BSc Communication Science

UNIVERSITY OF TWENTE.

Imagine what is behind the trees

The effect of spacious and fascinating nature on creativity as a function of creative activities

28-06-2019

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Abstract

Motivated by research that has found positive effects of nature on creativity, this study aimed to find out to what extent there is a difference in the effect of different nature landscapes. In addition, this study aimed to find out whether having performed creative activities in the past also had an effect on creativity. Accordingly, fascinating, spacious and urban images were displayed during a creative thinking task in a small study room. After completion of the task participants filled out a questionnaire reporting their creativity, ideas and pleasure. Furthermore, they were asked if they had participated in creative classes or performed creative tasks in the past for one year or longer. Most participants were students, half of them were Dutch, the majority was a student and followed a Beta study, and there was almost an evenly division of gender. Results showed that nature can enhance creativity and in particular fascinating nature. Additionally, it was found that not having done creative activities in the past has a positive effect on self-reported creativity and pleasure. These findings show that fascinating nature has bigger potential to enhance an individual's creativity than spacious nature and that having performed creative activities might negatively influence one's self-reported creativity. Future research should focus more on the effect of different kinds of nature on other aspects like wellbeing, focus and concentration. The results of this study could be useful for designing new work spaces, study environments and other spaces were creativity is valued and needed.

Keywords: Creativity, nature, fascination, spacious, creative activities, pleasure.

1. Introduction

These days, cities are getting bigger and bigger which results in the decrease of nature and people's access to it. Therefore, the time people spent in nature is also decreasing. However, this is not very beneficial for the human health, because different studies have shown that nature can improve someone's physiological and psychological health and wellbeing (Colléony, White, & Shwartz, 2019; Lahart, Darcy, Gidlow, & Galogiuri, 2019). Nature would have a restorative effect on someone's health (Kaplan, 1995) and restorative activities in nature, like walking in a park, could help people recover quicker from their illness. Cancer patients that did a restorative activity in nature at least three times a week for 20 minutes would have better physiological healing than those who did not do these activities (Cimprich, 1992, 1993).

Nature does not only benefit someone's wellbeing in general, but also one's creativity. Studies found that nature has a more positive effect on an individual's creativity than built areas (Kaplan, 1995; Van Rompay & Jol, 2016; Williams et al., 2018). Hence, it would be beneficial to provide people with more access to natural environments in order to enhance the creative process (Plambech & Konijnendijk van den Bosch, 2015). This could especially help in places where there is no or little access to nature, mostly in office spaces and schools. This access or connection to nature would be beneficial in order to enhance creativity. It would help to provide the people in these places a space where they feel like they are in nature by providing visual stimuli of nature. Plambech and Konijnendijk van den Bosch (2015) found that visual stimuli of natural environments could already enhance creative behaviour.

Different studies found that especially fascinating nature with more stimuli, so nature where there are more things to see, has a positive effect on a person's creativity (Epstein, 1996; Goucher-Lambert & Cagan, 2019). Seeing different stimuli would enhance creativity because it could stimulate different behaviours competing with each other, which helps moving the mind in different thinking directions (Epstein, 1996). When you see things that have nothing to do with your daily tasks, you will start thinking outside of the box because of the 'random' stimuli. One behaviour (your daily task) will get influenced by another kind of behaviour (in line with the stimuli). Moreover, researchers found that spaciousness in natural environments is beneficial for a person to feel more creative (Van Rompay & Jol, 2016). Spaciousness would give people the opportunity to have room for thoughts and ideas to develop, which could help to increase creativity.

Especially in this rapidly growing society, people are expected to be innovative and to come up with innovative or new ideas every day. To come up with these innovative or new ideas, people need to be creative. Some believe that this creative thinking can be taught (Ulger, 2019; Epstein, 1996). This creative thinking already starts in kinder garden, where children do all sorts of creative tasks, like drawing, painting, crafting and so on. However, in general, the older children get, the less they get encouraged to do creative tasks. Once teenagers finish high school most of them probably do not know any more how to think creatively because it has not been taught to them in years. Classes like drawing and music are barely chosen by students compared to science classes in the Netherlands (Dienst Uitvoering Onderwijs [DUO], 2017). While those classes are actually the ones that enable the student to enhance their creative thinking skills (Ulger, 2019).

Nonetheless, when graduating and going to University students are expected to come up with new ideas for their projects in order to prepare them for their future careers. This might not be easy for them, since they probably have forgotten how to be creative or think creatively. Again, they have to learn how to come up with new creative ideas, how to be innovative. They will probably look for ways to learn this or to adopt this skill as fast and easy as possible in order to use them during their study but also for their future career. It is highly important for businesses to be innovative if they want to keep existing (Sozo & Ogliari, 2019). Some might see creativity and innovation as two linked concepts. According to Amabile (1988) this is considered to be right, here it is described as the successful implication of creative ideas. Which means that innovation is considered to be the outcome of creativity. Therefore it is important for business to recruit creative employees in order to become an innovative and successful business. Therefore it would be beneficial for students, and everyone else that seeks a job, to engage more with nature in order to become creative. However, staying creative is not only up to them, but the companies should enable them to be creative by creating creative enhancing working spaces.

Even though businesses highly value innovation and therefore creativity, a lot of offices are still cut out from the real world without a glimpse of nature, which does not enhance creativity. Same goes for some universities, where rooms are suffering of old age and are designed in such a way to not get 'distracted'. The hierarchy in companies is changing and it has been changing for years now. More employees are expected to come up with new ideas, but the working space is not yet adapted for employees to enhance creativity. The same goes for universities where students are expected to come up with new ideas for their projects, but many rooms are still very boring and don't boost creativity. As mentioned before people are expected to be more innovative, more creative, but the environments are not yet adapted to it. These environments now mostly consist of plain colours like white, grey and black and have little to no accessories. But could making these rooms more looking like nature enhance the creativity of employees and students?

