

**How to feel ‘Good’?:
A Quantitative Study on the Effects of Nature and an Active Mental State
Positive Affect, Feelings of Creativity and Enjoyment.**

L.A.H. Rempkens (S2180820)

University of Twente

Bachelor Thesis Communication Science

dr. T. J. L. van Rompay

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Abstract

Aim: Individually oriented approaches to enhance well-being can be of crucial value in combating low well-being rates amongst a diversity of population groups. Motivated by research that showed the positive influence of nature on aspects of well-being such as positive affect and creativity, this study aimed to find out if such effects would also be present for nature paintings, and whether an active mental state would enhance such a positive effect.

Method: To this end, participants of an online questionnaire saw either a painting of a natural environment or of an urban environment and were asked to either write down a memory that matched the painting or to write down how many colours the painting counted, hereby serving for differences in participants' mental state. Thereafter, participants filled out a questionnaire including self-report measures for the well-being aspects positive affect, feelings of creativity and enjoyment of the painting. *Findings:* The results of this study showed positive affect, feelings of creativity and enjoyment of the painting to be enhanced by the nature painting. An interaction effect was found for feelings of creativity, indicating that the effect of nature painting more pronounced in the case of an active mental state, indicating a moderation effect of mental state. *Conclusions:* The study's results provide a foundation for an approach one can undertake individually to enhance their well-being. Future research should aim to explore differences between the effect of real or real-looking nature and nature paintings, and should aim to focus on different art types and styles. In addition, the effect of mental state on the relation between nature paintings and feelings of creativity should be further explored to support the findings of this study.

Keywords: Well-being, positive affect, creativity, enjoyment, nature, mental state.

1. Introduction

A great number of books, blogs, magazines, podcasts and articles cover what might actually be one of the most valued goals in present day and earlier times, ‘feeling good’. Although it is commonly referred to as ‘feeling good’ or ‘being happy’ in those readings, it is often really just ‘well-being’ that is being talked about. Well-being is broadly defined as what is ‘good’ for someone and can be improved by a variety of aspects, amongst which are happiness (or: SWB), creativity and enjoyment (Ryan & Deci, 2001; Ryff, 1989; Tamannaefar & Motaghedifard, 2014).

Research shows that happier people have a better longevity, and happiness is also said to serve for higher social intelligence and moral competence, better work performance, higher levels of income, and successful marriages and friendships (Robertson & Cooper, 2011; Veenhoven, 2008; Veenhoven, 2010). Creativity shows similar positive effects on well-being by enhancing vivacity and reducing difficulties in life (Collins, 2006; Maltz, as cited in Tamannaefar & Motaghedifard, 2014). Likewise, enjoying life is demonstrated to put elderly people at lower risk of experiencing problems with daily activities (Steptoe, de Oliveira, Demakakos, & Zaninotto, 2014).

As higher feelings of well-being have positive effects on one’s life, research on how to enhance this state can be beneficial for improving quality of life for those who report lower feelings of well-being (Camberg et al., 1999), such as lower-educated people, those who experience long-term illnesses, and transgender and non-binary individuals (Camberg et al., 1999; Centraal Bureau voor de Statistiek [CBS], 2019; Aparicio-García, Díaz-Ramiro, Rubio-Valdehita, López-Núñez, & García-Nieto, 2018). Although one might suggest these population groups would benefit most from case-specific approaches such as better education through governmental policy, there are also approaches individuals can act upon themselves.

In that way, people can take matters into their own hands with regard to their well-being, while not solely relying on governmental policy. Considering such approaches that are more easily implemented can be of crucial value with regard to enhancing well-being amongst a diversity of people. The environment, and especially natural environments, can play a valuable role in this. Studies on the effect of environment on well-being aspects have, for example, shown happiness to be significantly higher for people living in green environments as opposed to those living in urban environments (Han & Kim, 2019; MacKerron & Mourato, 2013).

Research on this effect has not solely focused on nature that is physically present – e.g. walking through the woods, encountering a plant at the office – (i.e., intentional and incidental interactions; Keniger, Gaston, Irvine, & Fuller, 2013), in addition, viewing nature through virtual reality (VR) and watching nature videos have also been the topic of discussion (i.e., indirect interactions; Keniger et al., 2013). For instance, Hu et al. (2020) showed that COVID-19 essential workers who were shown short videos of natural scenes for five days in a row reported higher happiness compared to a group that watched urban scenes videos. However, although a considerable amount of research on well-being and well-being aspects is done on the effects of real-life nature and nature videos, photos and VR, little is known on the effect of abstract visualizations of nature (e.g. paintings or drawings) while art has been shown to improve well-being (Mastandrea, Fagioli, & Biasi, 2019).

Next to just the mere contact with nature that influences happiness, the effect has also been studied for active versus passive interactions with nature. Holt, Lombard, Best, Smiley-Smith, and Quinn (2019) looked into an effect of active versus passive engagement and showed that students who frequently interacted with green spaces in an active way, for example by biking, running or walking, indicated to be happier than students who frequently interacted with green spaces in a passive way, think of studying, meditating, or relaxing.

However, active and passive states are here both seen as physical conditions, while barely any attention has been paid to a possible moderating effect of an active mental state on the effect of nature on well-being.

As mentioned above, previous research showed the positive effect of nature on individuals' well-being. Yet, little research is done so far on whether more abstractly visualized nature can also enhance well-being aspects in addition to real or real-looking nature (e.g. VR). Next to that, the question whether individuals' mental state moderates the positive effect of nature on well-being as has been shown to be the case for individuals' physical state currently unanswered. Therefore, this study aims to address these questions by analysing the effect of an abstractly visualized natural environment versus an abstractly visualized urban environment on three aspects of well-being, and examines a potential interaction effect between mental state and the visualized natural environment. The three aspects of well-being considered in this study concern positive affect (component of happiness), feelings of creativity, and enjoyment. Accordingly, a 2 (painting: nature versus urban) x 2 (mental state: active versus passive) between-subjects design was conducted to study participants' reported positive affect, feelings of creativity and enjoyment. The main research question for this study is:

RQ 1: To what extent do paintings of a natural (as opposed to an urban) environment influence positive affect, feelings of creativity and enjoyment and to what extent does an active mental state influence this effect?

