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The impact of nature on creativity – A study among Danish creative professionals

Trine Plambech [a,*], Cecil C. Konijnendijk van den Bosch [b,c]

[a] The Alexandra Institute, Rued Langgaardsvej 7, 2300 Copenhagen S, Denmark
[b] University of Copenhagen Institute of Geosciences and Natural Resource Management, Rolighedsvej 23, DK-2000 Frederiksberg, Denmark
[c] Department of Landscape Architecture, Planning and Management, Swedish University of Agricultural Sciences, Sweden

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ABSTRACT

This article investigates the ability of natural environments to enhance creativity. Seventeen qualitative interviews were performed with Danish creative professionals of different age, sex and profession about their creativity, their relation to nature as well as their experience of nature's ability to stimulate their creativity. Findings from this study show that nature does indeed have the capacity to enhance creativity. This study explains how nature has the ability to evoke the creative way of thinking by making us more curious, able to get new ideas as well as flexible in our way of thinking. Nature also helps us to recharge our directed-attention which is needed when analysing and further developing ideas. Nature especially plays a role in the two first phases of a creative process, the Preparation phase and the Incubation phase. Natural environments which offer the perceived sensory dimensions 'Nature', 'Space' and 'Serene' seem to be of particular importance for the creative professionals. The results suggest that it is fruitful to provide access to natural environments of different kinds in order to support creative processes.

Introduction

The aim of this study is to investigate the relation between natural environments and human creativity. Our society's need for creative people calls for different perspectives on how we enhance creativity. Innovative organisations need creative employees because creativity provides the raw intellectual materials – ideas, concepts, insights and discovery – that eventually become new theories, approaches, tools, products and services which underlie innovation (Vithayathawornwong et al., 2003; Baumann and Boutellier, 2009; Dul and Ceylan, 2011).

Psychology is one of the fields that describe and look into creativity. Questions like "what is creativity?", "who is creative?" and "how can the creative person, process and work environment be understood?" have been explored and described in the literature rather comprehensively (Guilford, 1950; Oldham and Cummings, 1996; Hennessey and Amabile, 2010). An extensive amount of research within the area of human–nature interaction, especially within the field of environmental psychology explains why and how nature impacts us and may reduce human stress and relieve burn-out symptoms (Ulrich, 1984; Kaplan, 1995; Kaplan et al., 1998; Grahn and Stigsdotter, 2010). In spite of this work, nature's ability to stimulate our creativity has only been investigated to a very limited extent within the areas of psychology and environmental psychology. To our knowledge, the attention from other fields (such as landscape architecture) for nature–creativity linkages has also been limited.

This study therefore aims to investigate the relationship between nature and creativity, as it may reveal new and important knowledge about nature's role in creative processes which may be valuable in today's and tomorrow's society.

The creative person, process and work environment

Even though definitions of creativity differ, creativity is generally defined as 'a useful novelty' – not a novelty for its own sake, but a novelty that can be applied, and add value to products and services (Oldham and Cummings, 1996; Hennessey and Amabile, 2010).

Creativity, or creative performance, can be described in many ways. According to Dul and Ceylan (2011), creative performance depends on the person, the process, the social-organisational work environment as well as the physical work environment (as visualised in Fig. 1). The focus of this study has been on natural

* Corresponding author. Tel.: +45 30236622.
E-mail addresses: trine@plambech.com (T. Plambech), cck@life.ku.dk (C.C. Konijnendijk van den Bosch).

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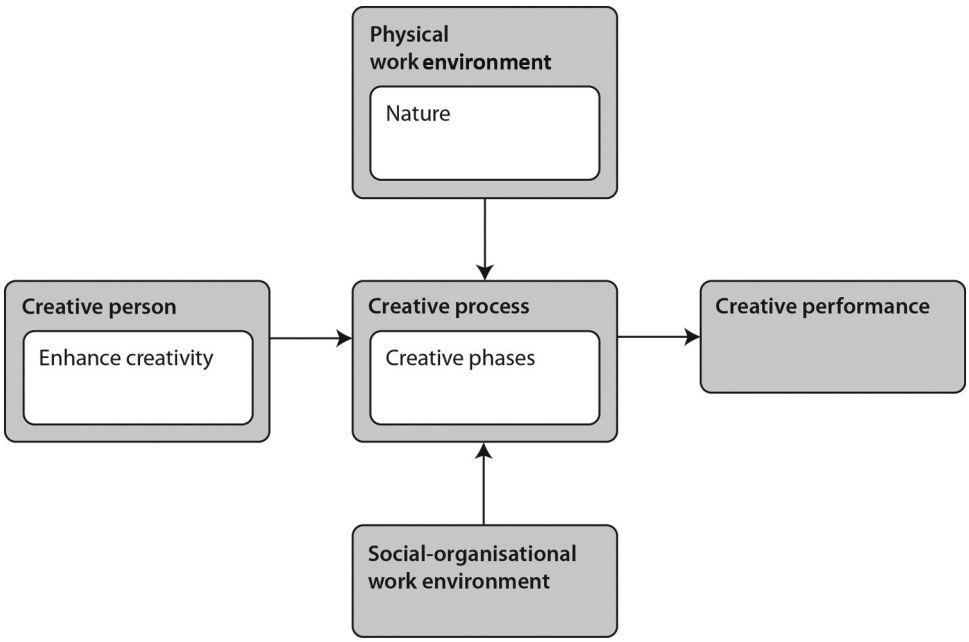

