The Effect of Plants on Individuals' Stress Level in an Indoor Work Environment

Marie-France Larsson

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Supervisor Richard Ahlström

Abstract

Many instances of sick leave can be linked to diseases caused by stress. An efficient way to counter the negative effects of stress is coping. However, trying to fit coping activities into an already busy schedule can be stressful in itself. Therefore it is interesting to study passive stress-reducing methods, for instance interaction with nature. This paper studied the effect of the presence of plants in a work-like environment on the stress level of 30 participants divided equally in a control group and a test group by measuring their heart rate. A factorial analysis of variance and a multivariate analysis of variance were used to analyze the data. Despite the heart rate of the control group being on an average 5 beats per minute higher than the test group, the difference was found not to be statistically significant. An explanation for this could be the poor reliability of heart rate as a measure of stress.

Keywords: coping, heart rate, indoors, nature, plants, stress, work

The Effect of Plants on Individuals' Stress Level in an Indoor Work Environment

Nowadays, health issues amongst workers are an important concern. It is a commonly known fact that stress has negative effects on people's psychological as well as physical health (Cassidy, 2003) and there is evidence (Bastin, 2003) that an increased amount of sick leave can be linked directly to stress-related diseases (e.g. back pain, insomnia). Stress, especially when prolonged, intensive or frequent, causes a lot of suffering and has negative consequences on people's health. As a consequence, this places an additional load on the healthcare system, likely raising stress levels in healthcare workers in turn. It also costs a lot of money to cover expenses for healthcare and sick leave. More importantly, stress can diminish people's quality of life and can even lead to death (Levi, 2000).

There are three important concepts when discussing stress, namely stress, stressor, and stress reaction (Levi, 1983). In this paper, a definition of stress provided in a publication by the World Health Organization (WHO) will be used. According to this definition, stress is defined as "…the body's response to situations that pose demands, constraints or opportunities" (Bryce, 2001). Stressor is further described as "… the stimulus that evokes a stress response" (Bryce, 2001). A stress response is the individual's reaction to a stressor (Levi, 1983). Just like we all have different physical capacities to endure physical pain, we all have different capacities to endure psychological ones such as stress (Levi, 2000). This psychological capacity can vary not only from individual to individual, but also throughout an individual's life (Levi, 2000). Factors such as family life, work, and economical situation influence us psychologically and consequently increase or decrease the degree to which we can handle different levels of stress (Levi, 2000). Alternatively, stress can provide the increase of energy that is necessary to accomplish something, be it physiological or psychological (Levi, 2000), as in the rush many get before starting a race or when a deadline approaches. In other words, stress can be good. The difference between good stress and bad stress can be difficult to define precisely since the concept is so relative to each individual (Levi, 2000). An excess or lack of stress can be hard to define since this depends not only on the individual but also on the individual's life situation since, as before, an individual's capacity to handle stress varies throughout their life (Levi, 2000). However, even an excess of good stress, just like bad stress, can lead to exhaustion and burnout if continuous (Levi, 2000).

Nevertheless, people who are frequently exposed to high levels of stress do not necessarily become ill; it seems like lack of coping or even bad coping strategies are important factors which lead to stress-related diseases (Cassidy, 2003). In fact, stress itself may not be a problem as long as one has efficient coping strategies, which allows the sufferer to effectively handle stress and recover from it (Cassidy, 2003). There are many different coping strategies, some better than others, and the coping strategy an individual chooses seems to be closely connected to their lifestyle (Cassidy, 2003). For example, someone who smokes and drinks heavily might initially rely on those habits in order to cope with stress. However, these strategies are not beneficial against stress over an extended period of time and are harmful to the sufferer's health. On the other hand, a healthier lifestyle tends to lead to more efficient coping strategies (Cassidy, 2003). Social

support and activities such as training, gardening, hiking, painting, or simply being surrounded by nature can all be efficient coping strategies.

Then again, attempting to combine work, family life, and free time can also become a stressor. Considering that most fulltime workers work at least 40 hours per week, the right balance can be hard to achieve. Assuming that an individual works 40 hours per week and sleeps 8 hours per night, it leaves 72 hours of free time per week. Csikszentmihalyi and Kleiber found that, of those free hours, 40 are spent on necessary every day errands (transportation, shopping, cooking, household chores, hygiene). Furthermore, most people actually spend more than 40 hours per week at work and some of the remaining 32 hours are in reality spent working. If not spent on work, they will probably be spent on social responsibilities such as volunteering or family (as cited in Bell, Greene, Fisher & Baum, 2001). In between work, family and other duties, people do not necessarily have time to plan coping activities in their daily routine. Trying to compress coping into an already busy schedule might in itself become stressful, which obviously has the very opposite effect to what those activities are intended to achieve.

