowledge through practice, training, and self-reflection. A powerful way to strengthen your connection to and knowledge of this work is through professional development courses such as Embodiment for Forest Therapy Guides, Guiding Children, Guiding in Winter, Story Weaving, and others offered by ANFT. It is also possible to choose related courses offered by other organizations or create your own learning path (FTHub Certified Forest Therapy Practitioner Program, 2023; Nature & Forest Therapy Guide Certification Online, 2021).

SESSIONS

Just as there are many ways to become a forest guide, there are many ways to incorporate therapy into your work, according to the region and the vision and expertise of the guide. It is relevant to mention that there could be incorporated six types of therapies in FT programs: plant therapy, water therapy, diet therapy, psychotherapy, weather therapy, and exercise therapy (Park et al., 2022; Yeon et al., 2021). In addition, components such as forest contemplation, forest meditation, *Qi-Qong*, aromatherapy, herbal tea therapy, and crafting with natural materials can be incorporated into each program (Yeon et al., 2021; Yi et al., 2022a).

Thus, in order to maximize the therapeutic effects, these programs utilize specific healing factors from the forest such as sunlight, natural landscapes, temperature, phytoncides, healthy food, natural sounds, and humidity (Yi et al., 2022a).

The following is a model of a basic structure for an FT session after extensive research and knowledge gathering. It is important to note that this example is a general framework and actual FT sessions may vary depending on the type (guided or unguided), facilitator experience, location, and participant needs. A holistic approach that takes into account both the scientific evidence and the experiential benefits of FT is ensured by incorporating elements from various articles (Bratman et al., 2015; Kim & Shin, 2021; Li, 2018; Qing Li et al., 2016; Park et al., 2010). This program can take up to eight sessions in total:

The first session should be focused on the participants getting to know the leader and vice versa, as well as each other. Briefly explain the structure of the session, its goals, and the guidelines for ensuring everyone's safety so that it's a positive experience for everyone.

Later, in a second session, members can participate in a short, guided meditation or mindfulness exercise to cultivate present-moment awareness. The facilitator encourages participants to connect with their senses and root themselves in the natural environment. This session can be extended and repeated.

In the next session, a slow, quiet, intentional walk through the woods is invited. The facilitator can emphasize a relaxed pace, encourage the elements to pay attention to their surroundings and engage their senses, or even suggest stretching exercises. Various techniques, such as focusing on specific sounds or textures, can also be introduced to deepen the sensory experience.

Next, to promote connection with and observation of nature, participants are encouraged to sit quietly next to a tree or explore natural objects. The facilitator can provide guidance on how to observe and appreciate the intricate details of the forest ecosystem, such as leaf patterns or bird songs.

Later, around the fifth or sixth session, the group gathers in a designated place for a reflection session. The facilitator guides members through a series of prompts or questions to encourage personal reflection on their experiences in the forest. The facilitator may even encourage members to walk barefoot. Members are invited to share their ideas and observations, fostering a sense of community and connection.

Finally, the closing and integration session expresses gratitude for the healing qualities of nature and the participant's participation. The final moments may include a collective activity such as a group hug, a symbolic gesture, or a prayer.

BENEFITS OF FOREST THERAPY

FT has gained popularity in Japan as well as other countries due to its numerous benefits (Zhang et al., 2022). Through the current literature, it is found that there is a reduction in negative emotions such as anxiety, depression, anger, fatigue, and confusion in people who participate in forest experience programs. This may also be beneficial for emotional exhaustion; cognitive, on concentration, and even on cognitive functions (Lee et al., 2017; Park et al., 2022; Yeon et al., 2021). Physiological studies support that it has positive effects on the central nervous, autonomic nervous, and endocrine systems. In comparison to walking in an urban environment, a short walk in a forest environment significantly increased participants' parasympathetic nervous system activity while decreasing their sympathetic nervous system activity and heart rate (Chorong Song et al., 2019). Immunology research shows that forest-related activity can increase human immune function by facilitating the activity of NK cells and anticancer

proteins. Also, clinical trials prove that forest therapy programs can be effective for hypertension and non-insulin-dependent diabetic patients (Rajoo et al., 2020).