Fig. 1. A modified version of the conceptual model of the relationships between creative person, creative work environment and creative performance (adapted from original figure in Dul and Ceylan, 2011) showing the focus of this study in the white boxes.

environments as part of the Physical work environment and as impacting the Creative person and the process.

On a psychological level there is no distinction between the creativity that is used by artists, and the creativity we all use when we try to create something new within our field (Mikkelsen, 2009).

It was J.P. Guilford, test and intelligence researcher, who for the first time defined what characterises the thoughts involved in a creative process:

1. Being sensitive towards problems (we are aware of things that do not work or fit together and it makes us curious to find out why).
2. We get lots of ideas, and our ideas are new and not just replications of old ideas.
3. We are flexible and able to shift between different perspectives. We can view a problem from different angles and branch out into new channels of thought.
4. We think in a synthesising way – organising ideas into larger, more inclusive patterns and as part of it analyse to see the relevant and interesting aspects (Guilford, 1950).

The creative process consists of a number of phases (Wallas, 1926):

- *Preparation*: when the person directs his attention to a particular topic, and starts to gather information and look into issues that are interesting and arouse curiosity.
- *Incubation*: conscious work stops, and attention is directed to other things, while unconsciously the creative process continues. The unconscious scanning is based upon personal, visual and sensory qualities (Ehrenzweig, 1968).
- *Idea*: the moment when new ideas suddenly come to mind, and the work done during the preparation phase turns into concrete and conscious ideas.
- *Evaluation*: when logical and rational thought returns to decide, whether the insight is valuable and worth pursuing.

The output of the creative process is a creative performance.

Many creative thinkers have recognised the potential role of the environment in influencing creativity (Amabile et al., 1996; McCoy and Evans, 2002).

Theories of human–nature interactions

Nature, in the broadest sense, is equivalent to the natural, physical, or material world or universe (Wikipedia, 2014). The natural environment encompasses all living and non-living things occurring naturally on Earth or some region thereof. It is an environment that encompasses the interaction of all living species (Johnson et al., 1997). Humans have a major impact on nature and natural environments, especially in urbanised countries (Hauxner, 2011).

Highly relevant research has been carried out within the field of environmental psychology. Below, three theoretical perspectives are introduced that are considered of high relevance to the focus of this article.

The Attention Restoration Theory (ART) by Steven Kaplan (1995) identified two types of attention. One refers to the direct attention system, which is used in unnatural environments, like urban environments, office work or when driving a car. In these situations our brains are 'hit' by 11 million bits of information per second, which demand our attention, while only 15–20 bits of information are cognitively adapted. The rest we have to sort out, and this demands energy, which will become mentally tiring (Kaplan, 1995). The other concerns spontaneous attention, or soft fascination, which is the ability to experience things unnoticed, thus stimulating the brain without being mentally tiring. In nature, this type of attention is used and stimulated (Kaplan et al., 1998). As illustrated in Table 1, there are four factors, in particular, that are important for a restorative feeling and they can all be found in nature (Kaplan et al., 1998).

The Affective Aesthetic Theory (AAT) differs from ART by having its focus on psychological and affective reactions, rather than cognitive ones (Ulrich, 1983).

Evolutionary forces have shaped human beings, and natural environments have been of crucial importance for survival during most of human evolutionary history. To be able to survive, it was important to be able to trust our affects. Affections are bodily

Table 1
The four factors that are important for a restorative feeling (adapted from R. Kaplan et al., 1998).

Being away	Settings that differ from the normal surroundings, making it possible to obtain a distance to the mental routines in your normal surroundings.
Extent	Restorative settings are often described as being in a whole different world. It is about being in a large enough setting that its boundaries are not evident.
Fascination	Nature is full of objects of fascination in flora, fauna, water, and the endless play of light. Humans also tend to be fascinated with natural processes such as growth, succession, predation, and even survival itself.
Compatibility	It is about compatibility between one's inclinations and environmental circumstances.

reactions that occur unconsciously and instinctively and within fraction of a second, they can tell us if an environment is secure or insecure. Thus we know when we can rest, or when we should be active, including being prepared to flee or fight (Ulrich, 1984; Ulrich et al., 1991; Nemiah, 1994). We cannot trust our affects in an urban landscape. Instead, we have to use our logical thinking, which may result in fatigue and stress. In a natural environment, we can trust our affects, which is why humans have a preference for natural landscapes (Stigsdotter, 2008).

