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# **Virtual Nature, Mindfulness, And The Potential For Altruism**

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**I declare that this thesis was composed by myself, that the work contained herein is my own except where explicitly stated otherwise in the text.**

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## **Abstract**

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### **Virtual Nature, Mindfulness, And The Potential For Altruism**

This research set out to examine whether the experience of beautiful nature in a virtual reality setting could evoke altruistic behaviour in people. 24 healthy adult participants took part in this research experiment. Participants in the experimental group experienced a virtual nature setting while participants in the control group experienced a virtual city setting. Following the virtual experience each participant took part in an experimental economics game designed to measure altruism. Levels of individual trait mindfulness and individual differences in tendency to perceive natural beauty were measured before the experiment. The results did not support the primary hypothesis that a virtual nature experience would be associated with higher levels of altruistic behaviour when compared to a control setting. Participants across both conditions showed an overwhelming tendency to behave altruistically following the virtual experience. The results also showed that those individuals who are more mindful displayed a greater tendency to engage with natural beauty. Thus it appears to be the more mindful person who is engaging with natural beauty and experiencing positive psychological wellbeing. Applications include using virtual nature as a healing tool to increase wellbeing for individuals whose circumstances deprive them of nature experiences in the real world.

# Introduction

## ***Restorative Nature***

Natural environments are often promoted as sanctuaries offering rejuvenation from the stresses of modern urban life. Compared with urban environments nature has a favourable influence on affective states, cognitive performance and physiological levels of stress (Hartig, Mang & Evans, 1991; Gullone, 2000). Ryan et al. (2010) demonstrated that exposure to nature enhanced subjective vitality, defined as having more physical and mental energy, feelings of vigour, positive affect and calm energy. Following a walk in a park participants scored higher on a cognitive performance assessment than those who took a walk through a downtown area (Berman, Jonides & Kaplan, 2008). In a famous study conducted by Ulrich (1984), hospital patients who had a window view of a green space recovered quicker than those without a nature view, while also requiring less pain medication and suffering less post-surgical complications than their counterparts. Furthermore, a recent study conducted by Seresinhe, Preis & Moat (2015) quantified the impact of scenic environments on health by correlating geotagged scenic areas across Britain with census data on citizen-reported health, while controlling for socioeconomic indicators of deprivation such as income, employment and access to services. The researchers found that those living in scenic areas report better health, concluding that the aesthetics of the environment can have a measurable impact on our wellbeing. The current study aims to investigating the effect of beautiful nature on wellbeing by examining prosocial tendencies that may arise following nature experiences.

## ***Beautiful Nature Promotes Altruism***

Natural environments have also attracted research for their potential to increase altruistic tendencies in people (Weinstein, Przybylski & Ryan, 2009; Zhang, Piff, Iyer, Koleva & Keltner, 2014). Altruism is manifested by an overriding concern for the welfare of others. Altruism is the opposite of egoism, and those who exhibit altruism are characterised by empathy, compassion, generosity and kindness towards others. Individuals who volunteer are deemed to be psychologically happier and healthier, physically healthier and more likely to live longer (Borgonovi, 2009; Post, 2007). The Dalai Lama advises: “if you’re going to be selfish, be wisely selfish - which means to love and serve others, since love and service to others bring rewards to oneself that otherwise would be unachievable” (Hopkins, 2008, p. 176).

An experiment conducted by Weinstein et al. (2009) examined the effects of immersion in nature on altruistic behaviour. Participants were shown a series of slides depicting either nature or urban scenes, and following the slideshow participants took part in a behavioural economics trust game designed to measure levels of generosity (Croson and Buchan, 1999). Those who viewed the nature slides behaved more generously in the trust game than those who viewed the non-nature slides. The experimenters also measured the degree to which participants felt immersed in the slideshow scenes, and results showed that as participants felt more immersed in nature scenes they were more generous, whereas as they felt more immersed in the cityscapes they were less generous and greedier. Weinstein et al. (2009) attributed the increase in altruistic tendencies to the sense of connectedness to nature experienced, leading to increased feelings of personal autonomy and a more intrinsic value set, orienting participants towards a greater connection and focus on others.



Advancing on this research, a second study conducted by Zhang et al. (2014), performed a similar experiment while also measuring participants' individual differences in their tendency to perceive beauty in nature. The results of this experiment also showed that participants who viewed the nature images were more generous in the trust game, and this effect was moderated by individual differences in a tendency to perceive natural beauty. Zhang et al. (2014) found that subjective experiences of beauty in nature led to an influx of positive emotions which elicited prosocial behaviour. This finding that nature evokes positive affect which in turn elicits altruistic behaviour is consistent with Frederikson's (1998, 2001) broaden-and-build-theory of positive emotion, which posits that positive emotions broaden people's immediate repertoire of cognitive and behavioural options, motivating them to engage in behaviours that have enduring benefits, such as prosocial actions. In this manner when an individual experiences awe and elation in response to beautiful nature, this experience of awe can transform into a feeling of unity, compassion, empathy and generosity.

The present research advances the two studies by Weinstein et al. (2009) and Zhang et al. (2014), by conducting a similar experiment with some key changes designed to elucidate the effect of altruistic behaviour following exposure to nature. Neither Weinstein et al. (2009) nor Zhang et al. (2014) examined whether levels of individual trait mindfulness influenced the nature-altruism effect.

## ***Mindfulness***

There is significant research (Wallmark, Safarzadeh, Daukantaitė, & Maddux, 2012; Weng et al., 2013) suggesting that a mindful disposition can positively influence altruistic tendencies in people. In assessing the influence of mindfulness on altruistic behaviour, following an eight-week loving-kindness meditation course participants showed a significant increase in altruistic tendencies compared with a control group (Wallmark et al., 2012). Weng et al. (2013) found that compassion-meditation training increased altruistic redistribution of funds to a victim encountered outside of the training context. Condon, Desbordes, Miller, and DeSteno (2013) showed that meditation increases compassionate responses to suffering, by demonstrating that after a meditation course participants were more likely to give up their seat to a disabled confederate in a doctor's waiting room.

According to renowned mindfulness expert Jon Kabat-Zinn, mindfulness is “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment.” (Kabat-Zinn, 2003). There are two components central to Kabat-Zinn's operational definition, present-centered attention and acceptance of experience. Focusing attention on the present allows for a greater awareness and recognition of thoughts, feelings and sensations as they occur. The second attitudinal component comprises a curious, open and accepting stance towards observed experience. For example, if an aversive feeling arises, the mindful individual will observe the feeling closely as it arises, notice if the feeling manifests in bodily sensations such as tightening of muscles, watch as the feeling transforms and the mental events evaporate, allowing these experiences to come and go without attempting to resist, suppress or change them.

Engaging in an experiential mode of processing in this manner enables the individual to 'be present' to subjective or sensory phenomena as they unfold, rather than to channel each experience through conceptual filters in order to derive self-relevant meaning (Teasdale, 1999; Brown & Holt, 2011). Teasdale (1999) showed that this nonjudgmental, non-discursive and experiential mode of processing had favourable outcomes when compared with ruminative analytical self-focus (Watkins & Teasdale, 2004). Coffey, Hartman and Fredrickson (2010) supported these findings by deconstructing mindfulness to model the mechanisms through which trait mindfulness influences mental health. The researchers determined a key mediating construct in flourishing mental health to be “accepting one’s experience, and refraining from judging it”, while they also identified rumination as a key mediator in psychological distress. Levels of trait mindfulness in individuals are positively correlated with adaptive functioning such as openness to experience, self compassion, emotional intelligence, and psychological wellbeing. Conversely levels of trait mindfulness are negatively correlated with maladaptive cognitive and emotional processes like thought suppression, experiential avoidance, and rumination (Brown, Ryan & Creswell, 2007; Baer & Lykins, 2011). The present research assesses the impact of individual trait mindfulness on altruistic tendencies following nature experiences.

### ***Hypo-Egoic States Of Being***

In recent years contemporary psychologists have sought to examine psychological states in which self-absorption is minimised and their influence on wellbeing and adaptive functioning. Leary, Adams and Tate (2006) define such psychological states as 'hypo-egoic' states of being, a state in which “self-awareness is low, the phenomenal self is not highly individuated, and the person is not ego-involved”. An example of a hypo-egoic state is flow, in which ongoing activity requires so much

concentration that none is available for self-consciousness or self-relevant thoughts (Csikszentmihalyi, 1991). Leary et al. (2006) theorise that the cultivation of mindfulness allows the individual to deliberately enter into hypo-egoic states of being. In assessing the pro-social orientations that arise due to mindfulness, Leary and Guadagno (2011) attribute these other-oriented actions to hypo-egoic states of being, explaining that compassion, empathy, kindness, forgiveness and prosocial behaviours are more likely to arise when people are “minimally focused on themselves, see themselves as connected to others, and have a low level of ego-involvement in the outcome of the situation”. People struggle to be invested in the welfare of others when they remain preoccupied with their personal feelings, concerns and goals.