As mentioned before, research showed that nature has a positive effect on one's creativity, and that both spacious nature and fascinating nature enhances creativity. However, so far little research has been done in comparing these different kinds of natural environments in order to find out which natural looking environment has a better effect on a person's creativity. Therefore this study will aim to find out whether a natural looking fascinating (non-spacious) environment has a better effect on creativity or a spacious (non-fascinating) natural looking environment taking into consideration if people have done creative activities in the past or not. The research question that is used is: *To what extent do natural landscapes stimulate creativity and what type of natural landscapes works best? And to what extent is this effect applicable to people that have done creative activities in the past?*

2. Theoretical framework

2.1 Creativity and Attention Restoration Theory

Over the past few decades, and especially in the last few years, many researchers have explored the effect of nature on human beings (Basu, Duvall, & Kaplan, 2018; Van der Jagt, Craig, Brewer, & Pearson, 2017; Van Rompay & Jol, 2016; Plambech & Konijnendijk van den Bosch, 2015; Kaplan, 1995). Some state that nature has a restorative effect on a person's wellbeing (Basu et al., 2018; van der Jagt et al., 2017; Kaplan, 1995). Others state that it not only has an effect on the wellbeing, but also on one's creativity (van Rompay & Jol, 2016; Plambech & Konijnendijk van den Bosch, 2015).

Before looking further into the effect of nature, a definition of creativity should be given. Creativity has many definitions and can be described in many different ways. It is mostly described as a characteristic of a person, process or product (Amabile, 1988). Bosiok and Sad (2013) see it as a personal characteristics and describe creativity as 'the ability to think in ways and forms that are new, different and not seen in other individuals'(p. 67). Another definition of creativity states that it is 'the intellectual ability to create, invent, and discover, which brings novel relations, entities, and/or unexpected solutions into existence' (Wang, 2013, p. 903), here creativity can be seen as a process. Amabile, Conti, Coon, Lazenby, and Herron (1996) define creativity as 'the production of novel and useful ideas in any domain'(p. 1155). Steinberg et al. (1997) define creativity as the process that leads to a new product or idea. Taking into consideration all of these definitions, in this study creativity is defined as the ability of a person to produce new and innovative ideas. In this definition, creativity is used in the broadest sense and therefore described as the characteristic of person (ability), process (produce) and a product (new and innovative ideas).

Moving on to the effect nature has on a person's wellbeing and creativity, the attention restoration theory is a well-known theory and can be considered important when it comes to explaining the effect nature has on the wellbeing and creativity of an individual (Kaplan, 1995). This theory states that exposure to nature can help an individual restore their minds so they can fully focus (e.g. on their goals). This focus could help people think of new and innovative ideas because their mind will wander off to other topics, so the focus is fully on creating new ideas.

According to Kaplan, Kaplan and Ryan (1998), this restoration of the mind can only be accomplished if an environment matches four factors. An environment needs to give an individual the idea that he or she is away from their normal surroundings, which gives the individual the opportunity to let go of their mental routines. Furthermore, the environment needs to look like it is in another world, this world should look like there is no end. Also, the environment should be fascinating which, in case of soft fascination, could help the individual to reflect. The last factor is that there should be a link between a person's tendency and what the environment looks like. Nature mostly has these factors which makes it the perfect environment for people to empty their minds and to only think about the things they want or need to think about (Kaplan, 1995). Even though this theory mentions that there should be no end but that there should also be fascination is a little bit contradictory. Should there be an even division between spacious and fascinating nature? Or is one factor more important than the other? A closer look should be taken into these different kinds of nature.

More research on the concept of soft fascination has been conducted by Basu et al. (2018). There, both soft and hard fascination are described. Hard fascination represents stimuli that are hard to resist and that needs someone's full attention, there is little or no space left for reflection or other minor mental activities. Examples of hard fascination stimuli are social media, television, and games. Stimuli that do catch an individual's attention, but leave room for a person to think about other things as well, fall under the category of soft fascination. For instance clouds moving, wind blowing over the grass or seeing the water move in a river.

This concept of soft fascination is mostly seen in nature, which makes nature also the perfect place to enhance creativity since a person has much more room for other thoughts than only processing what is seen. There is space to come up with new ideas, to have new thoughts, to actually be creative. Olmsted (as cited in Kaplan, 1995) stated that nature gives both rest and the ability to think about new things, which is in line with the Attention Restoration Theory.

While research on fascination states that 'soft' stimuli enhance the restoration of the mind and increase the creativity (Basu et al., 2018; Kaplan, 1995), Van Rompay & Jol (2016) additionally stress that spaciousness is an factor that can positively influence one's creativity. Plambech and Konijnendijk van den Bosch (2015) also found that the limitlessness and openness of a natural surrounding makes people feel more open to 'new, different and wild ideas'(p. 259). Thus they feel more creative since creativity is related to new and different ideas. Furthermore, since nature is not especially created for human behaviour, this causes that people's thoughts are not forced in a certain direction which causes free creation of ideas. Spacious nature would enhance creativity since it is in line with some of the aspect that an environment has to comply to according to the Attention Restoration Theory (Kaplan, 1995).

As mentioned before, different researchers have found that both fascinating and spacious nature can have a positive effect on one's creativity. However, none of them actually found what the right division between spaciousness and fascination should be to have the most positive effect on creativity as possible. Should nature be more fascinating or more spacious? To find out more on this topic this research compares both environments to each other to see which one of them has a more positive effect.

H1: A natural looking environment that is fascinating and not spacious has a more positive effect on creativity than a natural looking environment that is spacious and not fascinating.

2.2 Creative activities

As mentioned before, Epstein (1996) argues that everyone can be creative and that it can be taught. However, not all researches confirm this finding and state that creativity might be related to personality traits (Feist, 2018; Goclowska, Ritter, Elliot, & Baas, 2018). However, this study does not focus on personality traits.

On the other hand, the extent to which an individual feels creative or can be creative might be due to their previous education. Students who have had art or music classes in high school are more likely to or can more easily be creative (Ulger, 2017). This helps them during their student time and career to think more creative than those students and employees who did not enjoy arts and or music education in high school. This might be due to their way of problem solving. Music, and especially arts students learn to solve problems that are unusual and ambiguous, this way of problem solving is also called non-routine problem solving (Ulger, 2017). Since these students and employees have learned how to come up with new ideas for

non-routine problems they are expected to more easily come up with new creative ideas since these ideas are new and therefore also 'non-routine'. This non-routine problem might also be adapted by only performing creative tasks and not participating in creative classes. Therefore, this research will look into the effect having performed creative activities in the past has on creativity.

H2: Having performed creative activities in the past has a positive effect on one's current creativity.

Based on the hypotheses and the aforementioned information, the following model was created (Figure 2.1).