Research indicates a relationship between sensory perception of natural environments and human health. Grahn and Stigsdotter (2010) describe that people perceive green spaces in terms of eight sensory dimensions (as illustrated in Table 2), where some dimensions are more important and preferred than others. People, in general, prefer the dimension Serene, followed by Space, Nature, Rich in Species, Refuge, Culture, Prospect and Social. These preferences, however, change depending on e.g., one's mental state. If someone suffers from mental fatigue the preferences change; then a combination of Refuge, Nature and Rich in Species, and a low or no presence of Social, could be interpreted as the most restorative environment (Grahn and Stigsdotter, 2010).

Hypotheses

The theoretical frame for this study is developed based on what research says about creativity as well as human–nature interaction. It has, however, not been possible to find a comprehensive theory describing *if*, *why* and *how* natural environments enhance creativity, and if some types of natural environments are preferred when it comes to the enhancement of creativity. The following hypotheses have been formulated with the purpose of outlining the knowledge gaps and enhance our understanding of the relationship between natural environments and human creativity:

1. The interaction between humans and nature evoke the creative way of thinking.
2. Nature plays different roles during the different phases of a creative process.
3. Some types of nature are preferred when it comes to the enhancement of creativity.

Methods

The presented study applies a qualitative approach, recognising that such research is particularly useful for "the description and interpretation of new or not well-researched issues as well as theory generation, theory development, theory qualification, and theory correction" (Bitsch, 2005, p. 76).

Data collection: qualitative interviews

Creative professionals were chosen as participants because the authors presumed that people within the 'classically' creative professions (A) have been thinking of and verbalised their creativity to some extent, and (B) could not do their work without being able to connect with their creativity.

The respondents were selected according to the following criteria:

- Danish creative professionals (performing arts, arts and crafts, architecture, design etc.) and recognised within their field.
- A variety in gender, age, profession and place of living.

A total of 17 semi-structured interviews were conducted by the first author during summer 2012 (see Table 3).

Nine of the respondents were recruited via the network of the first author – encompassing people she knows, though they are not personal friends. To make sure that contact was made with a broad range of creative people, as well as making sure that they were recognised within their field, the first author took advice from creative professionals (e.g. gallery owner) in finding the remaining eight respondents. New interviews were undertaken until a point of saturation was reached, i.e. when new interviews did not add new knowledge (Kvale, 1994). The interviews were conducted via the telephone or via Skype and each lasted approximately an hour. They were all conducted in Danish and written down by the interviewer during the interview. Quotes in this article were translated by the article's first author. The interviews were structured by using an interview guide (Kvale, 1994). The first section of the interview guide aimed at elucidating the respondents' understanding of and experience with creativity as well as the importance of the location to the enhancement of creativity. At this stage of the interview nature had not yet been in focus as it was regarded important to let the respondents talk about their creativity in general before they were asked about nature's influence on their creativity. The next set of questions aimed at gaining knowledge of the respondents' understanding of nature, the importance nature has to them as well as a description of their favourite kinds of nature. The subsequent questions were formulated to gain knowledge of the relation between nature and creativity.

Using images to create a shared nature experience

Ideally the interviews would have been performed outside in nature as walking interviews as this type of interview is regarded as an ideal technique for exploring issues of people's relationship with space (Jones et al., 2008; Skår, 2010). Time constraints, however, limited the possibility of visiting the respondents, who live all over Denmark. Instead, digital images of nature were used to get a shared nature experience as well as a visualisation of the different types of nature the respondents referred to during the interviews.

Using Grahn and Stigsdotter (2010) with input from Caspersen and Olafsson (2006) as the frame of understanding and identifying different types of nature based on perceptions, a set of images was developed consisting of eight sets covering different types of both urban areas as well as non-urban landscapes. The sets of sample of images refer to the eight perceived sensory dimensions (PSDs), presenting one sensory dimension per page. Each PSD is exemplified with four to eight images, a header and a short description. The images were selected by the first author of this paper through the careful reading and interpretation of the description of the eight PSDs. All images were found on Google or Flickr. They were all taken in Denmark. No editing of the images was undertaken. For

Table 2
The eight perceived sensory dimensions (PSDs) (Grahn and Stigsdotter, 2010).