The present research proposes that natural environments can also evoke hypo-egoic states in people. A recent study found that exposure to natural environments led to a reduction in rumination, a maladaptive pattern of self-referential thought which is associated with greater risk of mental illness (Bratman, Hamilton, Hahn, Daily & Gross, 2015). Thus it seems that natural beauty can also quieten the egoic self, perhaps because nature is rich in natural stimuli that cannot be conceptually filtered by the ego to determine self-relevant meaning. It is interesting to note that an individual's level of trait mindfulness is positively correlated with a sense of connectedness to nature (Howell, Dopko, Passmore & Buro, 2011), defined as “individuals’ experiential sense of oneness with the natural world” (Mayer & Frantz, 2004, p. 504). Thus it is reasonable to propose that the hypo-egoic states elicited by both mindfulness and nature could influence altruistic tendencies following these experiences.

## ***Relaxation***

From a physiological perspective, when urban dwellers visit rural settings they experience a reduction in stress hormone secretion and sympathetic nervous activity, and an increase in parasympathetic nervous activity (Lee, Park, Ohira, Kagawa & Miyazaki, 2015). One does not even need to be physically present in nature to experience these benefits, as the simple act of viewing natural scenes is enough to induce parasympathetic nervous system activity (Gladwell et al., 2012). These findings are explained in Kaplan's (2001) attention restoration theory (ART), which holds that natural environments are rich in fascinating stimuli that can be absorbed with effortless involuntary attention, while the levels of directed attention required to successfully navigate an excitatory urban environment are mentally costly and lead to fatigue. Immersion in natural environments enables us to recover from directed attention fatigue leading to rejuvenation.

Although physiological relaxation appears to be a common factor in the experiences of both nature and mindfulness, previous research did not examine the impact of relaxation on the nature-altruism effect. As discussed both experiences lead to a reduction in stress, in nature a calm tranquil energy (Ryan et al., 2010), and in mindfulness more benign cognitive appraisals of stress situations and adaptive coping (Weinstein, Brown and Ryan, 2009). The present research proposes that physical relaxation also plays a key role in altruistic tendencies resulting from these experiences. The present research hypothesises that experiencing physiological stress makes it more difficult to attend to the wellbeing of others, inhibiting altruism.

## ***Virtual Reality***

The experiment conducted by Weinstein et al. (2009) showed that the degree to which participants felt immersed in nature predicted levels of altruistic behaviour. The present research aims to increase subjective immersion by changing the setting from two-dimensional slides to Virtual Reality (VR). Virtual Reality has been used successfully in psychotherapeutic settings for a range of treatments including PTSD (Rizzo, Hartholt, Grimani, Leeds, & Liewer, 2014), anxiety disorders (Opriş et al., 2011) and pain management (Li, Montaña, Chen & Gold, 2011). Additionally, Giuseppe Riva and research colleagues at the university of Milan have spent two decades examining VR's potential to treat eating and body image disorders, and Riva has discovered that VR exposure is as effective as in vivo exposure (Gorini, Griez, Petrova, & Riva, 2010). Riva (in press) describes VR as an “embodied technology” due to its realism and ability to modify an individual's feeling of presence, and Riva capitalises on this embodied technology in the treatment of patients with body image disturbances by inducing controlled changes in the experience of the body (Riva, 2011; Riva, 2012).

Recent advancements in immersive VR technology have also yielded research on prosocial tendencies considered to have high ecological validity (Gillath, McCall, Shaver & Blascovich, 2008). Specifically in the case of natural environments, virtual nature settings have been shown to provide significant restorative effects (Valtchanov, Barton & Ellard, 2010; Waterworth & Waterworth, 2004). Thus the present research proposes that VR would enhance subjective feelings of immersion for participants in the nature-altruism experiment.

## ***The Present Research***

The present research advances on the research of Weinstein et al. (2009) and Zhang et al. (2014) by assessing the influence of an individual's level of trait mindfulness on the nature-altruism effect. In the study conducted by Zhang et al. (2014) the likelihood of altruistic behaviour was heightened among individuals prone to perceiving beauty in their natural environments. A theory proposed by the present research is that individuals higher in trait mindfulness more readily experience hypo-egoic states of being, which in turn leads them to be more perceptive of natural beauty, and resulting prosocial orientations.

The present study contends that hypo-egoic states of being underlie orientations towards prosocial behaviour. Juxtaposing the experience of natural environments with the practice of mindfulness, the salient common trait from these seemingly disparate experiences is that they promote hypo-egoic states of being, in mindfulness via a nonjudgmental, non-discursive and experiential mode of processing, and in nature via natural stimuli which cannot be filtered by the ego to derive self-relevant meaning. As it has been shown that trait mindfulness is positively correlated with connectedness to nature (Howell et al., 2011), and that the tendency to perceive natural beauty mediates prosociality (Zhang et al., 2014), this research posits that individuals higher in trait mindfulness will have a greater orientation towards perceiving beauty in nature, and will behave more altruistically in an economic trust game.

The present experiment exposes one group of participants to a virtual nature setting, while another control-group is exposed to a virtual city setting. Self-reported levels of trait mindfulness along with tendency to perceive natural beauty are measured prior to the virtual experience. Physiological measures of relaxation are taken during the virtual experience. Following the virtual experience both groups are invited to take part in an economic trust game measuring altruistic behaviour. This experiment differentiates from previous research by changing the setting to VR and assessing the impact of trait mindfulness and physiological relaxation on the nature-altruism effect.

### ***Research Questions & Hypotheses***

Q1. What effect does virtual nature have on an individual's tendency to behave altruistically?

H1. It is hypothesised that virtual nature is associated with higher levels of altruistic behaviour compared to a control setting.

Q2. What role does mindfulness play in an individual's tendency to perceive natural beauty?

H2. It is hypothesised that individual levels of trait mindfulness are associated with a tendency to perceive natural beauty.



Q3. What effect does tendency to perceive natural beauty have on altruistic behaviour following exposure to virtual nature?

H3. It is hypothesised that tendency to perceive natural beauty is associated with altruistic behaviour.

Q4. What effect does trait mindfulness have on altruistic behaviour following exposure to virtual nature?

H4. It is hypothesised that greater levels of trait mindfulness are associated with altruistic behaviour.

Q5. How does physical relaxation influence the potential for people to behave altruistically?

H5. It is hypothesised that greater physical relaxation is associated with altruistic behaviour.

# Method

## ***Design***

This research experiment was conducted using an independent-measures between-subjects design. A total of 24 healthy adult participants took part in this experiment, with random allocation of participants to each of the two conditions, virtual nature or virtual city, for a total of 12 participants assigned to each group. Given the nature of the experiment this design was necessary to eliminate carryover effects associated with within-subjects repeated-measures.

A two-level independent variable of setting (virtual nature or virtual city) was used in this study. A dependent variable of altruistic (true or false) was measured from participants' decision in the trust game. An attribute variable of mindfulness was measured by participants' score in the Mindful Attention Awareness Scale (Brown & Ryan, 2003). A second attribute variable of tendency to perceive natural beauty (PNB) was measured by participants' score in the Engagement with Natural Beauty scale. A third attribute variable of relaxation was measured by participants electrodermal activity (EDA) recorded on the PIP biosensor.

## ***Participants***

This experiment used a convenient sample from the general population numbering twenty four adult individuals. Regression analysis performed by Weinstein et al. (2009) revealed no main or interactive effects for gender, age, or ethnicity on the observed variables of immersion and altruism, thus a convenient sample from the general adult population was deemed to be sufficient.

## ***Measures and Materials***

***Mindfulness.*** The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item measure rated on a 6-point scale (1 = almost always; 6 = almost never), which measures the extent to which a person pays attention to experiences in the present moment. Items describe mindless experiences (e.g., “I find it difficult to stay focused with whats happening in the present”; “I do jobs or tasks automatically, without being aware of what I'm doing.”). Total scores are averaged and higher scores denote higher trait mindfulness. The MAAS is the most widely used measure for trait mindfulness today and has demonstrated internal consistency with Cronbach alphas ranging from 0.78 to 0.92 with evidence of test–retest reliability ( $r = 0.81$ ; Park, Reilly-Spong, & Gross, 2013). The construct has been validated by positive correlations with measures for internal state awareness, openness, positive affect and wellbeing, while being negatively correlated with anxiety, stress, neuroticism and rumination (Park et al., 2013). Normative information on the trait MAAS taken from 2277 participants revealed a mean value of 3.83 and standard deviation of 0.70 (Brown & Ryan, 2003).