For this reason, it is interesting to look closely at other factors that could help workers to decrease their stress level in a passive way which would not require additional time in the daily planning of work, family, hobbies, and so on. Passive interaction with different elements of the environment has been shown to help decrease people's stress level. It has been shown in many different studies that interaction with nature, which is known as a restorative environment, engenders restorative responses such as a reduction of stress and aggression levels, and a restoration of health and energy (Bell et al, 2001). For example, Nelson (2006) has shown that plants could significantly decrease the stress level in students taking a mathematics test. Plants and nature are of great interest when it comes to people's health and numerous researchers have in fact studied the effect of this variable on different outcome variables. For example, research was conducted to study the effect of plants in a work environment on people's productivity, attitudes and perceptions (Larsen, Adams, Deal, Kweon & Tyler, 1998). The results showed that the participants reported feeling happier when surrounded by plants, but were curiously less productive. One could presume that productivity decreased due to the soothing effect of plants. Furthermore, since it is known that nature has a beneficial effect on people, research was conducted to determine if landscape posters alone are sufficient to affect people's anger and stress levels (Kweon, Ulrich, Walker & Tassinary, 2008). In this study, the landscape posters seemed to decrease the participants' stress level and accordingly their anger level as well. The attention restoration theory (ART), which states that nature helps people to concentrate better after being surrounded by it since it requires involuntary attention, has been verified by many different studies (e.g. Berman, Jonides & Kaplan, 2008). In the latter study, both nature and pictures portraying nature had a significant effect on the participants' concentration capacity.

Overall, it seems as very little research has been conducted with respect to the effect of plants on people's stress level in an interior work environment. When shown pictures of different natural and urban environments, people prefer natural environments. However, they also prefer urban environments where even only a small number of natural elements are present to urban environments where there is no nature at all (Bell

et al, 2001). Bringing nature inside the office, which is an urban environment, can therefore be intrinsically good and improve the milieu. Furthermore, since plants placed in an interior work environment have significant effects on people's mood and productivity, and also because pictures of nature significantly influence people's stress level, it seems reasonable to assume that living plants also could have a significant effect on people's stress level. Therefore, the aim of this paper was to extend the current knowledge of the effect of plants on people by investigating the possible influence of plants on people's stress level in an indoor work environment. The ambition behind the design was to bring nature, which has a relaxing effect, inside the office in order to understand if workers' stress levels can be reduced through passive interaction with this bit of nature which has been brought indoors. The results of this paper were meant to be used to increase workers' quality of life by creating a workplace that is healthier for the employees. A lot is already known about how a workplace should be designed in order to avoid nuisance to workers, and this experiment was conducted with the hope to raise understanding of how to render the workplace more favorable for the workers.

For this study, it was predicted that the presence of greenery should decrease the participants' stress level while performing a computerized stressful task in an indoor work environment. For exploratory purposes, it was postulated as to whether there would be any difference between male and female participants due to the eventual effect of plants.

Method

Participants

Participants were recruited mainly from the human resources management program and psychology program at Mid Sweden University in Östersund. Other participants were also recruited from the economy, social work, nursing and sport technology programs at Mid Sweden University, as well as from the leadership and development program at Lernia in Östersund. Some individuals were sent a written invitation to the experiment via e-mail while others were invited personally during class. People were informed that there would be a lottery of a gift card at the local movie theater (Biostaden, value of 100 Swedish Crowns) which would be drawn amongst all those who signed up and participated. A total of 284 students were invited, 31 signed up and 30 participated. The sample consisted of 70% women and 30% men aged between 22 and 51 years old with an average age of 24.3 years old. The control group consisted of 4 males and 11 females, with an average age of 26.8 years old. The test group consisted of 5 males and 10 females, with an average age of 28 years old.

Apparatus

Room. An office-like environment was recreated in a room of approximately 13 square meters located on the first floor of the P building on Mid Sweden University campus (see figure 1). The room consisted of a working desk on which a computer screen, a keyboard and a mouse all connected to a computer were placed. In order to recreate an office realistically, accessories such as a penholder containing a pen, two pencils, a marker, adhesive tape and an eraser, a tray containing a notebook and written instructions, a stapler, hole punch and paperclip box were placed on the desk. A bookshelf containing books, binders, magazine holders, a box of compact discs, and a box of tissues was placed next to the desk. An office chair on which the participants sat during the experiment was also placed by the desk. In one corner of the room, a portable screen was placed and equipment used to compile the experiment's data was positioned behind it. The divider was also used as a notice board where a calendar, a map of the campus area as well as information about parking spaces on the campus area were posted to make the environment more realistic (see figure 2).

Figure 1. The experiment room without the plants.

