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Thoughtful paths of Nature Park „Ogres Zilie kalni”

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Abstract: In many countries around the world, urbanization has led to a disconnection from nature within major cities and this has prompted increased research into the significance of nature in the daily lives of urban residents. In the wake of COVID-19 pandemic, people began to visit the walking trails en masse and the habit has continued even after the COVID-19 pandemic. This study, which was conducted in July of 2023 is a part of a broader research initiative aimed at enhancing recreational opportunities and optimizing the physical and wellness benefits provided by walking paths.

The research is centered on the "Ogres Zilie kalni" nature park, which features recreational and activity trails. For a majority of residents, these walking paths and ski tracks are vital for recreation. The research's objective is to outline the planning principles for the nature park's trail network, drawing not only from landscape architecture but also from the field of environmental psychology. This holistic approach is expected to yield better recreational outcomes and subsequently improve human health.

The primary goal of this study is to investigate how different types of nature walking trails impact human attention dynamics. Using Schulte's Tables, a psychological method, the study assessed how various stimuli in trail planning and route selection influence human attention. The research results do not offer a definitive answer regarding the influence of path type on attention dynamics. However, the findings indicate that attention dynamics tend to improve after the second or third measurement, typically occurring at 20-30 minute intervals. This aligns with the theory that 20 minutes is sufficient for attention reset. Attention dynamics then diminish towards the end of the walk due to physical exhaustion. It was hypothesized that adequate rest could lead to improved dynamics.

In the modelling of the walking path network and route selection, cognitive factors such as the purpose of the walk, group participation, individual walks, social interactions, and the perception of the three-dimensional spatial environment serve as the foundation for designing the layout of walking paths. The study raises intriguing and complex research questions, further complicated by the diverse groups involved, including students, families, and the elderly. Social factors play a pivotal role in determining the optimal path for both fundamental research and practical applications. Understanding the mechanisms and information sources guiding decision-making in path selection should encompass not only psychological but also social aspects. This comprehensive approach will contribute to a better understanding of path planning for psychological wellness and the cultivation of emotionally positive behavioural patterns.

Keywords: urban forestry management, walking paths, environmental psychology, attention, COVID-19

Introduction

Nowadays, due to urbanization, the connection with nature has been lost in cities in many countries. The new generation, who have grown up in an era of computerization and digitization since early childhood, tend to have a stronger bond with digital tools than with nature. There is a growing trend among the new generation of completely disconnecting from nature, even in countries blessed with abundant green spaces [1].

In the administrative unit known as "Zilie kalni" (Blue Mountains), a network of walking paths, ski tracks, and cycling trails has been established, along with infrastructure for dog sledding and horseback riding. For most residents, walking paths and ski tracks are the primary means of recreation. In this study, we examined the structure of these walking paths, identified the most popular routes, and delved into the specific characteristics of individual routes. We also analysed the planning principles used in developing these paths, taking into account the need to protect natural habitats, avoid areas with protected plant species, assess landscape characteristics, consider expert opinions on improvement and landscaping requirements for preserving ground vegetation and soil, and prioritize psychological wellness. We observed how various stimuli and modifications to path and route layouts impact human attention. The quantity and diversity of stimuli play a pivotal role in influencing information flow, which is crucial in the planning of walking paths for assessing psychological comfort.

This study is part of a larger research effort aimed at facilitating more comprehensive recreation and ensuring that walking paths offer maximum physical and psych emotional comfort. The objective of this research is to illustrate the principles underlying the planning of a network of nature park paths, drawing not only from landscape architecture but also from findings in environmental psychology. This holistic approach is expected to yield superior recreational outcomes and subsequently contribute to positive effects on human health. THE RESEARCH OBJECTIVE: To investigate the influence of different types of nature walking trails on human attention dynamics. The research tasks are as follows: 1) Describe the theoretical framework of walking paths and its relationship with human

neurocognitive processes; 2) Design a quasi-experimental research methodology involving walking paths and attention measurement methods; 3) Analyse and interpret the obtained data. RESEARCH QUESTION: How does the type of nature path affect human attention?

Theoretical background

Walking paths and nature park "Ogres Zilie kalni"

Throughout history, people have consistently sought ways to lead comfortable and happy lives. The concept of happiness can take various interpretations, but in the context of urban environments, happiness has gained particular significance in recent decades. Urban social psychology defines happiness as an emotional state characterized by maximum attractiveness, where emotions are considered integral to the flow of information [12].