The section below provides an overview of previous research and theorizes on the expected findings. After this, the stimuli and conditions are presented together with the study's participants and procedure. Hereafter, the results of the conducted study are listed followed up with an interpretation of these results and the study's, practical implications, limitations and future recommendations for research in the field.

2. Theoretical framework

2.1 Natural and urban environments

2.1.1 Positive affect

Before elaborating on the effect of nature and art on positive affect, the following section will first shortly elaborate why this study focuses on the concept of positive affect for measuring as an aspect of well-being.

Positive affect is a component of happiness that is extensively studied in the light of well-being and nature research. That is, happiness – which is otherwise referred to as ‘subjective well-being’ (SWB) – includes two conceptualizations of which the affective conceptualization in turn consists of three components; positive affect, negative affect, and life satisfaction (Diener, Kesebir, & Tov, 2009; Phillips, Nyholm, & Liao, 2014). Positive affect refers to the extent to which positive moods like inspiration and enthusiasm are experienced (Miller, 2011). Since a considerable part of the research on the positive relation between nature and happiness focuses on positive affect, this study also analyses positive affect as an indicator of overall well-being instead of directing the attention to overall happiness.

Several researchers point out the positive relation between natural environments and (components of) happiness, amongst which positive affect. Two theories that are expected to constitute this effect are the psycho-evolutionary theory (PET) and attention restoration theory (ART). PET (Ulrich et al., 1991) implies that stress can be seen as increased negative emotion and that stress recovery is facilitated by environments that evoke interest, pleasantness, and calmness and that induce low levels of arousal (Hartig, 2011; Berto, 2014), generally characteristics of natural environments. As Hartig (2011) explains, according to PET “a scene with moderate and ordered complexity, moderate depth, a focal point and natural contents

such as vegetation and water would rapidly elicit interest and positive affect, hold attention, and so displace or restrict negative thoughts” (p. 44). Therefore, the process of restoring stress through nature implies decreasing negative emotions and increasing positive emotions, meaning that, amongst others, individuals’ positive affect increases.

A second theory associated with this positive influence of nature on positive affect is the attention restoration theory (ART; Kaplan & Kaplan, 1989). The theory, which was originally developed by Rachel and Stephen Kaplan in 1989, holds that “environments laden with stimuli that capture involuntary attention can restore the mental resources depleted by the prolonged engagement of voluntary attention” (Pilotti, Klein, Golem, Piepenbrink, & Kaplan, 2014, p. 3). The theory focuses on two forms of attention; directed (or voluntary) attention and involuntary attention. This involuntary attention requires little or no effort, while directed attention does require this effort. Directed attention is used to inhibit distractions (e.g. cars driving by, people talking loudly) and therefore requires energy (Rappe, 2005). As Rappe (2005) explains, if directed attention is required for a long time, it can be depleted which, according to Kaplan and Berman (2010) can cause difficulties in managing emotions. According to the ART, nature draws on involuntary attention as most natural stimuli (e.g. rippling water, flowers) only slightly capture attention. This engagement with the scene is also called ‘soft fascination’ (Kaplan & Kaplan, 2011) and is induced by four conditions; fascination, the feeling of being away, the perception of extent, and compatibility (Kaplan, 1995). Due to these conditions of natural environments that induce soft fascination, such environments enable depleted directed attention to recover (Pilotti et al., 2014) and so replace negative emotions by positive ones (Berto, 2014). With this in mind, one might argue that through replacing negative emotions with positive emotions, natural environments enhance positive affect.

Viewing art has been shown to positively influence subjective well-being as well, specifically through aesthetic experience (Silvia, 2009). Aesthetic experiences is said to be “the attitudes, perceptions, or acts of attention involved with viewing art” (Levinson, 2003) and includes amongst others an emotional dimension that is comprised of the positive and negative emotions that an individual derives from viewing art (Wanzer, Finley, Zarian, & Cortez, 2018). It is believed that, due to the positive influence that viewing art can have on positive affect, natural environments displayed as art (i.e. a painting) versus urban environments displayed as art can yield the same difference in positive affect as known for real-life nature versus real-life urban spaces. Hence, the hypothesis testing this states:

H1: A painting of a natural, versus urban, environment results in a higher level of positive affect.

2.1.2 Feelings of creativity

Just as positive affect is claimed to be influenced by the environment as well as by art, the same goes for creativity. Specifically, creativity or feelings of creativity have been shown to be positively influenced by natural environments as opposed to urban environments (van Rompay & Jol, 2016; Plambech & Konijnendijk van den Bosch, 2015) while the aesthetic experience theory has also shown art to enhance (feelings of) creativity (An & Youn, 2018). Kurtzberg (2005) argues this effect of art on (feelings of) creativity to be partly caused by the positive affect induced by the art as conforming to the theory of aesthetic experience. The researcher suggests however, that this effect of positive affect on creativity can also occur the other way around; (feelings of) creativity inducing positive affect (Kurtzberg, 2005). In addition to the positive effect of both nature and art on feelings of creativity independently, this suggests a positive relation between a nature painting and feelings of creativity to surface alongside the expected relation between nature painting and positive affect. To this end, this

study will measure whether a nature painting as opposed to a painting of an urban environment increases feelings of creativity. Therefore, the hypothesis testing this states:

H2: A painting of a natural, versus urban, environment results in a higher level of feelings of creativity.