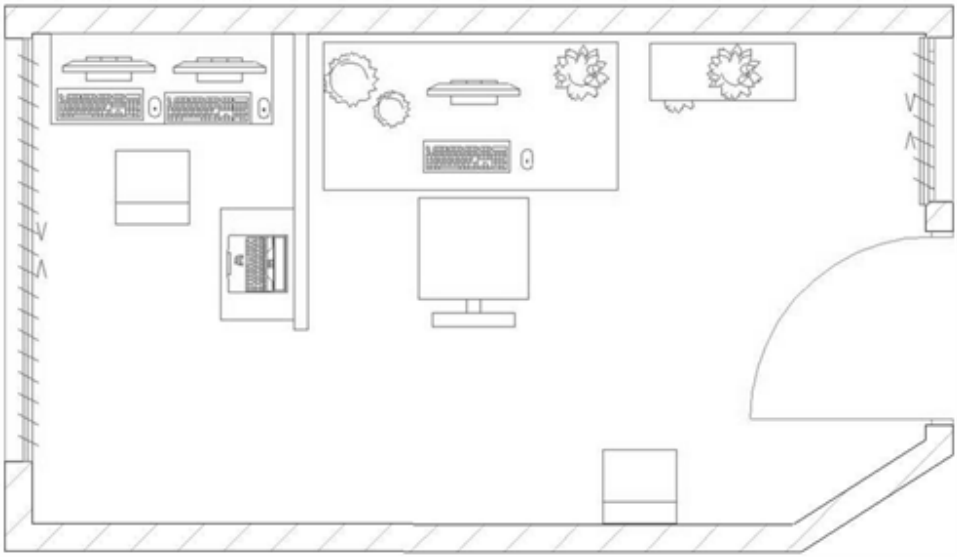

Figure 2. Setup of the experiment room.

There was a window on the exterior wall of the room as well as on the interior wall and on the door over which curtains were drawn during the experiment in order to avoid distraction or effects from the outside environment.

Plants. Five domestic plants were placed in the room during the experiments where greenery would be present. Two criterions were important when selecting the plants. The first condition was that the plant had to be mainly green and devoid of other bright colors. The second criterion was that the plant had to be leafy. The five chosen plants were two *Epipremnum Aureum* (Queen Marble), one *Epipremnum Pinatum* (Golden Pothos Vine), one *Dracaena Deremensis* (Ulises) and one *Spathiphyllum* (Peace Lilly). The plants were placed in white round flowerpots.

The Peace Lilly and the Golden Pothos vine were placed on the desk to the left of the computer and one Queen Marble was placed on the desk to the right. The other Queen Marble was placed in the bookshelf, and the Ulises was placed on the bookshelf. The plants measured between 30 to 45 centimeters in height and were placed in a manner that would allow the participants to continuously see them. The plants could be seen directly when the participant entered the room (see figure 3). When seated by the desk, the placement of the plants allowed the participants to see them directly (figure 4) or in the periphery. This placement assured that the participants would be influenced by the plants during the complete duration of the experiment.

Figure 3. The experiment room with the plants.

Figure 4. View of the desktop with plants.

Typing task. The program Stress Typer was used for the computer task. The task was to rewrite a text (see Appendix A) shown on the left side of the screen in a space provided on the right. If a typing mistake was made, the text turned red and the participant could not use the space or enter key until the word was written correctly. The text used for the exercise was instructions of how to do the task itself and an explanation of how this method could be used to create stress in a laboratory environment. The language used for the program and the text to be typed was Swedish. The program was started manually when the stress period started and stopped manually when the last resting period started. This test was used in preference to other tests due to its similarity to real-life work situations. The program was used without the sounds that are meant to create an even higher stress level and without the colored line that gave an estimate of the participant's performance. These options were not used so as to increase the similarity of the task to that of an actual work assignment.

Questionnaire. A questionnaire with 8 background questions was used in order to control individual differences in relation to heart rate. The questionnaire was written in Swedish (see Appendix B for the Swedish version of the questionnaire). Questions were

taken from the questionnaire “Hälsa på lika vilkor? En undersökning om hälsa och livsvillkor I Sverige 2009” that was coordinated by Statistics Sweden. The first question was “Are you a man or a woman?” (Male/Female). The second was “What year were you born?” The third question was “How much time every week do you spend doing moderately strenuous activities that make you warm? For example fast pace walk, gardening, heavy household chores, cycling, swimming. It can vary during the year, but try to give your answer based on an average.” (5 hours per week or more/More than 3 hours per week but less than 5 hours per week/Between 1 and 3 hours a week/1 hour at most/Not at all). The fourth question was “Do you smoke or use snuff daily?” (Yes/No). The fifth question was “How often did you drink alcohol during the last 12 months? The term “alcohol” includes medium-strong beer, strong beer, strong cider, wine, dessert wine and spirits.” (4 times per week or more/2-3 times a week/2-4 times per month/1 time per month or occasionally/Never). The sixth question was “How often do you drink 6 glasses or more during the same session? “One glass” means 50cl of medium-strong beer, 33 cl of strong beer, 10-15 cl wine, 5-8 cl dessert wine or 4 cl spirits” (Every day or almost every day/Every week/Every month/Occasionally/Never). The seventh question was “Do you use any medicine that affects your heart rate?” (Yes/No). The last question was “Do you have a heart condition?”(Yes/No). All those questions were used since these factors can affect the heart rhythm and partially explain individual differences in heart rate.