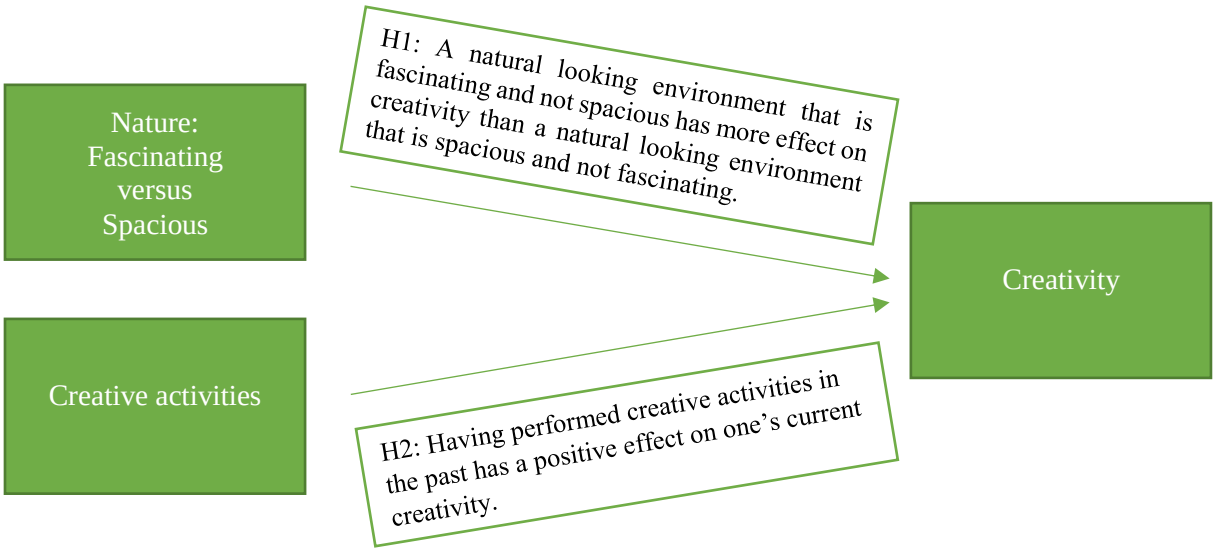

Figure 2.1 Model hypotheses 1 and 2.

3. Method & Instruments

3.1 Stimuli

In order to select images that could be used to visualize the environments during the experiment that match the criteria (spaciousness and fascination), a pre-test was conducted. This pre-test had the aim to find an image that was high in spaciousness and low in fascination, and to find an image that was high in fascination and low in spaciousness. Images were retrieved online, and 8 images that were high in spaciousness and 8 images that were high in fascination, according to the perception of the researcher, were used. In total 10 respondents filled in an online questionnaire in which they scaled (using 7-point bipolar scale) 16 pictures representing natural landscapes (Appendix A) on items about spaciousness and fascination (scale anchors: "Strongly agree" versus "Strongly disagree"). Items that were used to represent spaciousness were 'This landscape is open' and 'This landscape is extensive'. Items that were used to measure fascination were 'This landscape is fascinating' and 'This landscape contains many interesting things to look at'. In addition to these items, two more control items were included to check the beauty of the landscapes ('This landscape is beautiful') and if the landscapes were actually perceived natural ('This landscape looks natural').

The image that was high in fascination (M = 3.90, SD = 1.23) and at the same time low in spaciousness (M = 2.55, SD = 1.38) was image 9 (see Figure 3.1). This image was also considered beautiful (M = 4.90, SD = .83) and natural (M = 5.30, SD = .46). The image that was high in spaciousness (M = 4.65, SD = 1.23) and low in fascination (M = 2.75, SD = 1.22) was image 9(see Figure 3.2) and therefore used in the experiment. This image was not highest in spaciousness or lowest in fascination, however, this image did score higher on beauty (M = 4.60, SD = .66) and higher on nature (M = 3.30, SD = 1.55) than the images that were higher in spaciousness and lower in fascination and was therefore a better option and used in the experiment.

Furthermore, in order to make sure there was an effect of nature, a 'random' urban landscape (Figure 3.3) was added to the natural landscapes as a control condition. By adding this picture it could be seen if there is was actual difference between natural and urban landscapes.

It must be noted, that when spacious nature is mentioned this also implies that the spacious nature is non-fascinating. This is the same for when fascinating nature is mentioned, this implies that the fascinating nature is non-spacious.

Figure 3.1 Fascinating image 2

Figure 3.2 Spacious image 9

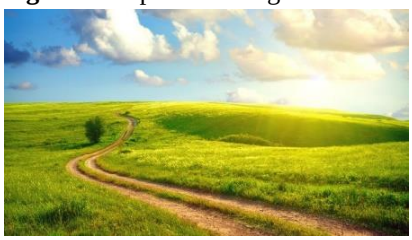

Figure 3.3 Urban image 17

Table 3.1

Results Pre-study Fascinating Landscapes

Image	Spacious		Fascination		Beautiful		Natural	
	M	SD	M	SD	M	SD	M	SD
1	4.50	1.17	4.55	1.20	5.00	1.18	5.40	0.49
2	2.55	1.38	3.90	1.23	4.90	0.83	5.30	0.46
3	4.40	1.10	5.10	.75	5.30	0.64	2.80	1.54
4	5.05	1.12	5.10	1.34	5.50	0.92	4.80	1.60
5	3.15	1.54	3.50	1.09	3.30	1.79	4.10	1.30
6	4.60	.93	4.65	.95	5.30	0.78	3.70	1.42
7	4.75	1.03	5.30	.71	5.40	0.49	5.00	0.63
8	4.70	1.22	4.45	1.18	5.30	0.78	4.70	1.19

Table 3.2

Results Pre-study Spacious Landscapes

Image	Spacious		Fascination		Beautiful		Natural	
	M	SD	M	SD	M	SD	M	SD
9	4.65	1.23	2.75	1.22	4.60	.66	3.30	1.55
10	4.85	1.27	1.70	.92	3.20	1.17	2.50	1.57
11	4.65	1.10	2.25	1.92	3.20	1.94	3.00	1.90
12	4.55	1.18	2.25	1.09	2.50	1.43	1.60	1.20
13	4.70	1.14	3.90	1.18	4.30	1.10	4.20	1.33
14	4.80	1.07	3.60	1.33	3.80	1.47	4.30	1.00
15	4.05	1.35	2.95	1.39	4.10	1.14	3.00	1.48
16	4.15	1.32	3.40	1.17	4.30	.90	2.80	1.17

3.2 Respondents

In total 72 respondents (35 male, 37 female) participated in the experiment. They were mostly students (95.8%) within the age range of 18 to 30. Most of them were asked to participate around the library of the University of Twente or via Social Media. A majority of the participants did a beta study (69.4%), while the rest did an Alfa study (27.8%). Only one participant studied ATLAS which fits into both categories. More than half of the participants (55.6%) was Dutch, a smaller amount was German (11.1%) and the rest of the participant varied in nationality. There were 59 participants that had performed a creative activity before. For more demographics see Appendix B.