Physical Benefits

This way, separating the physical benefits, we have presented the following:

- Blood Pressure

Blood pressure is one of several physical components that show significant improvement after FT, with only walking in the woods showing positive effects (Lee & Lee, 2014; Q. Li et al., 2016). In fact, a single 1-hour walk in a forest showed significantly more positive effects (8.4%) than a walk in an urban area (Lee & Lee, 2014). Compared to a 4h FT program, the reduction could be as high as 11.5% (Yu et al., 2017). The values show a significant increase after 20 sessions of walking on 20 consecutive days, with a significant reduction of 24.6% (Sung et al., 2012; Yau & Loke, 2020).

- Heart Rate

As mentioned earlier, in comparison to walking in an urban environment, a short walk in a forest environment, for about 17 minutes is sufficient to significantly increase participants' parasympathetic nervous system activity while decreasing their sympathetic nervous system activity and heart rate (Chorong Song et al., 2019; Song et al., 2015). Even a study in Japan found that sitting and looking at a forest for 10 minutes resulted in a 3.5% lower heart rate in the participants compared to those who were in an urban area (Song et al., 2017).

- Salivary Or Serum Cortisol Levels

Salivary or serum cortisol is produced by the hypothalamic-pituitary-adrenal axis in response to stress (Seplaki et al., 2004), and is recognized as a major component of the physiological stress response in humans (Ockenfels et al., 1995). That responsiveness to psychological stress may vary by sex, with males typically responding more strongly than females (Kudielka et al., 2004; Lovallo et al., 2006). Some studies have been conducted in Japan with young males, reporting lower salivary cortisol concentrations when viewing landscapes in forested areas, as well as walking in forested environments, compared to urban built-up areas (Juyoung Lee et al., 2011; Park et al., 2008; Park et al., 2010). In fact, it has been shown that the same thing does not happen when people are shown urban environments (Beil & Hanes, 2013). In summing, cortisol was shown to be significantly reduced with the use of FT (Tyrväinen et al., 2014; Yau & Loke, 2020).

Psychosocial Benefits

As previously mentioned, FT brings many benefits, from the physical ones listed above, but also psychosocial ones, such as a lower risk of depression symptoms, psychological distress, and sleep quality (Astell-Burt et al., 2013; Cheng et al., 2021; Gascon et al., 2015; Wood et al., 2017). In particular, psychosocial benefits have received special attention, since individuals who live and interact with green

spaces report greater energy, overall good health, and a sense of meaningful purpose in life (Sifferlin, 2016). On the other hand, residents in urban environments still have an increased risk of exposure to stressful situations and mental health problems, since there is not an increased difficulty for this population to access green spaces, which may represent a barrier to using this approach (Lee et al., 2017; Rajoo et al., 2020; Syed Abdullah et al., 2021). Here are some comments regarding the benefits in question:

- State Of Mood

Many studies in Europe, America, and Asia report that natural environments, in comparison to urban environments, improve human mood states (Hartig et al., 2003; Hartig et al., 1991; Morita et al., 2005; Tsunetsugu et al., 2013) as well as performance and concentration (Hartig et al., 2003; Hartig et al., 1991; Laumann et al., 2003). Studies have shown that even the mere exposure to photographic images of nature has beneficial effects on emotional states and cognitive performance in comparison to images of urban environments (Hartmann & Apaolaza-Ibáñez, 2010; Tyrväinen et al., 2014; Ulrich et al., 1991).

- Anxiety Level

The effect of FT on anxiety was found to be statistically greater for day-based compared to session-based FT. Furthermore, Costonis (1978) argued that participants are more likely to change with long-term interventions than with short-term interventions (Yeon et al., 2021). The effect size integrates psychological, cognitive, social and physiological functions, not only anxiety but also depression. In conclusion, forest therapy is preventive management and non-pharmacologic treatment to improve depression and anxiety (Yeon et al., 2021).

