

# **THE EFFECTS OF LUNCH BREAK ACTIVITIES ON EMPLOYEE CREATIVITY**

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## ABSTRACT

Some activities and experiences employees encounter during their off-work time are shown to be more beneficial than others in terms of successful recovery, but very little is known how different kinds of respite activities affect creativity. Even short breaks during the working day, such as lunch breaks, give employees a chance to unwind from work demands and thus release cognitive resources for other uses, such as creative thinking. The activities employees engage in during the break may impact this process differently. The aim of this study was to examine how exposure to nature and relaxation during lunch breaks affect creativity compared to each other and to lunch breaks spent as usual. Also, the potential effects of stress, psychological detachment, positive work reflection, enjoyment of lunch breaks and feelings of relaxation on creativity were explored.

A group of 186 employees were recruited from 8 Finnish organizations. The study was carried out in two phases (spring and fall) and the employees were divided into four groups: the nature exposure group, the relaxation group and two different control groups. The participants 1) walked in a park, 2) relaxed during their lunch breaks or 3) spent their lunch breaks as usual for a total of 10 working days during a two-week intervention period. Three weeks after the intervention period their creativity was assessed using the Alternative Uses Task developed by Guilford. During the intervention weeks the participants also provided information about their stress level, emotions, experiences and the qualities of their lunch breaks.

The results showed that the nature exposure group and the relaxation group did not differ from each other or from the control groups in terms of creativity. The more park walks the nature exposure group completed the lower they scored on top 2 originality, fluency, flexibility and uniqueness. In the relaxation group no such effect was found. Stress seemed to play an important role in creative thinking as the more stress the employees experienced, the higher they scored on top 2 originality, fluency and flexibility. Also the positive relationships of creativity and the variables closely linked to stress, namely fatigue and low level of positive affect, supported this finding. This study points to the importance of situational factors in creative thinking and also suggests that mechanisms underlying creative thinking might work differently in the working environment than in other settings.

Key words: creativity, lunch break, relaxation, nature exposure, stress, working time

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## TIIVISTELMÄ

Joidenkin vapaa-ajan aktiviteettien ja kokemusten on huomattu olevan työntekijöiden palautumisen kannalta hyödyllisempiä kuin toisten, mutta erilaisten vapaa-ajan toimintojen vaikutuksista luovuuteen tiedetään vielä hyvin vähän. Jopa lyhyet työpäivän aikana pidetyt tauot, kuten lounastauot, antavat työntekijöille mahdollisuuden irrottautua työn vaatimuksista ja täten vapauttaa kognitiivisia resursseja muuhun käyttöön, esimerkiksi luovaan ajatteluun. Eri taukoaktiviteetit voivat vaikuttaa tähän prosessiin eri tavoin. Tämän tutkimuksen tarkoituksena oli tutkia, miten lounastaukojen aikana koetut luontoaltistukset ja rentoutuminen vaikuttavat luovuuteen verrattuna sekä toisiinsa, että tavalliseen tapaan vietettyihin lounastaukoihin. Lisäksi tutkimuksessa tarkasteltiin stressin, psykologisen työstä irrottautumisen, työn positiivisiin piirteisiin suuntautumisen, lounastauoista nauttimisen ja rentoutumistuntemusten mahdollisia vaikutuksia luovuuteen.

Tutkimukseen osallistui 186 työntekijää kahdeksasta suomalaisesta yrityksestä. Tutkimus toteutettiin kahdessa erässä (kevät ja syksy) ja työntekijät jaettiin neljään tutkimusryhmään: luontoaltistusryhmään, rentoutumisryhmään ja kahteen erilaiseen kontrolliryhmään. Osallistujat joko 1) kävelivät puistossa, 2) rentoutuivat tai 3) viettivät lounastaukonsa tavalliseen tapaan yhteensä kymmenenä työpäivänä kaksi viikkoa kestäneen interventiojakson aikana. Kolme viikkoa interventiojakson jälkeen työntekijöiden luovuutta arvioitiin Guilfordin kehittämällä luovuustestillä (Alternative Uses Task). Interventioviikkojen aikana osallistujilta kerättiin myös tietoa heidän stressitasostaan, emootioistaan ja kokemuksistaan, sekä lounastaukojen sisällöstä.

Työntekijöiden luovuudessa ei havaittu eroja luontoaltistusryhmän ja rentoutumisryhmän välillä, eikä kummankaan ryhmän luovuudessa ollut eroja myöskään kontrolliryhmiin verrattuna. Luontoaltistusryhmässä puistokävelyiden määrä oli yhteydessä luovuuteen siten, että mitä enemmän puistokävelyitä ryhmäläiset suorittivat, sitä matalammat pisteet he saivat ideavuolaudesta (fluency), ajattelun joustavuudesta (flexibility), ideoiden ainutlaatuisuudesta (uniqueness), sekä kahden luovimmaksi ideakseen arvioimansa vastauksen omaperäisyydestä (top 2 originality). Rentoutumisryhmässä samanlaista vaikutusta ei havaittu. Stressi vaikutti olevan tärkeässä roolissa luovassa ajattelussa, sillä mitä stressaantuneempia työntekijät olivat, sitä korkeammat pisteet he saivat ideavuolaudesta, ajattelun joustavuudesta ja kahden luovimmaksi arvioimansa idean omaperäisyydestä. Tätä havaintoa tukivat myös positiiviset yhteydet luovuuden ja stressiin läheisesti liittyvien muuttujien, erityisesti uupumuksen ja heikon positiivisen affektiivisuuden, välillä. Tämä tutkimus osoittaa tilannetekijöiden tärkeyden luovalle ajattelulle ja lisäksi viittaa siihen, että luovuuden perustana olevat mekanismit toimivat työympäristössä eri tavalla kuin muissa ympäristöissä.

Asiasanat: luovuus, lounastauko, rentoutuminen, luontoaltistus, stressi, työaika

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# 1. INTRODUCTION

## 1.1. Background

The purpose of this study is to examine the effects of different types of lunch break activities on employees' creativity. Studying the possible relationships between creativity and activities people engage in during their lunch breaks may help us to understand how creative thinking could benefit from various off-work activities and how employees could better recover during their working days to foster creativity.

Creativity is defined as the “production of novel, useful ideas or problem solutions” (Amabile, Barsade, Mueller, & Staw, 2005). Novelty means that the created idea or solution is either completely new, uncommon or has not been used before in the same context, a quality referred to as *originality* (Guilford, 1967). Originality is one of the four characteristics of creative output introduced by Guilford (1967) in his factor model of creative problem solving. The other factors in his model are *fluency*, defined as the quantity of ideas produced, *flexibility*, which implies the degree to which the ideas differ from each other, and *sensitivity to problems*, described as the ability to recognize problems that need to be solved (Guilford, 1967). Creativity is needed when we encounter situations that require novel solutions which can not be achieved through logical thinking. In the world of business, for example, creative thinking might come in handy when a company needs new ways to reduce their costs without having to reduce the number of workers.

