The impact of green and blue space on stress, affect and happiness

2018

Dissertation submitted in partial fulfilment of the requirements of Cardiff Metropolitan University for the degree of Bachelor of Science
DECLARATION
I hereby declare that this dissertation is the result of my own independent investigation under the supervision of my tutor. The various sources to which I am indebted are clearly indicated. This dissertation has not been accepted in substance for any other degree and is not being submitted concurrently for any other degree.

____________________  Candidate
Acknowledgements

Firstly, I would like to thank my supervisors for their continuous support and guidance throughout the year.

Secondly, I would like to thank my family, who have played a vital role in helping me reach the end of my degree, particularly my Mum for her encouragement and help throughout this project.

Finally, thank you to my participants for giving up your time.
Abstract

The findings from previous research demonstrate that nature is beneficial to psychological wellbeing. In this area, it is unclear on the type of environment that is most beneficial for psychological wellbeing. Therefore, there is an undoubted need for further high quality research. This study aims to investigate the impact of green space and blue space on stress, affect and happiness in real life environments to incorporate all the human body senses. Individuals completed measures of stress, affect and happiness before and after walking in green space and blue space. Everyone participated in both trials. There was a significant interaction of environment and time on stress score $F(1, 9) = 5.666$, $MSE = 3.840$, $p < .05$, where stress decreased overtime and more so in blue space than green space. Although results revealed that environment and time also had an impact on positive and negative affect, and happiness, this was not statistically significant. Thus, this study concludes that walking for 30 minutes in blue space reduces stress significantly more than walking for 30 minutes in green space. Results also showed that walking in either natural environment for 30 minutes reduced stress and negative affect and increased positive affect and happiness.
## Contents

Declaration .........................................................................................................................i
Acknowledgements ...........................................................................................................ii
Abstract ............................................................................................................................iii

### Chapter one

1 Introduction ..................................................................................................................1
1.1 Benefits of exercise .................................................................................................1
1.2 Natural vs. laboratory environments .................................................................1
1.3 Attention Restoration Theory .............................................................................3
1.4 Blue exercise ...........................................................................................................3
1.5 Green exercise .........................................................................................................4
1.6 Summary and Rationale ........................................................................................5
1.7 Aims and Hypotheses ..............................................................................................5

### Chapter two

2 Method .......................................................................................................................7
2.1 Participants .............................................................................................................7
2.2 Design ....................................................................................................................7
2.3 Materials ................................................................................................................7
2.4 Procedure ...............................................................................................................9
2.5 Statistical Analysis ...............................................................................................12

### Chapter three

3 Results .......................................................................................................................13
3.1 Does walking for 30 minutes in a natural environment affect our emotional state, independently of the type of natural space? ..................................................................13
3.2 Does being in a green space or a blue space affect our emotional state independently of whether we have been walking or not? ................................................................14
3.3 How does walking in a green environment and walking in a blue environment impact on emotional state?

Chapter four

4 Discussion
4.1 Summary of hypotheses and findings
4.2 Links to previous research
4.3 Considerations
4.4 Conclusion

5. References

6. Appendix

7. Declaration of word count

List of tables and figures

Table 1. Cronbach’s alpha scores for PANAS (Watson et al., 1988)
Table 2. Approximate temperatures at times of walks
Figure 1. Green walk route
Figure 2. Blue walk route
Table 3. showing the effect of 30 minute walking on mean scores for stress, positive and negative affect and happiness
Table 4. showing the effect of environment on mean scores for stress, positive affect, negative affect and happiness
Table 5. showing the effects of environment and time on stress, positive affect, negative affect and happiness
Graph 1. showing the effect of time and environment on stress
Graph 2. showing the effect of time and environment on positive affect
Graph 3. showing the effect of time and environment on negative affect
Graph 4. showing the effect of time and environment on happiness
CHAPTER ONE

1. INTRODUCTION

1.2 Benefits of Exercise

The benefits of exercise for mental health include increasing participants’ mood, particularly in previously sedentary individuals (McAuley, 1991). Further evidence for this comes from Kerr, Fujiyama, Sugano, Okamura, Chang, & Onouha’s work (2006) who found significant increases in positive, and decreases in negative, emotions between pre-and post-exercise. For this reason, exercise can also help individuals with mental health issues, such as anxiety disorders, which are among the most prevalent.