This definition has guided our study towards investigating the potential for achieving enhanced recreational outcomes in the "Ogres Zilie kalni" nature park, which is situated within the administrative unit of "Zilie kalni." Ogre, a city in Latvia, is located in close proximity to the "Ogres Zilie kalni" nature park. Notably, Latvia boasts ample green spaces within short distances of its cities and towns, with forests covering 53 % of the country's territory, and recreational areas making up eight percent of this total [13].

Andrew Przybylski, a professor at Oxford University, highlights that nature has the capacity to alleviate the negative aspects of social interactions that tend to alienate individuals from each other, particularly evident during the challenges posed by the COVID-19 pandemic [24].

Ogre, being easily accessible to the residents of Riga, transformed into a tranquil resort town during the first half of the 20th century. Following the Second World War, the adjacent pine forest area became part of Ogre's green belt. In 2003, the first nature protection plan was formulated for the urban forests of Ogre and Ikšķile, leading to the establishment of the specially protected nature territory known as the "Ogres Zilie kalni" nature park [11]. In 2010, an administrative unit was created to manage the territory efficiently, encompassing the "Ogres Zilie kalni" nature park, which constitutes 312 hectares of the administrative unit's territory [14]. Situated conveniently between Ogre and Ikšķile, the urban forests of the "Zilie kalni" administrative unit are not only ecologically valuable due to their biodiversity but also serve as crucial recreational resources. One notable feature of these extensive green areas is their suitability for modular and decentralized projects, offering operational flexibility. A primary responsibility of the administrative unit's management is the establishment and enhancement of environmentally friendly improvement and landscaping infrastructure, which includes optimizing the path network and developing path layouts.

It is essential to recognize that a nature park, or any park for that matter, cannot be fully utilized without an appropriate walking path structure, as paths serve as the lifeblood of a nature park. The goal is not only to ensure that visitors can traverse the territory but also to provide them with a sense of physical and emotional satisfaction and contentment. One of the traditional criteria for path use is the walking path's surface covering, which can be either comfortable or uncomfortable (even, covered in tree roots, bumpy, too wet, or too sandy), natural or artificial (gravel, woodchips, cobblestone, or concrete paving, concrete, asphalt, or other surface materials). In today's planning considerations, path network layout is equally crucial, taking into account the emotional perception of the path layout, where factors such as the number of stimuli and the flow of information are significant. The landscape view should incorporate "openings" and "closings" to achieve a sense of horizontal balance, with a recommendation for harmonious scale and proportions [15, *77*].

Within the administrative unit of "Zilie kalni," the path network extends for over 40 kilometers, gradually forming over time as people regularly visit the area. This territory is a favored destination for walkers, joggers, cyclists, skiers, and holidaymakers who gather at the Dubkalni Water-reservoir. Over an extended period, certain visitor groups, notably skiers and cyclists, have undertaken unauthorized efforts to enhance and landscape areas used for their fitness activities.

A ski track runs alongside the water-reservoir, offering skiers a captivating panoramic view of the reservoir and the picturesque forest landscape beyond it. Further along the track, it meanders into the forest. Through deliberate and incremental efforts spanning from 2014 to 2020, ski tracks were established, and maintenance activities were implemented during the winter months. Notably, approximately ten kilometres of these ski tracks are illuminated by lighting fixtures, contributing to both the physical and emotional safety of visitors and providing a sense of psychological comfort. Consequently, this well-maintained network attracts a significant number of visitors.

The appeal of a trail and the level of emotional comfort it offers are influenced not solely by landscaping efforts. Layers of the landscape or distance zones (foreground, middleground, and background) play a crucial role in landscape perception [15, *77*]. Along the trail adjacent to the Dubkalni Water-reservoir, for instance, visitors are presented with a distant view encompassing both the foreground and the midground (water) in addition to a varied and evocative background. This design principle, which incorporates at least two landscape layers, holds significance in organizing paths through forests as well, whether it involves an open landscape adjoining a forest, a forest with a panoramic view of a body of water, or other combinations. The planning of walking routes should also account for direct sensory diversity [18], providing distinct information and various stimuli, such as the linear view of a path extending straight ahead, alterations in the