3.3 Procedure

Participant were asked to do a creative thinking task and fill in a small questionnaire (Appendix C) on a laptop in a small room without windows, in the library of the University of Twente. An A2 paper with an image was put on the wall and participants were placed in front of it. Participants were randomly assigned to the three different landscapes, 23 participant were shown the spacious (non-fascinating) landscape (Figure 3.2), 24 participants were shown the

fascinating (non-spacious) landscape (Figure 3.1) and 25 participants were assigned to the control condition and shown the urban landscape (Figure 3.3). Before the participants started they were told that they were participating in a study about the influence of different environments on one's creativity. They were not told about the nature aspect beforehand because not all participants were shown a nature image. The control group was shown an urban image which does not match the idea of nature. So in order to avoid confusion, it was only explained to the participants afterwards, that the study was about the effects of nature on creativity. Before the task, participants were also told that they could step out at any time and that they were allowed to ask questions during the experiment if they did not know what to do anymore. Participants were made aware beforehand about the time limit per object, however, they were not shown when the time was over. Participants had 2 minutes for every object to perform the task. After they consented to participate in the study, the participants were first shown an example of the task (see Figure 3.4) they were going to perform before they started with the task itself. After they completed the task they were asked to fill in a small questionnaire, and once they completed that they were done with the experiment. The participants were thanked for their participation again and they were told the actual aim of the study. Additionally they were offered some chocolate to thank them.

3.4 Measures

In order to measure how creative people would be when seeing the different nature images, the Alternative Uses task from Guilford (1967) was used. This is a divergent thinking task which is widely used by researchers. In this task participants were given a simple object, and they were asked to write down as many uses for this object within two minutes. In total they were given five objects, namely, an Apple, Shoe, Paper Clip, Light Bulb and a Pillow. The things they wrote down were coded with points on different aspect, namely, 'Originality', 'Fluency', 'Flexibility' and 'Elaboration' (alpha = .69). Especially Originality is closely related to creativity, and therefore an important factor to measure creativity (Dippo & Kudrowitz, 2013).

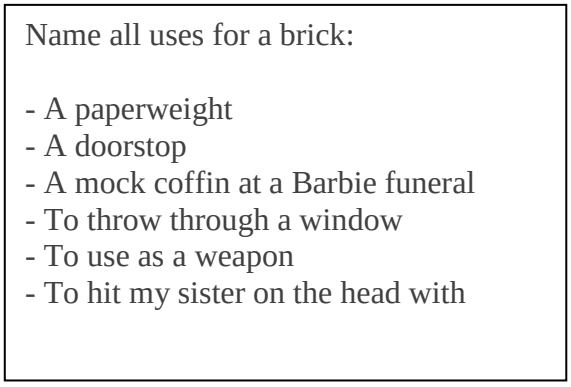

Figure 3.4 Example object and uses

For every use a maximum of two points for Originality could be given if the use was only mentioned by one percent of the participant, one point would be given if the use was mentioned by 5% of the participants. For every use that was mentioned 1 point for Fluency was given. For Flexibility, not more than the amount of points that was scored on Fluency could be given. Flexibility is about the amount of themes that were presented in the different uses. Taking the example (Figure 3.4), 'To hit my sister on the head with' and 'to use as a weapon' could be both categorized as 'weapon', and therefore only one point would be granted for those two uses on Flexibility, while a second point for a paper weight would be given because it is in another category and so on. For Elaboration a maximum of two point could be given for every use. Taking for example 'doorstop', no point would be given here, but if the answer would have been 'a door stop to prevent a door slamming shut in a strong wind' two point would have been

granted. One point for ‘door slamming’ and one point for further detail about the wind. Of all the answers that were given, 10% was coded by a second coder to calculate the Cohen’s Kappa to see if there was interrater reliability (Table 3.3).

Table 3.3

Cohen’s Kappa

Factors	Percentage Agreement	Cohen’s Kappa
Originality	92.5%	0.88
Fluency	100%	1
Flexibility	75%	0.68
Elaboration	72.5%	0.66

After finishing the task, the participants were asked to answer a few questions on their perceived creativity, if they had a hard time coming up with ideas, and if they enjoyed the task. Responses were recorded on 5-point rating scales (scale anchors: “Strongly agree” versus “Strongly disagree”). Participants’ perceived creativity was measured with the items “I felt inspired” and “I felt creative” (alpha = .67). If people had a difficult time coming up with ideas was measured with the item “I had a hard time coming up with ideas” [reverse coded]. To measure if the environment had a positive effect on people, the items “I felt comfortable during the task” and “I enjoyed the task” were used (alpha = .67).

Furthermore, the participants were asked to fill in if they participated in any ‘creative’ classes for one year or longer, or if they did any creative tasks themselves for one year or longer. These answers were combined into the variable ‘creative activities’. By including this variable two groups within the environments were created, the people who did perform creative activities in the past for one year or longer, and a group with people that did not perform creative activities in the past for one year or longer. Therefore, this study is a 3x2 design, 3 environments (2 nature, 1 control) and 2 creative activities groups (not having performed creative activities versus having performed creative activities). For the task and the questions the web app Qualtrics was used. All the data was analysed in SPSS.

4. Results

4.1 Creativity performance

Univariate analyses of variance with nature type and creativity activities as independent variables and, respectively, creativity, task enjoyment and self-reported creativity as dependent variables were conducted to test the hypotheses.

First, all the means of the total creativity score of the 3 conditions (i.e., including the urban landscape) were compared to see the difference between the nature images and the urban image. A main effect of nature was found and was marginally significant, $F (5, 66) = 2.37$, $p = .10$. It was found that both the fascinating ($M = 69.38$, $SD = 19.86$) and the spacious ($M = 68.13$, $SD = 18.53$) landscapes scored higher than the urban landscape ($M = 60.36$, $SD = 18.32$). So, fascinating nature has more effect on performed creativity than spacious nature. There was no main effect of creative activities ($F < 1$, ns). No interaction effect was found between nature and creative activities, $F (5, 66) = 1.01$, $p = .37$.

The total performed creativity was a combination of the four factors that the participants could score points on. Therefore, the means of the different factors were also analysed separately to see whether there was a difference in the effects on the different aspects of performed creativity. Starting with Originality, no significant effects were found (all F's < 1, ns).