- Depression

The trials showed a significant improvement in depression in terms of changes in depression levels. The studies that did not show a significant improvement in depression scores were those that included only healthy adults (Lee et al., 2017). Heart rate variability (HRV) is a physiological marker that reflects the functioning of the sympathetic and parasympathetic nervous systems and is also a well-established indicator of stress and depression. Given that a significant reduction in HRV has been observed in patients with depression compared to healthy adults (Kemp et al., 2012; Stein et al., 2000), we will therefore be able to confirm improvements at the level of depression (Lee et al., 2017).

- Sleep Quality

Two hours of walking in the forest improved sleep characteristics, not only in terms of quality but also in terms of depth and immobility. The trend in mean minutes of immobility was similar to the mean effective sleep time trend. Walking in the woods improved nighttime sleep conditions in people with sleep disorders, possibly as a result of exercise and emotional improvement. In addition, studies suggest that the increase in sleep duration after an afternoon walk is greater than after a morning walk (Morita et al., 2011).

BENEFITING POPULATION

With regard to the population, FT may be of added value in various situations such as in patients with depression, anxiety, hypertension, and affective disorders, post-traumatic stress, among others (Lee et al., 2017; Poulsen et al., 2016; Song et al., 2015). Recent studies show that a program lasting one hour, and forty-five minutes has a positive impact on the mental health of patients with affective disorders, corroborating findings of other previous studies on other pathologies as well (Lee et al., 2017; Poulsen et al., 2016; Woo et al., 2012). This intervention was shown to be effective as a form of therapy, as patients reported significantly lower levels in four negative aspects of mood, assessed using the POMS questionnaire: tension-anxiety, depression-dejection, fatigue, and confusion. In addition, there was a significant increase in the positive mood indicator, and vigor, after the intervention. The levels of anxiety, assessed by the STAI-S questionnaire, also showed a significant decrease. These results are in line with studies investigating the effect of forest therapy on healthy young adults in Poland (Bielinis et al., 2019; Bielinis et al., 2018), which concluded that exposure to a forest environment resulted in a reduction in some negative mood indicators.

There were also some differences in terms of age group and gender. For example, Japanese studies have reported that FT was effective in reducing salivary cortisol by 2.5 μg/dL in middle-aged hypertensive women (Ochiai et al., 2015; Yau & Loke, 2020). Even at the level of the children, it has been studied for some time. Downe-Wamboldt (1992), for example, showed that children who see woods around their homes perform better in terms of memory, impulse control, selective attention, and concentration. For younger children, growing up in an urban environment without access to green spaces increases several risk factors. These include the risk of academic underachievement (Brooks-Gunn & Furstenberg Jr, 1986), juvenile delinquency (Schweinhart et al., 1985), and teenage pregnancy (Furstenberg, 1976). To avoid these outcomes, self-discipline is needed, which may mean specially directed attention, a limited resource that can be renewed by getting involved in nature. The literature shows that a view of nature through a bedroom window can, on average, improve performance on tests of concentration, impulse inhibition, and delay of gratification. For girls, the view accounted for 20% of the improvement, while for boys, who typically spend less time playing in and around the house, the view from the house showed no relationship to performance on any measure. These findings suggest that, for girls, green spaces in the immediate vicinity of the home may help them to lead a more effective and self-disciplined life. In boys, more distant green space may be of equal importance (Taylor et al., 2002).

FOREST THERAPY IN VIRTUAL REALITY

As we can see, this is a current theme with much literature produced and yet to be produced. After all the benefits pointed out, and many others, FT has been a therapy on the rise, especially after the pandemic that haunted the world in 2019. As of late 2019, due to the COVID-19 pandemic, human health issues such as depression, anxiety, sleep problem, increased sedentary behavior, and physical inactivity need special attention more than ever as they represented exponential growth due to the pandemic ravaging the world for 3 years (Zhang et al., 2022).

