MindTerior: A Mental Healthcare Game with Metaphoric Gamespace and Effective Activities for Mitigating Mild Emotional Difficulties

Ain Lee
Graduate School of Culture Technology / Games and Life Lab, Korea Advanced Institute of Science and Technology, Republic of Korea
ainlee@kaist.ac.kr

Juhyun Lee
Graduate School of Culture Technology / Information-Based Design Lab, Korea Advanced Institute of Science and Technology, Republic of Korea
leejh@kaist.ac.kr

Sooyeon Ahn
Department of Industrial Design / DxD Lab, Korea Advanced Institute of Science and Technology, Republic of Korea
little1209@kaist.ac.kr

Youngik Lee*
Graduate School of Culture Technology / Social Computing Lab, Korea Advanced Institute of Science and Technology, Republic of Korea
yiklee@kaist.ac.kr

ABSTRACT

Contemporaries suffer from more stress and emotional difficulties, but developing practices that allow them to manage and become aware of emotional states has been a challenge. *MindTerior* is a mental health care game developed for people who occasionally experience mild emotional difficulties. The game contains four mechanisms: measuring players' emotional state, providing game activities that help mitigate certain negative emotions, visualizing players' emotional state and letting players cultivate the game space with customizable items, and completing game events that educate players on how to cope with certain negative emotions. This set of gameplays can allow players to experience effective positive emotional relaxation and to perform gamified mental health care activities. Playtest showed that projecting players' emotional state to a virtual game space is helpful for players to be conscious of their emotional state, and playing gamified activities is helpful for mental health care. Additionally, the game motivated players to practice the equivalent activities in real life.

CCS CONCEPTS

• **Applied computing** → Computers in other domains; Personal computers and PC applications; Computer games.

KEYWORDS

Serious Game Design, Relaxing Emotion, Inducing Behavior, Mental Health Care

*The authors are listed in alphabetical order. The authors contributed equally to this work.

CHI EA '23, April 23–28, 2023, Hamburg, Germany

ACM ISBN 978-1-4503-9422-2/23/04.
https://doi.org/10.1145/3544549.3583831

ACM Reference Format:
Ain Lee, Juhyun Lee, Sooyeon Ahn, and Youngik Lee. 2023. MindTerior: A Mental Healthcare Game with Metaphoric Gamespace and Effective Activities for Mitigating Mild Emotional Difficulties. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems (CHI EA '23), April 23–28, 2023, Hamburg, Germany.* ACM, New York, NY, USA, 6 pages. https://doi.org/10.1145/3544549.3583831

1 INTRODUCTION

Contemporaries often experience negative emotions due to daily stressful situations. However, it is difficult to properly recognize one's mild emotional problems, and the lack of care services and the burden of counseling costs preclude people from receiving appropriate support [1]. In this situation, digital games have considerable potential to increase the impact of online interventions on mental health care in the virtual space [2]. In order to explore new way of accessible and sustainable mental health care methods, we focused on the potential of digital games. We aimed to allow players conscious of their emotional difficulties easily, so we visualize and project the player's emotional status in the game. In addition, we gamified real-life activities like walking, coloring, gardening, and writing, which help maintain mental health and reduce negative feelings such as depression and anxiety [3–5]. Therefore, we have developed the game as a highly accessible and enjoyable way to help people with emotional difficulties.

2 LITERATURE REVIEW AND OUR NOVELTY

2.1 Mental health care game

Games have the potential to effectively improve mental health by making use of fun elements and also providing alternative game worlds to meet the needs of the player [6, 7]. A study by Jones et al. revealed that games could contribute to human mental health by actively utilizing the story, giving clear goals, and letting players engage with the game [7]. For the gamification strategy, a case study-based research by Siriaraya et al. suggested a framework for the gamification of mental health care therapies with 4 different components of a game therapy world: the performance space, rules, content, and structure [8]. There are several games that utilized