2.1.3 Enjoyment of the painting

Again, the same applies for enjoyment as various studies report enjoyment to come along with increases in components of subjective well-being as well (Focht, 2009; Raedeke, 2007). This might seem logical as 'joy' is a positive state, meaning that an increase of joy by natural stimuli ultimately increases positive affect. One could therefore argue that the effect of environment on positive affect is mediated by an increase of enjoyment by viewing nature or carrying out a task. To illustrate, Raedeke (2007) showed that an increase of positive affect after exercising was positively related to participants' enjoyment of that exercise.

Furthermore, MacKerron and Mourato (2013) found a positive relation between natural environments and subjective well-being. However, the researchers noted that participants of their study might have been influenced by their enjoyment of leisure while filling out the questionnaires so that this enjoyment might have influenced the relation between environment and positive affect that they found.

Altogether this suggests an increase in enjoyment to come along an expected increase of positive affect induced by a nature painting as opposed to an urban painting. Accordingly, this study will test whether a nature painting increases enjoyment as opposed to an urban painting. This 'enjoyment' will focus on the painting displayed to get more insights into whether the painting increases this enjoyment or that it may be something outside of the scope of this study as MacKerron and Mourato (2013) suggested to be the case in their study.

Hence, the following hypothesis states:

H3: A painting of a natural, versus urban, environment results in more enjoyment of the painting.

2.2 Mental state

In addition to testing the relation between nature versus urban paintings and positive affect, feelings of creativity and enjoyment of the painting, the effect of an active versus passive mental state on this relation was also of interest. That is, would the positive effect of a nature painting on the positive states be stronger when one experiences an active mental state? This suggestion is formed upon the findings of a consumer-product experiment by Behe, Sage, Bae, and Huddleston (2015) that showed high involvement consumers to pay more attention to the product and its visual elements and showed them to spend more time in processing this information. Therefore, it is suggested that participants experiencing an active mental state – and as such are more involved with the painting – will pay more attention to the elements of the nature or urban painting. This will emphasize the paintings' elements which is expected to enhance the previously predicted positive influence of nature painting on positive affect, feelings of creativity and enjoyment of the painting itself. In other words, this means that the proposed effects of nature painting on the positive states are more pronounced when experiencing an active mental state. Therefore, the following hypothesis states:

H4: Effects of a painting of a natural, versus urban, environment on positive affect, feelings of creativity and enjoyment of the painting are more pronounced in the case of an active, versus passive, mental state.

3. Method & Instruments

3.1 Stimuli

3.1.1 Painting

Two combinations of four small paintings were created to distinguish between the nature condition and urban condition. One combination therefore existed of four small nature paintings while the other combination exists of four urban paintings. The paintings themselves were made on small pieces of paper with paint markers (see Fig. 1).

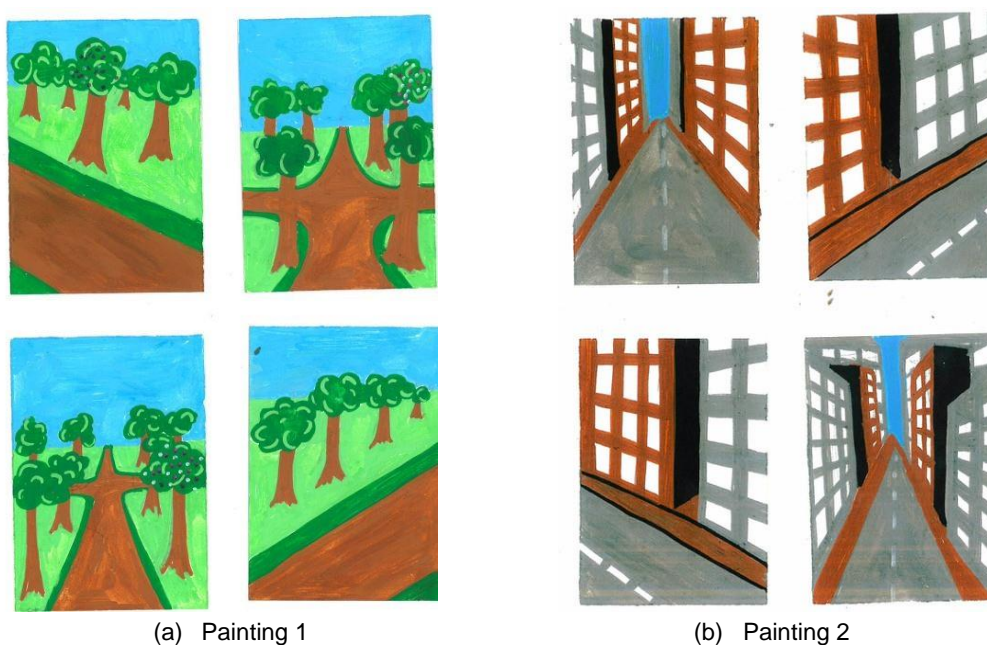


Fig. 1. Paintings used in the study: (a) painting 1, nature (b) painting 2, urban.

3.1.2 Mental state

In order to see whether a participant's active mental state would influence positive affect, enjoyment of the paintings, and feelings of creativity, two tasks were created, a task requiring more active participation and a task requiring less active participation (see Table 1). The assignment testing an active mental state required participants to think of a memory that

suited the painting displayed to them, it therefore asked participants to actively memorize past events as expected to require more mental effort. The assignment testing a passive mental state asked participants to indicate how many colours were used in the painting displayed, as expected to require less mental effort than the memory assignment.

Table 1

Tasks used in the study.

