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The Effect of a Virtual Nature Environment on the Experience of Bronchoscopy Patients, measured by Psychological and Physiological Measurements.

Key words: Bronchoscopy, quasi-experimental between-group design, nature stimuli, skin conductance, perceived anxiety.

(Adorama Learning Center, 2018)

Abstract

Evidence is found that nature has a relaxing effect on people. However, hardly any research about nature is implemented at bronchoscopies. Therefore, a quasi-experimental, between-group design research is implemented to test whether anxiety in bronchoscopy patients can be reduced by showing them a nature video. Two groups (n=32) were compared: a nature group (n=19) in which patients wore video glasses with moving nature images and a no-nature condition (n=13) without those glasses. To gather data, an Empatica E4 wristband measured physiological data (skin conductance) during the bronchoscopy to test the patients' stress level. Furthermore, the patients' experience of their anxiety is measured by three questionnaires: before, right after and a week after the bronchoscopy.

When analysing the data, a significant effect can be found in the physiological data: a significant difference occurred within the groups between the three time stages. No significant difference was found between the two conditions nor the interaction (time * condition). In the questionnaires, a significant difference can be found between the two conditions in the participants' recalled experience of the working of anaesthesia (p=.016). The participants in the nature group showed a higher amount of recalled pain, a week after the bronchoscopy. Mood-arousal (p=.051), the patients' experienced comfort at the continuation of the bronchoscopy (p = .075) and follow-up of the comfort at insertion of the bronchoscope (p=.051) were found to be close to significant in favour of the no-nature condition.

Given these findings, it is inconclusive that nature videos have a positive effect on bronchoscopy patients. A possible explanation for this is that the nature video was not tailored to the participants' preferences, according to the Affective Response Theory. Furthermore, a larger and more expanded target group should be researched and limitations can be prevented by applying diverse methods. More research is necessary to draw a reliable conclusion.

Introduction

Bronchoscopy as a treatment

A bronchoscopy is a treatment with many purposes. People who are expected to have a possible diagnosis of lung disease, tumour, chronic cough or an infection, must undergo a bronchoscopy to examine their lungs (Healthline, 2017). Despite the vision that a bronchoscopy is a safe treatment, it can be an uncomfortable and painful procedure for patients, due to the insertion of the apparatus through the airways (Xie, 2017). An experience of asphyxia, cough, nausea, and feeling of choking can be present during the bronchoscopy (Yildirim, Özkaya & Yurdakul, 2017). In some cases, pain is present in such an extreme manner, that the procedure must end immediately (Xie, 2017).

These negative aspects can make the patient anxious in turn. In total, 56.7% of the patients experience anxiety to receive the treatment, according to Ketata et al. (2011). This anxiety is mainly agitated on receiving pain and the occurrence of breathing problems (Poi, Chuah, Srinivas & Liam, 1998). By the occurrence of these complications, many people remember the bronchoscopy as a negative experience and can therefore refuse to have a second bronchoscopy in the future (Putinati, Ballerin, Corbetta, Trevisani & Potena, 1999). Fujimoto et al. (2018) support this finding by showing that discomfort during a bronchoscopy is increasing the anxiety of a patient to undergo a second bronchoscopy, while comfort reduced this anxiety significantly. When anxiety, and as a possible consequence of it pain and discomfort will be lowered, the number of failed bronchoscopies will be reduced and the overall experience of the patient with the bronchoscopy will be improved. This in turn accounts for a better patient care and a better treatment course.

Procedure of the bronchoscopy

In a bronchoscopy, an instrument called a bronchoscope is inserted through the nose or mouth into the lung airways, to examine whether a diagnosis is positive or whether something extraordinary is present in the lungs. A bronchoscope is a flexible tube with a focusing lens and light attached to orientate in the lungs (Medisch Spectrum Twente, n.d.a). Next to this, a biopsy can be taken to examine suspicious tissue. The treatment itself lasts for around 30 minutes and can detect blockings, bleedings, infections or a redundancy of mucus in the lungs (Healthline, 2017; National Heart, Lung and Blood Institute, n.d.).

When no narcotic or systemic medicines are given, the patient can leave the hospital after the bronchoscopy (Medisch Spectrum Twente, n.d.b). Otherwise, the patient has to stay in the hospital until the medicines are worked out. It can take some hours until the effects of the medicines are absent completely (Healthline, 2017). Bronchoscopy is known as a safe treatment to apply. According to Facciolongo (2016), the incidence of complications at a bronchoscopy is 1,08% and the incidence of mortality is 0,02% in a participant population of 20,986 patients. Possible complications that can occur are minor bleedings, fever, pneumonia or an infection in one or both lungs (National Heart, Lung and Blood Institute, n.d.).