Most employees around the world are allowed to take occasional breaks from work varying from micro-breaks that take only a few seconds or minutes to vacations of several weeks. Breaks give employees a chance to take their mind and body off from work (Fritz, Lam, & Spreitzer, 2011). Several studies have shown that physiological and psychological detachment from work increases well-being and recovery from work-related stress (e.g. Sonnentag & Fritz, 2015; Zijlstra & Sonnentag, 2006). As described in the effort-recovery model by Meijman and Mulder (1998), dealing with work-related tasks requires employees to devote effort into their tasks, which in turn depletes their mental and physical resources and elicits psychological and physiological changes in the body. In order to restore these limited resources, employees need time to recover. Recovery is the process during which employees replenish their resources and unwind from physical, cognitive and emotional demands of their jobs and it occurs when work demands are removed, even if only temporarily (Zijlstra & Sonnentag, 2006). Not only long vacations, but also shorter breaks, such as weekends or breaks of different lengths during the working day, seem to be beneficial for recovery (Dababneh,

Swanson, & Shell, 2001; Drach-Zahavy & Marzuq, 2012). Among the respites occurring within the working day, especially lunch breaks have gained recent research interest (e.g. Krajewski, Wieland, & Sauerland, 2010; Trougakos, Hideg, Cheng, & Beal, 2013), mainly because lunch is most often the longest and therefore the most remarkable break during the day in terms of recovery.

Research has implied that not only free time itself, but also the activities or experiences employees encounter during the respite impact recovery levels (De Bloom, Geurts, & Kompier, 2012; Krajewski et al., 2010; Sonnentag & Fritz, 2007; Tyrväinen et al., 2014). For example, relaxation experiences, such as yoga, meditation or listening to music, are found to be connected to successful recovery, whereas experiences of time pressure or poor psychological detachment from work make it more difficult to recover from work stress (Sonnentag and Fritz, 2007). Another study examined the restorative effects of short-term visits in natural environments compared to visits in built urban environments after a working day and found that even short-term exposures to natural environments have positive effects on perceived stress relief, whereas in built environments the feelings of restoration decreased (Tyrväinen et al., 2014). Studies on different forms of spending lunch breaks have reported similar results, showing that some lunch break activities are more beneficial than others in terms of recovery (Krajewski et al., 2010; Trougakos et al., 2013). In a comparison of two different forms of spending lunch breaks (having small-talk with colleagues or taking part in a relaxation exercise), Krajewski et al. (2010) found that only the relaxation exercise had a decreasing effect on employees' post-lunchtime strain states.

In addition to increased well-being, a previous study's findings indicate that having a recess from work has a positive impact on creativity, or at least some of its dimensions (De Bloom, Ritter, Kühnel, Reinders, & Geurts, 2014; De Jonge, Spoor, Sonnentag, Dormann, & Van den Tooren, 2012). In the study carried out by De Bloom et al. (2014), employees' creativity was measured before and after a long summer holiday with the help of the Alternative Uses Task (Guilford, 1967). Compared to pre-holiday levels, employees generated more diverse ideas after the vacation, thus displaying higher levels of cognitive flexibility, albeit at the same time originality remained unaltered (De Bloom et al., 2014). In another study, an increase in cognitive job resources (achieved through taking a break, for example) was related to higher levels of creativity, although the relationship existed only in case of low cognitive detachment from work (De Jonge et al., 2012). Not only has off-work recovery positive impacts on creativity, but the relationship appears to work the other way around as well. Eschleman, Madsen, Alarcon and Barelka (2014) studied how engaging in creative activities during free time affects recovery and found that creative activity was positively associated with recovery experiences as well as with higher job creativity, described as a tendency to come up with alternative solutions to work-related problems. In addition, the broaden-and-build theory developed by Fredrickson (1998)

posits that experiences of positive emotions can lead to creative thinking by enabling a person to think more broadly. Engaging in creative activities in turn produces more positive affect, initiating a cycle of positive emotions (Fredrickson, 2001). Thus, if employees were encouraged to think creatively by offering them experiences of positive emotions, it is assumed to have positive effects on their recovery, which in turn could lead to higher levels of creativity at work.

So far, the evidence on links between breaks and creativity collected from empirical research is very limited. More research is needed in order to gain more knowledge on this subject and to explain the mechanisms behind the relationship between creativity and off-work recovery. In addition, what has not been studied yet, is whether breaktime activities, such as taking part in a relaxation session or engaging in physical activity in natural environments, affect creativity.

## **1.2. Objective of this study**

In this study, I examined how exposure to nature and relaxation during lunch breaks affect creativity compared to each other and to lunch breaks spent as usual. I studied a sample of employees divided into two intervention groups and two control groups: one group took a 15-minute walk in a park during the lunch break, the second group engaged in a relaxation session for 15 minutes and the two control groups spent their lunch breaks as usual. The intervention period covered a time span of two weeks (a total of 10 working days) and creativity was measured using the Alternative Uses Task. I took into account the various dimensions of creativity (fluency of ideas, cognitive flexibility and originality). In addition to this, I examined if self-reported stress, psychological detachment from work, positive work reflections, enjoyment of one's lunch time activity and feelings of relaxation affect the possible relationship between creativity and lunch break activities.

## **1.3. Nature exposure**

Previous study findings indicate that exposure to natural environments has positive impacts on creativity (Atchley, Strayer, & Atchley, 2012; Jones, 2013; Tyrväinen et al., 2014). In a study on pre-service teachers' perceptions of creativity carried out by Jones (2013), 61% of respondents reported that engaging in learning activities in natural environments (a Japanese garden) had a positive influence on their creativity. The participants of this study reported that the natural environment

liberated them from the constraints of a class room and provided a stimulating setting for creative thinking. Tyrväinen et al. (2014) compared employees' self-evaluated feelings of creativity in two natural environments and an urban environment and found that the ratings on creativity were higher in the natural environments compared to the urban setting. Atchley et al. (2012) found similar effects in their study on the impact of natural environments on creativity, comparing the results of the Remote Associates Test of a group of hikers prior to a backpacking trip to the test results of a group that had spent four days hiking in the wilderness. The higher creativity score of the in-hike group led the researchers to the suggestion that spending time in natural environments increases creativity by offering an emotionally positive environment that gives attention abilities a chance to replenish, leading the mind to a state of introspection (Atchley et al., 2012; Berman, Jonides, & Kaplan, 2008). Positive emotions triggered by natural surroundings might be an essential component in this relationship, as according to the broaden-and-build theory, positive emotions are the key factor in broadening one's thought repertoire and encouraging the exploration of thoughts (Fredrickson, 1998; Fredrickson, 2001). Entering the state of introspection might in turn engage the "default mode" networks, a set of brain areas that are active during tasks that require divergent thinking, a thought process associated with the generation of creative ideas (Atchley et al., 2012; Plucker & Renzulli, 1999). It is expected that exposure to nature during lunch break enhances creative thinking by offering employees a short break from the constraints of their working environment and thus allowing them to freely examine their thoughts. Therefore, I hypothesize that exposure to nature during lunch breaks is more beneficial in terms of creativity than lunch breaks spent as usual.