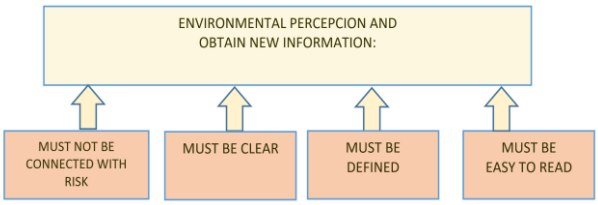

Fig. 1. The important for an individual to obtain new information [Ulrich, 1977]

viewing direction of the landscape, changes in path elevation, the utilization of diverse path surface materials, and more. Environmental diversity serves as a stimulus for cognitive development, as suggested by Zhang et al. (2018), who noted that "enriched environmental stimuli may affect neuromorphological structure and behavioural function" [26].

The nature park's unique characteristics impose significant constraints as it is situated within a specially protected natural territory. The Environmental Protection Plan for "Ogres Zilie kalni" Nature Park (2011-2026) [11] stipulates the need for optimizing the existing dense network of paths by eliminating redundant parallel routes. Therefore, a meticulous assessment is essential to determine which walking paths should be preserved and further developed.

Presently, the situation reveals that smaller paths are considerably widening due to the substantial anthropological foot traffic. This results in soil compaction, making it harder to traverse, with tree roots encroaching on the path, causing visitors to stray from the designated route, further widening it unintentionally. To counteract this spontaneous path expansion, improvements in path surface coverage are imperative to enhance comfort and walking path direction planning must be undertaken to strengthen the emotional connection. However, this task is complicated due to the nature park's management restrictions.

Creating panoramic views emerges as a pivotal factor in determining the desired walking path direction. Nevertheless, there are limitations on logging activities for the purpose of establishing open panoramic vistas or crafting new walking paths. Consequently, a comprehensive analysis of visitor behaviour patterns becomes essential.

Walking path impact on human wellness and attention

In the contemporary landscape, stress and the shift to remote work during the COVID-19 pandemic have opened up new avenues for the development of green spaces. According to information available on the website of the Centre for Disease Prevention and Control of Latvia (SPKC), "*the good mental health of an individual and society as a whole is a key prerequisite for shaping a stable, safe, and prosperous society [...]. It is crucial that an individual can reach their full potential, effectively manage the daily stresses of life, work productively, and contribute to society*" [16]. Drawing from studies in environmental psychology, it is evident that individuals benefit from exposure to diverse and abundant information, thereby ensuring psychological comfort and subsequent positive impacts on human health [22].

One study highlights seven overarching environmental aspects that enhance health and stimulate cognitive activity. These aspects include the necessity for a natural, aesthetically pleasing environment that is informative and comfortable. Furthermore, the environment should possess qualities such as being engaging, diverse, and dynamic, while also contributing to cognitive improvement across various dimensions, including the differentiation between cognitive phases, engagement of the five senses, and elicitation of a range of emotions [26]. Psychologist Roger Steffen Ulrich posits that throughout the course of human development, those who thrived were often the best-informed individuals, as situations allowing the acquisition of new, biologically rewarding information were favoured. It is vital that information acquisition does not involve undue risk. Therefore, the environment or landscape must remain clear, well-defined, and easy to navigate, devoid of hidden dangers – such as darkness in a forest or an incomprehensible walking path direction (Figure 1) [22].

A number of studies emphasize the significant role of nature, environmental conditions, and the infrastructure of natural territories in improving health [5; 21]. The primary attraction of this administrative unit lies in its captivating landscape relief, characterized by eskers and protected open pine forests interspersed with extensive stands of firs and deciduous trees. A prominent landscape and recreational feature is the Dubkalni Water-reservoir, which was formed in 2003 following the closure of a gravel pit.

The paths are used for walking by the elderly, families with children, as well as by groups of pupils and students. This is associated with the natural need to maintain a connection with nature and to be in a scenic environment that stimulates all five senses. On the other hand, Chinese-born American geographer Yi-Fu Tuan and interior architect Heinrich Hermann emphasize that spatial order [4], where stimuli do not disturb but create inner silence, diverts the visitor's thoughts from the external to reflection and contemplation [15, *78*]. This becomes increasingly necessary every year in today's fast-paced life.