Active mental state	Passive mental state
<p>Based on the images displayed above, what memory do you think of? It can be a memory of something you experienced today, last week, last year or even 10 years ago. Finish the sentence below to clearly describe this memory.</p> <p>When I see these images, I think of...</p>	<p>How many different colours are used in the images displayed above? Fill in the dots below to clearly state your answer, do this by writing down (a) number(s).</p> <p>In these images, in total(amount of) colours are used.</p>

3.1.3 Conditions

Based on the aforementioned stimuli (i.e. painting and mental state), four conditions were created to serve for a 2 (painting: nature versus urban) x 2 (mental state: active versus passive) between-subjects design (see Fig. 2). A timer of 2.5 minutes was set to prevent that participants would skip to the next page of the questionnaire too quick, as they were expected to focus less on the painting displayed if they could quickly continue to the questionnaire.



Based on the images displayed above, what memory do you think of? It can be a memory of something you experienced today, last week, last year or even 10 years ago. Finish the sentence below to clearly describe this memory.

You can go to the next page after 2.5 minutes.

When I see these images, I think of...

(a) Condition 1

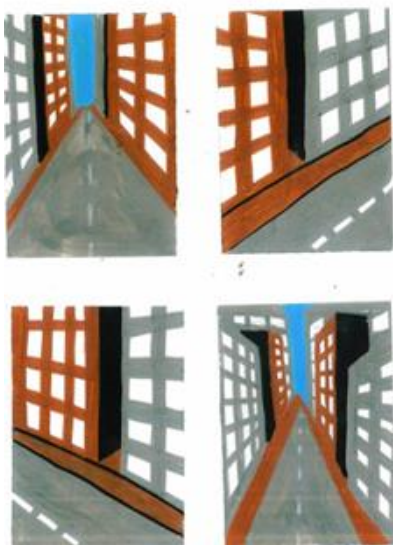


How many different colours are used in the images displayed above? Fill in the dots below to clearly state your answer, do this by writing down (a) number(s).

You can go to the next page after 2.5 minutes.

In these images, in total(amount of) colours are used.

(b) Condition 2

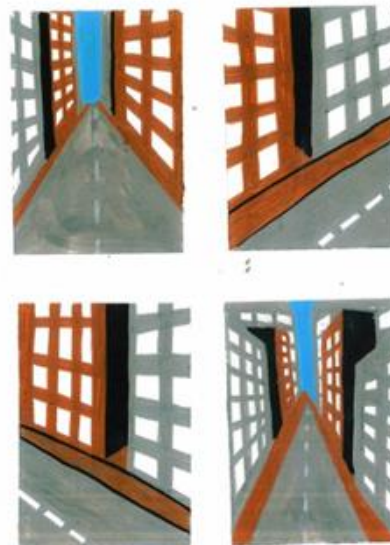


Based on the images displayed above, what memory do you think of? It can be a memory of something you experienced today, last week, last year or even 10 years ago. Finish the sentence below to clearly describe this memory.

You can go to the next page after 2.5 minutes.

When I see these images, I think of...

(c) Condition 3



How many different colours are used in the images displayed above? Fill in the dots below to clearly state your answer, do this by writing down (a) number(s).

You can go to the next page after 2.5 minutes.

In these images, in total(amount of) colours are used.

(d) Condition 4

Fig. 2. Conditions used in the study: (a) condition 1, nature-active (b) condition 2, nature-passive (c) condition 3, urban-active (d) condition 4, urban-passive.

3.2 Participants

The faculty's ethics committee (see: <https://www.utwente.nl/en/bms/research/ethics/>) was approached for approval to conduct the study. In total 209 respondents voluntarily participated in the online questionnaire and were reached through convenience sampling given the study's time limitations. Additionally, as a result of using convenience sampling, the age of the majority of participants was expected to be between 18 and 30. Therefore, in order to prevent outliers in age and guarantee an approximately equal division of age across the conditions, a condition of filling out the questionnaire was to be aged between 18 and 30. After the deletion of incomplete responses and responses of participants older than 30 years old the amount of participants was brought back from 209 to 151 (64 males, 85 females, 2 other; mean age: 22,68 years; age range: 18-30 years; 124 Dutch, 13 German, 15 other nationality). A one-way ANOVA indicated that there were no significant differences of age across the conditions ($F(3, 147) = 1,46, p = .228, \eta^2 = .03$). Chi-square tests showed that gender was equally distributed across the four conditions ($X^2(6, N = 151) = 3.84, p = 0.698$). Similarly, nationality was also found to be equally distributed across the conditions ($X^2(6, N = 151) = 5.72, p = .455$; see Table 2).

Table 2

Participant demographics as a function of experimental condition – age, gender, nationality.

Condition	Male	Female	Other	Dutch	German	Other	Age	
	n	n	n	n	n	n	M	SD
Nature / active	18	21	0	31	4	4	22,08	2,81
Nature / passive	20	21	1	34	5	3	23,02	2,94
Urban / active	14	20	1	26	4	5	23,34	3,32
Urban / passive	12	23	0	32	0	3	22,68	3,16
Total	64	85	2	123	13	15		

3.3 Procedure

Due to the COVID-19 pandemic and associated regulations, it was decided to let the questionnaire solely take place in an online manner to prevent any physical contact. The questionnaire was created with the online survey tool Qualtrics where the four conditions derived from the two stimuli (i.e. painting and mental state) were distributed by randomization (see Appendix). A link to the questionnaire was created and shared on various social media platforms such as LinkedIn and Instagram. Before starting the questionnaire, participants were informed about the questionnaire's topic and procedure and about their rights as a participant by reading the briefing in the online environment. To be able to participate, the participants had to consent to taking part in the study. Participants only had to meet the condition of being aged between 18 and 30 years. The participants were asked to indicate their demographics, after which they were randomly assigned to one of the four conditions. After completing the task, the participants filled out the questionnaire. After completion, the participants were thanked for their participation.