#### **1.4. Relaxation**

When it comes to relaxation, in their meta-analysis on links between mood and creativity, Baas, de Dreu and Nijstad (2008) concluded that positive and activating mood states (e.g. joy, anger), rather than mood states of low levels of activation (e.g. sadness, relaxation), produce more creativity by facilitating cognitive flexibility and combining of information. Therefore, due to the deactivating impact of relaxing, my second hypothesis is that engaging in relaxation sessions during lunch breaks is less beneficial in terms of creativity than lunch breaks spent in natural environments or lunch breaks spent as usual.



## 1.5. Additional variables

In this study, the employees' self-reported levels of stress, cognitive detachment from work, enjoyment of the lunch break activity, positive affect and feelings of relaxation might affect the results even in the case that no significant connection between creativity levels and the interventions is found. First of all, the interventions are expected to offer the employees a chance to recover during the working day and thereby decrease the level of psychological and physiological stress they experience at work. When people are freed from stress, cognitive resources needed in creative thinking become available and the probability of creative ideas increases (Martindale, 1999). Therefore, my hypothesis is that employees who report low levels of stress will score higher in the creativity task than highly stressed employees.

As the study by De Jonge et al. (2012) indicates, cognitive detachment from work can have negative effects on employee creativity. One possible explanation for this comes from a study by Fritz, Yankelevich, Zarubin and Barger (2010), who theorized that employees who disengage their minds from work need longer time to get back into a "working mode", which in turn may cause negative effects on performance-related activities, such as creative thinking. Thus, employees reporting high levels of psychological detachment from work during lunch breaks may express lower levels of creativity than employees who reported low psychological detachment. My hypothesis is that high levels of psychological detachment from work are associated with lower creativity levels than low psychological detachment.

Third, reflecting on the positive aspects of one's job during off-work time is shown to be positively associated with active problem solving (i.e. creative thinking) and pursuit of learning when returning to work, whereas negative work reflections tend to block creativity (De Jonge et al., 2012; Fritz & Sonnentag, 2005). Therefore, I hypothesize that employees who report reflecting on the positive sides of their work during lunch breaks express higher creativity levels than employees who reflect less positively on their work during lunch breaks.

Fourth, according to broaden-and-build theory, in order to enhance creativity it is essential that the activity people engage in produces positive emotions, or in other words, people enjoy the activity they are engaged in (Fredrickson, 1998; Fredrickson, 2001). Therefore, my fifth hypothesis is that employees who report low enjoyment of lunch breaks will exhibit lower creativity scores than employees who enjoy their lunch breaks. Also, employees who report high level of positive affect will have higher scores in the creativity task than employees who did not experience much positive affect.

Finally, based on the study findings of Baas, de Dreu and Nijstad (2008) mentioned above, it is expected that the self-reported feelings of relaxation after lunch breaks affect creativity levels in a way that employees who report feeling relaxed have lower creativity levels than employees who are less able to relax during the sessions. Therefore, I hypothesize that high level of relaxation during lunch breaks is associated with lower creativity levels than low level of relaxation.

## **1.6. Overview of hypotheses**

To summarize, the main hypotheses of this study are:

1. Exposure to nature during lunch breaks is more beneficial in terms of creativity than lunch breaks spent as usual.
2. Engaging in relaxation sessions during lunch breaks is less beneficial in terms of creativity than lunch breaks spent in natural environments or lunch breaks spent as usual.

In addition to these main hypotheses, I also hypothesize that:

3. Employees who report low levels of stress score higher in the creativity task than highly stressed employees.
4. High levels of psychological detachment from work are associated with lower creativity levels than low psychological detachment.
5. Employees who report reflecting on the positive sides of their work during lunch breaks express higher creativity levels than employees who reflect less positively on their work during lunch breaks.
6. Employees who report low enjoyment of lunch breaks exhibit lower creativity scores than employees who enjoy their lunch breaks. Also, employees who report high level of positive affect have higher scores in the creativity task than employees who do not experience much positive affect.
7. High level of relaxation during lunch breaks is associated with lower creativity levels than low level of relaxation.

## **2. METHOD**

### **2.1. Procedure**

The data in this study was collected during the year 2014. Occupational health service supplier Tampereen Työterveys ry assisted in the recruitment of participants. A description of the study was sent to their client organizations and a request to participate was emailed to these organizations a few days later. Information collected from the participants included background information (age, gender, formal education, family status, tenure and supervisory position), results of the creativity task from each employee, and information about job demands and resources, break characteristics, free-time activities and personal characteristics of the employees. The exclusion criteria were also checked to exclude participants who were doing shift work or who had irregular working hours, had allergies or illnesses that prevented them from going outside for a walk or had no parks nearby.

The data was collected during two separate 7 week long phases. The first phase took place in spring and the second one in fall. The participating companies were randomly assigned to the first or the second phase of the study. The intervention period covered a time span of two weeks during the 7 week phases and participants were randomly assigned to one of four groups. The participants 1) walked in a park, 2) relaxed during their lunch breaks for 15 minutes per working day for two consecutive weeks (a total of 10 working days), or 3) spent their lunch breaks as usual (control groups). The first control group filled in all the same questionnaires as the intervention groups but did not participate in the interventions (i.e., no relaxation exercises or park walks during lunch breaks), whereas the second control group consisted of participants who only filled in the pre-intervention and post-intervention questionnaires.

### **2.2. Participants**

The sample consisted of 186 participants, of which 83 participated in the first phase (spring), 70 in the second phase (fall) and 33 filled in the pre and post-online questionnaires but did not participate in any other way, thus forming one of the two control groups. Of the 153 participants in the spring and fall groups, 51 participated in the nature exposure group, 46 in the relaxation group and 56 in the second control group. The professional fields the employees represented included engineering, health care, media, finance, education and public sector. The variety of professions was more diverse in the

spring group, which contained employees from the six professional fields, whereas the participants of the fall group were employed mainly in education or public sector.

Most of the participants (159 employees) were females. Mean age of the whole group was 47.5 years (range 25–62). The mean of years working for the current employer was 13.5 (range 3 months–41 years) and 11.8 % reported working in a supervisory position. Most of the employees had a graduate degree (40.9 %), an undergraduate degree (20.4 %) or a vocational college level qualification (26.3 %). When it comes to family status, 46.8 % of participants reported living together with a partner and children, 28.5 % lived together with a partner (without children), 12.9 % lived alone and 5.4 % were single parents.