Electrocardiogram (ECG). The program AcqKnowledge was used to measure the participants’ heart rate. It was started manually at the beginning of the experiment beginning with the first rest period and stopped manually 15 minutes later at the end of the experiment when the final rest period was finished.

Procedure

The design of this study was created in order to evaluate the effect of plants on individuals’ stress level in an indoor work environment. A room where an office-like environment was recreated was used to test participants under two different conditions. One group (15 participants) participated in the experiment without the presence of plants (control) while another group (15 participants) participated in the experiment with the presence of plants (test). In order to find eventual flaws in the procedure, a pilot test was done with two volunteers and necessary adjustments were made before participants began to be tested. All verbal and written communication with participants was conducted in Swedish.

Upon their arrival in the experiment room, participants were welcomed and it was explained that their heart rate would be measured with an ECG while performing a computer task. The procedure was explained in more detail and participants read the same instructions as those given verbally before the start of experiment. Written instructions (see Appendix C for the Swedish version) were used to ensure all participants would get the same amount of information. To put the participants’ mind at rest, they were invited to look behind the divider to avoid any unnecessary concerns. Participants were told that their participation was voluntary; it was therefore possible for the participants to withdraw from the experiment at any time they wished. In addition, participants were informed that all data collected during the experiment would be used

for research purposes only and that their personal information would be kept confidential. It was explained that no reported information would be presented which could be linked back to any specific individual.

ECG electrodes were attached thereafter to the participant, one on the neck, and one on each side of the rib cage. The participant then read the previously mentioned written instructions that were printed on a sheet of paper placed on the desk where the participant sat during the experiment. The instructions stated that the experiment would start with a rest period of 5 minutes, after which the author would ask the participant to switch on the computer screen. It was then explained that the participant's task was to rewrite on the right side of the screen a text shown on the left in its entirety and as fast as possible but within a limit of 5 minutes. Should a mistake be made, the text would turn red and the error have to be corrected in order to continue the task. It was stated that it was important to write the entire text in order to create a more stressful situation, but in reality the performance on the task had no meaning. The participants were informed of this falsehood afterwards in a follow-up message. When the 5 minutes of the stress period had passed, the participant would be instructed to stop writing even if the task was incomplete and to switch off the computer screen as soon as the author would say "stop", and to then relax for another 5 minutes.

After those written instructions were read, the participant notified the author that they had finished reading the instructions, and the author then informed the participant that the experiment would start at that point with a rest period. The ECG was started manually at that moment. After 5 minutes the participant was told to switch on the computer screen and begin the typing task. Five minutes later, the participant was told to stop and relax. After the final 5 minutes, the ECG was stopped manually and the participant completed the questionnaire regarding background questions in order to control individual differences in heart rate variation. Each participant was thanked with a present at the end of the experiment (a small candy bar).

In order to avoid bias and to randomize the participants in the groups, the condition in the room was changed after every other participant, in other words, two participants in a row participated in the test group, and then two others in the control group, and so on. To balance the groups in respect of gender, male participants were scheduled to be equally distributed in the control and test groups.

Results

SPSS was used to analyze the collected data. The alpha level for statistical tests for this analysis was 0.05. To assure that the participants were significantly stressed by the computer task, the heart rate measurements were tested with a one-way analysis of variance (ANOVA) for repeated measures using the group as the independent variable and the heart rate of the 3 different periods as the dependent variables. A factorial ANOVA was used to determine if the difference between the two groups with regard to gender was significant using the group and gender as the independent variables and the average heart rate throughout the entire 15 minutes of the experiment as the dependent variable. A multivariate analysis of variance (MANOVA) was also used to evaluate if the difference in the mean heart rate of the groups during the 3 different phases of the experiment was statistically significant with regard to gender. The group to which the participants belonged as well as their gender was used as the independent variables. The heart rates during the first, second and third phases were used as the dependent variables. The scores on background questions could not be used as covariates since all of them were calculated with a nominal or ordinal scale, with the exception of age that was intended to be used as a descriptive variable only. Background questions were consequently used for exploratory purposes only using descriptive statistics and t-tests.

The one-way ANOVA for repeated measures revealed a significant difference in the average heart rate of participants between the experiment's different time periods regardless of group. Mauchly's test indicated that the assumption of sphericity had been violated, $\chi^2 (2) = 9.35$, $p < .01$, therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = .82$). The results show that heart rate was significantly affected by how stressful the time period was, $F (1.63, 47.27) = 47.96$, $p < .001$.