1.3 Natural vs. Laboratory environments

Adherence to exercise regimes has been low, partly due to lack of enjoyment of the exercise recommended (Kerr et al., 2006). Research has shown that the environment in which we exercise may be an influential factor for adherence to exercise. Specifically, exercising in natural spaces has additional benefits, not only for adherence, but also for mental health. Evidence for this comes from Kerr et al. (2006) who found that participants experienced higher pride when exercising in natural environments compared to laboratory conditions. However, the environment did not impact affect, when the participant was running (Kerr et al., 2006). On the other hand, Maas, Verheji, Vries, Spreeuwengen, Schellevis, & Groenewegen, (2009) stressed the importance of green space (i.e grass, trees) to reduce morbidity. Their study shows a correlation exists between exercising in green space and the number of self-reported general indicators of physical and mental health such as reducing cardiovascular diseases. Annual prevalence rates for most diseases were found to be lowered for those who lived within a 1km radius of green space. The strong relationship they found also suggests that mental health, in particular, might be affected by the amount of local green space, as the relationship was strongest for anxiety and depression. In addition to this, it was likewise stronger for children and people with low socioeconomic status and in slightly urban spaces, and not evident in extremely strong urban spaces.
Contradictory evidence for this comes from Huynh, Craig, Janssen, & Pickett, (2013) who found, when investigating Canadian youths, that emotional well-being may not be impacted by the amount of exposure to natural spaces. However, this conclusion is limited to the youth population and differs greatly to findings from studies using more generalizable samples (Maas et al., 2009). Moreover, this study did not consider the quality and usage of natural spaces, factors which are likely to have a critical impact on emotional wellbeing. This was a finding by D’Alessandro et al. (2015) as they concluded that green space does have psychological benefits. They also suggested this has many implications, for example providing people with green space in urban areas, a strategy that has already been implicated in some cities. Further evidence is needed to build a justified argument for open space to promote public health in other cities.

The literature also demonstrates that nature is beneficial to psychological wellbeing (Wilson, 1984). He suggests that humans possess an innate affinity for nature, which is defined as “Biophilia”. The biophilia hypothesis proposes that humans possess an innate tendency to seek connections with nature and other forms of life. Kellert and Wilson’s (1995) Biophilia Hypothesis proposes that an individual’s mental health is associated to their contact with nature. Research backing this conclusion comes from Howell et al. (2011) who investigated potential associations of nature affinity, mindfulness and wellbeing. Significant associations appeared among measures of nature connectedness and indices of wellbeing. They concluded that there were positive associations of nature affinity and psychological wellbeing.

Considering this, research now suggests that participating in physical activity in outdoor natural environments has more promising effects on mental wellbeing than in indoor environments (Coon et al., 2011). They found that, when exercising in natural environments, participants experienced higher levels of revitalization and positive engagement and decreases in tension, confusion, anger, and depression, and increased energy. However, the results also showed decreased feelings of calmness post-exercise in natural environments. In concordance with previous findings, they also found greater satisfaction and enjoyment whilst exercising in natural environments as well as a higher intention of future participation in physical activity. Moreover, Teas et al. (2007) conducted an experimental study whereby participants’ moods were assessed on a questionnaire and saliva samples. They found that walking outside improves mood for healthy postmenopausal women, but walking indoors was associated with higher scores of worry, compared to walking outdoors. Thus, suggesting
that walking outdoors reduces feelings of worry and has a positive impact on stress. Teas et al. (2007) also concluded that walking outdoors may have other benefits as it is associated with improved mood, which may reduce the risk of breast cancer indirectly by promoting regular exercise. Therefore, the significance of exercise environment on mood and stress that might impact exercise adherence should be considered by health professionals and individuals who wish to use exercise to decrease stress and increase mood.

1.4 Attention Restoration Theory

Numerous mechanisms have been suggested to explain the mental health benefits attributed to green and, in a less extent, blue spaces. These mechanisms comprise partly of intrinsic qualities of green and blue spaces to enhance health or wellbeing (restoration theory). Evidence for this comes from Felston (2009) whose results suggested that green and blue environments may be useful to restore attention, particularly in students. Students evaluated the apparent restorative benefits of indoor campus settings that varied by view of nature: some had no views of nature, some had window views of nature with built structures present, and some had views of computer-generated nature portrayed as large nature murals. Students valued settings with views of vivid nature murals, particularly those with water, as more restorative than settings with window views of actual, but mundane nature with built structures present. The results propose that large nature murals in indoor settings used for study breaks may offer students with attention fatigue opportunities for restoration when views of nature are inaccessible or limited in restorative potential. This is known as attention restoration theory (ART; Kaplan, 1995), which suggests that natural environments turn out to be exceptionally rich in the features essential for restorative experiences.

1.5 Blue Exercise

Whilst paucity exists in empirical research, theorists have suggested that blue space may have restorative potential. White et al. (2010) discovered that equally natural and constructed sights encompassing water were related with greater preferences, greater positive affect and higher apparent attention restorative qualities than those deprived of water. They also found that images of “constructed” natural spaces were generally rated as positively as green spaces. Research to support the influence of blue space on affective responses comes from Wheeler et al. (2012) who found that, consistent with similar experiences of green space
accessibility, the positive effects of coastal proximity may be greater amongst more socio-economically deprived communities. They suggested that these effects may be due to greater opportunities to reduce stress and increase physical activity levels. Moreover, Nutsford et al. (2016) found that residential exposure to visual blue space, but not green space, is associated with lower psychological distress. They investigated blue and green space in a capital city, which may be an important area to concentrate on as urbanisation increases it is vital that, if blue environments do lower stress, residents in urban areas experience exposure to blue spaces. As this study was only conducted in Wellington city in New Zealand which is surrounded by sea, further research is needed in other cities and other areas to confirm whether blue space does lower psychological distress.