Current treatment

A current common strategy to reduce pain, is to give the patient medicines at the start of the bronchoscopy (Xie, 2017). With each bronchoscopy, patients are given medicine to anaesthetize the nose and the throat and to reduce arousal (National Heart, Lung and Blood Institute, n.d.). Next to this, Remifentanil can be given in specific cases, to reduce pain that is experienced. Still, despite the medicines, the process before and during the treatment remains stressful. Another possibility for patients is to undergo the bronchoscopy under general anaesthesia. This procedure is experienced as less stressful than the bronchoscopy with local anaesthesia (Raafat, Abbas & Salem, 2014). Despite this advantage, general anaesthesia has some negative side effects. Patients can have effects such as dizziness, nausea or bruising (Newman, 2018). However, for older patients who are more likely to undergo a bronchoscopy, the risk of a heart attack, stroke or pneumonia increases.

Stress reduction by exposure to nature

In order to make a bronchoscopy more efficient and to lower the possibility of complications, anxiety and stress should be reduced. Research shows that the apperception of natural stimuli reduces stress (Alvarsson, Wiens and Nilsson, 2010), rumination (Bratman, Hamilton, Hahn, Gretchen & Gross, 2015), anxiety (Beyer et al., 2014) and pain during a bronchoscopy (Diette, Lechtzin, Haponik, Devrotes & Rubin, 2003). These natural stimuli include visual images (Shaffee & Shukor, 2018), virtual sounds (Conniff & Craig, 2016; Diette et al., 2003), the smell of roses (Barati, Nasiri, Akbari & Sharifzadeh, 2016) and virtual nature environments (de Kort, Meijnders, Sponselee & Ijsselsteijn, 2006). The latter study explains that virtual nature environments have a restorative working on a stressed person, but the effect of simulation qualities was never researched systematically so far. In this research, participants watched a video with a high or low immersive screen to test whether simulation quality had an influence on a participants' restorative effect. The researchers found out that a significant effect occurred between the two conditions in the physiological data. No significant effect occurred in self-reported measurements.

The theory that the study of de Kort et al (2006) is based on, is the Attention Restoration Theory. This theory declares that simulations of nature or actual nature can recover the direct attention that a person posits (Kaplan & Berman, 2010). According to this Attention Restoration Theory (ART), people can concentrate better after being in nature or the perception of a natural environment. When this direct attention is restored, a person is better able to cope with stress, pain and anxiety (Kaplan, 1995).

Next to this, research shows that improvement on a persons' mood works directly after being exposed to nature (Brooks, Ottley, Arbuthnott, Sevigny, 2017). When a person concentrates or stresses, the direct, conscious attention (also called 'fascination') is used, which requires energy (Kaplan, 1995). Fascination can in turn be separated in hard-fascination and soft-fascination. Hard fascination is the use of involuntary attention, in which the person does not have the possibility to reflect and cannot think about other things (Kaplan, 1995). In contrast, soft-fascination is the part which stimulates reflection and therefore restores the direct attention. Soft-fascination has this restoration effect due to different characteristics in the natural perception. An example is the presence of more depth and spaciousness (Kaplan, 1995). By the perception of soft-fascinating nature, fatigue, as a consequence of the energy loss, can be counteracted by watching natural images and listening to nature sounds. Energy will be restored in this way and patients retain their direct attention span.

By restoration of this energy, the possibility of complications is reduced and a patient will experience a reduction of stress, pain and anxiety. Despite this reduction of stress, pain and anxiety, the video has to be tailored to the person, according to the Affective Response Theory. This theory states that people have a different response and different preferences for the type of nature presented (Ulrich, 1983). When the video is tailored to the participants' preference, the optimal amount of stress reduction can be achieved.

In addition to this, the Stress Reduction Theory declares that people who are aroused, show a reduction in arousal and more positive emotions when experiencing a natural environment, compared with the view of an urban environment (Ulrich, 1983). The use of nature sounds and images can be applied directly in for example the waiting room. By playing nature sounds and make enough sunlight and plants available, stress can be reduced (Pouyesh et al., 2018; Dijkstra, Pieterse & Pruyn, 2006). One possible explanation of this stress reduction is because patients perceive the waiting room with plants as more attractive than waiting rooms without plants (Dijkstra, Pieterse & Pruyn, 2008). When stress reduction occurs in the waiting room, this reduction possibly can be generalized to the treatment room, when patients have to undergo a bronchoscopy.