Thus, due also to COVID-19, virtual FT experiences have been more practiced and well accepted as part of self-care activities. Although studies still point to greater efficacy on the part of face-to-face FT compared to virtual FT, the latter still show an improvement in well-being and may impose their position

in cases of inability to travel to the face-to-face setting (Markwell & Gladwin, 2020). Additionally, in early (pre-pandemic) studies there has been the revelation that exposure to virtual nature, such as photographs, videos, nature sounds, and virtual reality can reduce stress (de Kort et al., 2006), increase physiological arousal, and be restorative (Madan et al., 2020), as well as improve indicators of cardiovascular health and relaxation (heart rate variability) (Annerstedt et al., 2013; Hansen et al., 2017; McEwan et al., 2022).

Given this, virtual reality (VR), on the other hand, is a technology that allows users to experience immersive, simulated environments, so it has been used for various therapeutic purposes, such as the treatment of anxiety disorders, phobias, and post-traumatic stress disorder (PTSD) (Wang et al., 2019a).

In this way, VR may also provide opportunities for people who would not otherwise have access to natural environments to experience the benefits of FT. However, more research is needed to determine the effectiveness of virtual reality as a viable and beneficial tool in FT (Wang et al., 2019a).

VIRTUAL REALITY IN WELL-BEING

Recent technological advances in the mental healthcare field foresee a revolution in these services, highlighting VR as an important tool for new opportunities and learning contributing to enhancing individuals' psychological well-being (Mohamad Yahaya et al., 2023). VR allows immersion in interactive worlds generated by a computer, which digitally replaces real-world sensory perceptions, mimicking the sense of presence in new environments (Freeman et al., 2017). This sense of realism is due to the precise control of sensory cues that this technology is able to manipulate, particularly for auditory, tactile, and olfactory systems (Jessica L. Maples-Keller, PhD1, Brian E. Bunnell, PhD2, Sae-Jin Kim, BA1 & Rothbaum, 2017).

There are several studied benefits of using this technology as a therapeutic tool. As previously mentioned, VR's features of control over the stimuli produced allow precision in the implementation of therapeutic strategies. VR makes it possible to reproduce scenarios or environments that, in certain contexts, it would be almost impossible to recreate in real life. With this, the fact that individuals know that the virtual environment in which they are immersed is not real – even if their minds and bodies behave as such – can act with a comfort factor and thus facilitate the involvement and participation in these situations and therapeutic challenges proposed and can all be ceased in just one click (Freeman et al., 2017). It is also noteworthy that the immediate availability and higher frequency of treatments using VR reflect a great advantage and flexibility in the provision of services. The increasing accessibility to high-quality VR devices in the market makes it feasible to take this technology from the lab into different environments (Freeman et al., 2017). Thus, VR can provide opportunities and allow many more people to benefit from the best therapies and positive outcomes (Freeman et al., 2017), as is the case with FT. Therefore, this chapter proposes to explore the use of Forest Therapy in a Virtual Reality environment, by venturing into its potential and challenges, as well as pragmatic recommendations and requirements for its use and, ultimately, studying the relevance of research and investment in this area.

FOREST THERAPY POTENTIALS AND REQUIREMENTS IN VIRTUAL REALITY

Nowadays, there is an emerging presence of many modern technologies, namely augmented reality, 3D industry, automated driving, and virtual reality, brought about by the fourth industrial revolution (Jo et

al., 2021). VR, sometimes called Artificial or Synthetic Environment (Jo et al., 2021), creates interactive virtual worlds that digitally replace the sensory perceptions of the real world, mimicking the sensation of being present in new environments (Freeman et al., 2017) (Jo et al., 2021). This technology is based on the concepts of "presence" and "telepresence", which refer to the feeling of being present in a naturally generated or mediated environment. For this mediation, the manipulation of simulated environments, natural abilities, sensation and perception, and sensing devices are essential (Wang et al., 2019b). The primary goal of this technology is to provide an experience that resembles reality by harnessing the human brain's processing of visual, olfactory, auditory, and tactile experiences (Jo et al., 2021). This sense of realism is due to the precise control of the sensory cues that this technology can manipulate (Jessica L. Maples-Keller, PhD1, Brian E. Bunnell, PhD2, Sae-Jin Kim, BA1 & Rothbaum, 2017). In this way, VR aims to stimulate the human senses in the virtual world in a similar way to the real world (Jo et al., 2021).