White et al. (2015) found that participants were most willing to repeat exercise in the blue environments (rivers and coastlines). Participants’ evaluations of exercise when watching simulated green or blue space were more positive than when they were exercising in a control or urban simulated environment. As the urban simulated environment was not evaluated as positively as green and blue environments, this suggests that the more positive evaluations were not simply due to having a distraction. The most preferred setting in which to exercise was the blue environment which was suggested to be because the blue environment was more fascinating and more likely to induce a sense of flow (White et al., 2015). Simulated environment also moderated affect, particularly in the first 5 minutes (White et al., 2015). While participants stated a decrease in positive affect throughout Control and Urban exercise, there was an increase in positive affect throughout Blue and Green exercise. The findings of this study have far reaching implications for physical activity promotion campaigns as, if people like exercising in blue environments, whether natural or man-made, then they are more likely to be willing to repeat it, even in simulated environments, and campaigns can focus on getting people out and about in nature. Gyms could also provide nature videos in indoor exercise settings. However, the sample of this study is limited to postmenopausal women thus meaning it cannot be generalised to the wider population, although it is consistent with results from studies using broader samples.

1.6 Green Exercise

Focht (2009) added to the research by conducting a study measuring enjoyment and intention for future participation following walking outdoors and indoors. Focht’s (2009) findings do
suggest that the environment influences the affective responses to brief walks as environment was found to have a positive impact on affect. Additional research comes from Rogerson et al. (2015) who asked participants to complete questionnaires before and after a 5km run, at indoor and outdoor locations. Rogerson et al. (2015) found that green exercise offers accessible provision for improving acute psychological wellbeing and happiness. Even though nature-based exercise surroundings can facilitate effective outcomes, the overall type of nature may be less critical. However, one minor weakness of this study is that it has received contradictory evidence from Gascon et al. (2015) who found limited evidence of mental health benefits of long-term residential surrounding greenness in adults. The present recommended distance between residence and the nearest open public space is 300m. This recommendation may be supported by the fact that 300-400m is the threshold after which use of green space starts to quickly decline. For access to green space and for studies in children the evidence was insufficient. The main limitations of their review were the limited number of studies available and heterogeneity across studies. Currently there is not a standardized method to define exposure to green (or blue) space, or to define what is actually meant by surrounding greenness or access to green space, concepts that sometimes can also overlap. Measurements such as the percentage of greenness based on land-cover maps may vary across studies when different criteria are chosen to define green space (i.e. inclusion or exclusion of private gardens, exclusion of green spaces smaller than a certain size, inclusion of the total or the usable green space, etc.) and therefore results and conclusions might also differ.

1.7 Summary and Rationale

The research clearly establishes that there are psychological benefits achieved from exercising (Kerr et al., 2006; McAuley, 1991) such as improving mood (Teas et al., 2007). The findings from the research further demonstrate that nature is beneficial to psychological wellbeing (Howell et al., 2011; Kellert & Wilson, 1995) and that exercising outdoors in more natural settings can have greater psychological benefits than exercising indoors (Coon et al., 2011; Focht, 2009; Rogerson et al., 2015). Therefore, healthcare professional recommendations for exercise should include gym and non-gym based exercise options. Furthermore, research has shown coastal environments are preferred over other environments (White et al., 2010). Despite this, there are no recommendations of which green or blue space indicators are better to use and there is not a consistent use of them. In this area, there is an
undoubted need for further, high quality research in order for health professionals to recommend exercise in green and blue space. To fully understand the effects of exercise in different environments, namely green space and blue space, on mental wellbeing, further research needs to be conducted using well designed trials in populations who might benefit the most from the potential advantages of outdoor exercise. Moreover, there is paucity in research in this area, in addition to a lack of research using real life environments as opposed to simulating blue space and green space with a screen. By using real life environments this present study will incorporate all the human body senses as opposed to just sight.

1.8 Aim and hypothesis

The aim of this current study is to investigate the impacts of exercising in green space and blue space on stress, affect and happiness. Based on findings of previous research it is expected that the current study will find that time and environment (independent variables) will impact stress, affect and happiness (dependent variables). It is also expected that time will decrease stress and negative affect and increase positive affect and happiness. As the literature concerning the type of environment most beneficial for psychological wellbeing, it is difficult to present an expected direction of the effect of environment on stress, affect and happiness.
CHAPTER TWO

1. METHOD

2.1 Participants

Ten participants were recruited through personal contacts (friends and family) who already engaged in walking in blue and green space. The sample included a broad spectrum of ages from 20 – 70 years old, although the inclusion criteria was anybody over the age of 18 who answered “No” honestly to all the questions on the health screening questionnaire (PAR-Q) and already engaged in walking in blue and green space. Most of the sample were undergraduate university students (six), with others in full and part-time employment and retirement. All participants were retained throughout the study, a 0% dropout rate.