3.4 Measures

Positive affect was intended to be measured using the positive affect items of the full form Positive Affect Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1998), five separate positive affect items were added to this as they were found to be relevant in the study's context, specifically *confident*, *joyful*, *amused*, *satisfied*, and *comfortable*. A factor analysis showed four PANAS items to not measure the same component and were thus left out of further measurement of positive affect, these were the items *active*, *alert*, *attentive* and *determined*. Therefore, positive affect was ultimately measured using the items *enthusiastic*, *excited*, *inspired*, *interested*, *proud*, *strong*, *confident*, *joyful*, *amused*, *satisfied*, and *comfortable* ($\alpha = .92$), with high scores indicating stronger positive affect. Participants indicated until what extent they were experiencing these states on that very moment on a 5-point Likert scale ranging from "very slightly or not at all" to "extremely". Responses on the positive affect items were summed and averaged to arrive at a general 'positive affect' measure.

Four statements were included in the questionnaire to measure participants' feelings of creativity, being "I felt inspired", "I felt creative", "I felt original", and "The assignment gave me new insights". A factor analysis showed the statement "I felt inspired" to more strongly correlate with dependent variable "Enjoyment of the painting", this statement was therefore left out for the dependent variable "Feelings of creativity". The three remaining statements together showed a Cronbach's alpha of .83. Participants were asked to what extent they agreed with the statements and indicated their answers on a 5-point scale from "strongly disagree" to "strongly agree". As for positive affect, the responses to the creativity statements were summed and averaged to serve for a general creativity measure.

A scale comprising seven statements was included in the questionnaire to measure participants' enjoyment of the paintings. These statements were "I enjoyed looking at the

images”, “The images looked appealing to me”, “The images bored me” (reverse coded), “It was pleasant to look at the images”, “The images were interesting enough to hold my attention”, “It was relaxing to look at the images”, and “Looking at the images made me feel recharged”. As the factor analysis showed the statement “I felt inspired” to strongly correlate with this variable, the statement was included to “Enjoyment of the painting”. A reliability analysis for these statements showed a Cronbach’s alpha of .74. When removing the statement ‘The images bored me’ (reverse coded), this increased to .88. As this increase was expected to make a considerable difference, it was decided to leave this statement out, therefore ending up with an alpha of .88 for “Enjoyment of the paintings”. The participants were asked until what extent they agreed with the statements on a 5-point scale from “strongly disagree” to “strongly agree”. Responses to the statements were summed and averaged to attain a general enjoyment of the painting measure.

4. Results

Univariate analyses were conducted to examine the effect of painting on positive affect, feelings of creativity and enjoyment of the paintings and to check for interaction effects between painting and participants' mental state. For these analyses, a cut-off score of .05 was applied, meaning that p-values of .05 and lower were reviewed as significant. Additionally, p-values of between .05 and .10 were reviewed as marginally significant, indicating that the results are in the predicted direction but not significant conforming the official cut-off score.

4.1 Positive affect

The main effect of painting on positive affect showed to be marginally significant ($F(1, 147) = 3.781, p = .054, \eta^2 = 0.03$), meaning that participants exposed to the nature painting reported higher positive affect ($M = 3.23, SD = 0.80$) compared to participants exposed to the urban painting ($M = 2.97, SD = 0.83$; see Table 3). A non-significant effect was found for the interaction ($F(1, 147) = 1.526, p = .219, \eta^2 = 0.01$).

Table 3

Mean values of positive affect for each experimental condition.

Condition	Positive affect	
	<i>Mean</i>	<i>SD</i>
Nature / active	3.26	.86
Nature / passive	3.20	.76
Urban / active	2.83	.79
Urban / passive	3.11	.87

4.2 Feelings of creativity

A univariate analysis of variance with feelings of creativity as dependent variable yielded a significant main effect of painting ($F(1, 147) = 6.85, p = .010, \eta^2 = 0.05$). This indicates that the nature paintings resulted in higher reported feelings of creativity ($M = 2.57, SD = 0.99$) compared to the urban paintings ($M = 2.17, SD = 0.95$; see Table 4). The interaction between painting and mental state yielded a marginally significant effect ($F(1, 147) = 3.490, p = .064, \eta^2 = 0.02$; see Fig. 3).

Further analysis showed a significant simple effect of mental state for the nature painting ($p = .014$), indicating that the effect of a nature painting on feelings of creativity is only present in case of an active mental state (i.e. an effect of nature painting is moderated by mental state). Specifically, reported feelings of creativity were, on average, 0.529 higher for participants who participated in the nature/active condition than for those who participated in the nature/passive condition.

Table 4

Mean values of feelings of creativity for each experimental condition.

Condition	Feelings of creativity	
	<i>Mean</i>	<i>SD</i>
Nature / active	2.85	1.11
Nature / passive	2.32	.92
Urban / active	2.14	0.99
Urban / passive	2.20	0.92

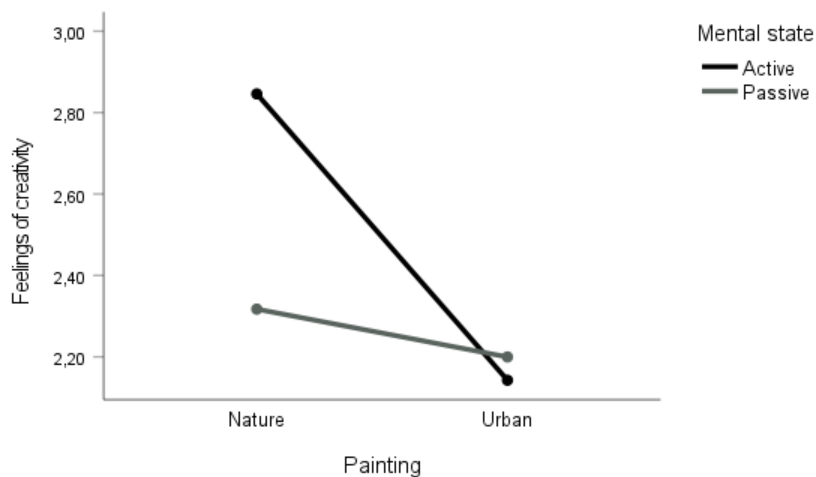


Fig. 3. Feelings of creativity as a function of painting and mental state.