VR can be used in a wide range of fields such as medicine, education, the arts, entertainment, and the military, and has recently been widely used in the health sector (Wang et al., 2019b). The advantages of manipulation of this technology as a therapeutic tool have been the subject of research. As mentioned above, the controlled nature of the stimuli produced by VR allows for precision in implementing therapeutic strategies (Freeman et al., 2017). This type of immersive experience is now being used by multiple studies to supplement other treatments, as an adjunctive distracter, for both physical symptoms – pain, nausea, blood pressure, heart and breathing rates – and psychological symptoms – anxiety, fear, and stress (Hsieh & Li, 2022). Researchers have suggested that relaxation can be achieved and symptoms of anxiety and depression can be reduced by using natural environments in VR (Chan et al., 2021), and as this technology continues to be explored and studied, it could present an alternative to real natural immersion through the creation of a simulated environment (Hsieh & Li, 2022). Although there's a considerable body of evidence about the benefits of visiting forests, urbanites struggle to visit them and reap their positive effects. The emerging VR-based technology that provides an immersive environment to simulate interactions with real nature has been developed as an alternative solution to this problem (Alyan et al., 2021), ensuring that the best possible therapy is available to many more people (Freeman et al., 2017). The immediate availability and greater frequency of treatments using VR also stand out, reflecting a great advantage and flexibility in the provision of services. The growing accessibility of high-quality VR devices in the market makes it feasible to transfer this technology from the laboratory to other diverse contexts (Freeman et al., 2017). At the same time, VR has better ease of use than exposure in a real setting, offering advantages such as proximity to reality, reduced human input and material resources, and better control over independent variables. As a result, this technology has the potential to become an expanding part of environmental research (Wang et al., 2019b).

Current findings in the literature show that VR technology is growing rapidly and is proving to be effective at replicating natural forests for health and mental health applications (Alyan et al., 2021). In addition, recent studies have attempted to create virtual forests in VR to put theory into practice and analyze the results, and have demonstrated that immersion in VR-generated forests has significant positive psychological and physiological effects (Alyan et al., 2021); (Jo et al., 2021) (Hsieh & Li, 2022);(Ross & Jones, 2022). Other studies have shown that watching a video for as little as six minutes can improve mental health (Hsieh & Li, 2022). Watching 360-degree videos of natural landscapes for fifteen minutes with VR devices was also proven to have a relaxing effect (Hsieh & Li, 2022). In another study, it was shown that the emotional state of the participants, both young adults and senior citizens, was improved by taking a short walk in a virtual forest (Chan et al., 2021).

Furthermore, evidence has also explored the use of nature in other technological devices, highlighting the beneficial effects of technological nature in promoting mental health. (Hsieh & Li, 2022). Viewing natural images can help recover from physiological stress and relax emotions, a study has shown (Chen et al., 2023). A growing body of research has shown that exposure to forest landscapes through technology improves health (Hsieh & Li, 2022). Others examined the effects of computer-mediated viewing of nature in the form of slide shows on physio-psychological processes (Chan et al., 2021). This study also compared watching video recordings of a walk through a street with houses and shops and a walk through a forest, and concluded that the latter had a better effect on the participant's mood (Chan et al., 2021).

Considering the aforementioned theory, realistic environments have been shown to be more effective in reducing stress levels (Alyan et al., 2021), and VR technology is the most capable of providing this, offering a sense of realism and presence that other devices simply cannot (Jessica L. Maples-Keller, PhD1, Brian E. Bunnell, PhD2, Sae-Jin Kim, BA1 & Rothbaum, 2017). The current findings suggest that virtual nature produces similar effects to real nature, making VR a safe alternative to experiencing nature (Chan et al., 2021) and a suitable substitute for people who are unable to visit natural areas for whatever reason (Alyan et al., 2021);(Chen et al., 2023). In this way, the introduction of forest therapy into the virtual world seems to be a promising step.