2.2 Design

A repeated measures experimental design was employed. The advantages of using a repeated measures design include the ability to eliminate the effects of individual differences, as significant variables remain the same. Repeated measures design is a more robust design than independent groups and is a development on most studies in this area that use independent groups (Coon et al., 2011). Each participant participated in both trials (Green and Blue environments) with order randomised to control for order effects. The environment was the independent variable with two levels (green and blue). Trials consisted of walking for 30 min by the coast or in green space (with grass and trees) at a comfortable pace. The dependent variables for this study are stress, affect and happiness. Pre-walk and post-walk measures were obtained for all three dependent variables.

2.3 Materials

Stress, affect and happiness were measured using different scales, the first being the Stress Visual Analogue Scale (VAS) which is a one-item question asking how stressed participants feel on a scale from “not stressed” to “very stressed”. This is a reliable scale which adequately measures current stress (Burckhardt & Jones, 2003). The second measure will be the VAS of Happiness. Similarly, to the Stress VAS, happiness is measured by asking
participants to place a distinct mark on a straight line at a point corresponding to their current degree of happiness. The scale begins at “unhappy” and ends at “very happy” making it a simple and useful method to evaluate degree of subjective happiness (Burckhardt & Jones, 2003). These VAS were selected as this study measured acute stress and happiness and wanted materials that have been shown to discriminate subtle changes over short time periods. VAS have been successfully used to show changes after short interventions (Bijur et al., 2008). Other, longer measures were considered that measure variables over time i.e. Perceived Stress Scale (PSS; Cohen et al., 1994), which asks how you have been feeling over the last months and thus was not appropriate for this study. This study also needed some measures that were short, as participants would be completing questionnaires at multiple time points in different locations.

The third measure is the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). This 20-item scale consists of a number of words that describe different feelings and emotions, for example, irritable, interested and distressed. The scale uses 5 point rating whereby 1 is ‘very slightly or not at all’, 2 is ‘a little’, 3 is ‘moderately’, 4 is ‘quite a bit’ and 5 is ‘extremely’. Participants were instructed to read each item and then list the number from the scale next to each word. They were also told to allocate the number to indicate to what extent they felt that way at that present moment in time. A score was then calculated for positive and negative affect. The PANAS is a frequently used measure for general affective states as it demonstrates excellent validity and reliability. Reliability for the PANAS (Watson et al., 1988) was measured by Cronbach’s Alpha and found to be moderately reliable. All subscales consisted of 10 items and had a Cronbach’s alpha score of above .7 which is the acceptable figure according to Bowling (2014). This is excluding the negative affect scale measured post-blue space, which had a Cronbach’s alpha of .683 (see Table 1.)

<table>
<thead>
<tr>
<th>Positive subscale pre-green</th>
<th>Negative subscale pre-green</th>
<th>Positive subscale post-green</th>
<th>Negative subscale post-green</th>
<th>Positive subscale pre-blue</th>
<th>Negative subscale pre-blue</th>
<th>Positive subscale post-blue</th>
<th>Negative subscale post-blue</th>
</tr>
</thead>
<tbody>
<tr>
<td>.909</td>
<td>.893</td>
<td>.884</td>
<td>.726</td>
<td>.872</td>
<td>.882</td>
<td>.885</td>
<td>.683</td>
</tr>
</tbody>
</table>

Table 1. Cronbach’s alpha scores for PANAS (Watson et al., 1988).
Other materials include a PAR-Q (see Appendix), participant information sheets and informed consent forms. The latter two were created on Microsoft Word (see Appendix). The PAR-Q is a self-administered questionnaire that comprises of 7 yes or no questions concerning symptoms of heart disease and bone or joint problems. For instance, one question asks, ‘Have you ever felt pain in your chest when you do physical exercise?’ Participants were instructed to use their common sense when answering the questions, to read them carefully and check ‘yes’ or ‘no’ opposite the question. In this study, in order not to complicate matters and comply with ethics, any participant who answered ‘yes’ to any of the questions was not eligible to partake in the study. If they answered ‘no’ to all the questions, it gave a general indication that they may partake in physical activity, although participants were made aware that there was no guarantee that they will have a normal response to exercise. The PAR-Q is intended to recognise adults for whom physical activity might be unsuitable or those who should have medical advice concerning the type of activity most suitable for them.