Nature	The experience of a wild, free-growing untouched room with a dynamic and intrinsic vitality. The experience includes a feeling of being in nature on its own conditions and the experience of the inherent force and power of nature. There are few other visitors. The relaxing atmosphere makes the visitor feel safe. It might be free-growing lawns in urban areas.
Space	A green environment experienced as spacious and free and having a certain amount of connectedness, and an opportunity to enter a 'whole different world'. There are few or no roads or paths. It can be the space that occurs between ground and several tree crowns, or when viewing an open area or field.
Prospect	Areas with prospect experience values can be described as large, open and robust rooms with a prospect e.g. vistas over the surroundings. It can be an urban park or urban open space with plane and well-cut grass surfaces, which offers possibilities of many different sorts of activities.
Rich in species	A room offering the experience of life in the form of a vast variety of both animals and plants. This factor is about finding a wide range of expressions of life.
Culture	A room offering the experience of fascination for a lost time. These landscapes contain elements of human artefacts: fountains, statues, exotic plants, ponds etc. The green space can be interpreted as decorated, as containing cores of human culture.
Refuge	An enclosed room offering the experience of safety and shelter, where you feel safe, play or watch other people being active. The park or urban open space harbours animals that children and adults may feed and pet. Their equipment for playing to be found here, like swings, slides, etc.
Social	A room offering the experience of amusement where everything is available, prepared for, and organised.
Serene	A silent and calm room that offers the experience of retreat, being one with nature, and being undisturbed. Serene landscapes do not harbour many people; there is no litter, no noise. They are places providing the feeling of heaven, almost a holy place where you feel safe. It may comprise areas with views over lakes or water or a silent and calm green space.

Table 3
List of interviewees.

Profession	Sex/Age	Lives	Leisure living
Textile designer	Woman/57	House, village on Funen	—
Multi-artist	Man/65	House, Copenhagen	Summerhouse, Southern Zealand
Actor	Woman/37	Apartment, suburb to Copenhagen	Summerhouse, North coast of Zealand
Architect	Man/69	House, village in Northern Jutland	—
Painter	Woman/44	House, suburb to Copenhagen	—
Ceramist	Woman/40	Apartment, Copenhagen	Is looking for a summerhouse near the North coast of Zealand
Journalist	Woman/37	House, village in Southern Zealand	Summerhouse, Sweden
Designer, urban dev.	Man/34	Collective, city in Jutland	Summerhouse, North West Zealand
Painter & author	Man/73	House, village in Southern Zealand	—
Jeweller	Woman/45	Apartment in Copenhagen	An allotment in Copenhagen, Summerhouse by the North Sea
Musician, guitarist	Man/35	House, town in Zealand	—
Animator	Woman/28	Apartment, town in Jutland	—
Actor	Woman/49	Apartment, town in Zealand	Summerhouse, South Zealand
Sculptor	Man/58	House, city in Jutland	—
Silversmith	Woman/39	Apartment, city in Jutland	—
People centric-innovation designer	Man/37	House, town on Zealand	Summerhouse, on Funen, in Sweden and in France
Artist, Painter	Man/50	Apartment, city in Germany	Visits family on South Funen

copyright reasons, the images cannot be reproduced in this article. To strengthen the selection of images, the samples of images were e-mailed to the authors of the above mentioned articles, Ulrika Stigsdotter and Anton Stahl Olafsson, who provided good feedback. The sample was then updated according to the feedback.

The set of images was e-mailed to the respondents before the interview and shown to the respondents in the last part of the interview which gave the respondents a chance to describe nature in their own way, before they were presented with the images and asked if they could recognise the type of nature they have just described. In that way the images created a visual link between the respondents and the interviewer.

Data analysis

Analysing and interpretation of all data were conducted according to the principles of qualitative empirical social research (Kvale, 1994). All the transcripted interviews were printed out and carefully read several times. While reading, a list of possible patterns and categories occurred. Each pattern was colour-coded and the text related to that pattern in each interview, got the same colour. The interviews were read and the list of patterns was adjusted again and again, until there was very little left to adjust. Possible interpretations, thoughts and comments were noted in the margin along the way. In this process, interesting quotations were also highlighted. In the process of interpretation the hermeneutic principles of interpretation were used (Kvale, 1994).

Literature study

Parallel to the interviews an extensive literature study was performed. This study included research articles and scientific books, and was done within the areas of psychology, landscape architecture and environmental psychology. The theoretical frame as well as the literature studies played an important role in discussing, understanding and seeing patterns in the large empirical set of data (Andersen, 1990).

Results

Hypothesis 1. The interaction between humans and nature evoke the creative way of thinking

As described in the theoretical frame, creativity can be fostered by the physical environment including elements from nature (Kaplan et al., 1998; McCoy and Evans, 2002). Being asked if nature may enhance their creativity, all of the respondents said yes: nature plays an important role in the ability to be creative.

> "When something is wild and on nature's terms it helps opening up to my creativity". (Actor, Woman/37)

From the theoretical frame we know that there are different characteristics of creative thinking. It seems as if nature plays a role in stimulating this particular way of thinking.

Sensitivity towards problems

The first characteristic is about being sensitive towards problems, being aware of things that do not work or fit together as well as being curious to find out why (Guilford, 1950).