The intervention group, control group and pre-post only group did not differ from each other concerning age ( $\chi^2 (102) = 78,533$ ;  $p = .959$ ), education ( $\chi^2 (15) = 18,411$ ;  $p = .242$ ), family status ( $\chi^2 (9) = 12,210$ ;  $p = .202$ ), tenure ( $\chi^2 (123) = 131,281$ ;  $p = .288$ ) or position in the organization ( $\chi^2 (3) = 1,322$ ;  $p = .724$ ). The gender distribution of the pre-post only group differed from the other groups ( $\chi^2 (3) = 12,505$ ;  $p = .006$ ) as half of the participants in the pre-post only group were males whereas in other groups the majority were females. All participants of the intervention groups completed at least six out of ten relaxation/walking exercises during the two-week intervention period. In both the nature exposure group and the relaxation group 37 % of participants completed all ten exercises. The mean score of completed exercises was 8.61 in the nature exposure group and 8.50 in the relaxation group.

### **2.3. Intervention groups**

In the month before the study started, all participants attended a training session during which the study procedure was explained and the participants were offered a chance to ask questions about the study. Verbal and written instructions for each type of measurement were also given to the participants. The trainers of the mutual training session as well as the separate group sessions were psychologists or psychology students in an advanced stage of their studies.

The participants were randomly assigned to one of the two intervention groups or the control group that participated in the measurements during the intervention period. The second control group was formed of employees of companies that had only few participants. As these employees worked in different companies than the employees of the intervention groups or the other control group and because they did not fill the questionnaires during the intervention period, they were less likely to be influenced by the interventions and self-reporting tasks. The participants in the nature exposure group

received maps and walked a predetermined route in a nearby park with the trainers. They were given an instruction to walk the same route every day at a slow pace, paying attention to nature and avoiding conversation during this 15-minute walk. The participants in the relaxation group attended a 1.5-hour training session on applied relaxation. Applied relaxation is a relaxation technique based on acceptance exercises, deep breathing and progressive muscle relaxation which is relatively easy to learn and widely used in clinical settings due to its efficiency (Bernstein, Borkovec, & Hazlett-Stevens, 2000; Hayes-Skelton, Roemer, & Orsillo, 2013). The participants used this method to relax for 15 minutes per working day. In both intervention groups the participants evaluated their level of relaxation before and after each exercise. The control groups spent their lunch break as usual.

#### **2.4. Alternative Uses Task**

Creativity was assessed three weeks after the intervention period using the Alternative Uses Task developed by Guilford (1967). The task was included in the digital post-online questionnaire. In this task the employees were asked to list as many creative alternative uses for a newspaper as they can in two minutes. After writing down all answers the respondents chose two answers they thought were their most creative ones.

After the data collection, the answers given in the Alternative Uses Task were scored on originality, fluency, uniqueness and cognitive flexibility in order to evaluate the creativity of the participants. The data collected during fall and spring were scored separately, but using the same scoring instructions, and these separate data sets were later combined. After the data collection the answers were typed into a spreadsheet and translated from Finnish to English in order to make them understandable for all members of the multinational scoring team. The items were also arranged in alphabetical order to ensure that the same answers receive similar scores and also to prevent other answers of the same person to influence the scoring. Three independent raters received scoring instructions and keeping these instructions in mind scored each answer independently on a scale from 1 (not at all creative) to 5 (highly creative). The instructions described creative ideas as uncommon, remote and clever and the raters had to consider all three dimensions when judging the creativity of an answer, keeping also in mind that strength in one facet can balance weakness in another. For example, actual uses for a newspaper (e.g., reading) as well as very common uses (e.g., folding, wrapping) should receive low scores, whereas ideas that occur infrequently in the sample and are far from obvious (e.g., rain cover for cucumbers) should receive higher scores.

If the raters disagreed and an item received both very high and very low ratings, the raters discussed these items afterwards to make sure that there had not been any misunderstandings that had affected the scoring process of the answer. If a misunderstanding had occurred, the raters had a chance to modify their scores. The raters reached a moderate level of consensus on their scores for both the spring ( $\alpha = .691$ ) and the fall ( $\alpha = .701$ ) data. After the scoring process was finished, the raters' scores for each answer were averaged to form the originality score for each answer. The answers were then sorted by respondent and the originality score for each respondent was calculated by averaging the originality scores of all answers. Additionally, the ratings of the two answers the respondents had chosen as their most creative ones were averaged to form a separate "top 2" originality score for each respondent. This top 2 score takes into account people's best efforts by allowing respondents to pick only their best ideas for evaluation, thus representing their best level of performance (Silvia et al., 2008). Top 2 scoring also holds the number of evaluated responses for each person constant, thus balancing the scoring for those who have given only a few responses on the task.

The raters also gave the respondents a score on fluency (the number of responses given by each person) and cognitive flexibility (the number of categories the answers represented). While fluency represents the production ability of an individual, cognitive flexibility describes the ability to explore different kinds of solutions to a given problem, which in turn requires the capability to switch between perspectives and break the common patterns of thought (Guilford, 1967). In order to do the flexibility scoring, each answer was sorted into one of the 12 mutually agreed categories: arts and crafts, clothing, covering, fire, gardening, household chores, pet care-taking, reading/gaining knowledge, stuffing, wrapping and insulation, random (answer is not understandable or the relation to the question is unclear), other (answer does not fit any category but relates to the question). The more categories the respondent's answers represented, the higher flexibility score they received. For example, wrapping a gift and wrapping flowers in newspaper fall into same category (i.e. wrapping) resulting in one point, whereas covering floors while painting and making a hat out of the newspaper fall into two categories (i.e. covering and clothing), resulting in two points. In addition, each response that appeared only once in the sample gained a uniqueness point. Uniqueness points of each respondent's answers were then summed to form the uniqueness score for each employee. When the spring and fall data were combined at the end of the scoring process, the raters went through the answers to check that similar answers had received same originality scores and categories and that the uniqueness scores matched the whole data set.

## **2.5. Additional variables**

After each working day the employees participating the intervention groups and the control group filled in a booklet to report the duration of their lunch break and the activities they engaged in and to indicate the degree to which they enjoyed their lunch break, degree of positive work reflections, degree of psychological detachment from work during their lunch break and degree of relaxation on a scale from 1 to 5. The participants of these groups also received SMS questionnaires in the morning, after their lunch break, in the afternoon at work and in the evening on two days a week in the week before the start of the intervention, during the two intervention weeks and three weeks after the intervention. These questionnaires asked the respondents to evaluate their level of stress, fatigue and positive affect on a scale from 1 to 7 using questions “I feel stressed and tense”, “I feel fatigued” and “I feel happy”. In addition, the intervention groups and the other control group also filled in the same online questionnaires as the pre-post only group two weeks before and three weeks after the intervention period. The pre-online questionnaire asked questions about personal and occupational background of the employees and asked participants to evaluate the degree to which they enjoy their lunch breaks in general, how positively they reflect on their work, how relaxed they feel after lunch breaks and the degree to which they psychologically detach from work during their lunch breaks. The post-online questionnaire assessed the same themes but focused on the weeks after the intervention period.