Existing research

Despite the evidence that nature sounds and environments have a positive influence on stress reduction at patients, little research is done in the area of bronchoscopy. The research implemented so far contain additional points of improvements or do not show a convincing outcome or significant differences. Recently, Boekel (2018) and Rupert (2018) both did research on whether putting on a virtual reality nature video with sounds to patients who had to undergo a bronchoscopy, had a reducing effect on stress and anxiety. The exposure to the video and sounds was done by application of a special head device named the RelaxMaker (n.d.). This RelaxMaker presents the nature stimuli right before the participant, but still gives the opportunity to remain in contact with the doctor and the situation by watching over or underneath the apparatus.

In the research of Rupert (2018) and Boekel (2018), the anxiety of the patient was tested by questionnaires and the amount of stress by two physiological measurements: heart rate and skin conductance. Heart rate is measured in heartbeats per minute and skin conductance by electric pulses that variable by sweat secretion from sweat glands in the skin. Skin conductance is the strength of electrical guidance of the skin, a psychophysiological measurement which expresses the arousal and attention of a person (Merckelbach, Nijman, Ravelli & Kenemans, 1995). It is separated in three aspects of physiological measurements: skin conductance response, amplitude and skin conductance level. Specifications of these measurements can be found in the method section.

An increase in these physiological measurements and heart rate represent an increase in psychological arousal (Hansson & Jönsson, 2006; Dawson, Schell & Filion, 2009). Skin conductance is associated with the cognition, attention and emotion of a person (Critchley, 2002). When a person is aroused, the sympathetic branch of the nervous system is activated, which in turn stimulates the sweat gland activity (Turaçlars, Erdal, Arslan & Yildiz, 1999; Knufinke, 2012). Therefore, the EDA is a valid measurement of arousal (Knufinke, 2012).

The stress hormone is an indicator for a persons' level of arousal (Cahill, Gorski & Le, 2003). Therefore, the EDA can measure the stress that a person experiences.

Current Research

In order to build on the outcomes that Rupert (2018) found, a follow-up research was realized with a more controlled design. The aim was to test whether there was a difference between a group that does not have a nature stimulus and the participants of Rupert (2018). The research question 'Do patients who have to undergo a bronchoscopy show a reduction in self-reported anxiety measured by questionnaires and stress reduction measured by skin conductance level, when viewing a nature video with sounds, in comparison with people who do not view this video?' was tested with a quantitative analysis of physiological data and questionnaires. In accordance with that, the expectation that a reduction in (perceived) stress and anxiety at the nature condition is ensued, compared with the no-nature condition. When the expectation is supported, more intensive research can be done. In the long term, when the hypothesis can be answered with confidence, the experience of a bronchoscopy patient can be improved and the use of medicines can be reduced.

Method

Design

The research employed had a quasi-experimental, between-group design. The independent variable (IV) in this study was 'virtual nature' and has two categories: the no-nature control condition and a virtual reality nature exposed condition. The dependent variables in this study were perceived stress and anxiety, measured by self-report and physiological measures.

Participants

In total, 32 patients participated (N=32), 25 of them were male (78.1%) and 7 were female (21.9%). Age was ranging from 43 to 87 years old with a mean age of 68.9. With a total of n=19 participants in the no-nature group, the mean age was 70.4, with a standard deviation of 9.4. The age was ranging between 50 and 82. 76.9% was male and 23.1% was female. The intervention group of Rupert (2018) showed a target population (n=19) with a mean age of 68.2, ranging from 43 to 87 and a standard deviation of 13.45. The gender in this population consist of 78,9% male and 21,1% female.

All participants were recruited in the Medisch Spectrum Twente (MST) in Enschede. The experimental group was requited in the period March until July in 2017 and 2018. The control group was gathered in the period March until July 2019. Participants were selected based on their willingness to participate. Exclusion criteria were reduced vision of more than -5 myopic, the use of a sedative medicine, insufficient mastery of the Dutch language and total anaesthesia during the bronchoscopy.

Procedure

When a person had to undergo a bronchoscopy, the researchers waited for this patient in the waiting room of the lung department in the MST. When the patient arrived, the researchers approached the participant. In here, the purpose of the research was explained to the patient and the request was accommodated to give the patient more information about the research. When the patient assented, an information letter with an explanation of the procedure and purpose was provided. The patient had the possibility to ask questions. Then, the informed consent was filled in: allowance to participate was written down on paper.