The key role played by the landscape in developmental psychology must also be taken into account from childhood to old age. Considering the choice of environments to promote the development of children's neural plasticity and cognitive abilities as much as possible, as well as to fundamentally facilitate their physical and mental health, the landscape must be stimulating. This stimulation can be achieved through diversity, among other factors. Specific sections designed for children may be included in the layout of walking paths, with additional signs pointing out environmental objects, panoramic views, and major focal points in the

landscape to capture a child's attention and develop their observational skills. When creating a network of walking routes, researchers emphasize the importance of a green, clean, and cheerful infrastructure that fosters imagination [17]. Outdoor activities can significantly enhance the physical and mental health of children. The results of a Canadian and Norwegian study show that activities in the forest or garden can improve attention focusing and self-regulation skills in preschool-age children and help prevent symptoms of attention deficit hyperactivity disorder [23].

The same aspects are equally important for other age groups with a high incidence of cardiovascular diseases. When planning trail directions, it should be taken into account that in the "Ogres Zilie kalni" nature park, eskers alternate with the so-called 'ice pits' – deep, crater-like pits with high sides formed in places where buried icebergs melted [3]. Here, on hot summer days with temperatures above 25-27°C, a zone of oxygen depletion can form, which may cause breathing difficulties for certain groups of senior citizens. Simultaneously, we must consider the mental health of the elderly, which is especially relevant today, as the number of people affected by dementia is on the rise. Recent studies have found that the period from 2020 to 2022 [2] has led to new habits among visitors to natural territories. This process of improvement and landscaping has prompted the idea of developing a larger number of small local recreational sites [10]. This approach is highly beneficial for the elderly, ensuring safe and enjoyable outdoor activities. Creating resting places next to walking paths encourages greater involvement of the elderly in longer walks, which can slow down the progression of dementia symptoms. Being active for just 20 minutes outdoors can stimulate the brain, releasing hormones that create an environment suitable for the growth of new cells. Outdoor activities also promote neural neuroplasticity, stimulating new connections among cells in the areas of the cerebral cortex responsible for speech, information processing, interpretation of sensory stimuli, coordination, and complex reasoning.

One of the ways in which these benefits manifest is through human attention. Attention is the means by which humans actively process a limited number of incoming stimuli [20]. When people are stressed, fail to take breaks, and actively try to focus on more than one thing at a time (multitasking), they expend their mental resources, further fatiguing their attention and other cognitive processes [19]. The way people focus their attention determines their neural pathways, and in turn, it affects their wellness [7]. If humans focus on negative, critical aspects, they develop negative thought habits (automatically), which in turn diminishes their mental wellness [6; 19]. When people allow themselves to focus on only one thing at a time, allow their attention to wander, and generally relax, their mental resources renew, and their ability to focus, attention span, switch attention from one object to another, and overall attention dynamics improve [8]. The issue is that our neurons can't switch off as quickly as people would like, and humans need an external method to facilitate this process. One effective method, as proven in experimental research designs, is walking in nature. This approach is also proposed by the attention restoration theory. Walks in nature stimulate the flow of oxygen to the brain, reduce stress, and promote wellness among trees. By developing these as habits, overall mental and physical health improves [25].

Materials and Methods

DATA OBTAINING METHOD: In order to obtain data about attention dynamics, Schulte Tables test electronic version was used. Schulte Tables test originally is a per-and-pencil test placed in a 5x5 matrix which has random numbers from 1 to 25 and usually the researcher asks to find consecutive numbers from 1 to 25. Usually, the researcher asks to identify and point with a pencil or pen at the numbers from 1 to 25 arranged in a jumbled sequence, recording the time for each table with a stopwatch before moving on to the next table that the researcher presents to the respondent. Due to the conditions of the research, this test would be difficult to administer in a group in this per-and-pencil format. Thus, the test is readily available as a mobile application. Each of the respondents downloaded the application in their phone, then instructed what to do and then they began the test. Respondents were asked to find consecutive numbers from 1 to 25 in a table by pressing with their finger in the mobile phone application. They had to fulfil five tables in each test. The time to complete each table was electronically recorded. In total the measurement was taken 55-times

RESPONDENTS: A total of 18 respondents, aged between 25 and 73, took part in the study. It is important to notice that all of the respondents are not residents of Ogre and does not visit the hiking trails on a regular basis, thus the trails were relatively unknown to them. The participation was voluntary, and respondents could leave the procedure at any moment they wanted to.