No main effect of nature on Fluency was found, $F (5,66) = 1.88$, $p = .16$. For creative activities also no main effect was found ($F < 1$, ns). Furthermore, for the interaction no effect was found, $F (5, 66) = 1.62$, $p = .21$.

The main effect of nature on Flexibility was found to be significant, $F (5, 66) = 3.38$, $p = .04$. Less difference between the scores in the two natural landscapes was found and more between those two landscapes and the urban landscape. The fascinating ($M = 22.29$, $SD = 4.70$) and spacious ($M = 21.48$, $SD = 5.49$) landscapes had a better effect than the urban landscapes ($M = 19.68$, $SD = 5.20$) so nature actually has positive effect on the flexibility of people. A post-hoc test was performed to see whether the difference in means of the fascinating and spacious landscape was significant, but it was not ($p = .58$). This means that there is an effect of nature but there is no difference in the effect of different kinds of nature. No main effect of creative activities on Flexibility was found, $F (5,66) = 1.10$, $p = .30$. The interaction effect of nature (environment) and creative activities on Flexibility was found to be marginally significant, $F (5, 66) = 2.54$, $p = .09$, which means that for people who did not perform creative activities in the past nature does have a more positive effect on one's Flexibility (see Table 4.2) than for those who did perform creative activities. Additionally, for people who had not performed creative activities in the past spacious nature had a more positive effect, but for those who had performed creative activities in the past fascinating nature had a more positive effect on Flexibility (see Table 4.2).

At last, for the factor Elaboration no main effect on nature was found, $F (5, 66) = 1.41$, $p = .25$. For creative activities and the interaction between nature and creative activities also no effect was found ($F < 1$, ns).

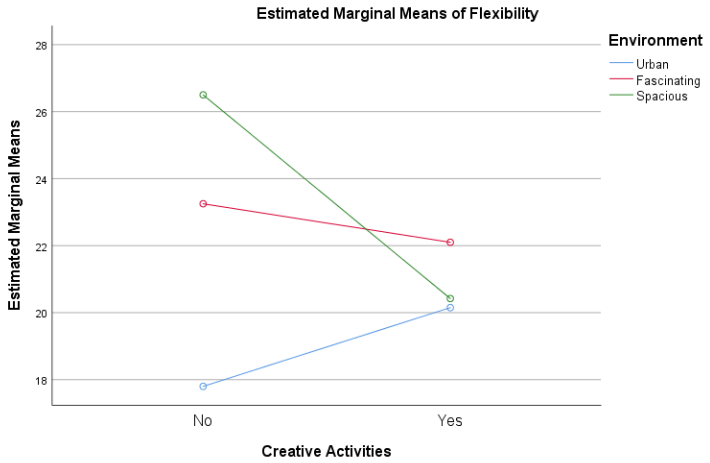

Figure 4.1 *Interaction effect on Flexibility*

Table 4.1

Explanatory values for mean values

	Mean	Median	Max	Min
Total Creativity	65.85	65.50	108.00	27.00
Originality	5.65	4.00	27.00	0.00
Fluency	30.90	30.00	54.00	13.00
Flexibility	21.13	21.00	36.00	10.00
Elaboration	8.18	7.00	23.00	0.00
All objects	13.12	13.10	21.60	5.40
Apple	13.47	13.00	26.00	6.00
Shoe	13.89	14.00	26.00	5.00
Paper Clip	13.19	12.00	28.00	6.00
Light Bulb	10.58	10.00	25.00	7.00
Pillow	14.47	14.00	29.00	3.00

Table 4.2

Mean values of creative task factors for different conditions and creative activities.

Condition	Creative activities	Total creativity		Originality		Fluency		Flexibility		Elaboration	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Urban	Yes	62.35	16.90	4.85	5.92	31.10	8.94	20.15	4.42	6.10	5.71
	No	52.40	23.66	4.60	5.17	23.00	9.19	17.80	8.01	7.00	4.69
	Total	60.36	18.32	4.80	5.68	29.48	9.40	19.68	5.20	6.28	5.44
Fascinating	Yes	69.45	19.82	6.30	5.14	32.05	9.76	22.10	4.99	8.95	6.61
	No	69.00	22.00	5.00	3.37	32.05	9.70	23.25	3.20	5.75	7.54
	Total	69.38	19.69	6.08	4.85	32.54	9.60	22.29	4.70	8.42	6.70
Spacious	Yes	66.37	19.86	5.95	4.50	30.42	9.63	20.42	5.46	9.84	6.44
	No	76.50	6.14	7.00	5.23	32.25	2.06	22.15	6.24	10.75	5.56
	Total	68.13	18.53	6.13	4.53	30.74	8.77	21.12	5.19	10.00	6.19

To see if there was a difference in difficulty of the objects again the means were taken into account. This would show if people were more creative when given a certain object or if nature of creative activities . Only for the object Pillow a main effect of nature was found, which was marginally significant, $F(2, 66) = 2.96$, $p = .06$. The fascinating landscape had the biggest effect ($M = 15.25$, $SD = 5.81$) on the answers given for the Pillow, but this result was very similar to the effect of the spacious landscape ($M = 15.09$, $SD = 4.55$). The effect of the urban landscape ($M = 13.16$, $SD = 4.16$) was much less compared to the natural landscapes. No main effect of creative activities was found ($F < 1$, ns), and neither for the interaction between nature and creative activities, $F(5, 66) = 1.73$, $p = .19$.

Table 4.3

Mean values of objects for different conditions.