2.4 Procedure

Ethical approval was granted from the Cardiff Metropolitan University Research Ethics Committee preceding the conduction of the study. The researcher conducted a risk assessment of both routes prior to the study. Participation in the study was voluntary. Potential participants were contacted by the researcher to arrange a date for a familiarization session. This session took place a week before the trial. During familiarization, the research process was explained and participants were presented with all the measures they would later be requested to answer. If they were satisfied with what was expected of them, participants were asked to sign an informed consent form. A health-screening questionnaire (PAR-Q) was also completed to confirm no participants had any health issues meaning they should not participate.

Data collection took place in January and February on days where the weather was clear and dry to ensure, as much as possible, consistency of experience (see Table 2.)
Table 2. Approximate temperatures at times of walks

<table>
<thead>
<tr>
<th>Participant</th>
<th>Approximate temperature on day of green walk (°C)</th>
<th>Approximate temperature on day of blue walk (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

Pre-walk, participants gave self-reports of stress with the Stress VAS, affect with PANAS and happiness with the VAS of Happiness. The participants were then asked to engage in a 30-minute walk during daylight hours, either in green space or blue space. On an alternative day, participants repeated this procedure in the other environment. Participants walked in small groups of three-six people accompanied by the researcher. After each walk, participants completed each measure again. After their second walk, participants were debriefed and thanked for participating. There were no incentives for taking part in the study.

Data collection took place in rural South West England, UK. To minimise the effects of extraneous variables, both walking routes had flat terrain, low risk of injury and were the same distance. For the blue environment, participants had sight of the sea for the entire walk and for the green environment participants had sight of fields and trees. Routes were examined on maps electronically before the main study (see figures 1. and 2.)
All data was anonymised. Due to the repeated measures design a coding system was used so that data could be analysed. The researcher and the supervisor had access to the data during the project. All data was stored in a locked drawer (questionnaires) and then data was being stored on a password protected PC. All participants had the right to withdraw from the study.
at any point up until the last point of data collection. At this point the data was anonymised and thus could not be withdrawn.

2.5 Statistical Analysis

Initially, the scale items for the PANAS (Watson et al., 1988) were added together to provide a total score. A Cronbach’s Alpha was then conducted to assess the reliability of the PANAS (Watson et al., 1988). This study used four two-way within repeated measures analyses of variance (ANOVA) to determine the effect of type of environment (blue vs green) and time (pre, post) on self-reported affect, happiness and stress. Analysis was conducted using Statistical Practise for Social Sciences Version 23 (SPSS), which is a software for statistical analysis. There were only 2 levels of repeated measures, meaning that there was only one set of difference scores and nothing to compare those difference scores against to indicate a violation of sphericity.
CHAPTER THREE

2. RESULTS

The mean scores of stress, happiness, positive affect and negative affect are presented in Tables 3, 4 and 5. A two-way within ANOVA was conducted that examined the effect of time and environment, on stress, positive affect, negative affect and happiness.

3.1 Does walking for 30 minutes in a natural environment affect our emotional state, independently of the type of natural space?

<table>
<thead>
<tr>
<th></th>
<th>Pre walk Mean (SE)</th>
<th>Post walk Mean (SE)</th>
<th>F value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress</td>
<td>3.85 (0.53)</td>
<td>2.13 (0.47)</td>
<td>28.77</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>31.50 (2.13)</td>
<td>39.40 (1.55)</td>
<td>30.38</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>17.00 (1.12)</td>
<td>11.45 (0.425)</td>
<td>26.73</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Happiness</td>
<td>6.19 (0.54)</td>
<td>8.18 (0.35)</td>
<td>26.09</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*Table 3.* showing the effect of 30 minute walking on mean scores for stress, positive and negative affect and happiness.

Table 3 shows the mean scores on the emotional scales before and after walking, independently of the type of environment. There was a statistically significant effect of time on all emotional states. In other words, walking for 30 minutes in a natural environment, whether in green or blue space, significantly increased mean scores for positive emotions (positive affect and happiness) and significantly decreased mean scores for negative emotions (stress and negative affect).
3.2 Does being in a green space or a blue space affect our emotional state independently of whether we have been walking or not?

<table>
<thead>
<tr>
<th></th>
<th>Green Environment Mean (SE)</th>
<th>Blue Environment Mean (SE)</th>
<th>F value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress</td>
<td>3.18 (0.60)</td>
<td>2.80 (0.61)</td>
<td>0.24</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Positive affect</td>
<td>32.10 (1.95)</td>
<td>38.80 (1.92)</td>
<td>14.17</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>14.50 (1.38)</td>
<td>13.95 (1.10)</td>
<td>0.07</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Happiness</td>
<td>13.02 (0.68)</td>
<td>7.85 (0.43)</td>
<td>2.52</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

*Table 4.* showing the effect of environment on mean scores for stress, positive affect, negative affect and happiness

As can be seen in Table 4, the mean scores for stress, negative affect and happiness were not significantly different in the green environment compared with the blue environment. Therefore, there were no differences in scores on stress, negative affect and happiness in each of the environments, when you take away the effect of walking. However, there was a statistically significant effect of environment on positive affect. This suggests that being in blue space, regardless of whether a person has been walking or not, significantly increased scores for positive affect more than green space.