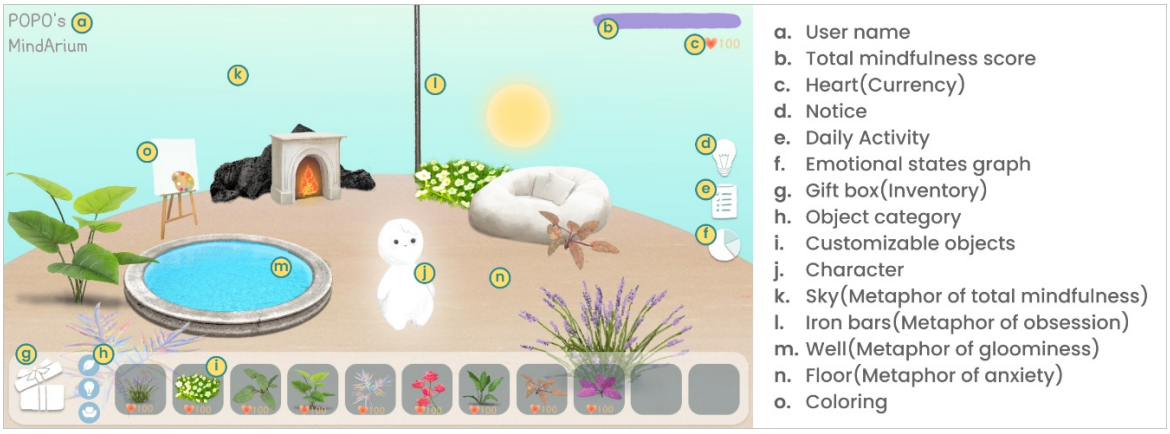

Figure 1: Game Overview

game elements for mental health care purposes, *SuperBetter* is a positive psychology game in which players earn points and level up as they progress through activities with the ruled approach as scoring and rewards [9]. The healing game *Daydream* utilized puzzle structure and music elements to help players manage mental health and emotions in stressful situations [10]. Finally, *The Guardians* adopted direct behavioral therapy to help players perform real-world actions in the game, and verified high therapeutic effects with long-term engagement in relation to the real-world [11]. In *MindTerior*, we actively reflect on visual objects and space that help represent emotions. Research-based mental health care activities and art therapy techniques were used for constructing gamified activities of the game. It also implemented a fun factor and reward system to induce players to continue performing mental health care activities.

2.2 Reflecting emotional state as spatial image

Human mind can be illustrated by an imagery representation, which represents the person's psychological state [12]. Likewise, games act as a place called a 'magic circle' that is distinct from real life [13]. We used this distinct place as a field for not only effectively reflecting one's mind state but also positively changing it. We named the game space *MindArium*, which combines the noun *Mind* and the suffix *Arium* meaning the place, that reflects the player's state of mind and emotion. We referred to prior studies examined certain visual factors that affect mood and health to encourage positive mental health care. For example, water and plant factors positively affect mental resilience, and landscape factors such as bamboo forests, aesthetic wallpaper, and windows have been proven effective in restoration [14]. Another study claims that plants placed indoors positively affect emotional state or increase creativity [15]. We implemented the study of therapeutic lighting, color, and shape of space that are considered important in interior design [16]. The contribution of our game is that it allows players to be intuitively aware of their mental condition through visualizing emotions as game objects. Furthermore, mental health care activities provided in the games can enhance the player's emotional state and mental health as well as *MindArium* which represents them.

Figure 2: Visual metaphors that represent three different negative emotional states and how they are applied to *MindArium*

3 GAME DESIGN

The goal of the *MindTerior* game is to help players manage their emotions steadily in their daily lives and therefore, we made it as a mobile game for better accessibility. The game activities were constructed based on proven effective mental health care activities [3–5]. In addition, using our unique concept, '*MindAruim: The game space that reflects the player's state of mind and emotion*', players can enjoy game activities such as cleaning and decorating the space, and recognize their game space getting improved (Figure 1).