4.3 Enjoyment of the painting

A univariate analysis of variance with enjoyment of the painting as dependent variable showed a significant effect of painting on enjoyment of the painting ($F(1, 147) = 13.783, p < .001, \eta^2 = 0.09$). This indicates that the nature painting resulted in more enjoyment of the painting ($M = 21.25, SD = 5.46$) compared to the urban painting ($M = 17.89, SD = 5.81$; see Table 5). The interaction between painting and active mental state ($F(1, 147) = 1.610, p = .207, \eta^2 = 0.01$) did not reach significance.

Table 5

Mean values of enjoyment of the painting for each experimental condition.

Condition	Enjoyment of the painting	
	<i>Mean</i>	<i>SD</i>
Nature / active	3.19	0.70
Nature / passive	2.89	0.83
Urban / active	2.54	0.91
Urban / passive	2.57	0.76

4.4 Memories

In addition to these results on positive affect, feelings of creativity and enjoyment of the paintings, it should be noted that the majority of the memories written down in the active mental state conditions were positive memories as opposed to negative or neutral memories. Additionally, the participants in the nature condition used approximately 63% more words than the participants in the urban condition to describe their memory (nature $M = 32.67$; urban $M = 19.94$).

5. Discussion

5.1 Main findings

Following up on research showing a positive influence of nature on subjective well-being, this study aimed to get more insights into whether such an effect would also appear for nature displayed as art. That is, since photos, videos and VR displays of nature have previously been shown to yield the same positive effects as real nature did, and, according to the aesthetic experience theory, art enhances well-being (Silvia, 2009), such a positive effect of nature on well-being aspects was expected to also surface when this nature was displayed as a painting.

Results showed a main effect of nature painting on positive affect, indicating that nature positively influences one's positive affect when this nature is displayed as art. Feelings of creativity were also found to be positively influenced by the paintings. Specifically, nature induced stronger feelings of creativity as was expected. The same appeared to be true for participants' enjoyment of the painting as this enjoyment showed to be higher for those who viewed the nature painting as opposed to those who viewed the urban painting. These outcomes are in line with previous studies analysing the influence of real-life or 'real-looking' (e.g. VR) nature on aspects of well-being (Berto, 2004; Hartig, 2011). This shows the widespread applicability of nature as it does not solely influence well-being when one is close to real nature or is viewing real-looking displays of nature, but also influences these states when nature is displayed in a more abstract way (i.e. art) as is suggested by the aesthetic experience theory.

A second independent variable measuring an active versus passive mental state was included in order to extend the knowledge on the positive influence of an active physical state on subjective well-being by adding insights into the effect of an active mental state.

An interaction effect was found for creativity, showing that the positive effect of nature painting on feelings of creativity is only present when a participant experiences an active mental state. This indicates that participants' mental state moderates the effect of nature painting on feelings of creativity as is in line with what was predicted.

However, several participants who took part in the passive mental state condition including the colour task later on indicated to be intrigued to what the answer to the question would be. They argued to have been doubting about black and white being counted as colours or not and were excited to hear about the 'correct' answer. These feelings of curiosity and excitement might have caused the participants of this task to experience an active instead of passive mental state as was intended. As no manipulation check was applied, differences in participants' mental state cannot not be guaranteed to have been present, meaning that participants' mental state in the passive conditions might indeed have been approximately equal to that of the participants in the active conditions due to, for example, the previously explained interest in the correct answer and discussion on what counted as colours.

Another alternative explanation for the interaction effect could then be the difference in the nature of the tasks. One could argue the memory task for the active mental state condition to enable participants to more freely use their ideas with regard to interpreting the paintings, allowing them to be more creative as opposed to the participants in the colours task which required participants to fill in a quite straightforward and more objective answer. Nevertheless, one might suggest that, if the active mental state task induced stronger feelings of creativeness, this would have induced positive affect as well since the memories written down were, almost exclusively, positive memories.

In contradiction to what was expected, no interaction effects were found for painting and mental state on positive affect and enjoyment of the painting. A possible explanation for this is that, if participants indeed paid more attention to certain elements of the painting when

experiencing an active mental state, these particular elements were more related to feelings of creativity so that only this effect surfaced. However, an alternative explanation could be that – as previously discussed – it is not an active mental state but for instance the nature of the task that induced the moderation on the nature-feelings of creativity effect. In that case, the memory task could possibly have effected feelings of creativity as it was more creatively oriented, explaining why positive affect and enjoyment might not have been influenced by it. These thoughts are, however, solely based on the condition that it was not mental activity that induced the moderation effect.

Although a thorough analysis goes beyond the scope of this study, it should be noted that the majority of memories that were written down in the active condition were positive memories, as opposed to negative or neutral memories. One could argue the nature of the task to play a role in inducing these positive memories so that the memories written down by participants were nearly all positive independently of which painting was viewed. However, in that case it is interesting that no interaction effect is present between the urban painting and an active mental state (i.e. memory task) on positive affect, that is, since the majority of memories were positive memories. In addition, participants in the nature/active condition seemed to have elaborated more on writing down their memories as is suggested by the longer answers. A possible explanation could be that the nature painting induced feelings of calmness as is argued by PET (Hartig, 2011; Berto, 2014), making participants feel as if they have the time to put down their thoughts. Needless to say, to draw firm conclusions on these memories, more thorough analysis should be done which is beyond the scope of this study.