When the treatment started, the two researchers followed the doctor and the participant to the treatment room. After the doctor informed the participant about the bronchoscopy procedure, the Empatica E4 was applied at the participants' wrist. Then, the participants' demographics, level of stress and mood were reported in a questionnaire as pre-test.

After the application of the Empatica and the questionnaire, the doctor asked the patient whether they were on an empty stomach, have allergies or have a removable dental prothesis. When answers were given and the participants received permission to undergo the treatment, the throat was stunned and the retch reflex of the participant was suppressed (Medisch Spectrum Twente, n.d.c). Both anaesthetics work immediately. After anaesthesia, the participant was asked to lie down. Under guidance of the researchers, participants of the nature exposed condition put on their video glasses. Then, the bronchoscope was inserted. This insertion took place around five minutes after the application of the Empatica. When the bronchoscopy was completed, the wristband was removed. Then, the participants had five minutes time to rest and recover from the bronchoscopy. After resting, the participants were asked to fill in a second questionnaire about their mood, the experience with the bronchoscopy and the emotions and feelings they experienced during the bronchoscopy.

After exactly a week, the follow-up questionnaire was filled out. In the nature group, the questionnaire was posted to them and the patients had to send the data back to the researcher. Due to nonresponse, the control group is contacted for the last questionnaire by telephone. This follow-up questionnaire measured how they remembered their experience of the bronchoscopy and their mood during the bronchoscopy.

Measures and Materials

Intervention. The virtual nature environment in this study was created by a special type of video glasses, called a Relaxmaker. This head device is represented in the image below this paragraph. The Relaxmaker has two LCD displays with 1280 x 720 (HD) pixels, a 98 inch screen, 26° sight and an aspect ratio of 16:9, 24-bit RGB colours (Beter door Beeld, 2018). The videos presented were two static nature images with moving elements. One containing soft-fascinating element and the second containing hard-fascinating aspects. Details of these videos can be found in Boekel (2018). Nature sounds are produced by the headphone that belongs to the Relaxmaker. Additional specifications of the Relaxmaker can be found in Rupert (2018) and Boekel (2018).

Image: Relaxmaker (n.d.)

Physiological outcome measures. During the bronchoscopy, skin conductance was measured by an Empatica E4 wristband. This is a wearable research device that provides real time physiological data. It can measure among others skin conductance, heart rate and acceleration (motion-based activity) (Empatica, 2018). It is researched that the Empatica E4 is measuring accurately at 85% at the time and can fill up unmeasured gaps (McCarthy, Pradhan, Redpath & Adler, 2014). The skin conductance is divided in three parameters. First, skin conductance response (SCR) measures changes that occur in a persons' electrodermal activity (Braithwaite, Watson, Jones & Rowe, 2013). The relation between SCR and emotion is known for decades (Figner & Murphy, 2011). A higher level of arousal causes a fall in skin resistance. Therefore, the electric current passes more easily and therefore a higher SCR can be measured. Next to this, a person's amplitude (AMP) is measured in spikes per minute. A spike per minute is the difference between the onset and the peak in conductivity (Figner & Murphy, 2011). Lastly, skin conductance level (SCL) represents the level of the electrical conductivity of the skin (Braithwaite et al., 2013). General changes in autonomic arousal can be measured considering changing background characteristics, such as an increase or a decline in skin conductance. These aspects of skin conductance taken together, represent a participants' psychological arousal (Knufinke, 2012).

Questionnaires. Since participants were recruited in a Dutch hospital, the questionnaires used were in Dutch language. In total, three questionnaires were adopted. One before the bronchoscopy (*baseline*), one right after the treatment (*post-test*) and the third one a week after the bronchoscopy (*follow-up*). In these questionnaires, different elements were measured.

The first item, *mood,* was measured in all three questionnaires and separated in 'mood-feelings' and 'mood-arousal'. The items were "what is your mood right now?" for mood-feelings and "how do you feel at this moment" for mood-arousal. Both had a scale ranging from 1 to 7, the former ranging from very bad to very good and the latter from tensed to relaxed. Originally, the former question is asked on a scale from -5 to 5 and the latter on a 7-point scale ranging from 0 to 6 (Hardy & Rejeski, 1989; Svebak & Murgatroyd, 1985). No research has been done to test the validity of these constructs so far. By these constructs, the mood just before and right after the bronchoscopy can be compared with the recall of their mood, measured by a questionnaire a week after the bronchoscopy.