3.1 Art Concept

3.1.1 The Characters in the Game. There is a character and non-player character (NPC) in *MindTerior* who help players immerse themselves in the game story and induce them to perform mental health care activities. The character is designed not to represent a specific gender so that various players can project themselves into their characters. Looking at the character and empathizing with it, players are motivated to improve their *MindAriums*, the space where the character resides. The NPC is designed as a cute dog. It instructs the tutorial and assists the player throughout the game play.

3.1.2 Game Object Design. Game objects are divided into *suggested objects* and *customizable objects*. *Suggested objects* representing three

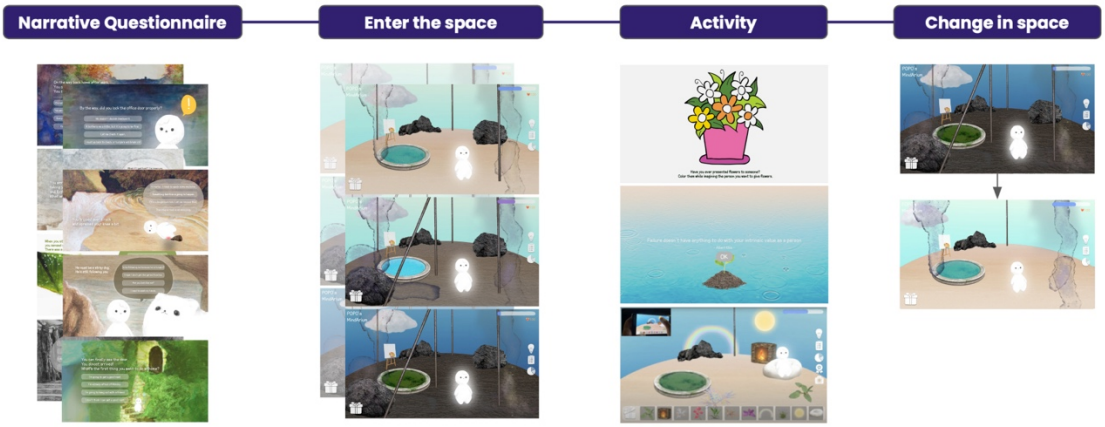

Figure 3: The structure of *MindTerior*

negative emotions are objects offered to the players. Among diverse negative emotions, we selected three emotions (gloominess, obsession, and anxiety) that are generally common and can be healed through mental health care activities. Figure 2 shows how *suggested objects* are applied to visualize the negative emotional states in the game scene. For example, the stagnant well symbolizes gloominess, which is a state in that sad feelings are accumulated and unsolved. The iron bars symbolize obsession, as iron bars are used for jail and birdcages to limit freedom. The texture and color of the floor represent anxiety, as people often compare an unstable state to shaking grounds. The state of these three *suggested objects* gradually is improved as players complete gamified mental health care activities. *Customizable objects* are objects such as plants, furniture, and lighting that players can use to decorate their *MindAriums* freely. By letting players decorate the spaces to their own taste, we intended to let players increase their attachment and intimacy to their *MindAriums*.

3.2 Game System Design

Figure 3 shows the game's structure. At the start of the game, players should answer the *Narrative Questionnaire*. It is the way to analyze a player's emotional status and the result is reflected on *MindArium*. Players can remove the obstacles in their *MindAriums* by completing the activities.

3.2.1 Narrative Questionnaire. The *Narrative Questionnaire* is the first stage of the game. It measures the player's emotional state while delivering the narrative of the game to the player. The *Narrative Questionnaire* consists of a total of eight questions, each question requiring players to select one reaction among four different reactions for the situations the character encounters on the way back home after work. The options were created using self-diagnosis scales such as PHQ-9 [17] for measuring the level of depression, GAD-7 [18] for measuring anxiety, and MOCI [19] for measuring obsession.