Condition	Creative Activities	All Objects		Apple		Shoe		Paper Clip		Light Bulb		Pillow	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Urban	Yes	12.39	3.42	12.65	3.73	13.65	3.70	11.75	6.10	9.75	5.12	14.15	3.54
	No	10.48	4.73	13.00	7.84	11.80	5.07	11.20	5.85	7.20	4.09	9.20	4.44
	Total	12.01	3.69	12.72	4.61	13.28	3.96	11.64	5.94	9.24	4.96	13.16	4.16
Fascinating	Yes	13.91	3.98	14.25	4.49	14.35	6.35	15.00	4.90	10.75	4.56	15.20	6.07
	No	13.80	4.40	14.00	4.97	15.25	5.44	12.75	6.10	11.50	4.93	15.50	5.07
	Total	13.89	3.95	14.21	4.46	14.50	6.11	14.63	4.77	10.88	4.52	15.25	5.81
Spacious	Yes	13.32	4.05	13.11	4.79	13.58	4.45	13.11	4.91	11.89	6.13	14.89	4.91
	No	14.55	.87	15.50	2.52	15.50	3.51	14.75	2.63	11.00	5.35	13.23	5.05
	Total	13.53	3.71	13.52	4.53	13.91	4.29	13.39	4.59	11.74	5.89	15.09	4.55

4.2 Questionnaire

4.2.1 Self-reported creativity

Univariate analyses of variance were conducted to see whether nature and creative activities had an effect on one's self-reported creativity. There was no effect of the environment or an interaction effect of the environment and creative activities ($F < 1$, ns). However, there was a significant effect of creative activities, $F (5, 66) = 4.39$, $p = .04$, which means that people who had not performed creative activities in the past ($M = 3.31$, $SD = 1.16$) reported a higher creativity level than those who had performed creative activities in the past ($M = 2.64$, $SD = .93$).

4.2.2 Ideas

Univariate analyses of variance were performed to see whether nature and creative activities had an effect on if people had a difficult time coming up with ideas. No significant effects were found (all p's > .10).

4.2.3 Pleasure

Univariate analyses of variance were conducted to see whether nature and creative activities had an effect on if people felt pleasure during the task. For the effect of nature no main effect was found ($F < 1$, ns) and neither for the interaction effect of nature and creative activities, $F (5, 66) = 1.54$, $p = .22$. For creative activities a significant effect was found, $F (5, 66) = 7.94$, $p = .01$. This means that participants who had not performed creative activities in the past felt more pleasure ($M = 2.42$, $SD = 1.04$) when performing the task than participants who had performed creative activities in the past ($M = 1.77$, $SD = .72$).

Table 4.4

Mean values of Self-reported Creativity, Ideas and Pleasure

Condition	Creative Activities	Self-reported creativity		Ideas		Pleasure	
		Mean	SD	Mean	SD	Mean	SD
Urban	Yes	2.73	.85	3.70	.80	2.00	.61
	No	3.60	1.29	3.60	1.14	2.10	.65
	Total	2.90	.99	3.68	.85	2.02	.60
Fascinating	Yes	2.53	.98	3.60	.82	1.65	.78
	No	3.80	1.60	3.25	1.26	2.63	1.50
	Total	2.67	1.11	3.54	.88	1.81	.96
Spacious	Yes	2.68	.99	3.53	1.22	1.66	.75
	No	2.88	.48	4.25	.50	2.63	1.11
	Total	2.72	.91	3.65	1.15	1.83	.82
Total	Yes	2.64	.93	3.61	.95	1.77	.72
	No	3.31	1.16	3.69	1.03	2.42	1.04

5. Discussion

5.1 Main findings

Based on different studies that found a positive effect of nature on someone's wellbeing and creativity because of its restorative effect, this study aimed to disclose whether there is an difference in the effect of fascinating (non-spacious) nature compared to spacious (non-fascinating) nature. After looking into studies that stated that people who participated in creative classes in the past would perform better on creativity, this study included whether people had done creative activities or not as second dependent variable. Following up on research that found that spaciousness (Van Rompay & Jol, 2016) and fascinating (Basu et al., 2018; Kaplan, 1995) nature has a positive effect on one's creativity, an image of a spacious natural landscape or a fascinating natural landscape was placed on the wall in a room where participants had to perform a creative thinking task. In addition to nature and following up on research that found that high school student who participated in creative classes were more creative (Ulger, 2017), this study included a short questionnaire with questions if participants had performed creative activities for one year or longer in the past. In line with previous research it was found that nature can have a positive effect on one's creativity, because there was a main effect of nature on performed creativity. There is the possibility that fascinating nature has a more positive effect on one's creativity than spacious nature because of this main effect. No effect of creative activities on performed creativity was found, however, a main negative effect of creative activities on self-reported creativity and pleasure was found. This showed that people who had performed creative activities in the past would report lower on self-reported creativity and pleasure than people who had not performed creative activities in the past.

5.1.1 Main effect nature

By comparing fascinating (non-spacious) and spacious (non-fascinating) nature and the effect it has on one's creativity, this study combined the results of multiple researches on the effect of fascinating and spacious nature to see whether there is a difference in the effect these two conditions have on a person's creativity. In line with the studies performed before, this study also showed that nature can have positive effect on one's creativity. Furthermore, it can be stated that there might be a possibility that fascinating nature has a more positive effect on creativity than spacious nature. This might be due to different stimuli that appear in fascinating nature, these different stimuli can give people many different ideas which makes those people creative.

Moreover the different aspects of creativity as used in the Alternative Uses Task (Guilford, 1967), were analysed separately to see whether there was one specific aspect nature had more effect on. Only for Flexibility a main effect of nature was found, which means nature can have a positive effect on how flexible people can be in their thinking, if they can think of things that are not related at all. The more flexible people are in their thinking, the more creative they are. However, no difference between spacious and fascinating nature was found. That nature can have a positive effect on Flexibility, might be due to that nature is not in line with what people think of or see in daily life (Basu et al., 2018). So people's minds will not be moved in certain directions. This gives them the possibility to lose any restrictions they have in their

way of thinking, and to think out of the box. This will help people to touch upon different ideas that address multiple topics which results in higher flexibility.

5.1.2 Main effect creative activities

The results that were found in previous research on the effect of having had creativity classes in high school, showed that this has a positive effect on one's creativity. This research do not necessarily confirm those findings. It was even found that, when it comes to self-reported creativity and pleasure, people who have performed creativity activities in the past report lower on creativity and pleasure than people who have not performed creativity activities in the past. No real explanation for this difference can be given, the only thing that might have something to do with it, is that people who performed creative activities in the past are already 'used' to being creative which results in them knowing they can 'do better'. People who did not perform creative activities in the past are not used to being creative and are therefore less aware of their abilities to be creative which they get more of when they do creative exercises. The same goes for pleasure when performing a creative task, people who have not performed creative activities in the past, experience for the first time the 'fun' of creative activities and therefore report higher on pleasure.

5.1.3 Interaction effect nature and creative activities

Additionally, an interaction effect between nature and creative activities on Flexibility was found. This showed that for people who had not performed creative activities in the past, nature had more effect on one's flexibility than for those who had performed creative activities in the past. Considering that people who have performed creative activities in the past have been 'taught' how to be creative (Ulger, 2017) this makes sense. They know how to be creative and do not necessarily need the help of nature, while people who have not performed creative activities in the past could benefit from the help of nature because they do not know how to be creative by themselves.