A second category measured was the *perceived discomfort* of the patient. This discomfort was measured in the second and the third questionnaire and consist of four constructs. "How pleasant or unpleasant was the insertion of the bronchoscope?", "How pleasant or unpleasant was the bronchoscopy after insertion of the bronchoscope?", "How effective was the sedation in reducing pain during the bronchoscopy?" were constructs measured in the second and the third questionnaire. They were indicated on a on a scale ranging from 1 to 10. The first two questions were ranging from 1 (very unpleasant) to 10 (very pleasant), while the question of the sedative ranged from 1 (bad, I experienced the procedure as very painful) to 10 (good, I did not experience the procedure as painful). The question "Suppose that you again have to undergo a bronchoscopy, how much would you dread it?" was the last construct and added in the follow-up test on a scale from 1 (I highly dread it) to 7 (I don't dread it at all). Additional information about these items can be found in Rupert (2018).

Lastly, the *tension dimension of the Profile of Mood States short form* (POMS-SF) was used to measure perceived stress (Baker, Denniston, Zabora, Polland, & Dudley, 2002). The emotions and feelings that occurred during the procedure were measured by questions ranging from 0 (absolutely not) to 4 (very strong). The POMS consisted of questions measuring nervousness, panicking, tension, restlessness, anxiety and insecurity and has a sufficient alpha (α= .856) (Baker et al., 2002).

Statistical analysis

In total, n = 32 participants were analysed with SPSS version 24, a statistical software programme to analyse datasets. The gender ratio and mean age were represented by calculating the frequencies. Both the questionnaires and the physiological data were quantitative data.

For the physiological data, an ANOVA with repeated measurements was analysed to test whether there is a difference between the nature and no-nature group. The three outcome measures were SCR, AMP and SCL. First, it was tested whether Mauchly's W is significant, and thus whether data had to be corrected. When this sphericity was assumed, an equal variance cannot be assumed and a Greenhouse-Geisser was observed. The Greenhouse-Geisser is the best-known correction for adjusting the degrees of freedom in the ANOVA test, which produces a more accurate significance level (Baguley, 2004). Otherwise, when sphericity was not assumed, the data does not have to be corrected and Wilks Lambda was analysed. Wilks Lambda is the most widely used multivariate analysis of variance, to observe whether there are differences between groups in multiple constructs simultaneously (Blackwell Science Ltd, 2000). To find possible significant differences, the significance level of time, condition and the interaction effect (time*condition) was payed attention to.

Furthermore, figures are made for each participant, with an overview of the skin conductance. In here, the different stages of the bronchoscopy: before (5 minutes before insertion of the bronchoscope), during the insertion and after the insertion (the remaining part of the bronchoscopy after insertion, until removal of the bronchoscope) can be perceived visually. In addition, it can be observed whether there is a visible difference in the SCR, AMP and SCL between the participants of both groups in a single-case analysis. More increase in skin conductance in time and more spikes per minute show a higher level of arousal. Two types of patients were compared: two with a steep increase in SCL and two who remain similar in SCL. The patients that were compared, were carefully selected to reduce the risk for selective bias (Podsakoff & Podsakoff, 2019). The patients have an equal gender and age range. Also, the participants reside in an equal living area.

The self-reported measures were tested in several steps. First, it was observed whether the data is normally distributed, by looking at a histogram and whether the mean and the median were deviating from each other. Then, a repeated measure was implemented for mood-feelings and mood-arousal, to test whether the three time aspects and the condition show a significant difference. In addition to this, a post-hoc contrast is implemented to test whether significant differences occur within the groups between the time periods. The normally distributed items were analysed by an independent-samples F-test, to test the difference between the nature- and the no-nature group. The means between the groups were compared to identify whether the difference is in favour or in contrast with the expectation. When an item had an inequal distribution, a nonparametric test was implemented to correct for the unequal distribution and to test whether the differences between the groups are significant. An independent-sample Mann Whitney U test is an appropriate medium to obtain this demanded information when the data is not normally distributed (Hart, 2001; Fay & Proschan, 2010), but both groups have a similar distribution (Laerd Statistics, 2018).

Results

Analysis of the physiological data

Skin conductance response, amplitude and skin conductance level

The SCR, AMP and SCL were analysed by an ANOVA with repeated measures. SCL had to be corrected, based on that sphericity was assumed ($p < .01$). In contrast, SCR and AMP can be analysed directly ($p > .05$). Wilks Lambda for SCR and AMP and Greenhouse Geisser for SCL are represented in table 1. Results for the three types of physiological data are presented for the differences in the groups (N.N. as the no-nature condition and N.C. as nature condition) in time (time), the difference between the groups without considering time (condition) and the differences between the groups in time (interaction: Time * Condition).