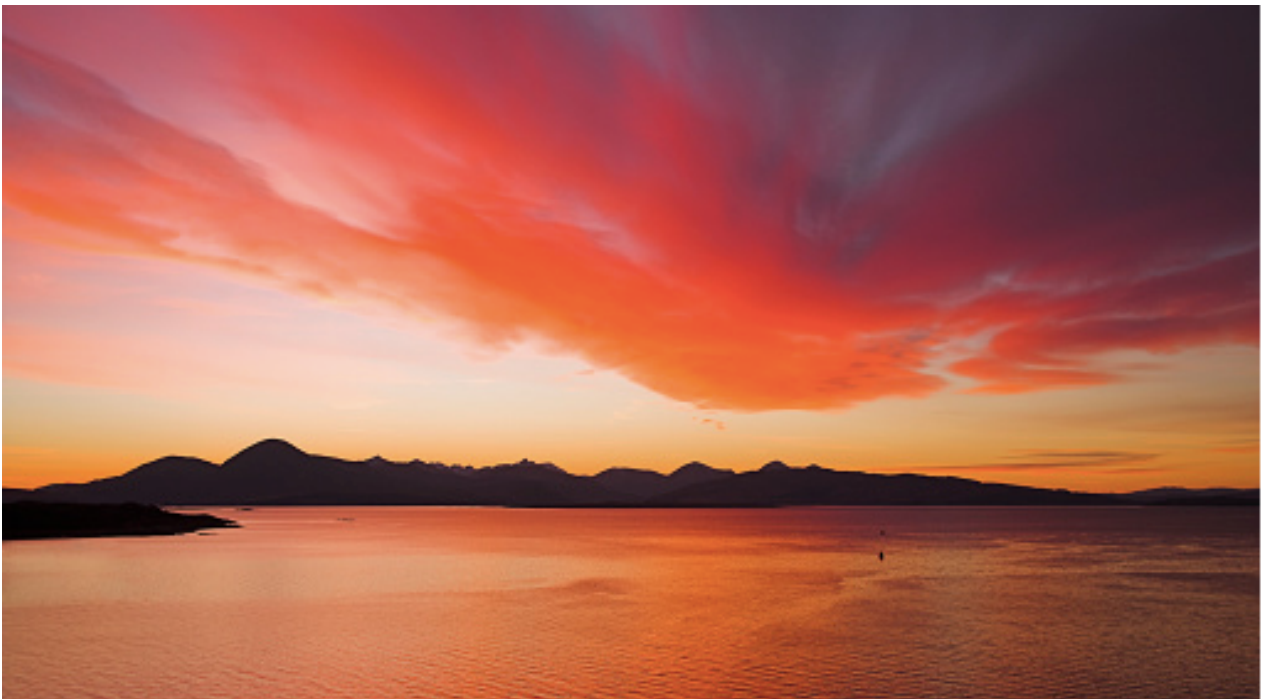
***Engagement With Natural Beauty.*** The Engagement with Natural Beauty subscale (from Engagement With Beauty scale; Diessner, Solom, Frost, Parsons, & Davidson, 2008) is a 4-item measure rated on a 7-point scale (1 = strongly disagree; 7 = strongly agree), which assesses an individual’s tendency to perceive beauty in nature (PNB; e.g., “I notice beauty in one or more aspects of nature”; “When perceiving beauty in nature I feel emotional, it “moves me”, such as feeling a sense of awe, or wonder or excitement or admiration or upliftment”). The measure has demonstrated high predictive, convergent, test-retest and discriminant validity ( $\alpha = 0.80$ ;  $r = 0.84$ ; Diessner et al., 2008). Normative information on the Engagement with Natural Beauty subscale

taken from 206 participants revealed a mean value of 20.7 and standard deviation of 5.1 (Diessner et al., 2008).

**VR Slideshow.** The virtual slideshow was facilitated by the Samsung Gear VR headset as shown in Figure 1. The scenes depicted in the slideshow were from the Samsung 360° Photos app. This is a 360° photo app that comes preloaded with the Gear VR. Each of the photos offer 360° views in any direction leaving the viewer with a sense that they are in each of the scenes. Participants assigned to the nature condition viewed beautiful nature scenes while participants assigned to the urban condition viewed urban marketplaces around the world (see Figures 2 and 3 for 2D examples of the nature and urban scenes used in the virtual slideshows).



*Figure 1.* The Samsung Gear VR



*Figure 2.* 2D representations of nature scenes used in the virtual nature slideshow.





*Figure 3. 2D representations of urban marketplace scenes used in the virtual city slideshow.*

**Relaxation.** The PIP biosensor was used in the present study to measure participants' EDA (PIP, 2016). The PIP biosensor is a small device which is held between thumb and index finger to measure levels of skin conductance (see Figure 4). In order to control for the confounding variables of temperature and humidity which are known to affect EDA, the room temperature for the procedure was set to a cool 20° Celsius. At the end of each PIP session participants are given a PIP score which was used as the relaxation measure. The PIP score is calculated using a proprietary algorithm which is described below.



*Figure 4.* PIP Biosensor used to measure participants' EDA.

**Pip Algorithm.** The Pip's signal analysis algorithm processes raw skin conductance in real time in order to identify three classes of event: stress, relaxation, steady (the latter indicating that the user is neither stressing nor relaxing). The Pip Score statistic is calculated from the relative number of stress/relax/steady events detected during a Pip session. A score of 100% corresponds to the user achieving the theoretical maximum number of relax events achievable for the session duration,

with no stress or steady events. An iPhone app is used to track and record each PIP session as shown in Figure 5.

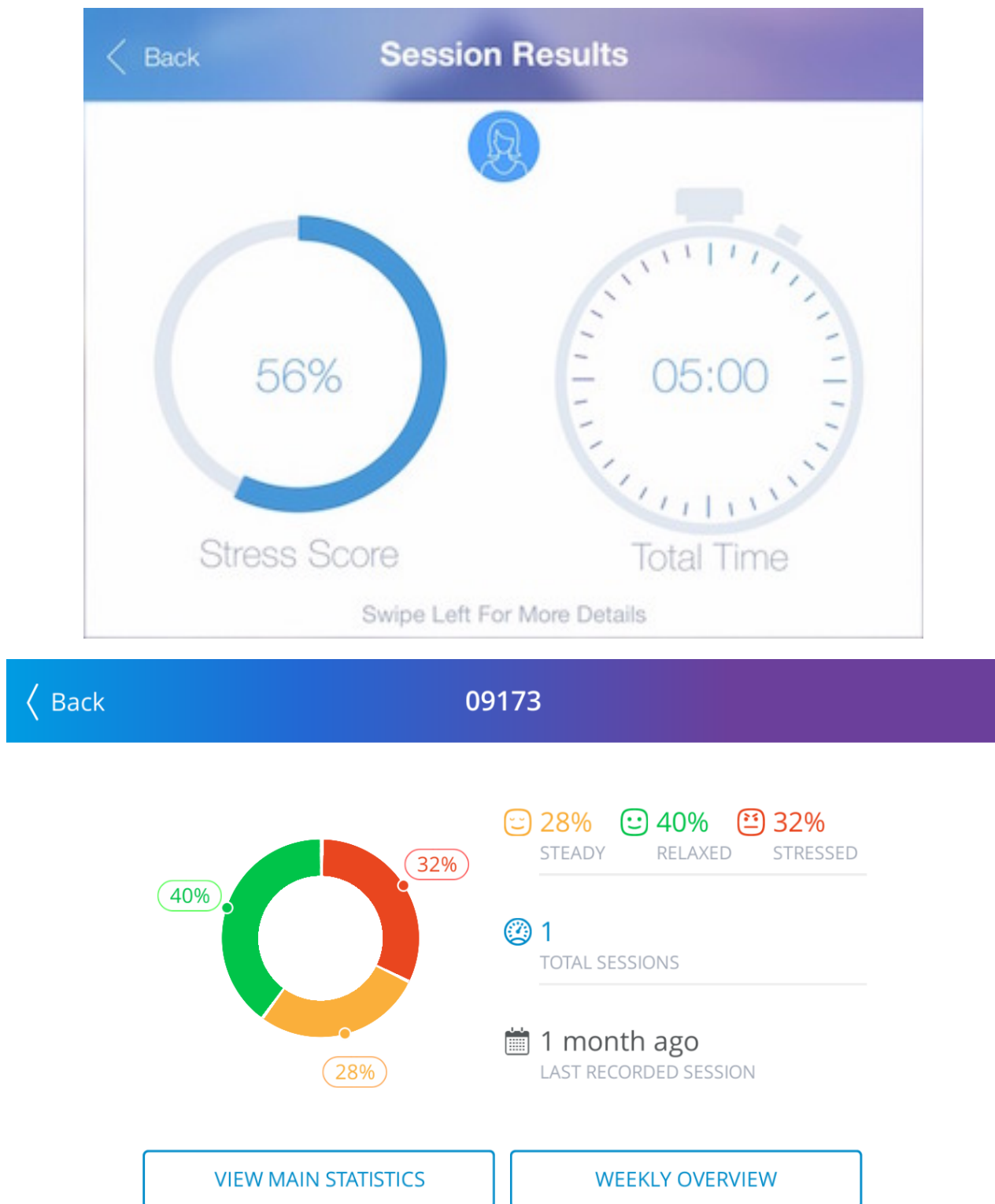


Figure 5. iPhone app used to track PIP Biosensor sessions.