Furthermore, people who had not performed creative activities in the past were more positively affected by spacious nature and people who had performed creative activities in the past were more positively affected by fascinating nature. This difference might be caused by the non-routine problem solving that probably people have who have performed creative activities in the past (Ulger, 2017). The different stimuli that are included in fascinating nature might benefit this non-routine problem solving because of its possible surprising effect. The fascinating image used in this study is not spacious, and has therefore many possibilities to surprise people because it is not possible to see what is behind the trees. For people who do not posses the ability to solve non-routine problems, it might be harder to think of things that might be behind the trees. They feel more free in spacious nature where they cannot be surprised and where they can stick to a routine (looking in to the distance) so it is easier for them to come up with new ideas.

5.2 Practical implications

While this research mostly contributes to the science, there are also some practical implications that could be beneficial for companies, universities and schools. By taking the results of this research into account, more creative work spaces could be designed with fascinating and/or

spacious nature depending on the general background of the target group. This could be done by placing a lot of plants in the room but also by putting a big image on the wall of fascinating nature so people can feel like they are outside in nature while they are working or studying. These real life examples are not the only things that are applicable. It could also be recommended to put on Augmented or Virtual reality glasses to give people really the feeling that they are in nature.

5.3 Limitations & future research

In order to substantiate the findings of this study, future research should include stimuli that score higher on fascination and spaciousness. For this research random images were picked that seemed spacious and/or fascinating based on the researcher's perception. Now it is known what kind of stimuli are fascinating and spacious, more similar stimuli could be picked for the pre-test in order for the spaciousness and fascination of the images to be higher. A variety of images could be selected based on the stimuli used in this study. Furthermore, in this research an urban image was randomly picked based on the researcher's perception and is therefore biased. In future research a variety of urban imagery should be included in the pre-test in order to be sure that participants actually perceive an image as urban. Also, a distinction between spacious and fascinating could be made in the urban imagery in order to have a fair division between spacious-fascinating and nature-urban.

In the framework of this study, it was mentioned that multiple studies found that personality traits have an influence on one's creativity. However, this was not included in this study in order to not ask too much time from the participant and due to limited time for the research. Personality traits could be included in future research instead of creative activities as moderator or as a second moderator. This variable could have an interesting effect on the results and might give valuable information. Studies looked into the effect of personality traits, it was found that the concept of plasticity has a more positive effect on creativity than the concept of stability. Both concepts are part of the Big Two model of Personality (Digman, 1997). Plasticity includes the personality traits of being open for new things and extraversion. Stability includes the traits of emotional stability, conscientiousness, and agreeableness. This means that creative people would be less emotionally stable, have more anxiety and stress, they are less conscientious, and they would be more stubborn than less creative people (Feist, 2018). Goclowska et al. (2018) confirm this and found that novelty seeking is linked to openness and extraversion, and that it can lead to greater divergent thinking. Further research could include the concepts of plasticity and stability and find out which concept belongs to the participants and then see if nature has an effect on one of these groups.

For this research, the sample size was too little. Due to limited time it was not possible to get more participants, which might have caused that some of results were not significant. Therefore it is recommended for future research to include a larger sample size. Especially when including creative activities as a variable, since this is a 3x2 analysis, so then there is the need to double the amount of respondents that participated in this study.

Moreover, the majority of the participants did perform creative activities in the past, which might have caused biased results. Therefore, for future research, the participants could be selected on if they have participated in creative activities before, and divided evenly over

the different environment accordingly. Nevertheless, in this study the amount was, by accident, evenly divided among the different environments.

For this study the images were printed on A2 format and placed on the wall in front of the participants. The participants were sitting very close to it, however, it cannot be stated for sure that the participants noticed the image or paid attention to it. To prevent this in the future, a bigger format could be chosen in order to let the participant see nothing else than the computer screen and the image. Another option would be to use a beamer and project the images on a white screen.

A last limitation of this study is that it cannot be stated for sure that participants felt like they were in nature and thus were affected by it. This might be due to the participants' ability to pretend to be somewhere else, but it might also be due to the environment they were in. It was a small room with white walls which could have limited the participants' ability to pretend to be in the displayed environments. Future research should explicitly state that participant should pretend to be in the displayed environment and the room itself should feel more outdoors. It would not be recommended to actually place participants in nature because these environments are very hard to manipulate. It would be possible, but then many more variables should be taken into account. Additionally, Augmented or Virtual reality could be used for participants to let participants really feel like they are in nature.

As this research only takes a closer look into fascinating (non-spacious) and spacious (non-fascinating) nature, future research could combine the two conditions. So then the effect of a fascinating-spacious environment could be investigated, to see if that enhances the creativity more. Also, these environments could be measured in its relation to other factors than creativity, like for example focus and concentration.

6. Conclusion

The research presented shows that nature can have a positive effect on creativity and that fascinating nature could have a more positive effect on creativity than spacious nature. However, this only applies for the outcomes of the performed creativity, and not for the self-reported creativity. Furthermore, this research also presents that not having performed creative activities in the past has a positive effect on self-reported creativity and pleasure. This research is an addition to previous research that is done on nature and creative activities. It adds that there is a difference in the effect of different natural looking environments in relation to creativity. It could be further investigated whether this is the same for wellbeing, focus, concentration and other aspects. It also adds, that there is a difference in self-reported creativity and pleasure if people performed creative activities or not. Much research has already been done on the effect of research on different aspects in life, but now it is time to take it one step further and look more into the effect of different kinds of nature and if it is actually nature that influences those aspects, or if there are other influences like creative activities in the past.

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Appendix A

IMAGE 1

IMAGE 2

IMAGE 3

IMAGE 4

IMAGE 5

IMAGE 6

IMAGE 7

IMAGE 8

IMAGE 9

IMAGE 10

IMAGE 11

IMAGE 12

IMAGE 13

IMAGE 14

IMAGE 15

IMAGE 16

IMAGE 17

Appendix B

Table 3.3

Respondents demographics

		Frequency	Percentage
Gender			
	Male	35	48.6
	Female	37	51.4
Age			
	18	2	2.8
	19	12	16.7
	20	2	2.8
	21	13	18.1
	22	13	18.1
	23	9	12.5
	24	9	12.5
	25	5	6.9
	26	3	4.2
	27	1	1.4
	29	2	2.8
	30	1	1.4
Student			
	Yes	69	95.8
	No	3	4.2
Alpha or Beta			
	Beta	50	69.4
	Alfa	20	27.8
	Other	1	1.4
Nationality			
	African	1	1.4
	Colombian	1	1.4
	Dutch	40	55.6
	Ecuadorian	1	1.4
	Estonian	1	1.4
	German	8	11.1
	Hungarian	1	1.4
	Indian	2	2.8
	Indonesian	2	2.8
	Italian	1	1.4
	Kenyan	1	1.4
	Lebanese	1	1.4
	Luxembourgish	1	1.4
	Norwegian	1	1.4
	Russian	2	2.8
	Serbian	1	1.4
	Spanish	2	2.8
	Spanish/Irish	1	1.4
	Surinamese	2	2.8
	Thai	1	1.4

Appendix C

Creative in nature

Start of Block: Informed Consent

Q1

Welcome to this research study!