There were differences in the average heart rates between the control group and the test group throughout the entire experiment (see figure 5). On average, participants in the control group for the entire duration of the experiment had a higher heart rate ($M = 79.64$, $SE = 2.79$) than participants exposed to plants ($M = 74.75$, $SE = 2.74$). The plants produced a non-significant effect on the participants' stress level, $F (1, 26) = 1.16$, $p > .05$. The gender of the participant had a significant effect on the level of stress, $F (1, 26) = 8.54$, $p < .05$, $\omega^2 = .11$. There was a non-significant interaction effect between the group a participant belonged to and their gender on the stress level $F (1, 26) = .000$, $p > .05$.

The average heart rate of participants differed between the control group and the test group, and also between genders. Males had a lower average heart rate than females, regardless of to which group they belonged and irrespective of the different phases of the experiment (see figure 6).

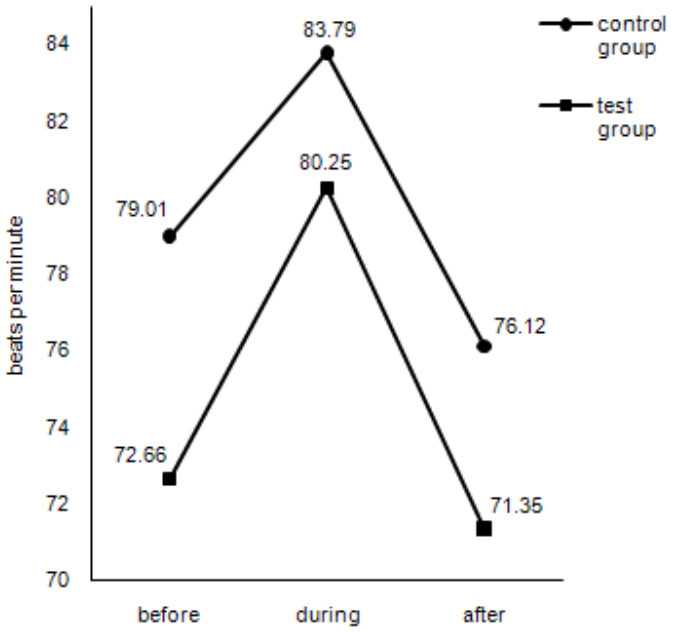

Figure 5. Groups average heart rate in beats per minute during the first 5 minutes (before), during the 5 minutes of the stress period (during), and during the last 5 minutes (after).

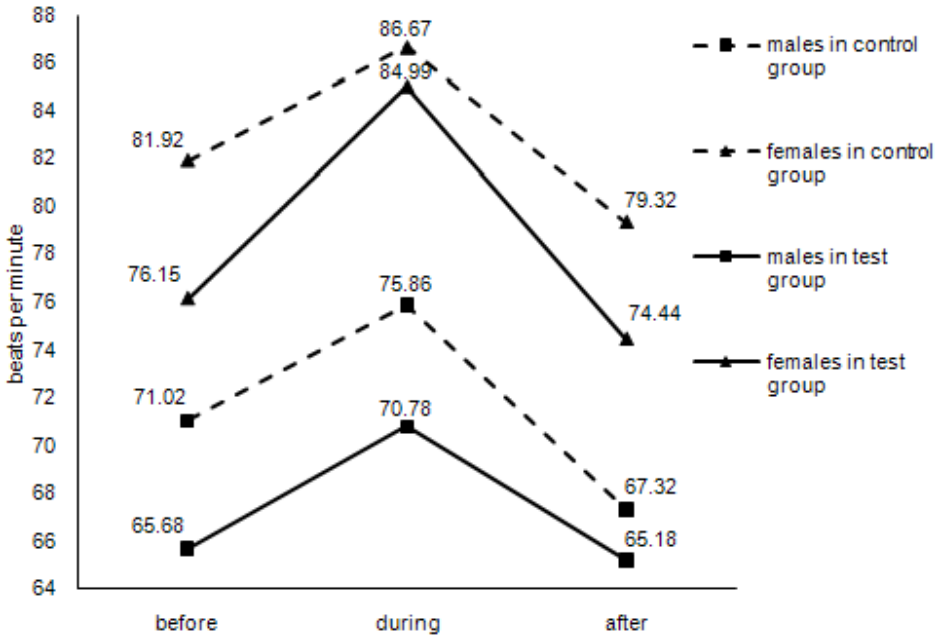

Figure 6. Participants' average heart rate in beats per minute according to the group they belong to and their gender.

Using Pillai's trace, there was no significant effect of the plants on level of stress, $V = .12$, $F(3, 24) = 1.1$, $p > .05$. Separate univariate ANOVAs on the outcome variables also revealed non-significant effect of plants before, $F(1, 26) = 1.82$, $p > .05$, during $F(1, 26) = .66$, $p > .05$, and after the stress period $F(1, 26) = .86$, $p > .05$. Using Pillai's trace, there was a significant difference between genders on the level of stress, $V = .29$, $F(3, 24) = 3.23$, $p < .05$. Separate univariate ANOVAs on the gender variable also revealed a significant difference between gender on the level of stress before $F(1, 26) = 6.72$, $p < .05$, during $F(1, 26) = 9.24$, $p < .05$, and after $F(1, 26) = 7.83$, $p < .05$ the stress period. Using Pillai's trace, there was no significant effect of the plants when both the group and gender were taken into account, $V = .07$, $F(3, 24) = .56$, $p > .05$. Separate univariate ANOVAs on this outcome also revealed non-significant differences before $F(1, 26) = .3$, $p > .05$, during $F(1, 26) = .17$, $p > .05$, and after $F(1, 26) = .13$, $p > .05$ the stress period.