**Altruism.** Participant levels of altruism were measured using an experimental economics game called the Trust Game (Croson & Buchan, 1999). In this game participants were invited to take part in a “funds distribution” task. Each participant is told that they have been awarded a €5 reward for taking part in the study, but they have a decision to make. The participant can keep the €5 for themselves or pass it on to a second participant who they have been randomly paired with. If they choose to give the €5 prize to the second participant in the study, the researcher will double the amount, and give €10 to the second participant to distribute as they like. If the second participant decided to return the €5, the first participant would get this money back, and both would have €5. If the second participant did not return the €5, the second participant would be left with €10, and the first participant would have nothing. Participants are told that the researcher would not know their responses which were reported online (see Figure 6), and they would not meet the other participant, and thus their decision would be completely private. In actuality, participants were not paired with a partner and only completed the first part of the game, the decision to keep the €5 (not altruistic) or give €5 (altruistic). This task assesses whether participants value others over valuing money, as participants stand to gain nothing if they decide to trust the other participant, but could lose their reward by doing so.

**Decision Game**

**You have been awarded €5 prize to distribute as you wish.**  
**You can keep the €5 for yourself or pass it on to the next participant.**

**If you choose to give the €5 prize to a second participant in the study, the researcher will double the amount, and give €10 to the second participant to distribute as they like. If the second participant decided to return the €5, you will have €5. If the second participant did not return the €5, the second participant would be left with €10, and you will have nothing.**

Participant ID

012345

Condition

nature

Keep €5   Give €5

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*Figure 6.* Custom web interface created by the researcher to record decisions in the trust game.

## **Procedure**

Firstly participants completed a booklet of questionnaires including the MAAS and PNB scales. Following this, participants in the nature condition viewed a VR slideshow depicting beautiful nature scenes, while participants in the urban condition viewed a VR slideshow depicting various urban marketplaces around the world. The virtual slideshows in both conditions were five minutes in duration. While viewing the VR slideshows the participants had 360° views of each scene, and

were instructed at the beginning of the slideshow to look around and absorb the views from each scene. During the VR slideshow the participants held the PIP biosensor between their thumb and index finger. Following the VR slideshow participants were invited to take part in the Trust Game as described above. Participants responded with their decision for distribution of funds using the web interface tailored for this sole purpose.

### ***Pilot Study***

A pilot study was conducted to determine if the testing materials were suitable and to identify any impediments in the overall process. Four healthy adult participants took part in the pilot study. The pilot study was invaluable in establishing equipment setup times and overall procedure times.

The feedback from participants was positive and confirmed that the questionnaire measures used for mindfulness and ENB were easily understood and no ambiguities existed. The overall procedure time for each of the participants was approximately fifteen minutes. There was one piece of important feedback which highlighted a critical associative prime in the title of the Trust Game. Due to the fact that the word 'trust' was in the title of the game, participants reported feeling an onus to act generously and trust that the other participant would reciprocate. In order to eliminate this associative prime, the title was changed to 'Decision Game' for the real experiment.

Another important piece of feedback was that there was no discomfort, dizziness, or nausea (VR-associated phenomenon known as 'Cybersickness') reported by the pilot participants during the virtual experience. Due to the static nature of the 360° Photos used in the virtual slideshow and advances in the VR technology used in the Samsung Gear VR consumer edition, it was suspected

that the virtual slideshow would not cause discomfort. This was confirmed by all participants in both the pilot and real studies.

## ***Ethics***

This research was conducted in a manner compliant with the ethical standards and guidelines of IADT DTPEC and PSI Code of Professional Ethics (2010). There were two ethical issues with the current study which required the submission of Ethics Form B. Firstly, the Trust Game was misleading to participants as they did not know that it was a measure for altruism, which could skew results. Secondly, real monetary compensation was needed for the Trust Game prizes in order to have an accurate measure for altruism. Justification for these issues were submitted in Ethics Form B which passed (see Appendix F).

## ***Research Integrity***

Prior to the experiment participants were issued with an information sheet (see Appendix A) detailing the nature of the experiment. Having discussed and agreed to the conditions participants were then asked to sign an Informed Consent form (see Appendix B). Data collected from participants during the experiment was anonymised immediately upon data entry. Following the procedure participants were invited to discuss any aspect of the experiment with the researcher. Each participant was given a debriefing sheet explaining the full nature of the experiment (see Appendix E).

## Results

A range of quantitative data was collected and interpreted using inferential statistics in SPSS. The design allowed for the calculation of chi-squared scores to test for difference between the independent variable of setting and the dependent variable altruism. Pearson's correlation coefficient was calculated to test for significant relationship between the attribute variables of mindfulness and PNB. Mann-Whitney U scores were calculated to test for significant difference between the dependent variable altruism and attribute variables mindfulness, PNB and relaxation.

***Hypothesis 1. Virtual nature is associated with higher levels of altruistic behaviour compared with control setting.***

Overall 100% of participants in the virtual nature condition were altruistic in the trust game, whereas 83% of participants in the virtual city condition were altruistic, as depicted in Figure 7.

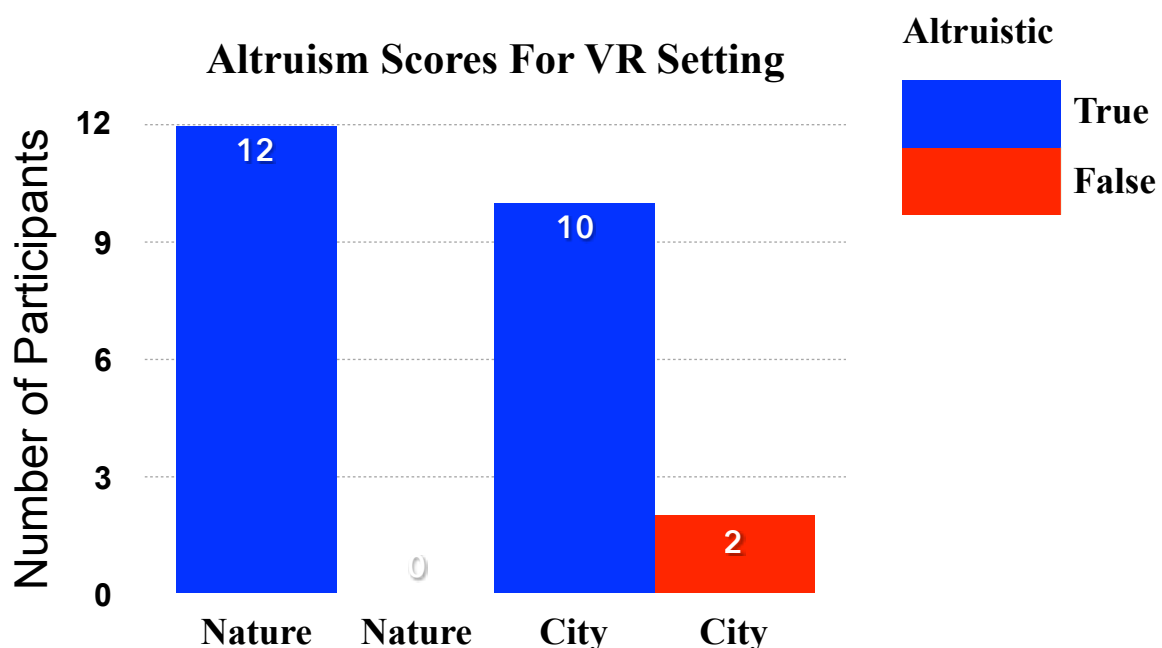


Figure 7. Participants' altruism result across both virtual settings.

The analysis showed that two cells had expected count less than 5, so an exact significance test was selected for Pearson's chi-square. There was a relationship between virtual condition and altruism as follows:

$$\chi^2 (2, N = 24) = 2.182, \text{ exact } p = .239$$

This relationship between virtual setting and altruism was not statistically significant.