## **2.6. Data analysis**

Descriptive statistics were calculated for mean, standard deviation and range for all variables in this study. Nonparametric methods were chosen due to the small sample size and a skewed distribution of variables. Kruskal-Wallis analysis of variance was applied to test differences in originality, top 2 originality, fluency, uniqueness and flexibility scores between the three experimental groups (exposure to nature, relaxation and control group) and the pre-post only group. The spring and fall groups were compared to see if there were differences in creativity scores between the intervention periods. Additionally, as it is plausible that differences in creativity become visible only when looking at the extremes, the 20 highest and lowest scored participants on every creativity scale were chosen and the representations of each group in these top and bottom 20 were compared in order to see if there were notable differences in these representations.

Spearman's correlation coefficients were calculated in order to examine the possible relations between creativity and stress, psychological detachment, positive work reflections, enjoyment of lunch break, positive affect and level of relaxation. Additionally, as it is possible that employees do not recognize the symptoms of stress as such, feelings of fatigue were also included in the analysis, as increased fatigue is a common and easily noticeable psychological reaction to stress (Sonnentag & Fritz, 2015). The role of stress was also analyzed by examining relationships between stress levels and creativity variables. Finally, relationships between the creativity scores and selected background variables, job demand and resource variables and personal characteristic variables of the employees were calculated using Spearman's correlation coefficients and the chi-square test. The analyses were carried out with SPSS version 23.0.

### **3. RESULTS**

#### **3.1. Creativity test scores**

The means and ranges of the Alternative Uses Task scores and the correlations between these scores are presented in Table 1. Three participants in the control group, one participant in the relaxation group and two participants the nature exposure group left the Alternative Uses Task unanswered, resulting in their exclusion from this analysis. In addition, five participants did not choose their top 2 answers, so their top 2 scores could not be calculated.

The mean of the originality scores was higher for top 2 answers (2.44) than for the regular answers (2.25), indicating that the raters gave higher scores for the answers the participants had also chosen as their most creative answers. This indicates the validity of the scoring method. Answers receiving high originality scores included, for example, "coffee filter paper", "pom-poms", "Christmas tree decorations" and "filling for one's wallet". Answers that received lowest scores were mostly common or random ideas, like "reading", "source of information" and "eating". Originality ( $\chi^2(1) = 17.974, p < 0.000$ ) and top 2 originality ( $\chi^2(1) = 4.769, p = 0.029$ ) scores were higher in spring group than in the fall group, whereas other creativity scores did not differ significantly between these two groups.

Concerning flexibility, the total number of possible categories was 12 and the categories were labeled as arts and crafts, clothing, covering, fire, gardening, household chores, pet care-taking, reading/gaining knowledge, stuffing, wrapping and insulation, random and other. The number of categories the answers fitted into varied between 1 and 13 and the mean score of flexibility was 5.68.



Although the number of categories was limited to 12, a flexibility score of 13 or higher was possible if the person had several answers that fitted into the category “other”. Every answer in this category was counted separately, as many different kinds of answers can fit into this category. Flexibility was controlled for typing speed by dividing each participant’s flexibility score by their fluency score, resulting in a controlled flexibility score. This score varied between 0.36 and 1, the mean score being 0.75. The range of fluency scores was rather wide, varying from 1 to 26, with a mean score of 7.92. Uniqueness scores varied between 0 and 10, but the mean score remained closer to the lower end of the range, being as low as 0.51.

As expected, the fluency score had a strong positive correlation ( $r_s = .83$ ) with the flexibility score, meaning that the more answers a person produced, the more categories the answers fitted into. When flexibility was controlled for fluency, the correlation between fluency and flexibility turned into moderate negative correlation ( $r_s = -.41$ ). Fluency correlated positively with uniqueness ( $r_s = .34$ ), implying that a person giving many answers also produced more unique answers than a person producing fewer responses. Uniqueness also had a weak, positive correlation with flexibility ( $r_s = .27$ ). Originality correlated positively with top 2 originality ( $r_s = .60$ ), flexibility ( $r_s = .26$ ), fluency ( $r_s = .28$ ) and uniqueness ( $r_s = .17$ ). Between flexibility and top 2 originality there was a significant, although relatively weak positive correlation ( $r_s = .34$ ), indicating a relationship between the number of categories and the scores of top 2 answers. Top 2 originality also correlated positively with fluency ( $r_s = .33$ ) and uniqueness ( $r_s = .17$ ). However, between controlled flexibility and top 2 originality a correlation was almost nonexistent ( $r_s = .04$ ).

### **3.2. Exposure to nature during lunch breaks compared to lunch breaks spent as usual**

The means and ranges of creativity scores for nature exposure, relaxation, control and pre-post only groups are presented in Table 2. The Kruskal-Wallis analysis of variance showed no significant differences in any of the creativity scores between the nature exposure and control group. No significant differences were found between the nature exposure and the pre-post only group either.

When taking into account only the 20 highest and lowest scored answers on every creativity scale (presented in Table 3 and Table 4), the control group had the strongest representation in the bottom 20 but also in the top 20. The pre-post group had the weakest representation also in both the top 20 and the bottom 20. However, note that the differences in representations between the groups were not statistically significant.

### **3.3. Engaging in relaxation during lunch breaks compared to lunch breaks spent in natural environments and to lunch breaks spent as usual**

In a comparison of all the four groups, the Kruskal-Wallis analysis showed no significant differences in creativity scores between the groups. The differences in creativity scores between the four groups were very small and none of them was statistically significant (Table 2). In some cases the scores were actually higher in control group or the pre-post only group than in the experimental groups.

TABLE 1. Means and ranges of creativity variables and correlations between the variables

	n	Mean	Range	Theoretical range	1.	2.	3.	4.	5.	6.
1. Originality	180	2.25	1 – 2.90	1 - 5	-	.60**	.26**	-.09	.28*	.17*
2. Top 2 originality	175	2.44	1 – 4.17	1 - 5		-	.34**	.04	.33**	.17*
3. Flexibility	180	5.68	1 – 13	not defined			-	.10	.83**	.27**
4. Flexibility <sup>controlled</sup>	180	0.75	0.36 – 1	0 - 1				-	-.41**	-.13
5. Fluency	180	7.92	1 – 26	not defined					-	.34**
6. Uniqueness	180	0.51	0 – 10	not defined						-

Note: controlled = flexibility controlled for fluency, \*\*  $p < .01$ , \*  $p < .05$

TABLE 2. Means and ranges of the creativity scores in the nature exposure, relaxation, control and pre-post only groups and their statistical comparisons

	Nature exposure group (n = 49)		Relaxation group (n = 45)		Control group (n = 53)		Pre-post only group (n = 33)		Kruskal-Wallis test	
	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Chi-Square	$p$
Originality	2.21	1 – 2.83	2.27	1 – 2.90	2.26	1.28 – 2.82	2.29	1.33 – 2.87	1.728	.631
Top 2 originality	2.47	1 – 4.17	2.38	1 – 4.17	2.48	1 – 4	2.40	1.17 – 3.33	2.597	.458
Flexibility	5.84	1 – 12	5.51	1 – 11	5.85	2 – 13	5.39	2 – 10	1.615	.656
Flexibility <sup>controlled</sup>	0.76	0.38 – 1	0.72	0.44 – 1	0.75	0.36 – 1	0.75	0.43 – 1	2.098	.552
Fluency	7.30	1 – 16	7.84	2 – 14	8.25	3 – 26	7.48	3 – 13	.285	.963
Uniqueness	0.51	0 – 3	0.49	0 – 5	0.53	0 – 10	0.48	0 – 3	.918	.821