As for the background questions, the largest and therefore most interesting differences were between participants using tobacco products daily and those not. On average, participants who did not use tobacco products daily had a lower heart rate ($M = 75.92$, $SE = 2.26$) than participants who did ($M = 83.56$, $SE = 1.98$). This difference was non-significant $t(28) = -1.47$, $p > .05$, however, it did represent a medium-sized effect $r = .27$.There was also an interesting difference between participants who did not use medication that affects the heart rhythm ($M = 76.61$, $SE = 2.06$), and those who did ($M = 85.35$, $SE = 4$). However this difference was non-significant $t(28) = -1.11$, $p > .05$, and represented a small-sized effect $r = .21$.

Discussion

In the light of the analyses, the hypothesis that plants would have a relaxing effect on participants and reduce their stress level while performing a stressful computerized task cannot be confirmed. Nelson (2006) also found non-significant heart rate differences in his research while the trend was similar to the one found in this study. The results also show that there was a difference in males' and females' stress levels, which is consistent with how males and females usually react in front of a stressor (e.g. Matud, 2004).

The descriptive statistics is quite interesting however when looking at the difference between the three phases considering group and gender. Males and females appear to have different patterns in front of a stressor and during the recovery period. Females in the test group appear to be more reactive than females in the control group, both when facing a stressor, and while recovering from stress (see figure 6 in result section for more details). Females also seem to have a bigger range in their variation when exposed to plants. Males appear to react differently according to the descriptive statistic of this study. Their stress responses seem to be similar whether they are in the control group or in the test group, but males' recovery response in the control group seem to happen faster than males' recovery response in the test group. These contrasting patterns between males and females in the recovery phase are interesting and could suggest gender differences in the environment's influence on an individual's stress level.

The fact that there is a significant difference between the different phases of the experiment regarding the stress level of participants, regardless of group, show that the computer task did create enough stress to generate a stress response, which was important in this case. However, the results do not show any significant effect of plants during the complete duration of the experiment or in any of the three phases. Nonetheless, since the results of this research consistently show a lower average heart rate in the test group, the absence of significance is not necessarily attributable to a lack of effect from the plants, but could instead be caused by flaws in the research design.

Limitations

Pulse alone is not a strong indicator of an individual's stress level, although it may indicate it partially. It would be better combined with other elements to measure stress, such as blood pressure, hormone levels, and even self-report questionnaires. Since this study only used the participants' pulse as an indicator of their stress level, conclusions about this experiment cannot be certain. Also, many other factors such as general health condition, tobacco habits and medication, influence an individual's pulse. For example, the average heart rate of smokers throughout the experiment, regardless of the group they belonged to, was approximately 8 beats per minute higher than the average heart beat of non-smokers. With regard to the participants who take medication that can affect their heart rate, their average heart rhythm throughout the experiment was almost 9 beats per minute higher than the average heart rate of the other participants. This difference of almost 8 beats per minute for tobacco users and 9 beats per minute for participants using medication that affects their heart rate is considerable and most likely influenced the outcome of this research. The non-significant differences of tobacco users and participants using medication that can affect their heart rate with the other participants could be due to the small size and disparity of the groups since only 5

participants were smokers and 2 used medication that could affect their heart rate. The background factors named above are important but difficult to control. In such a small sample, it can be inappropriate to exclude some participants based on background questions. The small size of the groups does not allow for much exclusion and to remove data from an individual may be more costly than beneficial. Because of the difficulty to control important individual differences, and due to the small number of participants, a within-group design would have been more appropriate to control variation between individuals. To paraphrase Field (2009), since it is a lot easier to control individual differences with a within-group design than it is with a between-group design, it is also easier to show significant differences. Nevertheless, a within-group design was deliberately not chosen due to time restrictions as well as the difficulty in recruiting participants for this kind of design in such short timeframes.

The questionnaire itself should have contained questions that could be measured on a continuous scale instead of the dichotomous or ordinal scales that were used. This would have allowed their use as covariates in an analysis of covariance for example. This would have allowed a more efficient control of individual differences despite the between-group design that was used. The background questions were nonetheless interesting when used to give more details using descriptive statistics.

A better randomization of the participants would also have increased the strength of the experiment's design. It would have been appropriate to measure each participant's general stress level with a self-report questionnaire to guarantee a better distribution of participants with regard to this variable.