The respondents explained how nature makes them more curious with an awakened desire to explore. In nature there is an infinite variety. The same place is never the same. Being in nature is intriguing, it makes one wonder and it is fascinating (as described in the theoretical frame).

"In nature nothing is locked, it changes every day. It appeals to curiosity, alertness, and presence. What's happening here?" (Designer/consultant, Man/37)

Many new ideas

The second characteristic is that we get a lot of ideas and our ideas are new and not just replications of old ideas (Guilford, 1950).

The respondents mentioned that the multiple sensory stimuli of natural environments – mainly visual ones, but also birdsong, water sounds, the taste and feel of the air – are conducive to creative behaviour, something which has also been described by Ulrich (1993). Together with the openness and limitlessness of nature it makes them more open towards new, different and wild ideas.

> The forest provides a high ceiling; it's a lovely place to be. Being able to see infinitely far away over the water makes you let go of all the things you have to do. [. . .] in nature you are allowed to think wild ideas, and big thoughts, and dream yourself away into one's inspiration where it all starts to get exciting. (Silversmith, Woman/39)

Nature is not designed for a specific human behaviour, as opposed to many elements of urban environments, e.g. a bench is designed to sit on, a swing to swing on etc. This is important for the idea generation because it does not force your thoughts in a specific direction. The freedom to explore and choose is characteristic of an environment that enhances creativity (Amabile, 1989).

> "Just the thought that nature does not want anything from me, it is just there. I can feel that it connects me to the state of mind that I have when I am creative". (Actor, Woman/49, personal communication)

When the respondents find themselves in natural surroundings they walk. If they stop walking, it is because they want to study something, or view a nature scene. They might also sit for a while but walking is the most common.

Walking stimulates the generation of ideas. When I walk my sight moves. One's gaze is not fixed to one place, and therefore the brain will also float around and move like a bouncing ball. It stimulates the brain, and therefore you get good ideas when you are in motion. (Painter, Woman/44)

Creative potential will be greater upon completion of moderate aerobic exercise (Steinberg et al., 1997). According to Csikszentmihalyi (1996) it is good to sit still and watch, but taking a walk seem to be even better. The reason why semi-automatic activities may stimulate our creativity is due to the fact that they take up a certain amount of attention, while leaving some attention free to make connections among ideas below the threshold of conscious intentionality. Walking in nature using our spontaneous attention also makes us able to experience things unnoticed (Kaplan et al., 1998).

Being calm and in peaceful surroundings with a sense of psychological safety may foster creativity (Ulrich, 1999; Heerwagen and Branch, 2002; Makhmalbaf and Do, 2007). According to AAT (Ulrich, 1993) we can trust our affects in natural environments, which make us feel safe and relaxed as described in the theoretical frame. Respondents described how nature makes them feel safe and has an ability to be calming and provide a space for peace and quietness, which makes one able to come up with new ideas and see things in a new perspective. One becomes 'recharged' by being in nature.

> "When I walk around in the garden, I become calm and loaded with energy–something which can be used when I am creative". (Architect, Man/69)

Nature's ability to make us less stressed by providing a space where we can leave everyday life with its struggles behind has also been described in the ART (Kaplan, 1995).

Flexibility

The third characteristic is the ability to be flexible and able to shift between different perspectives as well as view a problem from different angles and branch out into new channels of thought (Guilford, 1950).

Respondents mentioned that natural environments can make one feel playful and excited. When we see beautiful things it provides more excitement, and we are more likely to find new connections among ideas and new perspectives on issues we are dealing with (Csikszentmihalyi, 1996).

> "I am most creative when I have fun and play". (Painter, Woman/44)

Being playful is an important part of experiencing creativity. Playfulness is about creating new perspectives, ideas, and goals, and exploring new ethical and aesthetic standpoints, and is not limited to games and entertainment. Playful systems allow users to express their own creativity and to establish curiosity, exploration and reflection as key values (Vyas et al., 2008). In nature our attention is taken out of its customary groove and we become seduced to follow novel and attractive patterns (Csikszentmihalyi, 1996).

Nature can affect our mood in a positive way. Our mood is important when it comes to our creativity. Creative problem solving, being able to combine ideas in new ways and make new associations, is more likely to occur, when people experience positively toned moods, than when they are in neutral or negative moods (Isen et al., 1987; Amabile, 1996).

> "To be in a good mood is important for my creativity". (Musician, Man/35)

Creative problem solving is less likely when people are depressed, unhappy or stressed (Elsbach and Hargadon, 2006; Byron et al., 2010). This is because negative moods or stress tend to restrict attention, and lead to stereotypic responses (Heerwagen and Branch, 2002).

Synthesising

The fourth characteristic is the ability to synthesise and organising ideas into larger, more inclusive patterns and as part of it analyse to see the relevant and interesting aspects (Guilford, 1950).