This study aims to understand if and how visual stimuli can influence someone's creativity. First you are asked to peform a task and afterwards you will be asked to answer a few questions. Please be assured that your responses will be kept completely confidential.

The study should take you around 15-20 minutes to complete. Your participation in this research is voluntary. You have the right to withdraw at any point during the study, for any reason, and without any prejudice.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age or older, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.

- ○ I consent, begin the study
- ○ I do not consent, I do not wish to participate

End of Block: Informed Consent

Start of Block: Block 5

Q40 On the following pages you will be presented with an object, and you are asked to\wirte down as many possiblities to use this object as possible within 2 minutes. After 2 minutes you will immediately be presented with another object and you are asked to do the same as before. In total you will be shown 5 objects. There is no limitation when it comes to writing down the ways in which you can use the object.

Below you will find an example:

Name all uses for a brick:

- A paperweight
- A doorstop
- A mock coffin at a Barbie funeral
- To throw through a window
- To use as a weapon
- To hit my sister on the head with

End of Block: Block 5

Start of Block: Block 6

Q42 Name all uses for an apple:

_____

_____

_____

_____

_____

End of Block: Block 6

Start of Block: Block 7

Q43 Name all uses for a shoe:

_____

_____

_____

_____

_____

End of Block: Block 7

Start of Block: Block 8

Q44 Name all uses for a paper clip:

_____

_____

_____

_____

_____

End of Block: Block 8

Start of Block: Block 9

Q46 Name all uses for a light bulb:

_____

_____

_____

_____

_____

End of Block: Block 9

Start of Block: Block 10

Q51 Name all uses for a pillow:

_____

_____

_____

_____

_____

End of Block: Block 10

Start of Block: Creativity

Q36 I felt inspired.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree

Q37 I felt creative.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree

Q38 I had a hard time coming up with ideas.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree

Q39 I felt comfortable during the task.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree

Q48 I enjoyed the task.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree

End of Block: Creativity

Start of Block: Education

Q4 What is your gender?

- ○ Male
- ○ Female
- ○ Other

Q51 What is your age?

_____

Q3 Are you a student?

- ○ Yes
- ○ No

Q5 What do you study?

_____

Q49 What is your nationality?

_____

End of Block: Education

Start of Block: Block 9

Q52 In the following section you will be asked questions about creative classes or creative tasks. With creative classes is meant the classes you have chosen yourself for example at school or external, not the mandatory classes at school.

Q7 Have you participated in any so called 'creative' classes before? (e.g. drawing, crafting, music)

- Yes
- No

Display This Question:

If Have you participated in any so called 'creative' classes before? (e.g. drawing, crafting, music) = Yes

Q8 What kind of 'creative' classes did you take?

- ○ Drawing/painting
- ○ Crafting
- ○ Music
- ○ Other _____

Display This Question:

If Have you participated in any so called 'creative' classes before? (e.g. drawing, crafting, music) = Yes

Q9 For how many years?

- ○ 1 year
- ○ 2 years
- ○ 3-5 years
- ○ 5-10 years
- ○ 10 or more years

Display This Question:

If Have you participated in any so called 'creative' classes before? (e.g. drawing, crafting, music) = No

Q10 Did you perform so called 'creative' task by yourself before for a longer period of time(more than a year)? (e.g. drawing, crafting, playing a music instrument)

- ○ Yes
- ○ No

Display This Question:

If Did you perform so called 'creative' task by yourself before for a longer period of time(more tha... = Yes

Q11 What kind of creative task?

- ○ Drawing/painting
- ○ Crafting
- ○ Playing a music instrument
- ○ Other _____

Display This Question:

If Did you perform so called 'creative' task by yourself before for a longer period of time(more tha... = Yes

Q12 For how many years?

- ○ 1 year
- ○ 2 years
- ○ 3-5 years
- ○ 5-10 years
- ○ 10 or more years

End of Block: Block 9

Appendix D

Research questions literature study?

To what extent do natural landscapes stimulate creativity and what type of natural landscapes works best?
And to what extent is this effect applicable to people that have done creative activities in the past?
Concepts: Creativity, nature, fascination, spacious, creative activities, pleasure.

Criteria preferred materials

Journals and books in English language.

Selected databases

Scopus and Google Scholar, Scopus mostly used as first database, and google scholar as secondary database to look up sources that are used in articles or books.

Relevant terms

Concepts	**Related terms**	**Smaller terms**	**Broader terms**
Creativity	Inspiration, imagination, fantasy, originality	Characteristic, product	Process, Divergent thinking,
Nature	Green, outside	Trees, plants, grass	Earth, green life
Fascination	Soft, hard	Many stimuli	Busy
Spacious	Open	Extensive	Far away,

Search actions

	Date	**Database/setnumber**	**Search action + search technique (and/or/truncatie/phrase searching)**	**Total hits**
1	18-2-2019	Google scholar	Creativity and surrounding	760.000
2	13-6-2019	Scopus	‘’Work space’’, limited to social sciences and open access	2.978
3	26-6-2019	Scopus	Flexibility AND nature limited to: social sciences, business, management and accounting Search within: creativity Limit to: psychology and Environmental studies	29

Reflection

I oriented myself on the subject by looking in to normal not scientific articles and looking at google scholar, to see what all the options were and then I focused more on scientific sources that I could find on Scopus to use in my report. I mostly just used one term or a combination of two different terms that were related to the topic. I also looked for sources in the sources I already used. I assessed the quality of the sources by looking at how often they where cited and what journals they were published in. Next time I would more often look for sources in sources. These are often related and can generate more sources. I mostly used terms in combination with the term creativity. I also tried to limit the results by searching on studies like psychology, environment and social sciences.