***Hypothesis 2. Levels of trait mindfulness are associated with a tendency to perceive natural beauty.***

Table 1

*Mindfulness and PNB - Mean, Standard Deviation and Data Distribution.*

	N	Mean	Mean Std. Error	SD	Skewness	Kurtosis	Shapiro Wilk (Sig.)
<b>Mindfulness</b>	24	3.237	0.148	0.727	0.51	-0.339	0.481
<b>PNB</b>	24	17.333	1.077	5.280	-0.401	0.213	0.846

There was a significant positive correlation between participants' trait mindfulness and tendency to perceive natural beauty:

$$(r = .444, N = 24, p < .05, \text{ one-tailed}).$$

***Hypothesis 3: Tendency to perceive natural beauty is associated with altruistic behaviour.***

Table 2

*PNB by Altruism - Mean, Standard Deviation and Data Distribution.*

Altruistic	N	Mean	Mean Std. Error	SD	Skewness	Kurtosis	Shapiro Wilk (Sig.)
True	22	18	1.012	4.75	-0.152	-0.167	0.919
False	2	10	5	7.071	-	-	-

There was no statistically significant relationship between tendency to perceive natural beauty and altruistic behaviour:

(U = 6.000, N = 24, p = .116, two-tailed).

***Hypothesis 4: Levels of trait mindfulness are associated with altruistic behaviour.***

Table 3

*Mindfulness by Altruism - Mean, Standard Deviation and Data Distribution.*

Altruistic	N	Mean	Mean Std. Error	SD	Skewness	Kurtosis	Shapiro Wilk (Sig.)
True	22	3.292	0.156	0.736	0.356	-0.391	0.832
False	2	2.63	0.03	0.042	-	-	-

There was no statistically significant relationship between mindfulness and altruistic behaviour: (U = 7.500, N = 24, p = .145, two-tailed).

***Hypothesis 5: Physical relaxation is associated with altruistic behaviour.***

Table 4

*Relaxation by Altruism - Mean, Standard Deviation and Data Distribution.*

Altruistic	N	Mean	Mean Std. Error	SD	Skewness	Kurtosis	Shapiro Wilk (Sig.)
True	22	56.818	2.145	10.064	0.457	1.209	0.103
False	2	63	8	11.313	-	-	-

There was no statistically significant relationship between relaxation and altruistic behaviour:

(U = 14.000, N = 24, p = .464, two-tailed).



## Discussion

In summary, the results of this experiment did not support the primary hypothesis that virtual nature would be associated with higher levels of altruistic behaviour when compared to a control setting of virtual city. Participants demonstrated an overwhelming tendency to behave altruistically across both virtual conditions, as 100% of participants in the virtual nature condition were altruistic in the trust game and 83% of participants in the virtual city condition were altruistic. Furthermore, individual variations in trait mindfulness, tendency to engage with natural beauty and physiological relaxation were not significantly associated with altruistic behaviour following exposure to virtual nature.

### ***Mindful People Engage With Natural Beauty***

There was support for hypothesis 2 which revealed a significant positive correlation between individual trait mindfulness and tendency to perceive beauty in nature. Those individuals who have higher levels of trait mindfulness showed a greater tendency to engage with natural beauty. This finding provides further validation for both constructs, trait mindfulness and tendency to perceive natural beauty as measured by the MAAS and Engagement With Beauty scales respectively.

This link between mindfulness and appreciation of nature is an important finding when placed in the context of deriving health benefits from nature. In a more recent study conducted by Zhang, Howell and Iyer (2014), the researchers assessed the link between connectedness to nature and life satisfaction, while measuring individual differences in tendency to perceive natural beauty. The study revealed that the correlation between nature connectedness and positive life outcomes

would only be significant for those individuals who are predisposed to engagement with natural beauty. The results from hypothesis 2 showed that those individuals who are more mindful display a greater tendency to engage with natural beauty. Thus it appears to be the more mindful person who is engaging with natural beauty and experiencing positive psychological wellbeing.

### ***Theoretical and Practical Implications***

There was a significant correlation between individual trait mindfulness and tendency to perceive beauty in nature. This signifies that it is the more mindful person is engaging with natural beauty and reaping the rewards of psychological wellbeing. A theory proposed by the present research is that a mindful disposition fosters hypo-egoic states of being which underlie orientations towards prosocial behaviour (Leary & Guadagno, 2011). Given that participants showed a strong tendency towards altruism irrespective of which virtual condition they had been assigned to, perhaps the VR experience in itself impacted tendencies towards prosocial actions. When one is immersed in a virtual environment, due to the novelty of the experience one's attention is likely to be rooted firmly in the present moment, bringing a focused awareness to the novel surroundings and the sensations and perception of one's body in these virtual surroundings. Embodying the present moment in this fashion is a key tenet of mindfulness practice, as mindfulness involves paying attention on purpose to our thoughts, feelings, bodily sensations, and surrounding environment. When one's attention is anchored firmly in the present moment there is a break from the running-commentary of the egoic self, and so it is plausible that a presence-inducing experience like VR could evoke altruistic behaviour.

Recalling Riva's research group in Italy using VR to treat eating disorder (ED) patients, an interesting insight into the phenomenology of the virtual experience is a central component of a hypothesis offered by Riva for their successes in treating body image disturbances with VR. A common personality trait for those suffering from ED is that they show a tendency towards obsessive negative self-appraisals. The *allocentric lock hypothesis* posits that those suffering from ED are permanently locked in a third-person observer-view (allocentric) of themselves, and that their “perception-driven experience of the real body is no longer able to modify the allocentric memory-driven experience of a negative body”, leaving the patient locked in a negative objectified view of their own body (Riva, 2011; Riva, 2012). Riva discovered that VR can allow ED patients to induce a controlled sensory rearrangement that facilitates an update of the locked allocentric representation of the body, freeing the patient from critical self-objectification (Riva, 2011, Serino et al., 2016 ). Riva's hypothesis that VR allows ED patients to return to perception-driven experience is consistent with the idea that the virtual experience generates a psychological state of fully embodied subjective presence, which may have contributed to the high altruism scores across both conditions in the present experiment, as this state of presence would be hypo-egoic in nature and more likely to generate prosocial actions such as generosity and altruism (Leary & Guadagno, 2011).

From a practical perspective, the present experiment demonstrates that the recent advent of cheap commercially-available VR headsets enables people to immerse themselves in virtual nature. This may be of benefit to anyone who might otherwise be deprived of nature for various reasons. Recalling Ulrich's (1984) hospital study in which patients who had a window view of a green space recovered quicker than those without a nature view, perhaps there is potential for virtual nature to offer similar benefits. As Ryan et al. (2010) showed that even simulated nature can boost subjective vitality, if there is potential for natural beauty in a VR environment to improve

wellbeing for individuals whose circumstances deprive them of these experiences in the real world, then VR could be an ideal platform for those individuals to harness the healing power of nature.

### ***Strengths***

The principal strength was that a complex psychology experiment was undertaken and completed on target. Although the primary hypothesis was not supported, nevertheless the results contribute to knowledge by providing insight into psychological states following exposure to VR.

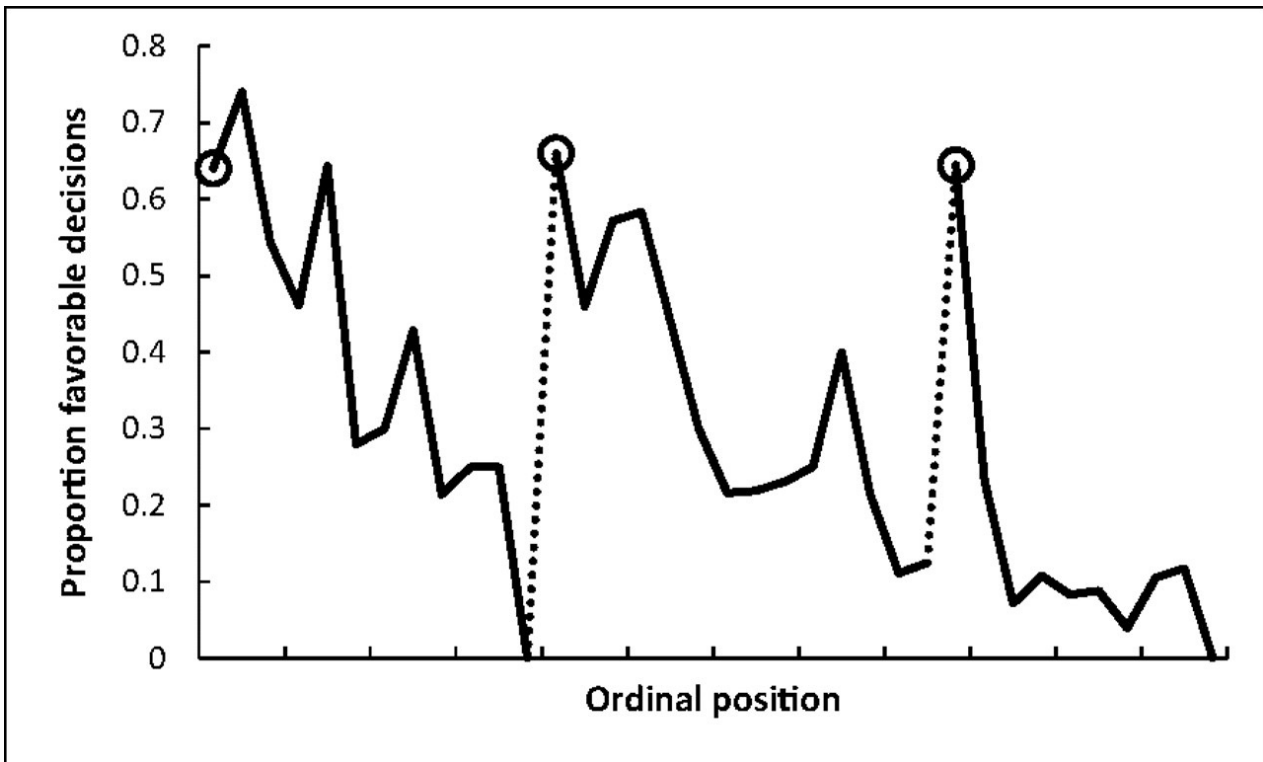
The significant correlation between trait mindfulness and engagement with natural beauty opens avenues for future research in order to explore this relationship. Furthermore this result adds weight to the construct validations for both the MAAS and PNB scales. Additionally the Cronbach's alpha values calculated during the present experiment ( $\alpha = 0.81$  and  $\alpha = 0.84$  for MAAS and PNB respectively) add further reliability to both measures.