PROCEDURE: In order to be able to assess the layout of the nature park paths on the dynamics of attention, an analysis of cartographic material and a topographic analysis of the path plan were carried out, as well as an assessment of the situation in the nature park. The intensity of the use of the paths that had been designed in different ways and the effect on the dynamics of attention were analysed and compared. After a face analysis of the mood of visitors and their choice of routes, principles of planning on the basis of environmental psychology have been proposed that are aimed at providing a higher level of psychological comfort. During the development of the strategy, findings of studies were used that show the impact of aesthetic informational stimuli, as well as landscape arrangement, proxemics, and landscape structure stimuli on sensor receptors [15].

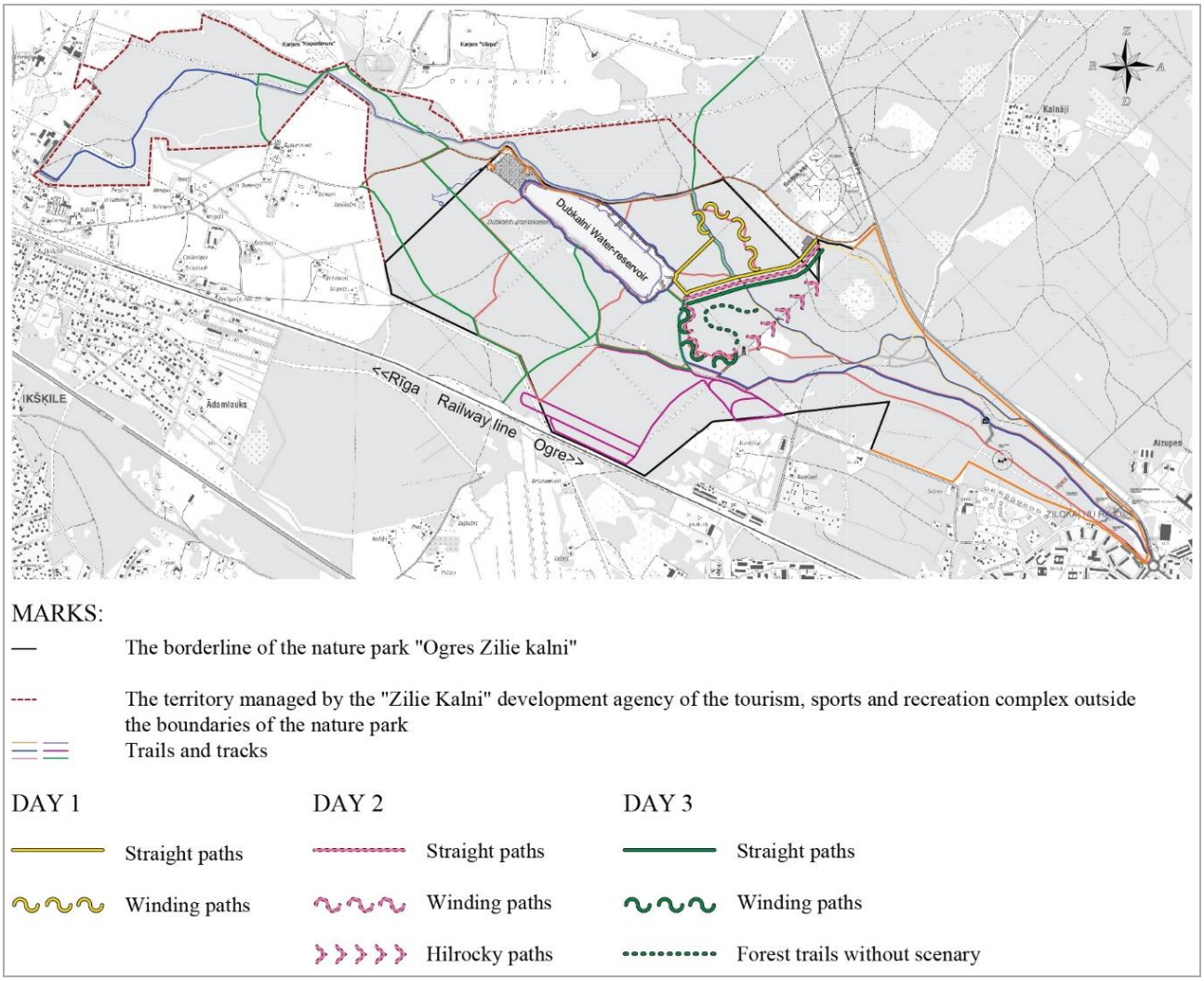

Fig. 2. The routes of the analysed paths of Nature Park „Ogres Zilie kalni" (Day 1, 2 & 3) [Created by I. Kraukle]