To make this happen, there are a number of steps to consider, starting with the VR-generated forest. Given the factor realism plays into the immersion's outcomes, it's important to ensure the fidelity of the virtual forest setting. VR fidelity refers to how closely the VR environment mimics the real-world (Chan et al., 2021). Today's VR technology allows for the development of high-fidelity natural environments. For instance, it is feasible to achieve dynamic natural processes, such as the light streaming through leaves and reflecting off the water; high-fidelity audio by synchronizing stereo recordings with visual cues, like the movement of trees swaying to the sound of wind and the rustling of leaves; and high-fidelity motion through sophisticated and accurate head-tracking and locomotion techniques that closely mimic real-world walking (Chan et al., 2021). People's perceptions of the space can influence their perceived recovery (Chen et al., 2023) and for this reason, it's relevant to take into account what the general preferences are when developing these virtual settings. A strong sense of privacy and security seems to be favorable and can be provided by manipulating certain landscape components, like trees and shrubs (Chen et al., 2023). A study found that forest therapy activities in water and lookout landscapes in spring, as well as activities in autumn, will produce a better recovery effect (Chen et al., 2023) so seasonal characteristics and elements could also be considered when designing the forest space.

A further step to be taken into account is regarding FT and its requirements. FT is an alternative form of therapy that uses physiological relaxation to boost immunity and improve mental health (Alyan et al., 2021). Two of the main components of FT are walking (Yi et al., 2022b) – which is possible in VR as long as both the virtual and physical spaces are programmed and prepared for exploration (Wang et al., 2019b) – and experiencing the forest through the five senses (sight, sound, touch, smell, and taste) – which can also be done in a VR environment, along with the use of other external physical materials (Yi et al., 2022b). Other activities essential to FT, such as forest viewing, forest meditation, Qi-Qong, aromatherapy, herbal tea therapy, and making handicrafts with natural materials (Yi et al., 2022b), should be integrated into a VR-based FT program and appear to be easily transferable and applicable in a virtual environment. Making sure the sessions take place in a quiet and private space is a rule that must be followed in Virtual FT as well (Wang et al., 2019b). Lastly, the duration of the immersion cannot be the as in a real-life FT session, as excessive exposure to VR devices may lead to negative responses (Hsieh & Li, 2022).

PROPOSAL OF A PROTOCOL FOR FOREST THERAPY IN VIRTUAL REALITY

To the best of our knowledge, a protocol for the application of FT in VR has not yet emerged. With this in mind, we propose a possible structure of what we believe an FT in VR programme should be in the light of the above findings.

Prior to the start of the sessions, the environment, both physical and virtual, in which the sessions will take place should be developed, ensuring that it allows for the stimulation and exploration of the different senses, as well as the implementation of the proposed activities.

In terms of the content of the sessions, we have made an important distinction between tasks that take place outside and inside the VR environment. One aspect highlighted by several studies is the duration of exposure to this technology, and prolonged immersion is not recommended. We, therefore, propose to limit the time spent in VR to a maximum of 20 minutes, with the rest of the session devoted to other tasks.

To be more specific, we suggest sessions of 45 minutes, divided into three phases: opening phase, main activity and closing phase.

Opening Phase

The opening phase, lasting 10 minutes, takes place in a real context, still outside the virtual environment, and is composed of two tasks:

- *Intention*: Discussion of the intention, expectation and purpose of the session;
- *Threshold of connection*: represents the separation from real life and the transition to the session and the activities that are about to take place.