3.3 How does walking in a green environment and walking in a blue environment impact on emotional state?

<table>
<thead>
<tr>
<th></th>
<th>Green pre walk</th>
<th>Green Post walk</th>
<th>Blue Pre-Walk</th>
<th>Blue post walk</th>
<th>Minimum – maximum range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td>Mean (SE)</td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>3.30 (0.72)</td>
<td>3.05 (0.68)</td>
<td>4.40 (0.83)</td>
<td>1.20 (0.55)</td>
<td>0 - 8</td>
</tr>
<tr>
<td>Positive affect</td>
<td>29.40 (2.39)</td>
<td>34.80 (1.97)</td>
<td>33.60 (2.39)</td>
<td>44.00 (1.99)</td>
<td>19 - 50</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>16.80 (2.23)</td>
<td>12.20 (0.87)</td>
<td>17.20 (1.90)</td>
<td>10.70 (0.42)</td>
<td>10 - 37</td>
</tr>
<tr>
<td>Happiness</td>
<td>5.92 (0.95)</td>
<td>6.45 (0.46)</td>
<td>6.45 (0.67)</td>
<td>9.25 (0.44)</td>
<td>0.2 - 10</td>
</tr>
</tbody>
</table>
Table 5. showing the effects of environment and time on stress, positive affect, negative affect and happiness

Graph 1. showing the effect of time and environment on stress
Graph 2. showing the effect of time and environment on positive affect

Graph 3. showing the effect of time and environment on negative affect
There was a significant interaction of environment and time on stress score $F(1, 9) = 5.666$, $MSE = 3.840$, $p < .05$, where stress decreased overtime and more so in blue space than green space. Therefore, it seems that walking in a blue space had a greater impact on reducing stress than walking in a green space. However, there was no significant interaction of environment and time on positive affect score $F(1, 9) = 2.805$, $MSE = 22.278$, $p > .05$; negative affect score $F(1, 9) = .405$, $MSE = 22.303$, $p > .05$ and happiness score $F(1, 9) = 2.881$, $MSE = 2.278$, $p > .05$. Therefore, it seems that walking in a green environment had no greater or lesser impact on reducing negative affect or increasing positive affect and happiness than walking in a blue environment.
CHAPTER FOUR

3. DISCUSSION

4.1 Summary of hypotheses and findings

The relationship between environment and psychological factors such as stress, affect and happiness has been long established amongst a large body of research (Nutsford et al., 2016; Rogerson et al., 2015; White et al., 2015). Nevertheless, previous studies have generated mixed results on the type of environment that reduces stress, and negative affect, and increases positive affect and happiness most significantly (Nutsford et al., 2016; White et al., 2015). Additionally, previous studies such as Nutsford et al. (2016) have used an independent groups design to examine the impact of blue and green space, without consideration of participant variables. The present study used a repeated measures design and set out to examine the differences between blue and green space and their impacts on stress, affect and happiness. Stress and happiness were measured by VAS and affect was measured by PANAS (Watson et al., 1988). A total of ten individuals participated in this research all of which were viable for analysis. For the stress and happiness VAS, participants had the opportunity to score from 0-10 on each one. For the positive and negative subscales of the PANAS (Watson et al., 1988), participants had the opportunity to score from 10-50 on each subscale. A counter balancing technique was used to eliminate order effects.

This present study predicted that time and environment would have an impact on stress, affect and happiness. The results showed that there was a significant interaction of environment and time on stress score but there was no significant interaction of environment and time on positive affect, negative affect or happiness. There may have been trends in the data to suggest that positive affect and happiness were increased and negative affect was decreased but these were not statistically significant. It was also predicted that time would decrease stress and negative affect and increase positive affect and happiness. The data shows that walking in a natural environment has a statistically significant effect on our emotional state. However, being in a green space or blue space, whether we have been walking or not, did not have a statistically significant effect on stress, negative affect or happiness but did have a statistically significant effect on positive affect.
4.2 Link findings to previous research

Some of these findings support previous research. For example, Rogerson et al. (2015) asked participants to complete questionnaires after a 5km run indoors and outdoors to measure happiness and psychological wellbeing, and found that outdoor environments do increase happiness particularly in green environments although they did suggest that the type of environment may be less critical. This is supported by the current study whereby walking in a natural environment for 30 minutes decreased stress and negative affect and increased positive affect and happiness, irrelevant of the type of natural space. Focht (2009) also found that exercising outdoors is beneficial for psychological characteristics such as affect.