Note: Controlled = flexibility controlled for fluency

TABLE 3. Number of participants of each group in the top 20 highest scored items

	Originality	Top 2 originality	Flexibility	Fluency	Uniqueness	Sum
Nature exposure group	5	6	5	5	6	27
Relaxation group	6	5	5	4	5	25
Control group	6	7	7	9	6	36
Pre-post only group	3	2	3	2	3	14

TABLE 4. Number of participants of each group in the bottom 20 lowest scored answers

	Originality	Top 2 originality	Flexibility	Fluency	Uniqueness	Sum
Nature exposure group	7	5	5	5	4	26
Relaxation group	5	7	5	5	6	28
Control group	5	5	6	6	7	29
Pre-post only group	3	3	4	4	3	17

### 3.4. Additional hypotheses

Spearman's correlation coefficients were calculated in order to examine the relations between creativity and stress, fatigue, positive affect, psychological detachment, positive work reflections, enjoyment of activity and feelings of relaxation. The correlation coefficients were calculated for variables measured during the intervention period and for variables measured three weeks after the intervention. The correlations between the creativity scores and these self-reported measures are reported in Table 5 and Table 6.

When looking at the correlations for variables measured during the intervention, a significant, although a relatively weak positive correlation can be seen between controlled flexibility and fatigue ( $r_s = .17$ ,  $p = .047$ ). The rest of the correlations were very weak and not statistically significant. Considering the variables measured three weeks after the intervention at the same time as the Alternative Uses Task, several significant correlations emerged, especially between creativity and stress. Somewhat surprisingly, stress correlated positively with top 2 originality ( $r_s = .18$ ,  $p = .042$ ), flexibility ( $r_s = .22$ ,  $p = .015$ ) and fluency ( $r_s = .24$ ,  $p = .006$ ). In addition, there were also significant positive correlations between fatigue and flexibility ( $r_s = .19$ ,  $p = .031$ ) and between positive affect and fluency ( $r_s = .19$ ,  $p = .035$ ).

TABLE 5. Correlations between creativity scores and self-reported feelings after lunch break for intervention groups and the control group, measured during the 10-day period using SMS-questionnaires and a paper-pencil booklet

	Originality	Top 2 originality	Flexibility	Flexibility <sup>controlled</sup>	Fluency	Uniqueness
Stress	.05	.05	.05	-.02	-.06	-.07
Fatigue	.06	.09	.11	.17*	-.01	-.02
Positive affect	.05	.05	-.02	.02	-.03	-.03
Detachment from work	-.02	-.05	-.11	.08	-.13	.02
Enjoyment of lunch break	.03	.04	-.02	.04	-.03	.08
Feelings of relaxation	.04	-.10	-.05	-.10	.02	-.01
Positive work reflections	.04	-.04	.03	-.11	.09	.11

\*  $p < .05$

TABLE 6. Correlations between creativity scores and self-reported feelings after lunch breaks for all groups together, measured three weeks after the intervention using a post-online questionnaire and SMS-questionnaires

	Originality	Top 2 originality	Flexibility	Flexibility <sup>controlled</sup>	Fluency	Uniqueness
Stress <sup>IC</sup>	.16	.18*	.22*	-.10	.24**	.08
Fatigue <sup>IC</sup>	.01	.04	.19*	.04	.11	-.06
Positive affect <sup>IC</sup>	-.07	-.01	-.15	.12	-.19*	-.08
Detachment from work	.00	.02	-.07	.04	-.10	-.06
Enjoyment of lunch break	.03	.02	-.04	.04	-.07	-.07
Feelings of relaxation	-.06	-.02	-.13	.01	-.10	-.06
Positive work reflections	-.00	-.00	-.05	-.07	-.00	.05

Note: IC = only the intervention groups and the control group, \*\*  $p < .01$ , \*  $p < .05$

In order to explain the role of stress for creativity, the changes in afternoon stress levels of the participants were included in the analysis. Average stress levels were calculated for participants in the two intervention groups and the control group for the week before the start of the intervention, during the two intervention weeks and three weeks after the intervention. The pre-post only group could not be included as they did not answer this stress questionnaire. The stress levels for each group at different points of time are reported in Table 7. These stress levels were compared to see if there were differences in afternoon stress levels between the intervention and control groups or within the groups between different points of time (before, during and after the intervention). In all groups the average stress level seemed to be lower during the intervention compared to stress levels before or after the intervention. However, the Friedman's two-way analysis of variance indicated that there were no statistically significant differences in stress levels between the three points of time within the nature exposure ( $\chi^2(2) = 1.684, p = 0.431$ ), relaxation ( $\chi^2(2) = .717, p = 0.699$ ) or control group ( $\chi^2(2) = 4.692, p = 0.096$ ), thus indicating that the self-reported feelings of stress did not change during the intervention in these groups. In addition, the Kruskal-Wallis analysis of variance showed no significant differences in stress levels between the groups at any point of time.

TABLE 7. Average stress levels before, during and after the two intervention weeks in the nature exposure, relaxation and control group.

	Before intervention	During intervention	After intervention
Nature exposure group	4.04	3.54	3.89
Relaxation group	3.93	3.67	3.71
Control group	3.65	3.60	3.97

In order to test if the level of stress measured through SMS-questionnaires was connected to creativity scores at all, the participants were divided into low stress, average stress and high stress groups based on their stress level at the time of the creativity test. The Kruskal Wallis analysis showed that there were statistically significant differences in originality ( $\chi^2(2) = 6.301, p = 0.043$ ), top 2 originality ( $\chi^2(2) = 6.349, p = 0.042$ ), controlled flexibility ( $\chi^2(2) = 7.093, p = 0.029$ ) and fluency ( $\chi^2(2) = 7.823, p = 0.020$ ) scores between the stress groups. Interestingly, the high stress group had the highest mean scores of originality, top 2 originality and fluency, whereas the low stress group had the lowest mean scores. The mean score of controlled flexibility was highest in the average stress group.

These results are in line with the correlations reported earlier, as they showed that top 2 originality, fluency and flexibility indeed correlate positively with stress.