After assessing respondents' readiness, they completed a series of 5 Schulte Tables test. Different types of paths were chosen – (A path), with a simplified, straighter route (less stimuli) and (B path) a winding, calmer and remote reflection-inducing paths (Figure 2). Respondents completed a series of 5 tables before starting the walk, then completed a series of tables completing the A path, and at the end of the walk completing the B path, totalling three measurements that were then compared with each other. Measurements were made several times, slightly changing the route. The total average length of the walk is 2 km, the average walking time is 40 min. The average length of each trail is 1 km, time – 20 minutes.

Results and Discussion

To study the influence of different pathway structures, total of 55 measurements were performed, using the Schulte Tables. Both simpler and more complex layouts of walking paths were chosen for the measurements. The measurements (Mr) were compared, and their ratio expressed as a percentage (Tab. 1).

The results demonstrates that on Day 1 and Day 2, the attention is most effective after winding paths which was

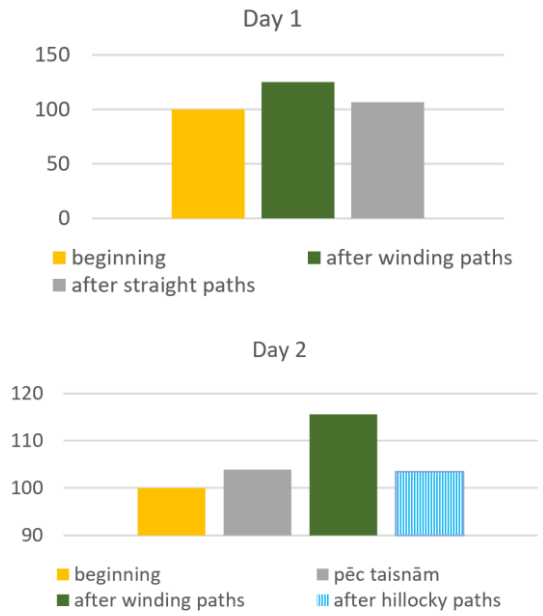

Fig. 3., Fig. 4. Summary results on the dynamics of attention (Day 1 and Day 2) [Created by R. Čaupale]

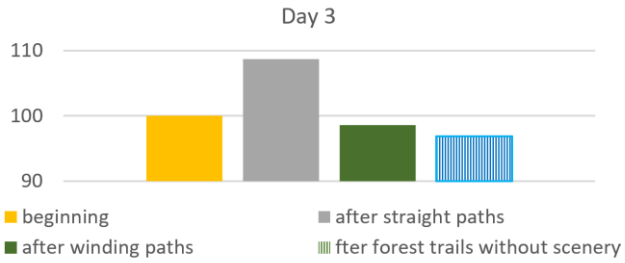

Fig. 5. Summary results on the dynamics of attention (Day 3) [Created by R. Čaupale]

TABLE 1

Improvement of the dynamics of attention (IDA), where Mr1 – measurement at the start of the trail section, Mr2 – measurement after the outlet trail section [Created by R. Čaupale]

Characteristics of the operation	Improvement of the dynamics of attention (IDA) IDA = Mr1/Mr2
Day 1	
Beginning.	**100 %**
Average Mr after winding paths.	**125.3 %**
Closing. Average Mr after straight paths.	**106.6 %**
Day 2	
Beginning.	**100 %**
Average Mr after straight paths.	**103.90 %**
Average Mr after winding paths.	**115.56 %**
Closing. Average Mr after hillocky paths.	**103.40 %**
Day 3	
Beginning	**100 %**
Average Mr after straight paths.	**108.7 %**
Average Mr after winding paths	**98.6 %**
Closing. Average Mr after forest trails without scenery.	**96.9 %**

the 2nd measurement on Day 1 and 3rd measurement on Day 2. On the Day 3 results indicated the same, attention peaked after winding paths, which was the 3rd measurement. Attention dynamics subsided at the end of the walk due to physical fatigue. Since the measurements were taken at different intervals time wise in each day, the attention dynamic peaked either on 3rd or 2nd measurement. On Day 3 the attention dynamics decreased at the end because this was the longest of walks and the physical fatigue impacted it. The aggregated results show distinct improvements in attentional dynamics, well-illustrated by the graphs (Fig. 3, 4, 5).