5.2 Practical implications

This study aimed to broaden the knowledge on what actions individuals can undertake themselves to increase their own well-being through three well-being aspects. The new

insights into positive affect, feelings of creativeness and enjoyment derived from this study can indeed contribute to facilitating individuals' own actions to enhancing these positive states in a variety of situations by engaging with artistic impressions. As an example, one could design a work space with not solely real nature and photos of nature, but also paintings of natural scenes to enhance their own positive affect, feelings of creativeness and enjoyment of the work. This means that greater possibilities are available for employees themselves to take care of their own well-being at work. In addition, next to implementing the broadened possibilities to work spaces, one can also implement such changes at home. This can be especially interesting for those living in bigger cities with only few urban green spaces close by, for example for those living in apartment buildings without a garden, or for those with a physical disability or those who live in elderly homes who might be dependent on others to visit natural spaces.

Another option – although not specifically an individually oriented approach – would be to include more activities in school that concern nature paintings or other specific natural objects to increase both children's happiness through positive affect and to increase their enjoyment of the task, as well as their feelings of creativeness towards it. The same applies for a company whose management can undertake action to include more art in the building's design that is nature related.

5.3 Limitations and future research

In order to further support the findings of this study, future research should include comparisons of nature displayed as paintings to investigate whether differences in spaciousness and unpredictability also induce differences in (feelings) of creativeness as it does for real-looking nature (van Rompay & Jol, 2016), and whether such effects are present for positive affect and enjoyment as well. In addition, further research should focus on

possible differences in types of art (e.g. paintings versus drawings) and art styles (e.g. abstract versus realistic). Not to mention, a research gap is present with regard to differences between nature displayed as real or as real-looking nature (e.g. photos, videos) and nature displayed as art. Possible differences between these ways of displaying nature should be explored in order to see if real nature might induce a stronger influence on positive affect, feelings of creativeness and enjoyment than it does when displayed as art, in that way examining the effectiveness of art as compared to real or real-looking nature. The opposite could be the case as well, since art can be even more colourful than real nature, art could be argued to strengthen the effect of the natural stimuli or the colours themselves might be – independent of whether a painting shows nature or urban spaces – of influence on positive affect, feelings of creativity and enjoyment.

Additionally, a manipulation check or pre-test is advised to be performed in future research when analysing the effect of mental state. In that way, a difference in participants' mental state can be guaranteed to ensure that this difference moderates the effect of, for example, nature painting on feelings of creativity as has been suggested to be true in this study, and not a difference is the nature of the task or other task-related aspects. Furthermore, for future research it is important to diminish any other differences between tasks that can possibly influence the effect of nature (painting) on well-being aspects or influence the suggested moderating role of mental state on this relation.

This study's framework included literature on well-being aspects, specifically positive affect, feelings of creativity and enjoyment. However, well-being concerns many more aspects than solely these three, such as physical health, social relations with relatives, and for some also spirituality. Therefore, more aspects of the state of well-being should be taken into account in order to develop proper individually oriented approaches to enhancing well-being amongst a diversity of population groups.

With regard to the participants, it should be noted that convenience sampling is used. This means that the study's results cannot be fully generalized as data from individuals older than 30 is missing and the majority of the participants was Dutch (124/151). Although the distribution of nationality was equal across the conditions – as shown by the chi-square test –, the overall percentages of nationalities were not approximately equal so that no firm conclusions can be drawn about whether or not the same results would be present for a sample group including more different nationalities. Therefore, in order to substantiate the findings of this study, it is recommended for future research to ensure nationalities and age groups to be more evenly represented in the study's sample.

Additionally, it would be interesting for future research to get more insights into the role of memories written down when participants are exposed to natural versus urban stimuli and are experiencing an active versus passive mental state.

6. Conclusion

This research study demonstrates that nature can enhance positive affect, feelings of creativity and enjoyment of natural spaces when this nature is displayed as art. As such effects of nature displayed as art on well-being have not been given much attention up until now, this research extends the knowledge currently held in the area of nature and aesthetic research and shows the applicability of PET, ART and the theory of aesthetic experience. In addition, this study's framework adds to well-being and psychological research by showing an interaction effect of nature paintings and an active mental state on feelings of creativity. Much research has been done on the effect of nature and an active state on well-being. However, also much is still unknown with regard to differences in displaying this nature and on what it is that an active state makes well-being to increase, whether this is purely physical or whether it can instead be an active state of mind as this study's results suggest. To ensure the applicability of nature-related approaches to enhancing well-being, more research should be done on an in-depth level, unravelling the small details explaining the influence of nature on well-being and the influence of an active state on this effect.

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Appendix

Just an environment or more?

Start of Block: Description & informed consent

Welcome!

You are being invited to participate in the research study titled “**Just an environment or more?**”. This study is being conducted by Louise Rempkens from the Faculty of Behavioural, Management and Social Sciences at the University of Twente as part of a bachelor thesis.

The aim of the research is to find out whether certain environments can influence happiness.

The study will take you approximately 5/10 minutes to complete. Your participation in this study is entirely voluntary and you can withdraw at any time.

It is believed that there are no known risks associated with this research study. Your answers in this study will remain confidential. Minimizing any risks will be ensured by storing the data offline and by deleting it after use. Personal identifiable data will not be collected.

Feel free to seek contact for any further information:

Name researcher: Louise Rempkens

E-mail: l.a.h.rempkens@student.utwente.nl

Informed consent

Please indicate below if you consent to taking part in this study

I consent

I do not consent

Skip To: End of survey if: I do not consent

End of Block: Description & informed consent

Start of Block: Demographics

Please state your demographics below

Your gender

- Male
 - Female
 - Other
 - Prefer not to say
-

Your age

Your nationality

- Dutch
- German
- Other

End of Block: Demographics

Start of Block: Description of the task

On the following page you will see a few images derived from the same scene, please take a look.