We utilized official Korean versions of the scales, and preserved the original expressions as much as possible, but since these scales were designed to diagnose mental illness, we weakened the expression considering the aim of our game, which is to deal with mild emotional difficulties. Depending on what choice the player made for each question, gloominess, obsession, and anxiety, are measured in four levels. The result is projected into *MindArium* by means of suggested objects. For example, the larger the overall negative emotion level of the player, the background color gets darker, and more rocks are placed. The result can also be observed through a bar graph in the upper right corner of the screen, which indicates *Total Mindfulness*.

3.2.2 Main Activities: Mental Health Care Activities. The core play activity of *MindTerior* consists of a total of five activities, *Walking*, *Coloring*, *Gardening*, *Positive Words*, and *Cleaning*. All of the activities have been proven to be effective in alleviating one or more of the three selected negative emotional states, when performed in reality [3–5]. After the player completes each activity, the level of associated negative emotions decreases, and players can recognize it by Mission Complete Notice and the change of the environment of *MindArium*. 'Change in Space' in Figure 3 shows how *MindArium*'s space and *suggested objects* changes as game activities are performed. *Walking activity* is based on the study that walking can help to reduce anxiety [3]. The game records the number of players' steps in the game by using the smartphone sensor. According to Ashlock, *Coloring activity* helps reduce anxiety [5]. Various templates are provided for coloring activities, and complex templates provide more reduction of anxiety level in the game. *Gardening activity* is based on the research that gardening in reality is effective against gloominess [4]. If the player places *customizable objects* of plants, the seeds are planted and can grow by playing the watering activity of *Positive Words*. Players have to complete sentences *(Positive Words activity)* that help alleviate three negative emotional states. The sentences are helpful quotes from renowned psychologists and therapists. The words of the sentences are raining, and players have to collect water for their seeds by putting

Figure 4: Screens of Event occurrence. Scenarios of anger, anxiety, and depression each.

the words in the right order to form a complete sentence. When players complete a sentence that is helpful for obsession, the obsession level decreases. According to Saxbe and Repetti, organizing the surrounding environment *(Cleaning activity)* is beneficial for general mood [20]. In the game, players are instructed to weed the garden, and not doing so results in the *MindArium* being covered with weeds, occupying the space for *customizable objects*. After the activity, players are suggested to clean their houses in real life.

3.2.3 Decorating MindArium. Players also can interact with their *MindAriums* by placing *customizable objects*. To build the circulatory system between main activities and *MindArium* decoration, we designed to purchase *customizable objects* with *Hearts*, a reward for main activities. Also, it is expected that enjoying improving and decorating their own *MindAriums* can motivate players to change their real-life surroundings.

3.2.4 Event. After players perform main activities several times, an *Event* occurs to learn how to cope with a particular emotion at its peak. Figure 4 shows when three *Events* scenarios occurred. In the *Event*, the NPC asks how to properly deal with the situation. Player should choose one of the two options, and then NPC gives feedback according to the response. After the *Event* is finished, the popup summarizes the learned countermeasures.

3.2.5 Scoring and Reward system. Total Mindfulness score (total score): After the *Narrative Questionnaire*, the total score is calculated and displayed on the top bar graph. At this time, the total score is calculated in inverse proportion after adding up the questions that measure gloominess, obsession, and anxiety. For example, in the case of 400 points of the negative emotions score, which is the highest, the top bar starts with the shortest.

Reward: When players finish an activity, they get an increase in their *Total Mindfulness score* and get a currency reward (*Hearts*). Accordingly, the negative emotion score decreases; *suggested objects* that are symbols of negative emotional states disappear with the increase in *Total Mindfulness score*. Second, they receive game currency that can be used to purchase items to decorate the space in the game.

3.3 Technical Note

The authors developed the game using Unity engine editor version 2021.3.8, with Visual Studio Code scripting. The coloring activity is supported with unity asset 'Drawing Coloring Extra Edition' from Indie Game Studio. Visual assets were created with Adobe Photoshop. Main background music was composed with Musecore and Logic pro X. The game build supports Android OS.

4 PLAYTEST

4.1 Participant and Method

Since *MindTerior*'s target user is everyone who has mild emotional difficulties, we recruited participants without limiting their age and gender. A total of eight participants were recruited for the playtest and they were in their 20s, 30s, and 50s (male 5, female 2, and undisclosed 1). The playtest was conducted in two sessions. First, we instructed players to play *MindTerior* developed in a mobile environment freely without time constraints. Second, through a survey, players' demographics, game experiences, and emotional experiences were collected. Third, in order to examine the emotional effects of the game, Aesthetic Emotions Scale (*Aesthemos*) responses were collected. The *Aesthemos* is a framework created to measure the emotional reaction to a stimulus while taking into account its aesthetic appeal. *Aesthemos* can observe a broad range of aesthetic emotions including not only prototypical aesthetic emotions such as the feeling of beauty and fascination, but also activating and relaxing effects of an aesthetic experience [21]. Additionally, to understand the possibility of inducing emotional relaxation behavior through gameplay, we asked if they were willing to perform an emotional relaxation act implemented in the game in real life and why. Since all the participants were Korean, all the playtest materials including *MindTerior* were provided in Korean All these sessions took an average of half an hour.

4.2 Result

4.2.1 Effectiveness of Emotion Relaxation. As a result, we were able to verify the two assumptions we set through the playtest. The first assumption, 'Players will be able to experience emotional relaxation by playing a game in which activities that help relaxation are implemented', and the second assumption, 'Gameplay will induce players to do mental health care activities also in reality'. These two assumptions were reviewed based on the game concept of experiencing and changing the space in which the player's emotions are projected.

4.2.2 Aesthetic Emotion Measuring and Reliability. Through a survey, we found that gameplay is effective in emotional relaxation based on *Aesthemos* subscale calculations with aesthetic emotion questionnaires. *Aesthemos*, which contains a total of 42 emotional statements, consists of a total of seven aesthetic emotional categories (*P*: prototypical, *E*: epistemic, *An*: animation, *NaR*: nostalgia and relaxation, *S*: sadness, *Am*: amusement, and *N*: negative). Among the 42 questions answered on a 5-point scale, the top five questions were 'beautiful (Q1, $M = 3.875$), calmed me (Q4, $M =$

4.125), liked it (Q6. $M = 3.875$), relaxed me (Q20. $M = 3.750$), felt motivated to act (Q41. $M = 3.750$)' (Cronbach's alpha = 0.725). In addition, the order of the highest aesthetic emotion scores for the seven subscale items is as follows: NaR ($M = 3.438$); Am ($M = 2.906$); An ($M = 2.896$); P ($M = 2.875$); E ($M = 2.854$); S ($M = 1.625$); N ($M = 1.347$).

4.2.3 Possibility of inducing mental health care activities in reality. According to the response from the survey, 62.5% of the players responded positively to the question of their intention to perform in reality during the mental health care (walking, coloring, gardening, positive words, and cleaning) implemented in the game. In addition, they expressed their intention to perform 'gardening' among the five activities.

4.2.4 Qualitative game feedback. After gameplay, descriptive responses and additional verbal feedback requested in the survey were collected. According to the player's response, many positive feedbacks on visual elements such as *'the overall graphic concept gave me peace of mind'*. In addition, six out of eight players responded that *'it was helpful to perceive emotions to face by projecting their mental state into a virtual space'*. Specifically, player 6 responded, *'I think space can fully express emotions, just as a house or office desk becomes messy and clean according to emotions'*. Player 3 responded, *'Emotions are abstract, but MindTerior provided an opportunity to experience my emotions by visualizing emotions as spaces'*. However, player 2 responded, *'I was confused because I couldn't easily reach what exactly the metaphor meant'* and that *'each visual analogy needed an explanation of what exactly it meant'*. Regarding game content, they also expressed regret over the lack of content such as *'rich content elements are needed to continue gameplay'*.