Lastly, Spearman's correlation coefficients were calculated between the creativity scores and selected background variables (tenure and education), self-reported feelings of job demands from the weeks after the intervention and personal characteristic variables of the employees (age and gender). The chi square test was used to test relationships between family status and the creativity scores. No significant relationships were detected between family status and creativity variables, but several significant correlations between creativity and other variables were found. Originality correlated positively with the level of education ( $r_s = .18$ ,  $p = .015$ ). Flexibility had correlations with education ( $r_s = .22$ ,  $p = .004$ ), age ( $r_s = -.17$ ,  $p = .024$ ) and the amount of completed exercises during the intervention ( $r_s = -.29$ ,  $p = .004$ ), whereas controlled flexibility correlated only with education ( $r_s = -.27$ ,  $p < .000$ ). Fluency correlated with education ( $r_s = .35$ ,  $p < .000$ ), tenure ( $r_s = -.16$ ,  $p = .031$ ), age ( $r_s = -.17$ ,  $p = .021$ ) and amount of completed exercises ( $r_s = -.31$ ,  $p = .002$ ). Uniqueness correlated with education ( $r_s = .19$ ,  $p = .010$ ), gender ( $r_s = .16$ ,  $p = .032$ ), work demands ( $r_s = .18$ ,  $p = .037$ ) and amount of completed exercises ( $r_s = -.23$ ,  $p = .023$ ). As the amount of completed exercises correlated with many creativity variables, these correlations were also calculated separately for nature exposure and relaxation groups in order to see if the type of activity (park walking/relaxation) affected these relationships. Surprisingly, the amount of completed relaxation exercises did not correlate with creativity in relaxation group, but in nature exposure group the amount on completed park walkings correlated negatively with top 2 originality ( $r_s = -.31$ ,  $p = .034$ ), flexibility ( $r_s = -.61$ ,  $p < .000$ ), fluency ( $r_s = -.65$ ,  $p < .000$ ) and uniqueness ( $r_s = -.30$ ,  $p = .036$ ).

#### **4. DISCUSSION**

The aim of the current study was to examine whether exposure to nature and relaxation during lunch breaks affects employees' creativity. Guilford's (1967) factor model of creative problem solving, which describes the characteristics of creative output, was used as a theoretical framework of this study. This framework was completed with recent advances in stress and recovery research (e.g. Fredrickson, 1998; Meijman & Mulder, 1998; Sonnentag & Fritz, 2015) in order to understand the factors that may affect the relationship between creativity and off-work recovery.

Exposure to nature was expected to offer employees a break from the constraints of their working environment and a chance to freely examine their thoughts, thus being more beneficial in terms of

creativity than lunch breaks spent as usual. The deactivating mood state produced by relaxation, on the other hand, was expected to lead to low creativity and thus engaging in relaxation sessions during lunch breaks was assumed to be less beneficial in terms of creativity than lunch breaks spent in natural environments or lunch breaks spent as usual. Additionally, stress and other personal and situational variables were expected to affect the relationship between creativity and the impact of the interventions.

#### **4.1. Creativity and lunch break interventions**

The intervention groups did not seem to benefit from the interventions in terms of creativity the way that was expected. All groups scored evenly on every dimension of creativity measured by the Alternative Uses Task and no differences between the intervention groups and the two control groups were discovered. Thus neither the hypothesis that exposure to nature is more beneficial in terms of creativity than lunch breaks spent as usual nor the hypothesis that relaxation leads to lower creativity than other forms of spending lunch breaks gained support.

The results do not necessarily indicate that engaging in the type of lunch break activities used in this study do not influence creativity at all. Instead, one possible explanation for the lack of visible impacts of the interventions might be the relatively long time between the intervention period and the creativity assessment. Previous studies that have examined the effects of various activities on creativity and reported improvement in creative thinking after these activities measured creativity immediately after the activity, but did not examine how long-lasting these effects were (e.g. Atchley et al., 2012; De Bloom et al., 2014). Therefore, it is possible that the effects of this kind of interventions are only short-term. This means that the interventions used in the current study may have had some impact on creativity, but as creativity was assessed quite a long time after the interventions, these short-term effects had already faded at the time of the creativity assessment. It is notable that many significant correlations emerged between creativity and self-reported feelings of stress, fatigue and positive affect when these feelings were measured at the time of the creativity test, but not when the correlations were calculated between creativity and the same feelings from the time of the intervention. Thus creativity was connected to stress, fatigue and positive affect expressed only when assessed at the time of the creativity test, indicating that situational factors had a stronger connection with creativity than the feelings the employees had during the intervention. A study by Krajewski et al. (2010) supports the notion of the short-term impacts of the interventions, as it showed



that engaging in relaxation sessions during lunch breaks reduced post-lunchtime and afternoon strain, but the influence of relaxation on strain states reported the same evening were much weaker. Similarly, lunch break relaxation may affect creativity for a couple of hours after the session, but not three weeks after.

However, if the idea that the interventions can have only short-term effects on creativity is put aside, the results contain slight indications that at least the nature exposure intervention had some effects on creativity. An indication of the effects are the correlations between creativity variables and the amount of completed exercises in the nature exposure group. These correlations point towards a negative relationship, meaning that the more park walks the employees in this group completed, the lower they scored on top 2 originality, fluency, flexibility and uniqueness. This finding is contrary to the results of previous studies on the effect of natural environments on creativity as well as the original hypothesis of the current study. Why the relationship was negative is not clear. One possible factor that may be influential is the setting in which exposure to nature takes place, which in this case was the lunch break. Perhaps the fact that the employees did not get to choose which activity to pursue during their lunch break affected the outcome, as lunch break autonomy is indeed shown to moderate the links between lunch break activities and their outcomes (Troughakos et al., 2013). Thus, if the employees felt that going for a 20-minute walk in the middle of a lunch break was more of a burden than a relief, this feeling may have twisted the outcome of the intervention into a negative one. However, more experimental research is needed in order to explain how natural environments affect creativity and through which mechanisms this relationship operates.

In comparison of the spring and fall groups, an interesting detail is that the originality and top 2 originality scores were significantly higher in the spring group than in the fall group. This may be due to seasonal factors, as the increasing amount of light and the anticipation of the upcoming summer in springtime may lead to positive and activating mood states, which in turn boost the cognitive processes needed in creative thinking. Another explanation stems from the occupational profiles of the spring and fall samples, as in the fall sample the participants were mainly employed in education or public sector, whereas the spring group involved employees from six different professional fields, thus being more diverse than the fall group. Therefore, it is possible that the professions represented in the spring sample require more problem solving and generation of new ideas than the professions of the fall sample and thus the employees in the spring sample were more accustomed to creative thinking than the employees in the fall sample. Professional background of an employee may also have affected, for example, the way how the employee reacted to a task asking a person to be creative. All in all, more research on this topic is needed in order to draw further conclusions about the impact of seasonal and occupational differences on creativity.

## 4.2. The role of stress

When it comes to the additional hypotheses, the relationship between stress and creativity was also somewhat surprising, as it seemed to work contrary to the hypothesis and most of the existing research about recovery experiences and creativity (e.g. De Bloom et al., 2014; De Jonge et al., 2012). The creativity variables, namely top 2 originality, fluency and flexibility, had positive correlations with reported stress levels, indicating that the more stress the employees experienced, the higher they scored on these dimensions. Also the variables closely linked to stress, namely fatigue and positive affect, correlated respectively with flexibility and fluency. Fatigue was positively connected with flexibility, whereas positive affect and fluency had a negative correlation, meaning that the more fatigued the employees were, the more diverse ideas they generated, and the more they experienced positive affect, the less answers they produced. Additionally, when the participants were divided into groups based on their self-reported stress levels and the creativity scores of these groups were compared, the high stress group scored highest on originality, top 2 originality and fluency, whereas the low stress group had the lowest scores.