The advent of relatively cheap VR technology significantly broadens the realm of opportunities in the field of experimental psychology. The present research shows that it is possible to run a complex psychology experiment with relative ease and efficiency with an average procedure time of fifteen minutes. As VR exposure has been found to be as effective as in vivo exposure (Gorini et al., 2010), instead of relying solely on participants' self-report data to explain human behaviour students and researchers alike now also have the additional option to place participants in hypothetical environments which closely resemble reality. It is the dawn of an exciting era for research in psychology.

## ***Limitations***

The present experiment was limited in a number of ways which are relevant. First and foremost, this experiment used a convenient sample comprised of individuals from the researcher's place of employment. An array of theories from evolutionary psychology suggest that reputation may affect the degree to which an individual behaves in ways that are considered other-oriented or altruistic (Carpenter & Myers, 2010; Barclay, 2011). In accordance with the social desirability bias (Grimm, 2010), this familiarity between participants and researcher in the present experiment could influence decisions in the trust game due to a perceived reputation risk by participants. If participants in the experiment suspected that their decisions in the trust game would be scrutinised at the level of the individual by their colleague-researcher, participants may behave altruistically to avoid jeopardising their reputation. Furthermore if participants suspected that the reason for the trust game itself was to measure generosity or altruism they might feel compelled to contribute favourably to a collective measure of altruism.

The time of day at which the experiment was conducted could also impact decisions in the trust game. A fascinating study by Danziger, Levav and Avnaim-Pesso (2011) revealed that Israeli parole judges were much more likely to grant parole directly after lunch. This research followed eight judges over the course of a year as they presided over a thousand parole applications. The researchers found that at the beginning of the day judges granted approximately 65% of the parole applications. As the morning elapsed the approval rate fell sharply (see Figure 8 depicting the impact of breaks on parole decisions), eventually hitting zero. After each of the two daily meal breaks clemency was restored as the approval rate returned to the initial 65%, only to see the same pattern of decline again as subsequent hours wore on.



*Figure 8. The Impact of Breaks on Favourable Parole Decisions*

The present experiment was conducted in the office of the researcher between the hours of 13:00 and 14:00. Two co-workers of the researcher participated in the experiment during this lunch hour each day. At this particular workplace people would generally take their lunch some time between 12:00 and 14:00. Whether or not participants had taken lunch was not controlled for in the present experiment. It is estimated that most of the participants would have taken the experiment directly after their meal break, with the few who had not yet eaten taking the experiment directly before their meal break. Based on the findings of Dazinger et al. (2011) there is strong evidence to suggest that the proximity of meal times to the experiment could impact a measure for generosity and altruism.

Due to the novelty of the VR technology used in this experiment, all participants expressed a sense of excitement and gratitude for the opportunity to experience VR. After the experiment participants generally expressed sentiments that the technology was very impressive and awe-inspiring. This influx of positive emotion due to experiencing novel technology could introduce another bias leaving participants predisposed to altruism. Consistent with Frederikson's (1998, 2001) broaden-and-build-theory of positive emotion, the excitement, gratitude and awe experienced by participants in the present experiment could broaden their immediate repertoire of cognitive and behavioural options, encouraging them to engage in behaviour which builds their psychological resources, such as behaving altruistically in the trust game.

### ***Future Directions***

It is not entirely clear what happens to people at the level of subjective experience when they experience virtual reality. Hence the most valuable avenue for future research is to understand what effect visiting virtual environments has on people from a phenomenological perspective. While much research has focused on specific applications of VR in therapeutic settings for treatments including eating disorders (Riva, 2011), anxiety disorders (Opriş et al., 2011) and pain management (Li et al., 2011), the research community could benefit from examining the nature of the VR experience and resulting subjective qualia. Participants in the present study showed an overwhelming tendency to behave altruistically across both virtual conditions, study limitations notwithstanding, so perhaps there are qualities inherent in the virtual experience itself which bare influence on psychological states. In support of this idea, VR has demonstrated analgesic qualities in the management of acute pain (Li et al., 2011), yet the neurobiological mechanism of action for this pain reduction are not understood. It is possible that there is therapeutic value in the

experience itself, irrespective of the virtual setting or tasks performed within that setting. Further qualitative research could help to elucidate the phenomenology of the virtual experience.

In order to test the healing potential of virtual nature, future research could replicate Ulrich's (1984) hospital study using virtual nature sessions instead of windows with a view. Such an experiment couple employ a between-subjects design to assess recovery times for surgical procedures when the experimental participant group is exposed to virtual nature sessions throughout their recovery. While VR has been examined as a distraction technique in the management of acute pain in hospital settings, if there is potential for natural beauty in a VR environment to improve wellbeing for individuals whose circumstances deprive them of these experiences, then VR can be platform for those individuals to harness the healing power of nature.

Future research should further examine the relationship between mindfulness, tendency to perceive natural beauty, and connectedness to nature. As Zhang et al. (2014) found that connectedness with nature only predicts positive life outcomes when “individuals are also emotionally attuned to nature’s beauty”. This research leaves the question: can an individual who is not ordinarily attuned to nature's beauty become attuned temporarily? As the present research revealed a correlation between trait mindfulness and a tendency to perceive beauty in nature, its possible a mindfulness meditation could temporarily induce engagement with natural beauty. Participants could take part in a guided mindfulness meditation before a virtual nature experience. Perhaps this could lead participants to be emotionally inspired by beautiful nature, absorbing more of the nature experience, and reaping more of the natural rewards on offer.



## ***Conclusion***

This research experiment did not support the primary hypothesis that a virtual nature experience would be associated with higher levels of altruistic behaviour when compared to a virtual city experience. Participants across both conditions showed an overwhelming tendency to behave altruistically following the virtual experience. Those individuals who scored higher in trait mindfulness showed a greater tendency to engage with beauty in nature. Considering the myriad physical and psychological health benefits available to those individuals who are emotionally inspired by beautiful nature experiences, future research should probe this relationship between mindfulness and nature appreciation in order to explain individual differences in predisposition to engage with natural beauty. Future research should also seek to elucidate what happens to the individual when they experience virtual reality from a phenomenological perspective, as the present experiment indicates that the virtual experience itself may hold intrinsic therapeutic value.

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# Appendix A: Information Sheet.

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Participant ID: \_\_\_\_\_

## Information Sheet

### **Effects of Dispositional Mindfulness on Relaxation Levels in Virtual Environments**

#### **Invitation**

You are invited to consider taking part in this research study conducted by James Glennon, in partial fulfillment of the MSc Cyberpsychology masters degree at IADT Dun Laoghaire. Before you consent to taking part in this research, please take the time to carefully read what this research entails. Please do not hesitate to ask for further information should there be any issue that remains unclear after reading the following information.

#### **Purpose of the Research**

This Research is being conducted to examine the relationship between dispositional mindfulness and levels of relaxation in various virtual environments.

#### **Is Participation Voluntary?**

Participation in this study is entirely voluntary. You can withdraw your agreement to participate in the study at any time up until February 20th. This withdrawal will have no negative repercussions. You may also stop the experiment at any time without giving an explanation or ask the researcher any questions you may have in relation to the study being conducted.