Observations over the last couple of years, especially during the COVID-19 pandemic, show that nature park visitors prefer paths that lead mainly towards remote contemplative routes. Even small bends that form organically in the forest reduce the impression of the walking path being a straight line. A trend of avoiding distinctly wide and dusty paths that are too straight if their route is oriented in a single direction only. As the small paths were not comfortable enough (possibly due to the characteristics of the surface covering), the large paths saw a concentration of an influx of visitors, and it was difficult to achieve the desired distancing, which goes against the principles of proxemics when attempting to provide psychological comfort.

Conclusion

The obtained research results do not provide an unequivocal answer about the influence of the type of path on the dynamics of attention. Results indicate that attention dynamic improves after 2nd or 3rd measurement, which was usually 20-30 minutes. This is consistent with theory that 20 minutes is just enough to reset attention. Attention dynamics diminished again at the end of the walk due to physical exhaustion. It was be hypothesized that after appropriate rest, the dynamics would improve. It can also be speculated that the results were impacted by the fact that respondents were communication amongst one another, thus disturbing them to focus on the environment and rather kept their attention engaged in social interaction. It would be beneficial to further research attention dynamics when people have less interaction and pay more attention to the paths and environment. In order to obtain more qualitative measurements, the research needs to be expanded, by performing the task on a larger number of respondents, supplemented with other methods, and taking into consideration 20–30-minute time limit per walk. In the next study, it is planned to evaluate whether the improvement of emotional wellness, which is also related to the quality of the dynamics of attention, is associated only with walking or is associated with different types of external stimuli, and what type of planning improvements (changes in the linear planning of trails, diversity of landscape layers, etc.) would be more successful.

When modelling the walking path network and path route, cognitive factors such as the goals of the walk, participation in a group or walking alone, social relations, as well as the perception of the three-dimensional spatial structure of the environment, which serves as a basis for creating the structure of the walking path layout. The study raises a number of interesting yet complex research issues, which are made more complex by the characteristics of the interacting groups of individuals – pupils and students, families, the elderly. Social factors play a key role in setting the right path both for fundamental studies and practical applications. Understanding of the mechanisms and information sources that drive decision-making in the choice of a walking path must include not only psychological but also social aspects, which would provide a more comprehensive understanding of path planning to create psychological wellness and an emotionally positive behavioural model.

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Kopsavilkums. Šodien daudzās pasaules valstīs urbanizācijas dēļ lielpilsētās ir zudusi saikne ar dabu. Tas aktualizē pētījumus par dabas nozīmi pilsētas iedzīvotāju ikdienā, it sevišķi pēc COVID-19. Esošais pētījums ir daļa no plašākas pētnieciskās ieceres, kā nodrošināt pilnvērtīgāku atpūtu, lai takas maksimāli sniegtu gan fizisku, gan psihoemocionālu komfortu. Izpētes teritorija – dabas parks "Ogres Zilie kalni", kur ir iekārtotas atpūtas un aktivitāšu takas. Lielākai daļai iedzīvotāju atpūtai svarīgākas ir pastaigu takas un slēpošanas trases. Pētījumu mērķis ir parādīt dabas parka taku tīkla plānošanas principus, kas balstīti ne tikai uz ainavu arhitektūru, bet arī uz vides psiholoģijas zinātni. Tādejādi var sagaidīt labāku rezultātu rekreācijai un secīgi labvēlīgi ietekmēt cilvēku veselību. Pētījuma mērķis: noskaidrot dažāda veida dabas pastaigu taku ietekmi uz cilvēka uzmanības dinamiku. Pētījumā, izmantojot psiholoģijas metodi *Šultes tabulas*, tika vērtēts, kā atšķirīgi stimuli taku un maršruta plānojumā, kā dabas taku veids ietekmē cilvēka uzmanību.