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Benefits of Viewing Nature: A Review of Landscape Health Research

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ABSTRACT

Nowadays, several studies demonstrate that viewing nature has positive effects on human health and well-being. This essay discusses about the essential methods of viewing natural environment and their impacts on human well-being by clarifying four important theoretical models: reducing stress, lowering heart rate, improving outcome of surgery, and increasing attention. In addition, some important research results in this field are taken as examples to introduce research methods. By collecting and organizing existing studies and theories about the relationship between viewing nature and human well-being, the methods of viewing nature can be divided into two parts: viewing nature through specific media (e.g., through a window, a book, a painting or a videotape) and being with the presence of nature. This study aims to clarify the research significance of viewing nature and find deficiency in this field to maximize the role of landscapes in human health and well-being.

1. Introduction

1.1 Nature and Health

No matter where we come from in this world, viewing natural landscapes seems to make us feel good. Several ways can be used to view nature: the first is viewing nature through a window; we often spontaneously view natural landscapes in this way, and we may not even realize it; the second is on television, in a painting or in a book; the third is being with the presence of nature (e.g., in a forest or in a normally nearby nature). This essay provides a general description of the relationships of viewing natural scenes with mental and physical health and cites certain previous studies to support it.

The belief that viewing vegetation, water, mountain, and other natural elements can reduce stress and be fa-

vorable to patients in the healthcare environment can be traced back to some earliest large cities, like Persia, China, and Greece. In the Middle Ages, the first hospitals in Europe were infirmaries in monastic communities where a cloistered garden was a fundamental part of the environment used to bring relief to the ill^[1]. In history, the relationship between nature and healing has been replaced by the increasing number of technical approaches, and the idea that access to natural environments can help recovery has lost its significance^[1-2].

Whereas, in the last 35 years, these traditional methods of connecting nature to healing have gradually reemerged as an important topic in the field of human health. Relatively rich studies have been conducted to help explain the methods of nature, and other environments have an effect on human health. Several theories and approaches have been proposed for explaining and evaluating the effect of

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natural scenes on human health. Ulrich's stress recovery theory is a relatively convincing theory, which suggests that natural scenes is beneficial to reduce stress, whereas settings in the built environment is favorable to hinder recovery from stress. Another theory states that people have a common innate bond with nature, which implies that certain kinds of contact with the nature may be directly advantageous to health^[3]. Some studies have shown that health benefits related to experiencing nature is based on the opportunity to notice and observe nature, rather than participating in natural activities^[4]. On the basis of the discussion about four important theoretical models and the elaboration of research methods by using three concrete studies, this essay categorizes the ways of viewing nature: viewing from the window (without being exposed to natural environment) and viewing in natural environment. The essay also points out the deficiency of the current research in this field.

2. Four Important Theoretical Models

2.1 Viewing Nature Contributes to Reducing Stress

Wells and Evans^[5] noticed that children aged 8-10 years old, who are exposed to indoor and outdoor vegetation in five upstate New York communities, are relatively less stressed out and more easily to get recovery from stressful events than those who live in homes with little green space^[5].

Xinxin Wang et al.^[6] revealed that urban parks offer great opportunities for people to enhance their physical health and psychological well-being. After finishing an oral examination as a stressor, participants were randomly assigned to watch one of the seven videotaped scenes during a stress recovery stage, including six urban parks and one urban roadway scene, and data were collected based on the changes in stress and attentional levels. The results suggested that people may increase the stress recovery potential of urban parks when the numbers of nature-based elements and reduced crowds are high^[6].

2.2 Viewing Nature Contributes to Lowering Heart Rate

A study of the effect of observing natural scenes on the physiological and psychological health of middle-aged hypertensive men has an interesting finding. The restorative effects of exposure on the forest environment were researched. Middle-aged hypertensive men were assigned to sit on chairs and viewed forest scenes for 10 minutes. The results suggest that parasympathetic nervous activity was much higher while viewing forest, whereas heart rate

was much lower while viewing forest, implying that forest landscapes can produce the benefits of physiological relaxation on hypertensive men^[7].

Another study of the function of viewing natural scenes on the physiological health of aged women also shows similar results. A quasi-experiment was conducted to measure the physiological characteristics of aged women when they observed different landscapes. Heart rate and blood pressure were monitored when aged women viewed a natural landscape, a built landscape, and a control room with no outside views. The results suggest that observing the natural landscape made for lower systolic and diastolic blood pressures and lower heart rates than those measured in the control room. Observing the built landscape also had the universal effect of lowering blood pressures and heart rates, although the effect was less consistent, and the magnitude was smaller than that induced by viewing the natural landscape^[8].

2.3 Viewing Nature Contributes to Improving the Outcome of Surgery

Records show that between 1972 and 1981, the recovery of patients from cholecystectomy in a suburban Pennsylvania hospital was tested to find out whether a room with a window view of a natural landscape can have restorative effects. Twenty-three surgical patients were arranged to rooms with windows where they can view the natural landscape. These people commonly had shorter postoperative stay, got less negative evaluative comments on nurses' notes, and used less analgesics than the twenty-three patients who stayed in similar rooms but without windows^[9].

Diette et al.^[10] found that pictures and sounds of nature have great benefits to patients. One group of patients was equipped with a landscape picture to view and listened to the sounds of birdsong and a brook before the operation of bronchoscopy. This group showed a 50% higher level of good or excellent pain control than those who were not equipped with pictures and sounds. It implies that more natural features can be equipped in operation rooms to help improve the outcomes of surgeries in the future^[10].

2.4 Viewing Nature Contributes to Increasing Attention

A theoretical view suggests that the individual's ability to concentrate may become fatigued when the need for attention increases. Once fatigue occurs, attentional restoration must have a response, and it can be promoted by looking at nature. This view was explored in detail in a

previous study, which explored whether college students who live in dormitories with more natural scenery outside the window are score taller than students in dormitories with less green views in a directed attention test. According to the views from the dormitory windows, 72 students are divided into four groups, ranging from nature to the built. A variety of objective and subjective measures were used to assess direct attention. The result supports the proposed theoretical view, that is, natural views have positive effects on promoting directed attention^[11].

Another study supports this finding to an extent. It focuses on examining whether observing nature pictures can improve executive attention in adults. The results show that, according to the results of the attention network test, viewing nature rather than urban pictures can greatly increase the executive attention of the young and older adults, and the effects observed in the two control groups are similar. The scores of alerting and orienting attention are unaffected by picture viewing^[7].

3. Research Methods

3.1 Study 1: Stress Recovery Effects of Viewing Urban Park Scenes

Wang et al.^[6] discussed the stress recovery effects of viewing different videotaped scenes, including natural and urban scenes. Although several studies have demonstrated that natural landscapes are beneficial to human health and wellbeing, few of them have seriously measured the restorative effect of specific landscape elements in Chinese environments. The urbanization in China brings many hardscape elements in cities; thus, exploring the restorative quality of urban green space is a significant issue. This study mainly covered the stress recovery capacities in different videotaped scenes consisting of six urban parks and one urban roadway scene. In this study, participants were recruited from the Architecture College, Tongji University. A total of 140 students aged 18-24 years old from this university were involved in this experiment. Considering that it is a public university, more than 90% of them coming from the area outside Shanghai. Moreover, these students are from 16 different disciplines, and all of them have been attending the university for more than one year. They (one half of male, one half of female) were randomly assigned to complete the experiment, watching one of the seven videos (20 subjects watched each scene).

A total of 76 urban parks were investigated in preparation for the study, which are located in the high-density districts of Shanghai. Before selecting the six representative parks from the sampling frame, all 76 parks were

catalogued. Two types of parks exist: 14 municipal-level urban parks and 62 district-level urban parks. Municipal-level parks serve people in the whole city (average 19.39 ha), whereas district-level urban parks serve people in the adjacent neighborhood (average 2.85 ha). In these potential sites, municipal-level urban parks were found numerous in different kinds of natural environments, and they are better maintained than district-level parks. In addition, the management and whether they have visible water feature were considered.

An urban roadway was selected to make a comparison among the scenes of urban parks, which have a similar openness to the scenes of the park in this research. This road was not served for recreational uses, as shown in urban parks, but it is common in high-density cities, such as Shanghai. This kind of road is generally viewed by high-rise buildings residents in China.

This study took a previous videotaped approach as reference^[12], simultaneously recording video audios and images on sunny days in April and May 2014. The video was taken at several different edges around each site, and some people were recorded in the video. Finally, an eight-minute colored video was made. The decision of making an 8 minutes video was referred to previous studies^[13-15]. In the pretesting, some participants showed impatience at the 10-minute mark, and few impatient participants were noticed in the eight-minute video.

This study conducted an 8 minutes timed English speaking examination as stress induction. All of the participants speak English as a foreign language. Karmanov and Hamel^[12] used examinations as stress induction. Meanwhile, Salehi and Marefat^[14] and von Wörde^[17] found that students feel stressed when speaking in English or other foreign languages. The examination in the study was administered by a computer during the whole process, and the participants were required to obey the instructions of an examiner who speaks English only.

Stress level has two major measures: physiological and psychological indexes. Physiological indexes include skin conductance response (SCR) and R-R interval. Skin conductance is a common measure of stress. Higher conductance indicates higher stress levels. In this study, a wireless device (Biopac MP150) was used. Participants were asked to wear a special shirt, which is equipped with a transmitter, allowing them to freely move their bodies during the experiment. Electrocardiography was also used to produce electrocardiogram (ECG), a graphic that traces the electrical activity of the heart. The longer the R-R intervals, the slower the heart rate, and vice versa, suggesting increased stimulation or stress. Psychological indexes consist of health status,

state anxiety, attention, restorativeness, and experience. Health status data were taken from the questionnaire, which used a five-point Likert-type response set. Participants were asked to rate their health condition and their frequency of suffering from physical illness. Some questions about emotional problems and whether such problems influence their social activities were also involved. State anxiety data were collected using the State Trait Anxiety Inventory (STAI-S)^[18-19]. Considering that data from ECR and SCR can only measure the emotional changes of participants, such data cannot be used to distinguish subtle emotions, such as anxiety, anger or excitement, all of which can influence heart rates. Attention data were collected using the Digit Span Backwards (DSB) test^[20], which can evaluate the attentional level of participants by asking them to recall a set of numbers accurately. Although the effects of stress reduction and attention restoration have some common characteristics and can be regarded as synthesized outcomes, they belong to different theories: stress reduction theory and attention restoration theory. The data of restorative effect and experience were collected using the perceived restorativeness scale (PRS). It has been extensively used as a tool for measuring the restorative quality of physical environments^[21-22].

Upon entering the laboratory, the participants were given a printed sheet, which introduced the goals and measures of the experiment. When filling out the sheet with their information (including health status), the researchers attached the sensors to the participants. The participants were seated on a chair at that time and were given 2 minutes to adjust the device on their bodies before conducting the ECG and SCR tests. They were also asked to sit for three minutes for recoding baselines. During the stress and recovery stages, all intervention stimuli were delivered on a 19-inch computer monitor. The stressor “mock English speaking examination” lasted for eight minutes on the monitor. Subsequently, the video directed participants to conduct the DSB test, which took about 3 minutes.

During the recovery stage, each participant watched one of the videos for eight minutes.

ECG and SCR measures were monitored throughout the stress and recovery stages. When the recovery stage was completed, the second round of the DSB task started. The participants also performed PRS test and STAI-S tests to show their emotional changes before and after watching the video.

The reason why this article was selected is because it has a well-designed experiment and introduced many common measures for researching about viewing nature.

Both factors are beneficial for the further research on this topic.

This study has good points. First, the sample size, that is, 140 is large. Second, the Pretest-Posttest Control Group was used. The sample was randomly selected, which makes the findings convincing. Third, the procedure was described in sufficient detail, which is beneficial for another researcher to repeat the investigation for further advancement.

However, the limitation of this study is that a selection problem exists. Only one semi-enclosed scene, walkway, was included. Therefore, fully exploring the differences in the restorative effects between open and semi-enclosed space is difficult. Further research can be organized to include a systematically varied range of scenes with different degrees of openness^[6]. In addition, given that the sample included all university students who have the same age range and same educational background, the research findings cannot represent the people from all walks of life. Future studies are supposed to include people of different ages, especially elders with reduced functional abilities who are greatly different from the age group tested here^[23]. A wide range of educational backgrounds can also be included in future research as Yu^[24] pointed that there are remarkable differences in landscape preference among different educational levels in his study.

3.2 Study 2: Physiological and Psychological Effects of Viewing Urban Forest Landscapes

Tsunetsugu^[25] measured the physiological and psychological influences of viewing urban forest landscapes in Japan using multiple methods.

Abundant studies have demonstrated the connection between contact with nature and good health to a considerable extent^[26]. Nevertheless, green space's health benefits are still not fully accepted in urban planning and decision-making^[27].

To raise the awareness of such an issue in urban planning, to evaluate the health benefits with credible measurements and providing sufficient evidence are necessary. Some reviews have indicated that quantitative data and controlled studies are lacking, although green areas and relevant interactive activities are recognized as sanative settings. Therefore, scientific research is essential to enhance the position of health benefits brought by nature in the governmental decision-making process^[28]. Several studies have gotten down to this requirement. Some previous studies have reported that visiting forests has more significant positive effects on low blood pressure and pulse rate than urban settings. However, these studies have only treated with a small group of subjects or only

targeted psychological responses. Therefore, this research explored the physiological and psychological responses to natural and urban settings in a larger group than previous studies. This study aims to find evidence for incorporating green space in urban design and planning by clarifying the influence of the two different settings. This research also focuses on two questions: (1) are there differences in the influences of environment between forested and urban environments? And (2) are there differences between short-term visits in accessible forests and long-period visits in the same settings?

The studies were implemented in four areas in central and western Japan (e.g., Kamiichi Town, Yoshino Town, Akiota Town, and Oita City). In each area, participants needed to visit two experimental sites: a forest site and an urban site. The forested area is among the important recreation areas in the local municipalities with 800-34,225 ha. The downtown area is located close to the commercial center of each town and city. Conifer species mainly populated two of the forest views. For the two other forest views, one was dominated by deciduous tree species, whereas the other had a view of a small lake combined with a forested landscape. No buildings or roads were found in the forested areas, except the spot facing a trail in Akiota. Every urban view consisted a road where traffic passed at a rate of 10-45 cars per minute. The studies took two days in different areas and were taken in August or September in 2011. 12 male university students (21.1 ± 1.1 years old) took part in each experimental area, hence a total of 48 subjects. They were assigned in the morning of the first experimental day and signed an informed consent. Half of them were assigned to the experiment in a forested setting, whereas the rest was tested in an urban setting on the first day. The participants took a bus to each site; the ride took approximately an hour to an hour and a half. In the experimental sites, each participant waited in turn to take part in an individual viewing session. When the time came, each participant was asked to fill in the Profile of Mood States (POMS) questionnaire, which evaluates the following six mood states: Tension-Anxiety, Depression-Dejection, Anger-Hostility, Fatigue, Confusion, and Vigor. After riding a car to a viewing spot to view a landscape for five minutes, each participant took a five-minute rest and underwent a camping chair's physiological measurements. Subsequently, they were asked to sit to view the landscape for 15 minutes. The physiological measurements consist of the continuous measurement of the periods between two consecutive heartbeats (AC-301A, GMS Corporation) and the measurement of systolic blood pressure and diastolic blood pressure

(HEM1000, Omron). After the 15-minute viewing, each participant experienced another blood pressure measurement. Three different questionnaires followed the physiological measurements: a subjective rating of the levels of comfort, sedation, and naturalness; the state of being refreshed; and the POMS. On the second day, the participants visited the opposite area to exclude the effect of order.

This study has good points. First, its purpose was clearly defined, and some common concepts were used. Second, the research design was suitable to answer the research questions. Third, methods to control relevant confounding variables were applied. For example, in the experimental design, participants were designed to visit the opposite area to eliminate the influence of order.

However, this study has certain limitations. First, each participant visited forest and urban areas only once for a short time, which induces the influence of repeated visits, and long-term effects remain unclear. Second, the participants purely comprised healthy young males. Therefore, whether the results can be generalized to different groups of people, such as children, seniors, females, and patients, is unknown. According to the authors' statement, the most direct solution to this problem is to conduct further research to ascertain diverse groups' effects. We can also speculate from previous studies, such as Ulrich^[9] who focused on hospitalized patients and Matsunaga, Park, Kobayashi, and Miyazaki^[29] who targeted on seniors.

3.3 Study 3: Psychological Benefits of Indoor Plants in Workplaces

Bringslimark^[30] attempted to discuss the potential benefits of indoor plants in a broad workplace context. Several studies have examined the positive effects of indoor plants on outcomes such as psychophysiological stress and ill health's task performance. However, these studies mainly focus on the value of indoor plants in work settings, and other reviews about how the effectiveness of plants may compare with those of other workplace characteristics must be conducted.

This study performed hierarchical regression analyses to evaluate the relationships that plants and several often-studied workplace factors have with perceived stress, sick leave, and productivity. Other variables, such as gender, age, physical workplace factors (air quality, temperature, lighting, noise), and psychosocial workplace factors (demands, social support) are also included in the study models. Relevant data were obtained from a questionnaire survey in which 385 Norwegian office workers participated.

An anonymous email questionnaire was sent to 605 office employees at three different workplaces in Norway for recruiting participants. In one place, a large private company in Oslo, the questionnaire was sent to 500 employees, randomly selected from departments, and filled during working time. The second place is a smaller private company in Oslo, the questionnaire was sent to 70 employees. In the third company, a governmental agency in Stavanger in which the questionnaire was also sent to 70 employees. In the latter two workplaces, all of the participants were from one department and were selected by the management based on cost. A total of 385 participants filled out the questionnaires during working hours, resulting in an overall response rate of 63.6%. The age range of the participants was 24-66 years (mean = 43.1 years). Moreover, 63% of the sample were male, and it predominantly consisted of long-term employees (range from few weeks up to 39 years, mean = 7.1 years). The three workplaces were selected since they are all office workplaces and located in large cities. Besides, the managers of these companies were willing to let their employees participate in the survey. Moreover, each of the workplace had a plant firm that is responsible for installing and maintaining plants. All employees can decorate their own workstation or office freely. The plants installed in these workplaces included “*Epipremnum aureum*”, “*Ficus benjamina*”, “*Spathiphyllum wallisii*”, “*Dracaena fragrans*”, “*Dracaena concinna*”, “*Beaucarnea recurvata*”, and “*Schefflera arboricola*”. These plants were placed on shelves, on top of cabinets or on the floor with varied sizes (up to 1.5 m height). In the email sent to the employees, the survey’s purpose was explained, and they were messaged that the responses would be totally anonymous. Meanwhile, two reminders were sent to non-respondents: the first one was sent after one week and the second after two weeks. To encourage participation, the employees were informed that their name would be entered into a drawing for an a1000 NOK (US\$160) gift card from a large shopping chain. The questionnaire used closed-ended questions; thus, participants only had two alternatives for responding: they could use one of the valid response options for any item (one- to five-point scale) or they could choose not to answer the question. A small percentage of respondents chose not to answer the given question. The questionnaires' responses were directly exported into an SPSS system file (SPSS14.0, 2006) by using Questback (a program for electronic surveys).

The 10-item version of the perceived stress scale (PSS)^[31-32] was used to measure the stress degree in the questionnaire. For instance, “How often did you feel nervous

and stressed during the last four weeks?” Sick leave was measured with a single question: “How many days last year have you been absent due to your own illness?”^[30]. Productivity level was measured by four questions. For example, “Are you satisfied with the quality of work you are doing?”, “Are you satisfied with the amount of work you are doing?” This measurement referred to a previous study^[33].

This study has good points. First, the sample is representative and adequate, which is greatly helpful to provide trustworthy conclusions. Second, the study has managed to lower mortality. For example, they sent an email to non-respondents twice as a reminder and offered an award as an incentive to participate.

However, the limitations in this study are obvious. First, the sample was disproportionately male (63%). Second, part of the measurements used in the study was not specific to work-related circumstances. For example, the 10-item version of PSS^[31-32] was a global measure and not specific to the work environment. The authors believe that this limitation can be overcome by judging the scale appropriately because most adults spend a large proportion of their time at their work environment.

4. Different Ways of Viewing Nature

4.1 Viewing from the Window

The evidence for the benefits of viewing landscape comes from the home and workplace. Windows in the workplace can alleviate the stress of labor, and people who work with windows over a long period have fewer illnesses, are more patient, complain less, and show more enthusiasm at work than those who work without windows. People can think better with green views, including university students, than those without green views^[34]. People in offices without windows usually place pictures of landscapes or indoor plants^[34] to compensate for the missing views and may become stressed or aggressive. One research involving Alzheimer patients in five houses suggests that people in the three houses with gardens exhibit low aggression and violence levels than those in the two houses without gardens^[35].

Green view is also important at home. Kuo et al.^[36] found that even a small piece of green space in Chicago’s barren urban environment makes a huge difference in people’s lives^[36-37]. Green views from home and nearby nature have a beneficial effect on children’s cognitive functioning. Residents in the two of the 10 poorest neighborhoods in the US positively evaluated the trees and grass near their blocks and said that the greener, the better. Moreover, buildings with more veg-

etation had 52% lower property and violent crimes than those without green space; the residents also reported lower levels of fear and aggressive behavior in the local neighborhood. Besides, the difference between non-green and moderately green buildings was more significant than between moderately green and highly green buildings, suggesting that a positive effect can accrue from a light-greening of all urban spaces, rather than a dark-greening of just a few^[37].

Certain studies about green views in hospitals also exist. Ulrich^[35] reported that patients in a Swedish psychiatric hospital had always complained and damaged paintings on the wall over a 15-year period. An interesting finding is that only abstract painting was reported to be damaged, and no record showed that any pictures of nature and landscapes were damaged. Diette et al.^[10] demonstrated that pictures and sounds of nature have great benefits to patients. One group of patients was equipped with a landscape picture to look at and listened to birdsong sounds and a brook before the operation of bronchoscopy. This group had a 50% higher level of good or great pain control than those who were not equipped with pictures and sounds. It implies that less money is needed to be cost on painkilling drugs for patients^[10].

4.2. Viewing in Natural Environment

Abundant studies show that viewing green in natural environment has significantly positive effects on human beings. A study that examined the restorative effects of viewing forest landscape has an interesting finding. Twelve 20-year-old Japanese male as subjects took part in a three-day field experiment. They were transferred to view forest and urban landscapes randomly during these days. Meanwhile, the physiological and psychological data of each subject were gathered. The results indicate that people who viewed forest landscape has lower values of salivary cortisol concentration (an index of stress response), diastolic blood pressure, and pulse rate than those who viewed urban landscape. This observation suggests that viewing real forest landscape may moderate stress, aid relaxation, and create positive emotion^[38].

Tsunetsugu et al.^[25] supported this finding. They used a control group to compare the difference between viewing natural landscape and urban forest landscape and found that participants who were allocated to view forest landscape for 15 minutes have greatly lower diastolic blood pressure and heart rate, and greatly higher parasympathetic nervous activity, implying that forest landscape can induce a positive mood. A short-term viewing of forests has physiological relaxing effects, such as lowered diastolic blood pressure and heart rate^[25].

Another novel study compared the restorative effects of the four types of landscape environment (i.e., urban, mountain, forest, and water) through questionnaires and by investigating the association between different environments and brain region activities by means of functional magnetic resonance imaging technology. The results reveal that the participants perceived more restorative effects when viewing natural landscapes than when viewing urban landscapes. People show decreased ability to recover from fatigue when viewing urban landscapes. In addition, among the four types of landscapes, water, and mountain scenes have the best restorative abilities, followed by forest and urban landscapes^[39].

5. Conclusion

Natural landscapes influence human beings in diverse ways, including health and well-being and aesthetic appreciation. This essay mainly discusses the benefits of viewing natural landscapes to the physical and mental state of people. The restorative effects of viewing landscapes are the focus of this article, and other physiological and psychological benefits are mentioned. In general, viewing natural landscapes includes viewing natural vegetations, mountains, soils, lakes, and so on. The cases discussed in this article mainly focus on natural vegetations. Further research about other components of natural landscapes can be conducted to obtain additional generalized results.

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