#### **Is Participation Confidential?**

Information collected during the course of the interview will not be traceable to any participant. The researcher will not distribute any identifiable information to any individual or organization.

#### **If I take part what do I have to do?**

Complete a questionnaire measuring dispositional mindfulness. Experience a VR slideshow for 5 minutes using the Samsung Gear VR. Take part in a behavioural economics trust game.

## Appendix B: Consent Form.



Participant ID: \_\_\_\_\_

### Information Sheet

#### **Effects of Dispositional Mindfulness on Relaxation Levels in Virtual Environments**

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Complete a questionnaire measuring dispositional mindfulness. Experience a VR slideshow for 5 minutes using the Samsung Gear VR. Take part in a behavioural economics trust game.



## Appendix C: Mindfulness Attention Awareness Scale.



Participant ID: \_\_\_\_\_

**Instructions:** Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

	1 Almost Never	2 Very Infrequently	3 Somewhat Infrequently	4 Somewhat Frequently	5 Very Frequently	6 Almost Always
I could be experiencing some emotion and not be conscious of it until some time later.	1	2	3	4	5	6
I break or spill things because of carelessness, not paying attention, or thinking of something else.	1	2	3	4	5	6
I find it difficult to stay focused on what's happening in the present.	1	2	3	4	5	6
I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.	1	2	3	4	5	6
I tend not to notice feelings of physical tension or discomfort until they really grab my attention.	1	2	3	4	5	6
I forget a person's name almost as soon as I've been told it for the first time.	1	2	3	4	5	6
It seems I am "running on automatic," without much awareness of what I'm doing.	1	2	3	4	5	6
I rush through activities without being really attentive to them.	1	2	3	4	5	6
I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.	1	2	3	4	5	6
I do jobs or tasks automatically, without being aware of what I'm doing.	1	2	3	4	5	6
I find myself listening to someone with one ear, doing something else at the same time.	1	2	3	4	5	6
I drive places on 'automatic pilot' and then wonder why I went there.	1	2	3	4	5	6
I find myself preoccupied with the future or the past.	1	2	3	4	5	6
I find myself doing things without paying attention.	1	2	3	4	5	6
I snack without being aware that I'm eating.	1	2	3	4	5	6

## Appendix D: Engagement With Natural Beauty Scale



Participant ID: \_\_\_\_\_

1	2	3	4	5	6	7
Almost	Very	Somewhat	Neutral	Somewhat	Very	Almost
Never	Infrequently	Infrequently		Frequently	Frequently	Always

I notice beauty in one or more aspects of nature. 1 2 3 4 5 6 7

When **perceiving beauty** in nature I feel changes in my body, such as a lump in my throat, an expansion in my chest, faster heart beat, or other bodily responses 1 2 3 4 5 6 7

When **perceiving beauty** in nature I feel emotional, it “moves me” such as feeling a sense of awe or wonder or excitement or admiration of upliftment. 1 2 3 4 5 6 7

When **perceiving beauty** in nature I feel something like a spiritual experience, perhaps a sense of oneness or being united with the universe or a love of the entire world. 1 2 3 4 5 6 7

## Appendix E: Debrief Sheet

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Participant ID: \_\_\_\_\_

### Debrief

Thank you for taking part in this research study.

The aim of this research study is to assess whether virtual nature can evoke altruistic tendencies in people. The purpose of the Decision Game at the end of the experiment was to measure altruistic tendencies in participants following the virtual experience. The research also examines the relationship between trait mindfulness, a tendency to perceive beauty in nature, and levels of relaxation during exposure to natural environments in a virtual reality setting.

Please note that any data collected from your participation in this study will be treated with the strictest care and confidentiality. Your data is anonymized upon data entry. Your decision in the decision game is only interpreted in the context of the group and never scrutinized at the level of individual, and hence your decision remains completely private. Your completion of this study does not affect your right to withdraw or have any data destroyed or returned to you.

If you have any questions or queries, wish to request more information about the study or have your data withdrawn please do not hesitate to contact the researcher or their supervisor by referring to the contact details listed below.

If you wish to withdraw your data from the study it would be ideal if you could do so before 20<sup>th</sup> February 2016 as agreed.

Researcher: James Glennon at [jamesglennon@gmail.com](mailto:jamesglennon@gmail.com)  
Supervisor: Hannah Barton at [hannah.barton@iadt.ie](mailto:hannah.barton@iadt.ie)

Many Thanks,  
James Glennon.

## Appendix F: Ethics Form B Submission.

### DEPARTMENT OF TECHNOLOGY AND PSYCHOLOGY ETHICAL APPROVAL FORM B\*

Three printed copies of this form should be submitted to the chair of the ethics committee

Title of project Effects of Virtual Nature on Altruistic Behaviour

Name of researcher James Glennon

Email contact jamesglennon@gmail.com

Name of supervisor \_\_\_\_\_

		Yes	No	N/A
1	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	✓		
2	Will you tell participants that their participation is voluntary?	✓		
3	Will you obtain written consent for participation (through a signed or 'ticked' consent form)?	✓		
4	If the research is observational, will you ask participants for their consent to being observed?			✓
5	Will you tell participants that they may withdraw from the research at any time and for any reason?	✓		
6	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	✓		
7	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	✓		
8	Will you debrief participants at the end of their participation (i.e., give them a brief explanation of the study)?	✓		
9	If your study involves people between 16 and 18 years, will you ensure that <u>passive</u> consent is obtained from parents/guardians, with active consent obtained from both the child and their school/organisation?			✓
10	If your study involves people under 16 years, will you ensure that <u>active</u> consent is obtained from parents/guardians <u>and</u> that a parent/guardian or their nominee (such as a teacher) will be present throughout the data collection period?			✓
11	Will your project involve deliberately misleading participants in any way?	✓		
12	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?	✓		
13	Does your project involve work with animals?		✓	
14	Do you plan to give individual feedback to participants regarding their scores on any task or scale?		✓	
15	Does your study examine any sensitive topics (such as, but not limited to, religion, sexuality, alcohol, crime, drugs, mental health, physical health)?		✓	
16	Is your study designed to change the mental state of participants in any negative way (such as inducing aggression, frustration, etc.)?		✓	
17	Does your study involve an external agency (e.g. for recruitment)?		✓	
18	Do participants fall into any of the following special groups?		✓	
	People with learning or communication difficulties Patients (either inpatient or outpatient)		✓	

## Ethics Form B Submission (Continued).

		People in custody		✓	
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If you have ticked **No** to any of questions 1 to 10, or **Yes** to any of questions 11 to 18 you should refer to the PSI Code of Professional Ethics and BPS Guidelines. There is an obligation on the lead researcher to bring to the attention of the Department of Technology and Psychology Ethics Committee (DTPEC) any issues with ethical implications not clearly covered by the above checklist.

\* This Ethics B form should be completed by researchers whose studies involve any ethically questionable practices.



## Ethics Form B Submission (Continued).

I consider that this project **may** have ethical implications that should be brought before the DTPEC.



**Please provide all the further information listed below, adhering closely to the suggested word counts.**

1. Purpose of project with very clear and specific justification for the study [its potential benefits], given the acknowledged sensitivity of the topic of study or the methods used (approximately 100 words)

The purpose of the study is to broaden our understanding of altruistic behaviour. The study will examine the effects of virtual nature on altruistic tendencies in the general population. Research has shown that people who volunteer are psychologically happier and healthier, physically healthier, and may even live longer (Borgonovi, 2009; Grimm, Spring, & Dietz, 2007; Post, 2007). Given that there are significant health benefits to be realized by exhibiting altruism, an increased understanding of altruism due to this study could help people cultivate more altruistic attitudes and behaviours.

The primary hypotheses is that participants who experience a virtual nature setting will behave more altruistically than control group in an economics trust game. Also levels of immersion and relaxation will predict levels of generosity.

2. Proposed methodology (approximately 300 words). This must include:
  - a. Participants: recruitment methods, number, age, gender, exclusion/inclusion criteria.
  - b. Brief description of methods and measurements.

### **A**

This experiment will use a convenient sample from the general population numbering forty adult individuals of both genders. Participants with a history of motion sickness on common forms of travel will be excluded.

### **B**

#### **Method**

Participants will be randomly assigned to either the virtual nature setting or city setting. In both cases the participant will spend ten minutes in the designated virtual setting using a VR headset (Oculus Rift or Samsung Gear, TBD.). Participants will hold the PIP biosensor device between thumb and forefinger during the virtual experience.

After ten minutes immersed in the virtual environment, the virtual experience ends and the participant is asked to fill out a short questionnaire capturing levels of subjective immersion.

## Ethics Form B Submission (Continued).

Following collection of the self-report data participants are invited to take part in the “funds distribution” game. Participants will respond with their decision for distribution of funds using a web interface tailored for this sole purpose. Participants are then debriefed as to the full nature of the experiment, and the experiment ends.