Another weakness with this design was the short period of time during which the participants were exposed to the different environments. Ideally, longer periods of time should have been used in order for the situation to become more realistic. For instance, it could have been more appropriate to ask the participants to perform a task during a few hours in either one of the conditions, or if using a within-group design, in both conditions. This would have recreated a work situation more realistically and would have given the participants a greater opportunity to be influenced by the environment. Berman et al (2008) when exploring ART exposed their participants to an urban condition or to a natural condition for 50 to 55 minutes, and the experiment stretched over a period of a few months. It is therefore possible that, in this study, the individual did not have time to get influenced by the environment long enough for the presence of plants to produce a significant effect. However, the trend shown by the descriptive statistics indicate something worth exploring more rigorously. Once more, the lack of significance could be due to the flawed design and not necessarily a lack of effect by the plants.

A limitation worth pointing out but that is not unique to this study is the use of graduate students as participants to a psychological study. This is a critique that cannot be taken lightly due to the questionable possibility to generalize results to the rest of the population. Even though students are easier to reach, they are not necessarily the best participants to recruit since it can be questionable whether a student population is representative of the population in general. Like Taylor, Peplau & Sears (2006) state, students can be representative of the population; it all depends on the question that is studied. In this case however, since the focus was placed on the effect of plants in a work

place, it might be questionable whether a young (slightly over 24 years old) and mostly female (70%) group could accurately represent the office working population. Once more, the choice to recruit students was made being aware of these weaknesses and this decision was a compromise due to time limitations.

The afore mentioned weaknesses of this study undoubtedly influenced the result of this experiment. The chances are that the outcome of this study would be quite different if the design was modified and improved accordingly to the reasoning laid out above. Furthermore, I do not believe that statistics should be understood as categorical. Maintaining scientific rigor, it is not possible to affirm that plants had a soothing effect on participants using this research project. However, the fact that the descriptive statistics show such a clear distinction between the two groups, and because of all the limitations that possibly affected the result, I believe it is reasonable not to abandon this train of thought and to continue with more thorough research in order to better understand those differences. I believe that this study should be seen as an exploratory tool in the early phase of a worthwhile research project. As mentioned earlier in the introduction of this paper, stress is an important issue and ways to reduce it are important not only for individuals, but also for companies and society in general. This is an intrinsic reason why this area should be explored further.

Further research

More laboratory research is needed in order to draw stronger conclusions on the existence or nonexistence of the effect of plants on people's stress level. A within-group design where the participants' blood pressures and hormone levels would be measured and where participants are exposed to differing conditions during longer periods of time for instance could give a deeper understanding of the effect of plants on stress. To avoid the limitations of laboratory testing even more, it would be valuable to design an experiment in an actual work place where workers would either be exposed to plants or not during longer periods of time and where better instruments to measure stress would be used.

Conclusion

It is important to understand that passive interaction with the environment in order to reduce stress cannot replace a good and healthy physical and psychosocial work environment. Greenery or architecture alone, for instance, cannot compensate for stressful and uncontrollable work. There are some well established minimum requirements in Swedish law on how work should be organized and this research's aim was to seek new tools and ways to push the quality even higher, not replace what is already favorable and fundamental. There are already well established and recognized ways to help people cope and reduce the harmful effects of stress. This should not limit anyone to stop looking for more ways to reduce and cope from stress as a greater knowledge in this area can only be beneficial at many different levels.

References

Bastin, M. (2003). Sjuk av jobbet. *Välfärd, 2*, 4-6.

Bell, P. A., Greene, T. C., Fisher, J. D., Baum, A. (2001). *Environmental Psychology.* Forth Worth: Hartcourt College Publishers.

Berman, M.G., Jonides, J., Kaplan, S. (2008). The Cognitive Benefits of Interacting With Nature. *Psychological Science, 19 (12)*, 1207-1212.

Cassidy, T. (2003). *Stress, kognition och hälsa*. Malmö: Studentlitteratur.

Field, Andy. (2009). *Discovering Statistics Using SPSS.* London: Sage Publications.

Kwallek, N., Woodson, H., Lewis, C.M., Sales, C. (1997). Impact of Three Interior Color Schemes on Worker Mood and Performance Relative to Individual Environmental Sensitivity. *Color research and application, 22 (2)*, 121-132.

Kweon, B. S., Ulrich, R.S., Walker, V. D., & Tassinary, L.G. (2008). Anger and Stress: The Role of Landscape Posters in an Office Setting. *Environment and Behavior, 40*, 355-381.

Larsen, L., Adams, J., Deal, B., Kweon, B. S., Tyler, E. (1998). Plants in the Workplace: The Effects of Plant Density on Productivity, Attitudes, and Perceptions. *Environment and Behavior, 30*, 261-281.

Levi, L. (1981). *Preventing Work Stress*. Reading (MA): Addison-Wesley Publishing Company.

Levi, L. (2000). *Stress och hälsa 2000*. Stockholm: Skandia.