5 CRITICAL REFLECTION

MindTerior is a mental health care game that metaphorically expresses the player's emotional state in the game space. The difference from the existing games is that *MindTerior* applied activities that help relax emotions and care player's mind as game elements. In addition, built as a mobile game form to enhance daily accessibility, and various fun elements and reward systems were used to induce players to play mental health care activities sustainably. Furthermore, rather than using the game space only for the aesthetical side, the emotional state was directly projected into the space and used to recognize the player's emotions. However, certain visual elements (dark background, bars, etc.) might cause negative experience. This means that visual elements reflecting the emotional state should be improved. Moreover, according to the survey response, the mental health care activity experience in the virtual environment stimulated the motivation of the players' actual behavior, but it is difficult to confirm whether it was actually done with the currently implemented function. In order to induce more active behavioral change, a function in which actual activities and game activities can interact with each other must be implemented in the game.

6 LIMITATION AND FUTURE WORK

MindTerior is more like a positive mental health care game than a medical serious game, so its effect on medical use has yet to be verified. Also, since we tried to deal with a broad scope of emotions and suggest various items for players' needs, it is challenging to offer in-depth care for one or two emotions. Therefore, future development plan is to personalized mental health care activities and objects according to each player's different degree of negative emotions through level differentiation of activity and diversification of customization. In addition, gathering a larger number of playtest samples could be helpful for verification of the game's effectiveness.

7 DISCUSSION AND CONCLUSION

MindTerior is a mental health care game to help people perceive and care about their emotional states in their daily lives. The game analyzes players' negative emotional states through the *Narrative Questionnaire* and reflects them in the game space, *MindArium*. Players can improve their *MindArium* by performing main activities that are proven to be effective for mental health, and decorating them with customizable objects. We confirmed that players felt emotional relaxation and received motivation to carry out such mental health care activities in real life. However, there are still some risks and limitations that could be dealt with in the future research. For example, seeing emotion-reflecting elements might have negative effects. Also, more samples of playtest data should be provided in order to prove the game's effectiveness.

ACKNOWLEDGMENTS

This game was developed as the part of GCT742 Innovative Game Design class at Graduate School of Culture Technology, KAIST. We sincerely thank our advisors (Young Yim Doh, Sung-Hee Lee, Hwajung Hong), and NCSoft Experience Analysis Division (YongSoo Lee, Kunhee Kang, Naeun Yoo) and playtesters for their valuable feedback and support. This research was supported by Ministry of Culture, Sports and Tourism and Korea Creative Content Agency (Project Name: Research Talent Training Program for Emerging Technologies in Games, Project Number: R2020040211)

REFERENCES

[1] Sandra Bucci, Matthias Schwannauer, and Natalie Berry. 2019. The Digital Revolution and its impact on Mental Health Care. Psychology and Psychotherapy: Theory, Research and Practice 92, 2: 277–297. http://doi.org/10.1111/papt.12222
[2] Theresa M. Fleming, Lynda Bavin, Karolina Stasiak, *et al.* 2017. Serious games and gamification for Mental Health: Current Status and promising directions. Frontiers in Psychiatry 7. http://doi.org/10.3389/fpsyt.2016.00215
[3] Paul Kelly, Chloë Williamson, Ailsa G Niven, Ruth Hunter, Nanette Mutrie, and Justin Richards. 2018. Walking on sunshine: Scoping review of the evidence for walking and mental health. British Journal of Sports Medicine 52, 12: 800–806. http://doi.org/10.1136/bjsports-2017-098827
[4] Jane Clatworthy, Joe Hinds, and Paul M. Camic. 2013. Gardening as a mental health intervention: A Review. Mental Health Review Journal 18, 4: 214–225. http://doi.org/10.1108/mhrj-02-2013-0007
[5] Laura E. Ashlock, Cindy Miller-Perrin, and Elizabeth Krumrei-Mancuso. 2018. The effectiveness of structured coloring activities for anxiety reduction. Art Therapy 35, 4: 195–201. http://doi.org/10.1080/07421656.2018.1540823
[6] Luciano Gamberini, Giacinto Barresi, Alice Majer, and Fabiola Scarpetta. 2008. A game a day keeps the doctor away: A short review of computer games in mental healthcare. Journal of CyberTherapy & Rehabilitation 1, 2: 127–145.
[7] Christian M. Jones, Laura Scholes, Daniel Johnson, Mary Katsikitis, and Michelle C. Carras. 2014. Gaming well: Links between videogames and Flourishing Mental Health. Frontiers in Psychology 5. http://doi.org/10.3389/fpsyg.2014.00260
[8] Panote Siriaraya, Valentijn Visch, Marilisa Boffo, *et al.* 2021. Game design in mental health care: Case study–based framework for integrating game design into therapeutic content. JMIR Serious Games 9, 4. http://doi.org/10.2196/27953
[9] Ann Marie Roepke, Sara R. Jaffee, Olivia M. Riffle, Jane McGonigal, Rose Broome, and Bez Maxwell. 2015. Randomized controlled trial of SuperBetter, a smartphone-based/internet-based self-help tool to reduce depressive symptoms. Games for