Synthesising and analysing is dependent on our directed-attention abilities. After an interaction with natural environments, one becomes less stressed and able to perform better on tasks that depend on directed-attention abilities (Berman et al., 2008; Kaplan, 1995; Ulrich, 1984; Ulrich et al., 1991). So even though respondents explained that the process of synthesising and analysing most often take place at home by the desk or in the workshop, nature also plays an important role for this characteristic of creative thinking.

Hypothesis 2. Nature plays different roles during the different phases of a creative process

It may be a little bit difficult to say exactly in which phase of a creative process nature makes the biggest positive difference, because in real life these phases are often weaved together, overlapping one another in a sometimes iterative process. It does, however, seem as if nature makes the biggest positive difference in the first two phases: (1) the Preparation phase and (2) the Incubation phase. When one is in the Preparation phase and the Incubation phase it requires more private space than in the Idea phase and the Evaluation phase (Kristensen, 2004), something which one can obtain in nature.

Preparation phase

The respondents report how nature inspires them, and thereby enriches the creative process. Respondents explained how they visit nature to take pictures or study details of e.g., plants, experience textures, patterns, constructions, sounds, smells, symbolic or atmospheres. According to Ulrich (1983), human perception is characterised by a strong orientation to information that is structured or patterned.

> Nature is one of my biggest sources of inspiration [. . .] it has something to do with the shapes and especially constructions of nature. [. . .] When I look at the shapes, it is visually very exciting. It is the starting point of all my work. (Silversmith, Woman/39)

Incubation phase

The respondents explained that incubation is an individual process, where a walk in nature can create calm and new energy which can help defining what one is about to do.

> I use nature in a creative process to access the answers, which are already within me. It can help me listen, and therefore I often use nature in the phases, where I don't have the answer. (Designer/Consultant, Man/37)

It may also be a help to take a walk in nature, if one is stuck – a change of scenery can help the process get started again. Being creative sometimes requires you to take a break and to do something other than what you are presently working on (Amabile, 1996). The respondents have often experienced how taking a break suddenly leads to a break-through with what they are working on. Nature is a preferred place to take a break.

> If one is stuck, it is a good idea to take a walk in the forest. (Animator, Woman/28)

Idea phase

In the third and fourth phase it seems as if nature plays a smaller role. The respondents express that some of the ideas may come about in natural surroundings; nevertheless ideas can seemingly grow out of many different sources. If one has been through the first two phases, the ideas somehow just start coming. Some of the respondents mention that the Idea phase requires a high pace, and has to be done within a short timeframe, which is the opposite of what nature stimulates.

Evaluation phase

As explained, nature may make one better to perform on tasks depending on directed-attention which is needed in the more rational Evaluation phase (Berman et al., 2008; Kaplan, 1995; Ulrich, 1984; Ulrich et al., 1991). Nature's role in the Evaluation phase is therefore to prepare one for being focused at the task.

Hypothesis 3. Some types of nature are preferred when it comes to the enhancement of creativity

As explained, the respondents experience that nature can stimulate their creativity. Moreover, it does matter what kind of nature one is in. Different kinds of nature have different qualities, and striving for compatibility between one's inclinations and environmental circumstances guide the selection of type of nature and as part of this the location (Ulrich, 1983).

What kind of nature stimulates creativity?

When it comes to the enhancement of creativity, respondents preferred the PSDs 'Serene', 'Space' and 'Nature'. The reason seems to be that the creative way of thinking is the same way of thinking which are evoked when one is experiencing landscapes harbouring these kinds of nature.

Nature

The description of the PSD Nature (see Table 2) fits with the respondents' reasons to prefer this type of landscape. These landscapes cannot be overviewed at once. They represent places where you become curious and want to explore – where you can get surprised and challenged (in a positive way). And not least, they are a great source of inspiration.

> These areas give me a feeling of flow–walking here would sharpen my attention–I have to use all my energy sensing and watching, and in that way I get a break from all the things I normally think of–and thereby be prepared to look at it [my work, Author], with fresh eyes when I return. (Jeweller, Woman/45)

Being surprised and invited to habit-breaking activities is important for the cultivation of curiosity and interest (Csikszentmihalyi, 1996; Heerwagen and Branch, 2002).

Space

The description of Space (see Table 2) fits with the respondents' reasons for preferring landscapes that offers an experience of Space. They emphasise its ability to offer a feeling of peace, quietness and beauty. Being guided by the path, curious to see what is behind the next bend. It is about the feeling of space created by the high tree trunks and tree tops. Now and then with an opening to the sky, this figuratively helps one's thoughts to lift off. It can be an almost divine experience, like being in a cathedral.

The feeling of being away, extent and fascination, which the respondents combine with being in the PSD Space, is also described by Kaplan et al. (1998).