### **Measures**

#### **Immersion**

An adapted version of the presence subscale from the ITC-SOPI (Lessiter, et al., 2001)

#### **Relaxation**

The PIP biosensor will be used in the present study to measure participants' levels of skin conductance (PIP, 2015).

#### **Altruism**

Participant levels of generosity will be measured using an experimental economics game called the Trust Game (Croson & Buchan, 1999). In this game participants are invited to take part in a “funds distribution” task. Each participant is told that they have been assigned to a “decision maker” condition, and that they have been awarded a €5 prize to distribute as they wish. The participant can keep the €5 for themselves or pass it on to the next participant. If they choose to give the €5 prize to a second participant in the study, they are told that the researchers will double the amount, and give €10 to the second participant to distribute as they like. If the second participant decided to return the €5, the participant would get this money back, and both would have €5. If the second participant did not return the €5, the second participant would be left with €10, and the first participant would have nothing.

Weinstein et al. (2009) used this Trust Game to measure altruism following exposure to images of nature, with great success. We are replicating this experiment in a VR setting.

3. A clear but concise statement of the ethical considerations raised by the project and how you intend to deal with them (approximately 100 words).

Participants will not be told the purpose of the trust game (altruism measure) before the experiment, as reputation has been shown to affect altruistic behaviour (Barclay, 2011). Even though the participants' decision will be completely private in the trust game, and their personal reputation is not in jeopardy, they may still feel morally obliged to contribute favourably to a collective measure of altruism if they are made aware beforehand. Participants will receive monetary vouchers for all prizes awarded in the trust game in the form of one4all gift vouchers. Participants will not be made aware of the possibility for monetary prizes before the experiment, so the study will not attract vulnerable people looking to benefit financially. Real compensation is needed for an accurate measure of altruism, hypothetical compensation is insufficient, as people would behave more generously if there was nothing at stake.

## Ethics Form B Submission (Continued).

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4. Copies of all materials to be used in your study should be attached to this form. This must include consent and participant information arrangements and debrief forms. It should also include copies of all standardized and/or non-standardized questionnaires and instruments, as well as any interventions and/or audio-visual materials which will be used. Please note that these materials will not be returned to you, so you should ensure that you retain a copy for your own records. All loose materials (such as DVDs, handouts etc.) should be clearly labeled with your name. There is no word count limit on appendices, but no appendices should be included that will not be used as materials in your study.

I am familiar with the PSI Code of Professional Ethics and BPS Guidelines (and have discussed them with the other researchers involved in the project). I have read and understood the specific guidelines for completion of Ethics Application Forms.

Signed \_\_\_\_\_ Print Name \_\_\_\_\_ Date \_\_\_\_\_  
*Applicant*

Signed \_\_\_\_\_ Print Name \_\_\_\_\_ Date \_\_\_\_\_  
*Supervisor*

### REFERENCES

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## Appendix G: SPSS Output

```

CROSSTABS
  /TABLES=Setting BY Altruistic
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ
  /CELLS=COUNT EXPECTED
  /COUNT ROUND CELL
  /BARCHART
  /METHOD=EXACT TIMER(5).
  
```

### Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
VR condition * Altruistic	24	100.0%	0	0.0%	24	100.0%

VR condition \* Altruistic Crosstabulation

			Altruistic		Total
			True	False	
VR condition	nature	Count	12	0	12
		Expected Count	11.0	1.0	12.0
	city	Count	10	2	12
		Expected Count	11.0	1.0	12.0
Total		Count	22	2	24
		Expected Count	22.0	2.0	24.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	2.182 <sup>a</sup>	1	.140	.478	.239	
Continuity Correction <sup>b</sup>	.545	1	.460			
Likelihood Ratio	2.955	1	.086	.478	.239	
Fisher's Exact Test				.478	.239	
Linear-by-Linear Association	2.091 <sup>c</sup>	1	.148	.478	.239	.239
N of Valid Cases	24					

## SPSS Output (Continued)

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Mindfulness	24	100.0%	0	0.0%	24	100.0%
PNB	24	100.0%	0	0.0%	24	100.0%

Descriptives					Statistic	Std. Error
Mindfulness	Mean				3.2371	.14857
	95% Confidence Interval for Mean	Lower Bound			2.9297	
		Upper Bound			3.5444	
	5% Trimmed Mean				3.2194	
	Median				3.0600	
	Variance				.530	
	Std. Deviation				.72785	
	Minimum				1.93	
	Maximum				4.86	
	Range				2.93	
	Interquartile Range				1.20	
	Skewness				.510	.472
	Kurtosis				-.339	.918
PNB	Mean				17.3333	1.07788
	95% Confidence Interval for Mean	Lower Bound			15.1036	
		Upper Bound			19.5631	
	5% Trimmed Mean				17.4630	
	Median				18.0000	
	Variance				27.884	
	Std. Deviation				5.28054	
	Minimum				5.00	
	Maximum				27.00	
	Range				22.00	
	Interquartile Range				6.75	
	Skewness				-.401	.472
	Kurtosis				.213	.918

Tests of Normality						
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Mindfulness	.138	24	.200*	.962	24	.481
PNB	.124	24	.200*	.978	24	.846

\*. This is a lower bound of the true significance.

## SPSS Output (Continued)

### Altruistic

Case Processing Summary							
		Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
PNB	True	22	100.0%	0	0.0%	22	100.0%
	False	2	100.0%	0	0.0%	2	100.0%
Relaxation	True	22	100.0%	0	0.0%	22	100.0%
	False	2	100.0%	0	0.0%	2	100.0%
Mindfulness	True	22	100.0%	0	0.0%	22	100.0%
	False	2	100.0%	0	0.0%	2	100.0%

Descriptives					
Altruistic				Statistic	Std. Error
PNB	True	Mean		18.0000	1.01290
		95% Confidence Interval for Mean	Lower Bound	15.8936	
			Upper Bound	20.1064	
		5% Trimmed Mean		18.0455	
		Median		19.0000	
		Variance		22.571	
		Std. Deviation		4.75094	
		Minimum		8.00	
		Maximum		27.00	
		Range		19.00	
		Interquartile Range		7.00	
		Skewness		-.152	.491
		Kurtosis		-.167	.953
	False	Mean		10.0000	5.00000
		95% Confidence Interval for Mean	Lower Bound	-53.5310	
			Upper Bound	73.5310	
		5% Trimmed Mean		.	
		Median		10.0000	
		Variance		50.000	
		Std. Deviation		7.07107	
		Minimum		5.00	
		Maximum		15.00	
		Range		10.00	
		Interquartile Range		.	
		Skewness		.	.
		Kurtosis		.	.

## SPSS Output (Continued)

Relaxation	True	Mean		56.8182	2.14581
		95% Confidence Interval for Mean	Lower Bound	52.3557	
			Upper Bound	61.2806	
		5% Trimmed Mean		56.3283	
		Median		59.5000	
		Variance		101.299	
		Std. Deviation		10.06473	
		Minimum		40.00	
		Maximum		84.00	
		Range		44.00	
		Interquartile Range		13.50	
		Skewness		.457	.491
		Kurtosis		1.209	.953
	False	Mean		63.0000	8.00000
		95% Confidence Interval for Mean	Lower Bound	-38.6496	
			Upper Bound	164.6496	
		5% Trimmed Mean		.	
		Median		63.0000	
		Variance		128.000	
		Std. Deviation		11.31371	
		Minimum		55.00	
		Maximum		71.00	
		Range		16.00	
		Interquartile Range		.	
		Skewness		.	.
		Kurtosis		.	.

## SPSS Output (Continued)

Mindfulness	True	Mean		3.2923	.15694
		95% Confidence Interval for Mean	Lower Bound	2.9659	
			Upper Bound	3.6186	
		5% Trimmed Mean		3.2808	
		Median		3.1600	
		Variance		.542	
		Std. Deviation		.73610	
		Minimum		1.93	
		Maximum		4.86	
		Range		2.93	
		Interquartile Range		1.18	
		Skewness		.356	.491
		Kurtosis		-.391	.953
	False	Mean		2.6300	.03000
		95% Confidence Interval for Mean	Lower Bound	2.2488	
			Upper Bound	3.0112	
		5% Trimmed Mean		.	
		Median		2.6300	
		Variance		.002	
		Std. Deviation		.04243	
		Minimum		2.60	
		Maximum		2.66	
		Range		.06	
		Interquartile Range		.	
		Skewness		.	.
		Kurtosis		.	.

### Tests of Normality

		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
PNB	True	.129	22	.200*	.980	22	.919
	False	.260	2	.			
Relaxation	True	.163	22	.134	.926	22	.103
	False	.260	2	.			
Mindfulness	True	.124	22	.200*	.975	22	.832
	False	.260	2	.			

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction