ENVIRONMENTS EFFECT ON MOOD: A COMPARATIVE ANALYSIS OF ENVIRONMENTS ON MOOD ENHANCEMENT

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ABSTRACT

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Mental health is an issue that millions of people are suffering and struggling with, reconnecting with natural environments could be part of the solution to this problem. Although research demonstrated the significance of the healing properties of natural environments, little research compared natural environments to each other. This research explores which aspects of different natural environments have a positive impact on mood.

Using survey questionnaires, two environments were tested. The first being natural environments, where participant exposure to man-made or urban elements is limited and they are surrounded by natural elements. The second environment, urban environments, are spaces such as parks that are not separated from the urban environment. While in the urban environments' participants were still able to perceive the urban elements that surrounds the space, such as cars, buildings, and roads.

Participants were surveyed before and after using the spaces to allow the measuring and analysis of the change the participants experienced. Both the change in mental restoration, but also of the perceived variables of the space. Statistical analysis of the survey responses showed that a greater amount of change to the perceived variables, and mental restoration happened in natural environments, but both environments were restorative. This supports the idea that accessibility to a diverse set of environments and recreational elements will increase mental restoration. Therefore, policy practitioners, and designers should work to increase park space accessibility to a diverse set of environments and recreation amenities.

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1.0 INTRODUCTION:

Mental health is prevalent in a large proportion of people's lives. For some it is an internal struggle, while others experience its' prevalence in their friends or family. In 2019 51.5 million Americans 18 and older had some form of mental illness. (Substance Abuse and Mental Health Services Administration 2020) Some people have adopted actions that limit mental health issues within their own life. For example, there are many people that flock to the country, or the wilderness to escape the rat race of life. They go to breathe clean air, and to relax. This started with the wealthy retreating from cities to their country estates, and it continues now with camping trips or trips to a cabin. In the words of environmental conservationist John Muir "In every walk with nature one receives far more than he seeks" (Muir, n.d.). With the ideas that nature can be used for mental restoration, and the fact that mental health issues are on the rise in the United States (Weinberger, Gbedemah, 2018), landscape architects, designers, and planners need to find their way to contribute to the solution of this mental health crisis.

Although there is an abundance of literature that discusses the different restorative aspects of nature, most papers do not compare all of the different aspects to one another, and many are focused only on one variable. For example, some studies look at the visual qualities of a space but not the importance of soundscape. Other studies acknowledge that natural environments are good at decreasing stress, but the type of natural environments are not compared to one another or truly explored. To meet this end, this study proposes to compare two environments to one another, natural and urban, to distinguish which environment is the most mentally restorative. Furthermore, this study will explore the contributing variables and elements of these environments in regard to mental restoration.

By looking into these two environments, as well as the variables within them, this study aims to find design and policy solutions so that landscape architects, planners, and other designers and policy professionals can create spaces, or policy, that will help combat the current rise in mental health problems.

2.0 LITERATURE REVIEW:

2.1 Mental Health

The Substance Abuse and Mental Health Services Administration conducted a National Survey on drug use and health. From the survey they were able to estimate that 51.5 million people in America, aged 18 or older, had some form of mental illness in 2019. Of these, 13.1 million had a serious mental illness, (Substance Abuse and Mental Health Services Administration, 2020). Mental illnesses leads to suicidal behavior, and in 2018 48,344 people in the United States died from suicide, (Substance Abuse and Mental Health Services Administration, 2020). For every 1 person that dies from suicide there are an estimated 30 others that attempt suicide and do not succeed. (Substance Abuse and Mental Health Services Administration, 2020). This means that almost 1.45 million people attempted suicide in 2018. (Substance Abuse and Mental Health Services Administration, 2020). These rates of suicide and mental illnesses have not always been this high, and in countries around the world suicide rates have been increasing, (Substance Abuse and Mental Health Services Administration, 2018). In the United States this increase is significantly more rapid in youth when compared to all older age groups, (Weinberger, Gbedemah, Martinez, Nash, Galea, Goodwin, 2018). Although suicide is the extreme end of the spectrum for mental health, there are other impacts due to an increasing amount of mental health disorders. Mental health conditions are a leading cause of disability worldwide, and depression is one of the most prevalent of them (Walker, Simons, Losito, Fiorito, Miles, Zelson, 1991; Gaspar, Catherine, Dewa 2018; Zhang, Liu, Li 2019). Businesses have also taken notice; a survey found a 41% increase in companies reporting mental health problems within their staff, (CIPD, 2015). And it is estimated that the cost of mental health disorders in the U.S. is approximately $467 billion, making it not only one of the most prevalent health

concerns, but also one of the costliest disorders for the United States, (Gaspar, Catherine, Dewa 2018). The cost in the UK in 2011 was estimated at £3.6bn, and that estimate was considered to be conservative, (Oncology Nursing Society, n.d.). The growth of mental health disorders worldwide is an issue that needs to be addressed not only at a national level, but on the community level as well, (Zhang, Liu, Li 2019).