Thus, although it was presupposed that creative thinking benefits from experiences that boost recovery as the cognitive resources needed in creative thinking would become available only when people are freed from stress, it is also possible that creative thinking actually benefits from the neural activation generated by stress. In their meta-analysis on links between mood and creativity, Baas et al. (2008) suggest that a moderate level of stress fosters an activating mood state that is important for facilitating cognitive flexibility and combining of information, the precursors of creative thinking. Very low and very high stress levels, on the other hand, decrease the likelihood of creative responses, as low levels of stress deactivate the processes underlying creative thinking, whereas very high levels of stress reduce the processing capacity needed in creative problem solving (Baas et al., 2008). This curvilinear, inverted U-shaped relationship between creativity and cognitive arousal has been identified in other studies as well (e.g. Byron, Khazanchi, & Nazarian, 2010). In the current study, however, when the employees were divided into three groups based on their stress levels, the high stress group rather than the average stress group scored highest on originality, top 2 originality and fluency. This could be explained by the overall stress level of the sample, which might have not been very high as the employees included in the sample worked mainly in professions that can be expected to involve mostly low or moderate levels of stress. Therefore, it is possible that the group of employees who reported highest levels of stress might have actually been only moderately stressed on an overall scale, thus obtaining the optimal stress level for creative thinking. An interesting topic for future research would be to study whether differences in stress levels between different jobs are

indeed reflected in employee creativity. In the current study the relationship between stress and creativity could explain why there were no differences in creativity scores between the intervention groups and the control groups: because the stress levels of the groups measured at the time of the creativity test did not differ from each other, no differences in creativity emerged either.

#### **4.2. Methodological evaluation of the study**

A baseline creativity measure is needed in order to study changes in creativity levels within the same employees during an intervention. Now that the baseline measure was missing it was only possible to compare the intervention groups to each other after the intervention, but not to study changes in creativity within the groups. In further studies it would be useful to measure creativity at the beginning and in the end of the intervention period using different versions of the Alternative Uses Task, for example asking the participants to invent uses for a brick in the first version and for a newspaper in the second. This procedure would allow the comparison of the results with very few unwanted carryover effects.

Another limitation of the current study is the use of two scoring teams and separate scoring phases for spring and fall creativity data. Although this was due to situational factors and the scoring procedure was not intended to be carried out in two phases, the use of different raters for fall and spring data may have affected the originality evaluations. However, the differences in scores caused by the use of two scoring teams were intended to be minimized by going through the ratings and checking that same items had received similar originality scores, were categorized similarly and that the uniqueness points were given taking into account the whole data set. Therefore, the separate scoring phases should have resulted in very similar ratings.

The strengths of this study include the use of an experimental test to assess creativity in a field setting, the use of an actual working sample instead of students and the inclusion of a pre-post only group. Firstly, most of the previous studies used subjective measures (e.g. Jones 2013; Tyrväinen et al., 2014) or the Remote Associates Test (RAT) (Atchley, Strayer, & Atchley, 2012) rather than the Alternative Uses Task in assessing creativity. Subjective measures are found to be less reliable in studying creativity than objective measures, as the results of subjective assessment methods tend to be upwardly biased and affected by social desirability and consistency motive (Park, Chun, & Lee, 2016). As the participants were aware of the purpose of the study, placebo effects could have emerged if creativity was assessed using subjective measures. RAT, on the other hand, has been criticized to measure sensitivity to language rather than creative potential (Worthen & Clark, 1971). Therefore,

its validity as a method of assessing creativity has been questioned. The validity of the Alternative Uses Task as a method of assessing creativity, on the other hand, has been demonstrated in previous studies (e.g. Silvia et al., 2008), as well as in the current study. The correlations between the creativity variables used in this method as well as the correlations between creativity variables and background variables (e.g. age, gender) that are shown to be related to creativity in earlier studies (Kousoulas & Mega, 2009; Reese, Lee, Cohen, & Puckett, 2001) support the validity of the Alternative Uses Task as a method of assessing creative thinking. Therefore, it also has potential to be used in future research.

Secondly, as this study used a sample consisting of employees rather than students and the study was carried out in working places rather than in a laboratory setting, the study has a strong external validity. The lifestyle and educational level of students, for example, differ greatly from the lifestyle and education of employed people. In addition, working places have several unique features that other settings may be lacking, such as the restricted autonomy of employees during their working day, the requirement to work towards a specific goal usually defined by someone else and the presence of a working community. Thus, as the current study was carried out in real working places with real employees, the findings are easily applicable to other workplace settings and employee populations.

Thirdly, the inclusion of a pre-post only group helped to rule out testing effects that may have caused unwanted changes in the performance of the actual control group. Although neither the control group nor the pre-post only group participated in the interventions, it is possible that the mere task of reporting one's thoughts, feelings and experiences is enough to cause changes that may in turn affect creative thinking. Therefore, the performance of the actual control group may have benefitted from the participation in the study although they were not meant to participate in the nature exposure or relaxation exercises. The participants of the pre-post only group, on the other hand, filled in only the first and the last questionnaire and did not participate in any way during the intervention period, thus posing a low risk of being affected by it.

### **4.3. Conclusions**

This study opened some interesting new viewpoints to be added to the study of creativity especially when studying creativity in the working environment, where people face many unique challenges that are rarely found in other environments. The current study also suggested new elements that should be taken into account when designing interventions aimed to boost creativity, such as the timing of the intervention, the occupation of the employees included in the intervention and the duration of the

intervention effects. Additionally, this study found new links between stress and creativity that broaden the understanding of the qualities of psychological activation needed in creative thinking.

More research is still needed in order to deepen the understanding about the mechanisms that underlie the relationship between creativity and off-work recovery. In further studies it would be important to study the duration of the effects that the kind of interventions used in this study can potentially have on creativity. In order to design effective interventions aimed to enhance creativity of employees in the future, more research is also needed on creativity and its links with autonomy, personal preferences and occupational backgrounds of the employees. For example, an interesting idea for future research would be to study if personal or occupational differences affect the outcome of different kinds of interventions on employee creativity.

In the world of business, where creativity is constantly needed in order to keep up with the changing nature of work, to develop new products and business plans and to stay productive under the pressure of diminishing resources, new ways to foster employee creativity come in handy. The findings of the current study should be utilized in the design of further studies aimed to investigate the links between creativity and recovery during the working day. Also, the current study gave new hints about the optimal stress level needed in creative thinking. The findings can be utilized, for example, in the recognition of the most promising environments for creative insights during the working day. In the end, creativity is a multifaceted phenomenon which is highly susceptible to situational influences. More research is needed to better understand its links to recovery processes.

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