Serene

The description of the PSD Serene (see Table 2) and the connected feelings fits with the respondents' reason to prefer this type of landscape. As with Space, the respondents emphasise its ability to give a feeling of peace and quietness. They especially mention water (the sea or a lake) as very important. It is calm and sometimes wild, it is fascinating. It has an ability to blow all worries and stressful thoughts away – it clears the mind, and it is calming. According to Ulrich (1983), water is connected with high levels of preference. It is a landscape element that evokes interests, aesthetic pleasantness and tranquillity. The respondents also mention sounds being important in the calming process. Research shows

Table 4
Overview of the results of the empirical and literature study on how and why does nature stimulate creativity.

Why nature enhances creativity	How nature enhances creativity	How nature enhances a creative way of thinking	Sources
Infinite variety ART; fascination Details, patterns, textures, sounds, smells, constructions, atmospheres	Curious, wonder, want to explore, intriguing Presence Imaginative, playful Inspired	Sensitivity towards problems, curiosity	Guilford (1950) Ulrich (1983, 1993)
Limitlessness and openness Not designed for at specific human behaviour Multiple sensory stimuli ART; soft fascination (being away, extent) AAT; trust our affects Invites to take break and move	Big thoughts New, different and wild ideas Do not force behaviour and thoughts in a specific direction Open, new associations Calm and peaceful Feel safe Semi-automatic activities Moderate exercise Focus on something else	Many new ideas	Amabile et al. (1996), Csikszentmihalyi (1996) Guilford (1950) Heerwagen and Branch (2002) Kaplan et al. (1998) Makhmalbaf and Do (2007) Steinberg et al. (1997) Ulrich (1983, 1993, 1999)
Cannot be overviewed at once ART; fascination Beautiful and wild Not many people	More excitement, positive mood New connections among ideas New perspectives Curiosity, reflection, exploration Eustress, recharged with new energy	Flexibility	Amabile (1996) Byron et al. (2010) Csikszentmihalyi (1996) Elsbach and Hargadon (2006) Guilford (1950) Isen et al. (1987) Ulrich (1993), Vyas et al. (2008)
ART: soft fascination AAT; trust our affects	Less stressed Clear thoughts Focus	Synthesise	Berman et al. (2008) Guilford (1950) Kaplan (1995) Ulrich (1984, 1991)

that natural sounds facilitate recovery from stress (Alvarsson et al., 2010).

> "When I get carried away by the magnificent scenery, I feel like being part of something bigger–it is the same as creativity and it proves a feeling of happiness". (Actor, Woman/37, personal communication)

What kind of nature does not stimulate creativity?

In the same way as there are preferred landscapes, there are also places which the respondents would not seek out to stimulate their creativity. These places especially seem to relate to the PSDs Refuge and Social (see Table 2).

Refuge and Social

The description of the PSDs Refuge and Social (see Table 2), and the connected feelings, fits with the respondents' reason not to prefer this type of landscape when it comes to the enhancement of creativity. As mentioned, one of the qualities of nature (with the PSDs Serene, Space and Nature) is that it does not dictate one's behaviour. That is also, it seems, why Refuge and Social are not preferred. These types of nature which have a strong presence of these PSDs are too perfect and too much manipulated by man, and one's behaviour is dictated. According to Ulrich (1983) the presence of prominent man-made features in natural environments will usually depress aesthetic preference. Being here does not stimulate creativity.

> "When something is trimmed, the human being is in control, which is the opposite of letting you surrender to something bigger than yourself–creativity is where you do not control". (Actor, Woman/37)

The dimensions 'Social' and 'Refuge' provide nice places when you want to go and play with your children, or be together with friends. When you are together with other people, and especially children, they take up a lot of space. This is the opposite of what is mentioned to be qualities of spaces, which may enhance creativity.

Discussion

Compared to current theory the findings fill in part of the knowledge gap concerning the relation between nature and creativity. Enhancing creativity is a complex process, and current theory has explained the characteristics of a creative person (Guilford, 1950), the social–organisational work environment, the physical work environment (Dul and Ceylan, 2011), as well as the creative process and its phases (Wallas, 1926). The findings of this study builds upon current theory, and – as illustrated in Table 4 and Fig. 2 – also contributes with new knowledge.

Findings elaborate on the work by Guilford (1950) who described the characteristics of creative thinking but without concerns of how this way of thinking may come about. This study explains how nature has the ability to evoke the creative way of thinking by making us more curious, able to get new ideas as well as flexible in our way of thinking. Nature also helps us to recharge our directed-attention which is needed when analysing and further developing ideas. In the theoretical frame, two theories on human–nature interaction were introduced: AAT (Ulrich, 1983) and ART (Kaplan, 1995). These serve as a base for understanding *why* nature can enhance creativity. In different ways the theories explain nature's ability to make us fascinated, calm, relaxed, safe and less stressed which is important for the ability to be creative.