Previous research has also found more significant increases of positive affect and happiness in blue space compared to green space. White et al.’s (2010) qualitative study showed that coastal environments are preferred over other environments. However, this current study found no difference between green space and blue space on their impact on positive affect, negative affect and happiness. Nevertheless, walking in blue space reduced stress significantly more than walking in green space for 30 minutes, in adults who walk regularly. This finding is in accordance with White et al. (2010) who also suggested that blue space may be of more importance regarding stress reduction. This also supports Nutsford et al. (2016) who found that blue space, but not green space, lowered psychological distress.

4.3 Considerations

Previous research on green space and blue space has employed an independent groups design (Nutsford et al., 2016), which can generate less reliable results due to individual differences as this could be the cause of changes in stress, affect and happiness scores. For instance, one group of participants might experience greater levels of stress in general. Therefore, this current study used a repeated measures design. Repeated measures design is a beneficial design as this means there were no individual differences between participants. To avoid individual differences, future research should follow this present study and use a repeated measures design to produce further robust results about the impact of green space and blue space.
One limitation of this study is that it used self-report measures, which relies on the honesty of participants and their introspective ability to provide an accurate response. Participants may have changed their post-walk responses as they felt that there was an intervention which they were expected to respond to, rather than genuine changes in their emotional states. The results from the VAS’ and PANAS (Watson et al., 1988) suggest that walking for 30 minutes in natural space does affect our emotional state. These findings are consistent with previous research (Rogerson et al., 2015; White et al., 2015). The VAS’ are rating scales which were advantageous in terms of being quick to complete in this study. However, participants may have interpreted and used differently, what one participant rated as an ‘8’ on a 10-point scale, someone with the same stress level might only rate as a ‘6’ because they interpret the meanings of the scale points differently, thus the VAS is very subjective. More objective measures for stress, affect and happiness would therefore be advisable for future research.

The present study merely consisted of ten participants, which is a likely limitation as it can make the results less reliable and more difficult to generalise to a wider population. Whereas, previous research in green space and blue space consisted of much larger samples (442 participants) and achieved significant results (Nutsford et al., 2016). Therefore, it can be said that this study failed to find significant results for positive and negative affect, and happiness due to the low sample size which resulted in the null hypothesis being unchallenged. Therefore, producing inconsistent and inconclusive results (Cohen, 1962). This issue can be attributed to time restraints of the study, as ideally more participants are needed. To fully emphasise the impact of green space and blue space, future research should use a bigger population that may benefit more from potential decreased stress and negative affect and increased positive affect and happiness, and eliminate the flaws associated with a small sample. In addition to this, it was not possible to obtain normative data for stress and happiness scores from VAS’ and affect scores from PANAS (Watson et al., 1988). Therefore, it may be the case that the sample used in this study were, for example, extremely stressed before the study and so walking in a natural environment decreased their stress scores more significantly than if their stress levels were closer to the norm to begin with. This, again, makes it difficult to generalise the findings to a wider population, as without the normative data it is not certain whether these findings only apply to people who, for example, have higher stress levels.
Another limitation of this present study is the absence of a control group meaning that it is difficult to conclude that the reduction of stress and negative affect and increase in positive affect and happiness is due to time and environment rather than to other factors. Extraneous variables such as personal causes of stress, conversation during the walk and other individuals that participated in the walk at the same time may have influenced participant’s stress, affect and happiness scores. A control group could have been conducted in an indoor setting i.e. not in a natural environment where participants walked for 30 minutes on a treadmill which would have helped control for such extraneous variables and allowed more reliable conclusions to be made. However, despite the presence of extraneous variables, consistency was ensured as much as possible on both walks. For example, neither walk was too strenuous and weather conditions were similar on each walk for all participants. This helped to ensure participants experiences on each walk, as much as possible, only differed due to the presence of the green and blue space. Thus, attempting to keep the changes in data as only a result of changes in time and environment.

Future research should attempt to employ a larger sample that is representative of the whole population including children. Gascon et al. (2015) critically reviewed the evidence for the impact of blue space and green space and suggested that in future studies green space and blue space should be assessed at school (children) and at work (adults), as this is where those populations spend most of their time. In addition to this, it may be worth investigating different tools for assessing stress, affect and happiness, which are more reliable. Nevertheless, the measures chosen should suit the aims of the study and be appropriate to evaluate the outcomes of interest. Longitudinal study is also desirable to determine casual inference and whether these impacts are present over a longer amount of time. Finally, there is a need for additional data of the impact of green space and blue space from studies conducted in different countries, as they comprise of different features in terms of climate, culture and environment.

Confirmation of these results in more methodologically robust studies and other locations is important and would be of value to the health field. The implications of research on green space and blue space, and their impacts on emotional state, include prescribing green exercise and blue exercise participation for psychological health and wellbeing improvements. Such prescription can benefit a range of individuals, potentially without requiring specificity of natural environment type. Findings from this study, supported by findings in previous
(Nutsford et al., 2016) and future research, also have implications for public health. If walking in blue space and green space is beneficial for people’s emotional state then physical activity promotion campaigns might focus more on getting people out and about in nature.