Main Activity

The main activity will be developed in VR, in the forest environment, and, as mentioned above, will have a maximum duration of 20 minutes. The first 5 minutes of immersion should be devoted to *Embodied awareness*, which consists of encouraging connection with the environment through the senses. The remaining 15 minutes are devoted to the alternating activity. This is so named because there are three activities that are essential to the practice of FT and these, together with the reduction of exposure time to VR, should alternate throughout the programme. The three rotating activities are: *Walking in the forest* (this can be a slow walk while becoming aware of specific elements of nature), *Infinite possibilities* (the therapist conducting the session proposes between one and three "invitations" for the client to complete in the form of simple tasks) and *Sit spot* (this consists of an introspective moment where the participant has dedicated time to sit and take notice).

Closing Phase

The final stage lasts 20 minutes and consists of:

- *Tea Ceremony:* This ceremony is very characteristic of the traditional Japanese practice of FT and provides an opportunity for sharing;

- *Threshold of incorporation:* this should be the last activity before the end of the session and is a moment to reflect on what you have noticed before returning to normal life.

Potential of application

It is important to note that all the proposed activities relate to characteristic and essential steps of a normal FT session. The proposed programme results from the convergence of recommendations described in the literature on the practice of FT and the use of VR as a therapeutic tool, so its implementation and analysis of effects and results need to be studied. However, considering the data mentioned throughout this chapter, its effects seem promising.

CONCLUSION

The potential for the transition and applicability of FT in VR is, again, promising. Integrating this VR-based therapy into the healthcare system would compensate for the shortcomings caused by the difficulty in accessing forests (Jo et al., 2021). FT in VR would then be possible to be considered as a green prescription and therefore facilitated by healthcare professionals. Green prescription refers to the prescription of outdoor activities with exposure to nature and green spaces by health professionals. In the UK, for instance, due to the pandemic, the national health service recently made a 4 million pounds investment to tackle mental health problems through green prescribing. This has proven to have beneficial impacts on both physical and psychological symptoms (Wong & Osborne, 2022). Thus, FT in VR could be facilitated by healthcare professionals through green prescription to enhance mental health.

Some limitations of this technological intervention have been raised in the literature, namely the many sensory cues present in real natural environments that cannot yet be replicated in VR (Chan et al., 2021). Forest therapy includes various healing elements such as temperature, phytoncides, and humidity that cannot be reproduced by VR devices (Chan et al., 2021); (Yi et al., 2022b).

In light of all that has been said, it's important to note that the research on this topic is still in its early stages (Alyan et al., 2021), and the physical and mental health impacts of digitally-generated forest spaces still need to be further developed (Chen et al., 2023). However, exploring this field represents, in many ways, a unique opportunity for healthcare, and would reach a wider population, providing the best possible therapy for everyone who could benefit from it.

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KEY TERMS AND DEFINITIONS

Forest Bathing: Forest bathing is all about immersing yourself in a forest environment, consciously immersing yourself in the natural surroundings. It is a casual, self-directed practice focused on sensory experiences and conscious immersion in nature designed to relax, rejuvenate, and increase well-being. It emphasizes the personal connection to the forest environment and the benefits of sensory experiences.

Forest Therapy: It is a therapeutic practice that involves immersion in a natural forest environment for the promotion of physical, mental, and emotional well-being. It is based on the belief that being in the natural world, especially in the forest, can help improve human health.

Green Prescription: A health intervention in which time in nature is prescribed or recommended to improve a person's physical and mental health. Recognize the numerous benefits of spending time in nature and seek to harness these benefits to promote health and manage a variety of health conditions.

Mental Health: Mental health refers to the emotional, psychological, and social well-being that can affect an individual's quality of life. Coping with stress, relating to others, and making decisions are important components of mental health. They affect the way individuals think, feel, and act. Mental health is a critical component of overall health.

Urbanization: This refers to the process of shifting the population from rural to urban areas and expanding urban areas at the expense of the natural and rural environment. It involves growing cities and increasing numbers of people living in those cities.

Virtual Reality: An electronic arrangement of tangible and audible signals that duplicates a digital three-dimensional setting can be experienced in a realistic way with the help of certain gadgets. It seeks to produce an immersive impact by offering not just visual and auditory experiences, but also touch and scent sensations, thus making the user feel like they are actually present in a virtual environment.