Matud, P. (2004). Gender Differences in Stress and Coping Styles. *Personality and Individual Differences, 37*, 1401-1415.

Nelson, R. (2006). Mitigating Stress in College Students by Enhancing Testing Center Environments Through Passive Interaction With Plants (Doctoral dissertation, University of Idaho in Moscow ID, 2006). *Dissertation Abstracts International Section A: Humanities and Social Sciences, 67* (6-A), 2053.

Pan Amerecan Health Organization. (2001). *Insights into the Concept of Stress*. [Brochure]. Bryce, CP: Author.

Statistiska centralbyrån (2009). *Hälsa på lika villkor? En undersökning om hälsa och livsvillkor i Sverige 2009*.

Taylor, S. E., Peplau, L. A., & Sears, D. O. (2006). *Social Psychology*. Upper Saddle River (NJ): Pearson Prentice Hall.

Appendix A

Hej och välkommen!

Du har 5 minuter på dig att slutföra denna uppgift.

Din uppgift är att skriva av denna text i rutan här bredvid, precis så som den står skriven. Alla tecken måste vara korrekta annars kommer Du inte vidare. D v s om något tecken blir fel kommer det att vara rödmarkerat tills Du korrigerat ordet. Alla tecken måste bli svarta när du trycker mellanslag eller enter.

Kom ihåg att du endast har fem (5) minuter och att det är viktigt att skriva av texten i sin helhet!

När jag säger "stopp" måste du stänga av dataskärmen omgående, även om du inte är färdig med uppgiften.

Om du hinner ända hit kan du fortsätta att skriva. Detta är alltså ännu en metod som man kan använda sig av när man vill skapa stress i labmiljö. Det går förstås att lägga till ytterligare moment med ett flertal uppgifter eller andra ljud etc.

Jag återkommer med mer information om experimentet inom några veckor och skickar min rapport när den är färdig i januari 2010.

Appendix B

Bakgrundsfrågor

1. Är du man eller kvinna?
□ man
□ kvinna

2. Vilket år är du född?
År 1 9 □ □

3. Hur mycket tid ägnar du en vanlig vecka åt måttligt ansträngande aktiviteter som får dig att bli varm?
T.ex. promenader i rask takt, trädgårdsarbete, tyngre hushållsarbete, cykling, simning. Det kan variera under året, men försök ta något slags genomsnitt. Ange ett alternativ.
□ 5 timmar per vecka eller mer
□ Mer än 3 timmar per veckan, men mindre än 5 timmar per vecka
□ Mellan 1 till 3 timmar per vecka
□ Högst en timme per vecka
□ Inte alls

4. Röker eller snusar du dagligen?
□ Ja
□ Nej

5. Hur ofta har du druckit alkohol under de senaste 12 månaderna*?*
Med ”alkohol” menas folköl, mellan-/starköl, alkoholstark cider, vin, starkvin och sprit.
□ 4 gånger/vecka eller mer
□ 2-3 gånger/vecka
□ 2-4 gånger/månad
□ 1 gång/månad eller mer sällan
□ Aldrig → gå vidare till fråga 7

6. Hur ofta dricker du sex ”glas” eller fler vid samma tillfälle?
Med ett ”glas” menas 50 cl folköl, 33 cl starköl, 10-15 cl vin, 5-8 cl starkvin, 4 cl sprit.
□ Dagligen eller nästan varje dag
□ Varje vecka
□ Varje månad
□ Mer sällan än en gång i månaden
□ Aldrig

7. Använder du medicin som påverkar din hjärtrytm?
□ Ja
□ Nej

8. Har du någon hjärtsjukdom?
□ Ja
□ Nej

Appendix C

Hej och välkommen!

Glöm inte att stänga av din mobil under experimentet.

Experimentet börjar med en viloperiod på 5 minuter som startar när du har läst klart instruktionerna (säg till när du har läst klart). Du ska bara slappna av och ta det lugnt under den perioden. När jag säger till att slå på dataskärmen som finns framför dig ska du trycka på den stora knappen. Det tar några sekunder innan bilden framträder.

Därefter ska du göra ett test under vilket du måste skriva av en text precis som den ser ut utan att göra stavfel. Skriver du fel blir texten röd och du kan inte skriva vidare utan att ändra stavfelet. Du har maximalt 5 minuter från då du slår på skärmen för att skriva av texten. Det är viktigt att du hinner skriva av texten i sin helhet och din prestation registreras under testet. Jag meddelar dig när halva tiden har gått.

När jag säger ”stopp” ska du stänga av dataskärmen omgående genom att trycka på den stora knappen, oavsett om du har hunnit skriva färdigt eller inte. Du ska sedan vila i 5 minuter: slappna av och ta det lugnt. Efter viloperioden kommer jag att koppla bort sensorerna och du ska fylla i en liten enkät.

Så enkelt är det! Tack för din hjälp!