Health Journal 4, 3: 235–246. http://doi.org/10.1089/g4h.2014.0046

[10] Chen Ji and Hiroki Nishino. 2020. Daydream: A Healing Game for Mitigating Quarantine-induced Negative Emotions with Music Adventure. Extended Abstracts of the 2020 Annual Symposium on Computer-Human Interaction in Play. http://doi.org/10.1145/3383668.3419928

[11] Craig Ferguson, Robert Lewis, Chelsey Wilks, and Rosalind Picard. 2021. The guardians: Designing a game for long-term engagement with mental health therapy. 2021 IEEE Conference on Games (CoG). http://doi.org/10.1109/cog52621.2021.9619026

[12] Joel Pearson. 2019. The human imagination: The cognitive neuroscience of visual mental imagery. Nature Reviews Neuroscience 20, 10: 624–634. http://doi.org/10.1038/s41583-019-0202-9

[13] Johan Huizinga. 2014. Homo ludens: A study of the play-element in culture. Routledge.

[14] Li Deng, Xi Li, Hao Luo, *et al.* 2020. Empirical study of landscape types, landscape elements and landscape components of the urban park promoting physiological and psychological restoration. Urban Forestry & Urban Greening 48: 126488. http://doi.org/10.1016/j.ufug.2019.126488

[15] Tina Bringslimark, Terry Hartig, and Grete G. Patil. 2009. The psychological benefits of indoor plants: A critical review of the experimental literature. Journal of Environmental Psychology 29, 4: 422–433. http://doi.org/10.1016/j.jenvp.2009.05.001

[16] Mi-Jeong Jang. 2017. An exploratory study on interior therapy. *Korean Institute of Interior Design Journal* 26, 1: 124–133. http://doi.org/10.14774/jkiid.2017.26.1.124

[17] Kurt Kroenke, Robert L. Spitzer, and Janet B. Williams. 2001. The PHQ-9. Journal of General Internal Medicine 16, 9: 606–613. http://doi.org/10.1046/j.1525-1497.2001.016009606

[18] Robert L. Spitzer, Kurt Kroenke, Janet B. Williams, and Bernd Löwe. 2006. A brief measure for assessing generalized anxiety disorder. Archives of Internal Medicine 166, 10: 1092. http://doi.org/10.1001/archinte.166.10.1092

[19] R.J. Hodgson and S. Rachman. 1977. Obsessional-compulsive complaints. Behaviour Research and Therapy 15, 5: 389–395. http://doi.org/10.1016/0005-7967(77)90042-0

[20] Darby E. Saxbe and Rena Repetti. 2010. No place like home: Home tours correlate with daily patterns of mood and cortisol. Personality and Social Psychology Bulletin 36, 1: 71–81. http://doi.org/10.1177/0146167209352864

[21] Ines Schindler, Georg Hosoya, Winfried Menninghaus, *et al.* 2017. Measuring aesthetic emotions: A review of the literature and a new assessment tool. PLOS ONE 12, 6. http://doi.org/10.1371/journal.pone.0178899