2.2 The Natural Environment and Mental Health

Mental health is a complex topic on its own, and the factors that can contribute to mental health disorders are almost countless. However, this is not a discussion of the breadth of these contributors, but a focused review on one; the natural environments effects on mental health. The access to, use, composition, and quality of parks and natural environments have all been shown to have a connection with mental health. Multiple studies have shown that increased accessibility to green space, can be linked to decreased rates of mental health disorders such as depression, and anxiety, (De Vries Sjerp, et al, 2016; Johnsen, Svein, Leif, Rydstedt, 2013; Louv, 2005; Min, Kim, Kim, et al, 2017; Sturm, Cohen, 2014). Studies have a variance on what accessibility is defined as, but for a park space to be accessible it usually means accessible by walking in a reasonable amount of time. For many studies, as well as public policy, park accessibility is a park space that is within a ½ mile, and/or a 10 minute walk, (De Vries Sjerp, et al, 2016; ParkServe, n.d.; Substance Abuse and Mental Health Services Administration 2018). A national survey of people in the US found that 2/3rds of their respondents agreed that quality of life would improve if they had a park within a 10 minute walk, (10 minute walk campaign, n.d.). One study found that those living in regions with the lowest number of parks and green areas had 16-27% greater odds for depression and suicide indicators in comparison to those living in the regions with the highest number of parks and green spaces, (Min, Kim, Kim, et al, 2017).

2.3 Natural Environment Settings, from Parks to Green Spaces

While parks are usually defined as natural areas that are set aside for recreation or retreat, (Molnar, 2015) there are many different types of park. City parks, cultural parks, national parks, pocket parks, and neighborhood parks are some of the most common. Different social needs drove the initial creation of these parks, and due to needs adapting over time, the parks had to adapt and change as well, (DPLA, n.d.). Some parks have weathered these changes well, by updating and adapting their programming and amenities. Central Park in New York is such a park, in the words of its designers "the primary purpose of the park is to provide the best practical means of healthful recreation for the inhabitants of the city of all classes. It should present an aspect of spaciousness and tranquility with variety and intimacy of arrangement, thereby affording the most agreeable contrast to the confinement, bustle and monotonous street division of the city." (Olmstead, Vaux, n.d.) This is a prime example of how parks, since their conception, have been for public health and recreation. Pocket parks, district parks, and regional parks in one study were all positively associated, but larger regional parks and district parks were found to hold the greatest positive impact on mental health, (Wood, Hooper, Foster, Bull, 2017).

Green spaces are defined as areas of grass, trees or other vegetation that is set apart for recreation or aesthetic purposes, (Oxford Dictionary, n.d.). Greenbelts, park systems, greenways, green chains, green grid and more all fall into the definition of green space. The main difference between green space and parks is naming. A park is named and defined as a place, whereas green space can include the buffers between a building and the street. In this way most parks are green spaces but not all green spaces are parks, (Price, 2017). Green space is also created based on the idea of green infrastructure, "a national natural life support system, and a correlated natural ecological network." (Xiaomin, 2014, p. 13). The idea of green infrastructure is to create a

network of varying sized green spaces for a variety of reasons, primarily ecological and for the increased quality of life, (Xiaomin, 2014). Another study looked into the accessibility of blue space; ponds, lakes, rivers or other water elements, instead of green space. This study found that blue space also had a significant relationship with mental health, (De Vries Sjerp, et al, 2016).