End of Block: Description of the task

Start of Block: Condition 1, nature_memory



Based on the images displayed above, what memory do you think of? It can be a memory of something you experienced today, last week, last year or even 10 years ago. Finish the sentence below to clearly describe this memory.

You can go to the next page after 2.5 minutes.

When I see these images, I think of...

02 30

End of Block: Condition 1, nature_memory

Start of Block: Condition 2, nature_colours



How many different colours are used in the images displayed above? Fill in the dots below to clearly state your answer, do this by writing down (a) number(s).

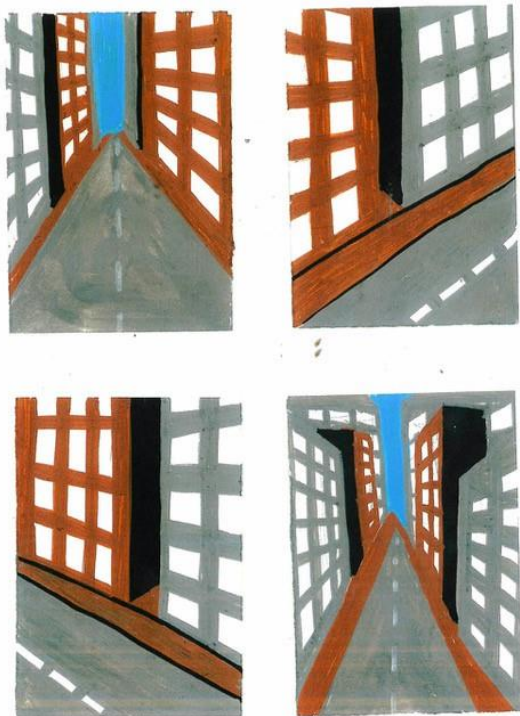
You can go to the next page after 2.5 minutes.

In these images, in total(amount of) colours are used.

0	2	3	0
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End of Block: Condition 2, nature_colours

Start of Block: Condition 3, urban_memory



Based on the images displayed above, what memory do you think of? It can be a memory of something you experienced today, last week, last year or even 10 years ago. Finish the sentence below to clearly describe this memory.

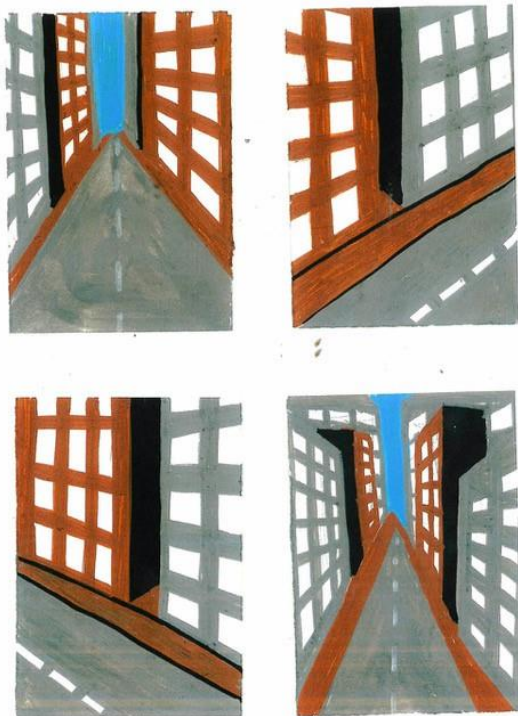
You can go to the next page after 2.5 minutes.

When I see these images, I think of...

0230

End of Block: Condition 3, urban_memory

Start of Block: Condition 4, urban_colours



How many different colours are used in the images displayed above? Fill in the dots below to clearly state your answer, do this by writing down (a) number(s).

You can go to the next page after 2.5 minutes.

In these images, in total (amount of) colours are used.

0230

End of Block: Condition 4, urban_colours

Start of Block: Positive_ affect (PANAS)

Thinking about how you feel right now at this moment, to what extent do you feel:

	Very slightly or not at all	Slightly	Moderately	Quite a bit	Extremely
Active	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alert	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Attentive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Determined	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Enthusiastic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inspired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Interested	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Proud	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Strong	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Positive_ affect (PANAS)

Start of Block: Positive_affect (additional separate items)

Thinking about how you feel right now at this moment, to what extent do you feel:

	Very slightly or not at all	Slightly	Moderately	Quite a bit	Extremely
Confident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Joyful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Amused	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Satisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Comfortable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Positive_affect (additional separate items)

Start of Block: Engagement and enjoyment study

Thinking about this study you participated in, to which extent do you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The study was engaging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Participating in this study required effort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt involved in this study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I had to pay only a low level of attention while participating in this study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thinking about this study you participated in, to which extent do you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I liked participating in this study	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I found participating in this study boring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would describe participating in this study as fun	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would participate in this study again	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Engagement and enjoyment study

Start of Block: Enjoyment of images

Thinking about the images you saw, to which extent do you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I enjoyed looking at the images	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The images looked appealing to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The images bored me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was pleasant to look at the images	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The images were interesting enough to hold my attention	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was relaxing to look at the images	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Looking at the images made me feel recharged	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Enjoyment of images

Start of Block: Easiness of assignment and creativity

Thinking about the assignment you carried out, to which extent do you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I could easily carry out the assignment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It was difficult to complete the task within the given timeframe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I clearly understood what I had to do	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The assignment was challenging	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thinking about the assignment you carried out, to which extent do you agree with the following statements:

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I felt inspired	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I felt original	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The assignment gave me new insights	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Easiness of assignment and creativity

End of Survey

We thank you for your time spent taking this survey.

Your response has been recorded.