The reduction of stress and increase of positive affect in blue space may be due to it being more open than green space which tends to be enclosed with trees and hedges and therefore may have less beneficial connotations if individuals feel like it is intrusive or crowded. Since the water in the blue space of this study was the ocean, it may also be the sound of waves and the smell of air passing over the ocean that helped to reduce stress. This would be an interesting area of investigation for future studies, especially since all the blue space in this study was oceanic. Results may differ in research that uses a fresh water environment. This may also have implications in urban areas where they do not have access to the ocean but could provide manmade water sources.

4.4 Conclusion

In conclusion, the current study used a moderately robust design to examine the effects of green space and blue space on emotional state. A repeated measures design meant that the study was not affected by individual differences. Also, the study used moderately reliable and valid measures of stress and happiness (VAS) and affect (PANAS; Watson et al., 1988), which have been widely used. Results showed that walking for 30 minutes in a natural environment decreased stress and negative affect and increased positive affect and happiness. In addition to this, stress decreased more after 30 minutes of walking in blue space than after 30 minutes of walking in green space. Even though there was no significant effect of time and environment on positive affect, negative affect and happiness, trends in the results suggest blue space decreased negative affect and increased positive affect and happiness more significantly than green space. Results also suggest that being in blue space, regardless of whether walking was involved, increases positive affect more than being in green space. Further investigation into green space and blue space could help to explain differences between types of natural environments and lead to beneficial implications.
4. REFERENCES


White, M., Pahl, S., Ashbullby, K., Burton, F., & Depledge, M. (2015). The Effects of Exercising in Different Natural Environments on Psycho-Physiological Outcomes in Post-


Appendix A: Participant information sheet

Participant Information Sheet
Reference Number:

Title of Project: The impact of blue space and green space on stress, affect and happiness
Information Sheet

Background
The study is being conducted in attempt to understand the impacts of green space and blue space on stress, affect and happiness. Previous studies have linked being outdoors, particularly in green areas such as woodlands and fields and blue space such as coastal areas, with improved wellbeing. By investigating the impact these environments have on stress, mood and happiness people will then be aware of potential benefits, for example feeling less stressed and more positive mood.

What would happen if you agree to participate?
You will be contacted by the researcher to arrange a date for a familiarization session. This session will take place a week before the first walk. During familiarization, the research process will be explained. If you are satisfied with what is expected of you, you will be asked to sign an informed consent form. A health screening questionnaire will be completed to ensure you do not have any health issues meaning you should not take part.
The walks will take place in January on days where the weather is typically clear. Pre-walk, you will be asked to give self-reports of stress, mood and happiness using different various scales. You will then go for a 30 minute walk with the researcher, first in green space (i.e fields) then on another day in blue space (i.e coastal). After each walk you will complete the scales of stress, mood and happiness again. You may stop walking at any time you wish. You have the right to withdraw at any time during the study but once the data collection is complete, due to anonymized data, it will not be possible to withdraw your data after the study is complete. All data will be confidential, raw data will only be seen by the researcher and their supervisor.
Appendix B: Participant consent form

PARTICIPANT CONSENT FORM

Reference Number:
Participant name or Study ID Number:
Title of Project: The impact of green space and blue space on stress, affect and happiness Name of researcher:

Participant to complete this section: Please initial each box.

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time before leaving the experiment, without giving any reason.

3. I agree to take part in the above study.

_______________________________________   ___________________
Signature of Participant                 Date

_______________________________________  ___________________
Name of person taking consent              Date

________________________________________
Signature of person taking consent
Appendix C: Physical Activity Readiness Questionnaire

Name:  
Date:  

PAR-Q FORM

Many health benefits are associated with regular exercise, and the completion of PAR-Q is a sensible first step to take if you are planning to increase the amount of physical activity in your life. For most people physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them. Common sense is your best guide in answering these few questions. Please read them carefully and tick YES or NO opposite the question if it applies to you.

YES  NO

1. Has your doctor ever said you have a heart condition and that you should only do physical activity recommended by a doctor?

2. Do you feel pain in your chest when you do physical activity?

3. In the past month, have you had chest pain when you were not doing any physical activity?

4. Do you loose balance because of dizziness or do you ever lose consciousness?

5. Do you have a bone or joint problem that could be made worse by a change in your activity?

6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?

7. Do you know of any other reason why you should not do physical activity?

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

1. Start a graduated exercise program
2. Take part in a fitness appraisal

However, if you have a minor illness (e.g., cold) you should postpone activity.

If you answered YES to one or more PAR-Q questions, you should consult your doctor if you have not yet done so recently before starting any exercise programme and/or having a fitness appraisal.
6. DECLARATION OF WORD COUNT

- Abstract 200
- Introduction 2,149
- Method 1,410
- Results 517
- Discussion 1,989

Total (excluding abstract) 6,063

Signed

_________________________________
Date

____20/04/2018____