The findings also elaborate on the work by Wallas (1926) in a way that nature's role in the different phases has not previously been explored. The study explains how nature especially plays a role in the two first phases, namely the Preparation phase and the Incubation phase.

The findings elaborate on the work by Dul and Ceylan (2011), as their results only relate to the indoor physical environment. The present work expands this by providing further knowledge of the outdoor natural environments' influence on human creativity,

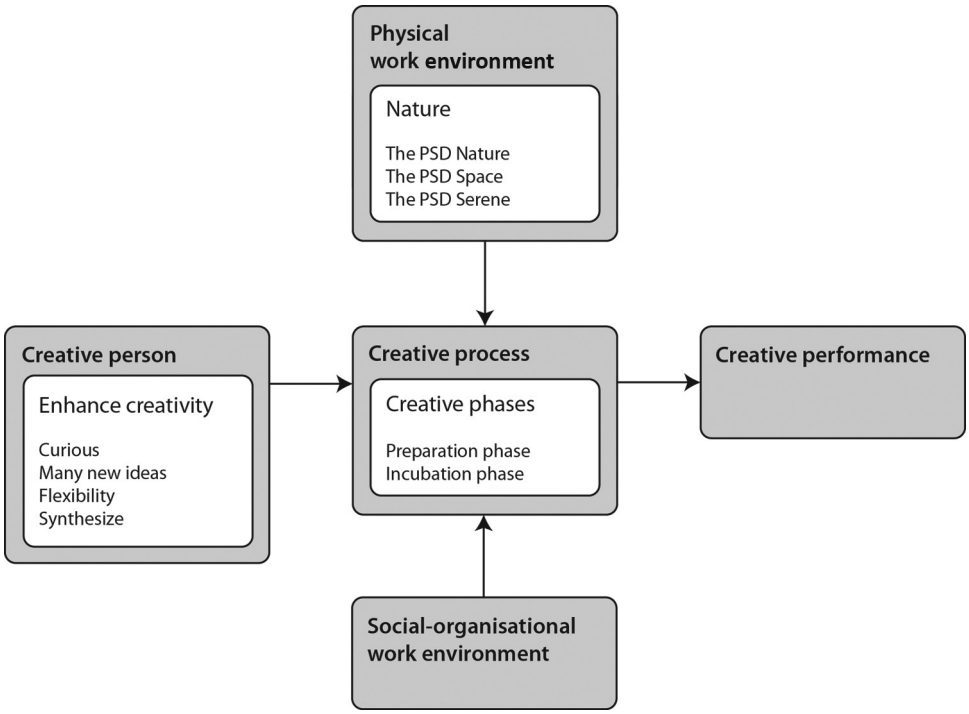

Fig. 2. Application of this study's findings to the conceptual model of the relationships between creative person, creative process, creative work environment and creative performance (adapted from Dul and Ceylan, 2011). This study's findings are illustrated in the white boxes.

stressing, for example, that just as it is specific characteristics of the indoor environment which enhance creativity the same holds true for the outdoor environment. The study explains how especially the PSDs Nature, Space and Serene have the ability to enhance our creativity. These PSDs are the same as those people generally prefer, as shown by Grahn and Stigsdotter (2010). When it comes to the least preferred PSDs, findings from the two studies differ. According to the present study the least preferred PSDs to enhance one's creativity are Refuge and Social, whereas Prospect and Social scored lowest among people in general according to Grahn and Stigsdotter (2010). The reason why Prospect is ranked higher in this study may relate to a view over open landscapes being one of the qualities of Prospect, something which may stimulate being open and unlimited. The low ranking of Refuge in the present study is due to the fact that a creative process is not stimulated by locations being designed for a specific behaviour as well as locations inviting for children's play or social activities.

In summary, this study comprises a step into an area with much potential for all of us being dependent on our creativity in our daily life. Its findings argue that it is fruitful to include and provide access to nature, especially in environments we use and are dependent on for our creativity.

Application of new knowledge and future perspectives

The results of this study can have several implications for practice. As the study indicates that nature can enhance creativity and explains how and why it can make a positive difference in several ways:

1. People who are dependent on their ability to be creative can benefit from knowing that their creativity can be stimulated in nature.
2. Within the public and private sector, nature can be incorporated in creative processes and activities, e.g. by bringing some of the creative processes out in natural surroundings.
3. When building and developing office spaces, nature can be incorporated both inside and outside. These findings also serve as another argument for it being beneficial to include more green spaces in urban environments.

As this research area of nature and creativity is a rather new area, and only a limited amount of research has been done on this topic so far, it is suggested that further research is initiated. As the understanding of nature's ability to enhance creativity requires knowledge from the different research areas as well as close collaboration with practice, future research would ideally be performed in a transdisciplinary manner.

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