2.4 Accessibility Versus Use

Although someone could have a park, or multiple parks accessible to them, it does not guarantee that they are using them. Parks, therefore need to not only be accessible, but used as well, as spending time or doing activities in natural environments has shown to enhance the mood of users, (Canfield, Elise, 2012; Coventry, Neale, Dyke, Pateman, Cinderby, 2019; Johnsen, Svein, Leif, Rydstedt, 2013; Shrestha, Di Blasi, Cassarino, 2021). One study found that the experience generated in a place and the presence of certain physical elements were equally important for the mental restoration of an individual, (Zhang, Liu, Li, 2019). Another study found that different levels of intensity and duration for exercising changed the amount of self-esteem improvement and mood enhancement, (Barton, Pretty, 2010). However, activity on its own can be the reasoning for mood enhancement or decrease in negative mental health problems. (Kvam, Kleppe, Nordhus, Hovland, 2016; Mammen, Faulkner, 2013; Stubbs, Vancampfort, Rosenbaum, Firth, Cosco, Veronese, Salum, Schuch, 2017). Multiple studies show the combination of the activity, as well as where that activity is taking place, leads to different levels of mental restoration, (Coventry, Neale, Dyke, Pateman, Cinderby, 2019; Shrestha, Di Blasi, Cassarino, 2021). The use of a space can even be specifically tailored to mood enhancement, and you see this with ecotherapy, or horticulture therapy where certain activities within an environment are used to enhance restoration. This is accomplished by mixing therapy techniques with natural environments and natural elements, (Summers, Vivian, 2018).

While how a user interacts with the space is important, the elements of the space, and the space itself play a key role in the level of mental restoration received. In one study the quality of the space used was found to be more significant for health benefits than the quantity of it. (De Vries Sjerp, et al. 2016; Francis, Wood, Knuiman, Giles, 2012). What other studies found was that users' comfort level in a space, or their perception of the space's safety, will impact the restorative benefits the space has. This was measured by asking participants about their perceived comfort and safety within an environment, and they found that with higher comfort and safety rankings, there was higher amounts of mental restoration, (Barton, Pretty, 2010; Orstad, Szuhany, Tamura, Thorpe, Jay, 2020). An environment with water and greenery was found to be the most effective in one study, (Barton, Pretty, 2010). And in another, larger sports spaces had a greater positive mental health impact than recreational or natural spaces, (Wood, Hooper, Foster, Bull, 2017). Different environments and elements of environments are therefore shown to have different levels of restoration. One study found that different sounds present are related to different levels of mental restoration, (Zhang, Yuan, Kang, Kang, 2017). And another found that perceived beauty of the space was most important quality for restorativeness, (Simkin, Ojala, Tyrvainen 2021) Additionally, biodiversity's effects on mental health have been underexplored, but under the Biophilia Hypothesis people have an innate tendency to connect with other forms of life and nature. Leading to the idea that a higher amount of biodiversity would connect with and be restorative to a larger quantity of people, (Aerts, Honnay, Van Nieuwenhuyse, 2018).

2.5 Theoretical Developments in Mental Health and Environment

A theory was developed about what criteria must be met for the space to be restorative. Attention Restoration Theory states that the space must have four elements. The first element is

being away: where the space should shift your mental focus to the natural environment. This stops the focus on whatever is draining someone, and instead allowing one to focus on what is around them. Secondly is softly fascinating: the space should capture one's attention without being overly gripping. Attention given to surroundings should never be in such an amount that it would inhibit restoration of mental health. Thirdly, extent is defined as the space being either large enough or capable in some way of enclosing the users from the influence of non-natural elements, such as the surrounding city or urban environment. Fourth and finally, compatible refers to the dynamic between the user and the environment and their comfort level within the space, (Kaplan, 1995).

What is interesting about these elements is that they are not specific variables such as amount of canopy cover, or square footage of turf. But specific variables can fit the criteria of the elements of Attention Restoration Theory. A park that has natural sounds instead of urban ones would help a participant with both being away, and extent. The sounds could even softly fascinate the user of the space and if the user finds them pleasing it could make the park more compatible to them, (Zhang, Yuan, Kang, Kang, 2017). Not only can the physical elements of the park space can fit into Attention Restoration Theory. Experiences and activities such as walking in a natural environment can create a sense of being away, and compatibility of the user with the space, (Coventry, Naele, Dyke, Paterman, Cinderby, 2019). This reinforces the ideas that the effectiveness of a space, in terms of mental restoration, are dependent upon more than just the physical forms of the space.

2.6 Measuring Mental Health from Environmental Design Discipline

The various literature has different metrics for mood enhancement and mental restoration. In search of a standardized measurement the Patient Health Questionnaire (PHQ-9) and the

General Anxiety Disorder (GAD-7) were found. The PHQ-9 is a survey form that is used to measure general mental health, while the GAD-7 measures anxiety, (Gilbody, Richards, Brealey, Hewitt, 2007;Rutter, Brown, 2017; Sunderland, Betterham, Calear, Carragher, 2018). The PHQ-9 was tested and developed in the late 1990's and early 2000's with an educational grant from Pfizer US Pharmaceuticals, (Kroenke, Spitzer, Williams, 2001). The GAD-7 was developed in 2006 for the measuring of general anxiety disorders by Spitzer and colleagues, (Rutter, Brown, 2016). The number in the name of the tests indicate the number of questions within them. Each question is answered with a response on a Likert scale. The answers can then be coded numerically to get a total value. There are then ranges for this value that are associated with different levels, or significance of mental health problems, (Kroenke, Spitzer, Williams, 2001; Rutter, Brown, 2016). These surveys are used widely in the health profession and have shown validity, (Gilbody, Richards, Brealey, Hewitt, 2007; Rutter, Brown, 2017; Sunderland, Betterham, Calear, Carragher, 2018).

These studies and theories referenced above have confirmed that access to green and blue space is an incredibly important resource for the mental wellbeing of people, not just in the United States, but all over the world. These resources highlight the need for an increase in publicly accessible green spaces. They also show the need for research to uncover which aspects of green space are the most restorative to the greatest number of participants. What the literature lacks is the exploration of types of park settings in regard to mental health. An inquiry on what variables are of the most importance in comparison to each other. Not simply a study on the significance of the variables by themselves.

This study explores this deficiency by comparing the mental restoration of nature-based parks, and urban parks. Nature based parks being spaces where users of the space have limited

exposure to human made elements while inside the park. Urban parks being park spaces where human made variables are very present to users of the park. The goal of this study is not only to compare the park spaces but to also look into the significance of visual quality, sound quality, safety, and comfort in regard to the mental restoration of the environment. It is hypothesized that the natural based parks will be more mentally restorative, and that visual and sound quality, as well as participant perception of safety and comfort, will have a level of influence on the restorative properties of the space. This hypothesis is based off of the literature within this review. The literature supports the idea that all park spaces are capable of mental restoration. The literature points to specific natural elements such as nature-based sounds, and the viewing of natural elements as key items for increased rates of mental restoration. Therefore, the hypothesis stems from the idea that park spaces with greater numbers of these natural elements would have increased mental health restoration.

3.0 METHODS:

3.1 Study Locations

Environments were selected for their characteristics of urban or naturalized spaces. Urban environments were defined by spaces that clearly contained elements of urban infrastructure that could be seen or heard. This means that while within the urban environment users could see buildings, paving and other man-made objects. They could hear things not generated by nature such as cars, air conditioners, or construction. Naturalized environments were defined as spaces that had a high level of natural enclosure and exposure to minimal amounts human made variables while inside the space. These types of spaces have more naturalized pathways for example dirt trails, a limited visual and auditory exposure to non-natural sounds, and separated the user significantly from urban environments or urban infrastructure. Figure 1 shows Valley Court Parks, one of the urban environments of this study. As shown in the photo visitors to the park can see urban elements such as buildings, cars, utility lines and signage. Figure 2 is a photo of Lake Lansing, one of the natural environments of this study. This photo shows a more natural scenery with natural planting coverage, tree canopy, and dirt paths as the trail instead of concrete or asphalt. These photos represent the archetypes of the environments of this study.

Figure 1: Valley Court Park

Figure 2: Lake Lansing Park North

3.2 Survey

Participants that were entering these spaces, and that were older than 18, were asked to take part in a two-part survey. The first part of the survey would be taken as they were entering, or before entering the space, to establish a baseline for mood and collect general participant information. The second section of the survey would be completed after they were done using the space. Collections were completed between October of 2020 and March of 2021. The survey was developed in Qualtrics and administered over the participants smart phone. Participants scanned a QR code that took them to the survey. The survey questions, instruments, and methods were classified as exempt by IRB. Participation was voluntary and participants were informed that they could end their participation at any time.

The survey measured 7 main variables, as well as collecting general participant information. General information was the participants gender and age. The survey also asked participants how frequently they used the space, why they use it, when they use it, how many

people they use it with, and if they know others that like using the space. The questions used to measure the independent variables focused on visual quality, sound quality, safety, and comfort. The questions used to measure the dependent variables focused on mood and feelings. Participants were asked to rank visual quality, sound quality, safety, and comfort, on a 7-point Likert scale. These variables, discounting safety, had multiple ranking questions associated with them, to give validity. The questions for these variables were generated by taking the questions from the PHQ-9 and GAD-7 and rewording them to focus on sound quality, visual quality, comfort and safety. PHQ-9 was used to measure what we called feeling and the GAD-7 was used for mood, (Kroenke, Spitzer, Williams, 2001; Rutter, Brown, 2017). Participants were asked to fill out the same questions in part one and in part two of the survey. This allowed a baseline to be established, a second data set was requested at the conclusion of their experience so that the change could be measured. The responses on the Likert scale were given values, and the difference in the values was used to calculate the change in mood and change in feelings from using the space. The change in mood and change in feelings score were used to quantify mental restoration. The mean values for change in feelings and mood were examined in the different environments to determine if there was any significant difference in amount of change/restoration between urban and natural environments. A similar system was used for the other variables. The questions were on a Likert scale, and participants answers were coded into numerical values. These values were used in the following statistical analysis.

3.3 Statistical Analysis

3.31 Cronback Alpha

Cronback Alpha tests were used to determine the internal consistency of the survey questions.

$$\alpha = \frac{N * \bar{c}}{\bar{v} + (N-1)\bar{c}}$$

Where:

N = the number of items

$\bar{c}$ = average covariance, between item pairs

$\bar{v}$ = average variance

3.32 Independent-sample t-tests

Independent-sample t-tests were used to determine if a difference exists between the mean of two independent groups on a continuous dependent variable.

$$t = \frac{\bar{\bar{x}}_1 - \overline{\overline{x_2}}}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$

Where:

x is sample mean

s^2 is the variance

N is the sample size

In turn, this is what was used to determine if there was a significant difference between Urban and Natural parks in visual quality, sound quality, comfort, feelings, and mood.

3.33 Levene's test

Levene's test for equality of variance was used to test homogeneity of variances.

$$W = \frac{(N-k)}{(k-1)} \frac{\sum_{i=1}^{k} N_i \, (Z_{i.} - Z_{..})^2}{\sum_{i=1}^{k} \sum_{j=1}^{N_i} (Z_{ij} - Z_{i.})^2}$$

3.34 Paired-sample t-test

Paired-sample t-tests were used to test the change in feelings and the change in mood in relation to the separate environments.

$$= \frac{\sum(X_1 - X_2)}{SE_{diff}}$$

3.35 Pearsons Correlations

And finally, Pearsons Correlations were used to test correlations between response variables within the survey, such as participants post use feelings to their perceived comfort. This was also used to test correlations between the environment the user was in, and the variables such as amount of time spent within the environment.

$$\mathfrak{r} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

Where:

$\mathfrak{r}$ = the correlation coefficient

x_i = values of the x-variable in a sample

$\bar{x}$ = mean of the values of the x variable

y_i = values of the y-variable in a sample

$\bar{y}$ = mean of the values of the x variable

3.4 Hypothesis

Primary Hypothesis: Nature based environments will be more mentally restorative than urban environments.

Secondary Hypothesis: Visual and sound quality, as well as participant perception of safety and comfort will have a level of influence on the restorative properties of the space.

4.0 FINDINGS:

4.1 General

122 participants clicked into the survey, 38 had to be removed due to incomplete responses. Of the 84 complete responses, 53 were female (63%) and 31 were male (37%). The majority of those that participated in the survey were either in the space by themselves, or with one other person. Table 1, lists the amount of participants in each of the categorized groups of amount of people with participant.

Table 1: Amount of People with Participant

Amount of people with Participant	Amount of participants with this response
Alone	22
1	35
2	10
3	3
4	4
5 or more	10

Time spent in the space varied but almost half of the participants (41) used the space for an hour or more. 9 participants were in the space for 5-10 minutes, 10 for 10-20, 5 for 20-30, 19 for 30-60 minutes, and 41 for 60 minutes or more.

The locations that the participants used as their environments were classified into two groups. Urban and Natural environments, there were 43 responses in urban environments and 41 responses in natural environments.

Table 2: Environment Participant Counts

Urban Environments	**Responses**	**Natural Environments**	**Responses**
Dexter B2B	5	Lake Lansing	2
Loch Alpine	2	Pinckney Recreation Area	38
Valley Court Park	21	Stinchfield Wood	1
Streetscapes	3		
Undefined Neighborhoods	2		

Table 2 (cont'd)

Hudson Mills Metropark	2		
Stoneview Park	2		
Other	6		
Total	***43***		***41***

4.2 Change

There was a statistically significant difference in the mean visual quality score between urban and natural environments in participants pre-use responses, P=.018. With Urban environments scoring higher on perceived visual quality than nature-based parks in pre-use. In post use, there was no statistical significance between the two groups, P=.985, mean visual quality scores were relatively equal between nature and urban environments. The same findings can be reported for sound quality and comfort quality. With a significant difference being found in pre-use responses for both variables, P=.24 for sound quality, and P=.01 for comfort. No significant difference was found in post-use responses. For all of these variables, pre and post, there was homogeneity of variances, as assessed by Levene's test for equality of variances is greater than .05.

Safety quality was dropped from statistical analysis after it was deemed to not be reliable based on question validity in the survey.

Feelings and Mood were the two measures for mental restoration, there was homogeneity of variance, for both variables, as assessed by Levene's test for equality of variances is greater than .05. There was a statistically significant difference in mean feelings, post-use, between those in the urban environment and those in the natural environments. Post-use feelings were more positive among those who visited the urban environment than those who visited the natural environments P=.039. Post-use feeling in the urban environment having a mean value of 43.10

and natural environment mean of 39.24. There was no statistically significant difference in mean post-use mood between participants in the two environments.

Paired-Sample T-Tests shows that visiting the urban environment elicited a mean increase of 6.68 in feelings with P=.000. Visiting the natural environment elicited a mean increase of 8.63 in feelings with P=0.000. Similarly Visiting the urban environment elicited a mean increase of 8.48 in mood with P=0.000. Visiting the natural environment elicited a mean increase of 10.84 in mood with P=0.000 Therefore natural environments had a higher mean positive increase for both mood and feelings. This supports the primary hypothesis.

4.3 Correlations

The Pearson Correlation was used to analyze correlations between the variables, change in feelings and change in mood. The Change in feelings was significantly correlated at the .01 level to post-use visual quality P=.306. It was significantly correlated at the .05 level with post-use sound quality P=.244 and post use comfort P=.245. Change in mood was only significantly correlated to post-use visual quality at the .05 level P=.253. Change in feelings and change in mood were significantly correlated to each other at the .01 level with P=.516.

The final findings were related to time. Pearsons Correlations with the change in feelings and mood in relation to time spent in the environment were tested. Both change in mood and change in feelings were correlated with time spent in the space at the .05 significance level. Change in feelings P=.241 and change in mood P=.244. Although not a significant difference, participants using the natural environments on average spent more time in the space than those using urban environments.

5.0 DISCUSSION:

5.1 Primary Hypothesis, Change

The mean change in participants' mood scores for urban environments was 8.48, and 10.84 for natural environments. The mean change in participants' feelings scores for urban environments were 6.68, and 8.63 for natural environments. The mean change in feelings for participants from pre-use to post-use was 1.95 higher for natural environments than for urban environments. The mean change in mood from pre-use to post-use was 2.36 higher for natural environments than for urban. As hypothesized both the natural and urban environments did cause a positive change in both mood and feelings but the mean change was higher for participants in the natural environments. The hypothesis is therefore supported but still must be explained. Why was there a greater change for natural environments over urban? I believe that this can be expanded on by looking not only at the change in mood and feelings, but also the change visual quality, sound quality, and comfort.

The findings of change in visual, sound, and comfort from pre to post use were interesting and went against what was expected. The expectation was that natural environments would score higher in pre and post use for all the variables. This was not the case. Natural environments scored lower than urban environments for pre-use scores, but in post-use scores natural environments and urban environments scored very comparably. There was no statistically significant difference in mean scores for any of the post-use variables. A greater change was shown in the scores for nature-based environments from pre-use to post-use. This greater amount of change is the point of interest.

On average more time was spent in nature-based environments, and the amount of time spent was significantly correlated to both change in feelings and change in mood. Therefore, it

could be explained that the greater amount of change in perception of these variables was based on the greater amount of time spent in the space. It is also possible that urban parks scored higher initially as they are more heavily designed spaces. Whereas at first glance the natural environments might not have been as pleasing, but upon further inspection, and more time spent in the space, the perception of the natural environment changed, and scores similar to urban were recorded. This could be due to the depth of the natural environments in comparison to the urban environments. Once the participant was fully immersed in the space and surrounded by nature their perception changed. Whereas in an urban environment, being fully immersed and separated is much more difficult, therefore eliciting a lesser amount of change.

Where people spent more time, there was on average more change in both mental restoration, and the perceived variables. So, this study would suggest that it is not only the environment you are in, but also the amount of time spent in it. Since the natural environments ended up scoring very similar to the urban environments in post use responses it's not that the quality is higher, but that you are more immersed in it and have a greater rate of change due to this immersion. The immersion is based on not only time but back to the variables mentioned by Kaplan in Attention Restoration Theory. The natural environments have a greater sense of being away and a greater level of enclosure and separation and therefore the greater amount of restoration can occur.

Further research could look directly into this rate of change, compared to the amount of time spent in the space. A study that has different environments, and then has specific treatment times within these environments, could explore these rates of change. They could see if the rate of change is more dependent on the time spent, or variables of the environment, such as visual quality, sound quality, and comfort.

5.2 Secondary Hypothesis, Preference and Capability

The secondary hypothesis was partially correct, with statistically significant correlations between change in feelings and sound quality, visual quality and comfort quality. Change in mood was only found to be significantly correlated with visual quality. From these results it could be interpreted that visual quality of a space is the most significant variable for mental restoration. This brings forward an interesting concept for perception from different participants. If visual quality is so important, would blind people then score lower on restoration? Sound quality was also important so would those that are hearing impaired experience the space differently? Would these differences in ability for perception change the level of restoration?

I think that people tend to adapt to their deficiencies, someone who doesn't have the best sight might rely more on hearing. And therefore for people who have a deficiency in a type of perception, they would then need a space that is more focused on the type they aren't deficient in for it to have similar restorative results. Mental restoration is universal, we all are capable of it, possibly at different capabilities but that is a different discussion. So although someone might be lacking a certain perceptive ability I still believe they would receive restoration, I just think that it would change the importance of the variables.

Additionally, visual and sound quality is user dependent on a preference standpoint as well as the capability. Two people with the same vision capabilities could have different opinions on the same image or surroundings. For an example we can use paintings. People have different preferences for paintings; some like renaissance, others prefer modern, or impressionism. For sound it's music; some like classical, others like pop, or metal or county. All these people could have the same hearing or visual capabilities but have a separate preference. This separate preference influences them in their daily lives, what music they listen to, what they

hang up on their walls and use for decoration. But it also influences how they experience places. For this study it influences the mental restoration qualities of a space. If the user enjoys the sounds that they hear, and they enjoy the things they see that space would be better suited for their mental restoration. But another user might need a separate environment to receive the same level of restoration, even if that user has the same capabilities in regard to perception.

Not only is the level of capability for perception a factor but so too is the expertise of the participant. This bias of perception was named by the French as 'déformation professionnelle' and it is the tendency that people have to look at everything from the point of view of one's profession, (Horowitz, 2014). A horticulturalist for example might be fascinated by the plants of the space and therefore an environment with more plant life would be favorable to them. However, an architect might prefer an urban park where they can examine the architecture of the buildings surrounding the park space. Conversely, someone who is deeply interested in the items of the space might focus on them too much, thus implying that someone who engages heavily in architecture would experience more restoration in a more naturalized environment. Kaplans take on this is interesting as they say you must be able to connect with the space, but also must not be too mentally engaged by it. Other literature talks about the importance of connection with the space as well, and therefore I believe that the comfort or relatability to the space is more important than it being overly fascinating to the user.

Further research could be completed that looks into these difference preferences, point of view, and capabilities. A sort of aptitude test could be taken to score visual, auditory, and other senses capabilities. And the profession or expertise of the participant would be collected as well. The participants responses could then be compared to one another to see if different professions,

perceptive capabilities, or preferences significantly altered the restorative capabilities of different spaces.

5.3 Further Variable Classification, and Relation to User

A more detailed outline of different spaces, with further classification outside of urban and natural to include more detailed descriptions and a more varied amount of treatment spaces could yield more detailed results. It could also allow the further classification of what variables are most important in regard to mental restoration within parks. Where this study looked at broad ideas of variables further studies could look at them more in depth. Instead of visual quality as a whole, researchers could look at the items that make up visual quality. Such as light levels, tree canopy, art installments, surroundings etc. Studies have been done that look into the variables at this level of detail, such as the *Effects of Soundscape on the Environmental Restoration in Urban Natural Environments* study. However, a comprehensive study that compares the variable all to each other is lacking. A study of this type could then inform designers more thoroughly about level of tree cover, amount of auditory elements and more specific design elements that could be implemented to increase the restorative capabilities of the space.

A study of this type would also need to take into account participant information. It would be possible to look at the importance of variables for restoration in comparison to the participants background, expertise, and demographic. This style of study could really enhance design recommendations by making them more specific. Using college students as a demographic of the study could lead to the finding of variables most important to college students in regard to mental restoration. These variables could then be ranked as some of the most important variables for college campus design. You could also include professors, and then find the variables in common between the two groups. Taking the variables in common and

including them at a higher priority within the design. This could be used for a wide variety of applications. Within inventory and analysis of a site, a designer could collect the demographic data of the people surrounding a proposed site, or the people that would use it most frequently. The designer could then take those demographics and reference these types of studies to find the most important variables for that park space. And now they truly would be designing for not only the physical health and welfare of the space's primary users, but also their mental health.

5.4 Application of Research

For the application of this research into design it would be believed that an environment that is visually appealing, has pleasant sounds, and is designed in such a way to foster comfort and perceived safety, will be the best type of space for mental restoration. But not everyone is the same, and what might be restorative for one, does not always mean it will be restorative to all. Meaning that different spaces within the park, or site can have varying levels of visual quality, sound quality, and comfort. Allowing for a greater range of people to be restored by the greater diversity of environments.

The best design solution would realistically be supported by policy. Parks that in themselves are diverse, but are part of a larger diverse park system, would be the most effective. This park system would be where the true diversity of the infrastructure could take place. Different parks could be spread throughout a city with different uses. This is similar to what is in place now for many parks department plans. However not enough effort is dedicated to truly make these parks different experiences, or different environment. You see similar elements in many parks of the same city. Or a focus simply on different types of activities within the parks, but not a focus on different environments. There is often a consistency within a city's urban park designs. This consistency isn't necessarily bad, repetition of form is important, wayfinding by

similarity is too. But this consistency can take over and lead to the creation of very similar urban parks. Making people go to the perimeter of cities, or to other communities to access the environment that is most restorative to them.

Natural environments need to be brought back into the urban areas, they need to be designed in a way that they can be an escape from the urban system. This idea can be traced back to the beginning of landscape architecture with Olmstead's idea for Central Park. But the urban parks are needed too, this study reinforces the idea that all environments have value, and they all have the capability of being restorative, it is up to the user to find the space that is best for them. And It is the responsibility of policy makers, planners, and designers to make sure that natural and urban park spaces are accessible to everyone.

This is where the 10 minute walk policy campaign is supported but is also lacking. The campaign is so focused on accessibility for all, it is not focusing on the diversity needed within these spaces. Accessibility to green infrastructure is supported by much of the reviewed literature as a very important aspect. It is also supported by the fact that both environments were restorative in this study. But the diversity needed of different types of spaces is not made as much of a priority by the current campaign.

Based on the findings of this study, restoration happens in urban and natural environments. Much like other studies found, different environments can rank differently for different people. And finding a space that is restorative to you means you need to find a space that you are comfortable in, enjoy the things you see, and enjoy the things you hear. By doing this you will be more likely to experience mental restoration from spending time in the space. If your focus is not on yourself but on the development of these spaces for others, then the recommendation would be to create a space that is appealing to the spaces most frequent users.

6.0 LIMITATIONS:

The collection of data for this study was completed during the 2020-2021 Global Corona Virus Pandemic. Due to this the collection of data was influenced by the restrictions that had been placed by the pandemic. Collections were originally delayed due to lock downs, and once allowed; social distancing, the wearing of masks, and contactless interactions were required. This research was further limited by an inability to test a wider variety of variables due to the lack of tested environments. An inability to test the treatments over a greater period of time due to the time constraints of a master's program. And finally, a lack of generalizability due to the lack of different tested environments.

7.0 CONCLUSION:

The conclusion from this work is that both natural and urban environments are mentally restorative. Natural environments produced a higher level of positive mental restoration on average, but the difference between the two environments restoration was not statistically significant. This supports the primary hypothesis. Visual quality was the most significant of the measured variables in relationship to mental restoration. It was the only variable that was significant for both mood and feelings, the two scores that represent mental restoration in this study. Sound quality, comfort, and time spent in the environment were also correlated to the change in feelings. The secondary hypothesis therefore was also supported for visual quality, sound quality, and comfort. Safety had inconclusive results due to a lack of validity.

8.0 CONFLICT OF INTEREST:

The author declares no conflict of interest.

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