Table 1: Results for skin conductance response, amplitude and skin conductance level

Skin conductance	Condition	Mean (SD) before	Mean (SD) during	Mean (SD) after	F	DF	p	Main/interaction effect
SCR	N.N. N.C.	2.8(1.9) 2.3(2.3)	3.5(2.1) 3.2(3.1)	4.5(3.1) 3.0(3.1)	4.1	2, 27	.027	Time
					.7	1, 28	.420	Condition
					1.3	2, 27	.289	Time*condition
AMP	N.N. N.C.	.3(.3) .3(.5)	.6(.5) .8(1.0)	.7(.8) 1.0(1.3)	4.9	2, 27	.015	Time
					.4	1,28	.521	Condition
					.1	2, 27	.879	Time*condition
SCL	N.N. N.C.	3.1(3.5) 1.6(1.9)	4.9(6.2) 4.0(6.0)	4.1(5.5) 2.3(2.4)	4.4	1.14, 28	.039	Time
					1.0	1,28	.334	Condition
					.2	1.14, 28	.696	Time*condition

Table 1 shows that a significant main effect of time was found. In the unified population, an increase in the insertion of the bronchoscope can be seen in SCR, AMP and SCL. After the insertion, the level of SCR, AMP and SCL persist during the continuation of the bronchoscopy. No significant difference was found in *condition*: no clear difference occurs between the nature and the no-nature group without considering the three time stages. The nature condition experience a lower SCR and SCL. In contrast, the no-nature group is in favour at the AMP. Still, these differences were found to be insignificant. In addition, the *interactions* do not show a significant effect. Time * condition in SCR F (2, 27) = 1.3, p = .289, time * condition in AMP F (2, 27) = .1, p = .879 and time * condition in SCL F (1,14, 28) = .2, p = .696 were observed. Despite the insignificant difference between the nature- and no-nature group across different time stages, participants show a general increase in SCR and AMP. SCL shows an increase during insertion, but a decrease for both groups after insertion. The conditions show a similar pattern in the three measurements, with the second phase (from insertion to during) of SCR as exception. In here, the nature condition declines in SCR while the control group continues increasing. There is no significant difference found between the nature- and no-nature group, across different time stages.

In figure 1, 2 and 3, the differences in the physiological measurements are presented visually. In here, the physiological data of the no-nature group is compared with the nature group in the three stages (before, insertion and during). Figure 1 shows that both groups show an increase in skin conductance response when the bronchoscope was inserted. After insertion, a difference can be seen between the two groups: the no-nature group keeps increasing in skin conductance response, while the nature group declines. A significant difference in 'time' can be seen.

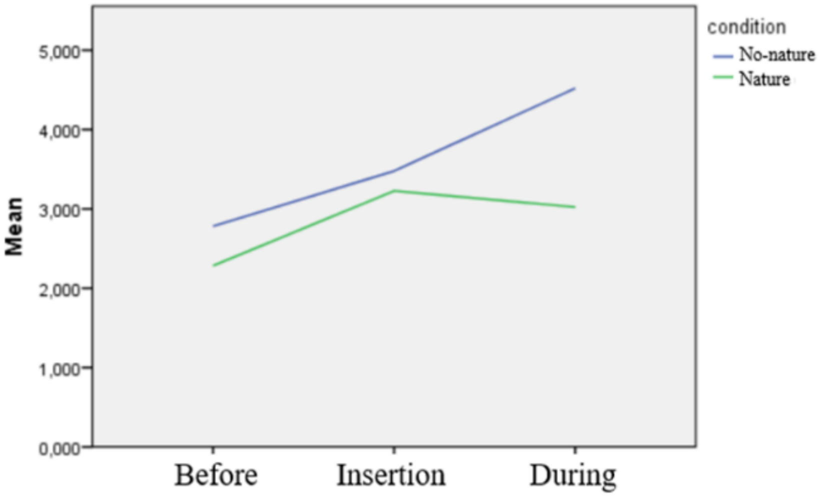

Figure 1: visual representation of SCR between the two groups

In figure 2, a difference in AMP is shown. Both groups show a sharp increase in AMP. However, the nature group shows a higher AMP than the no-nature group. Still, this difference is not significant as can be seen in table 1.

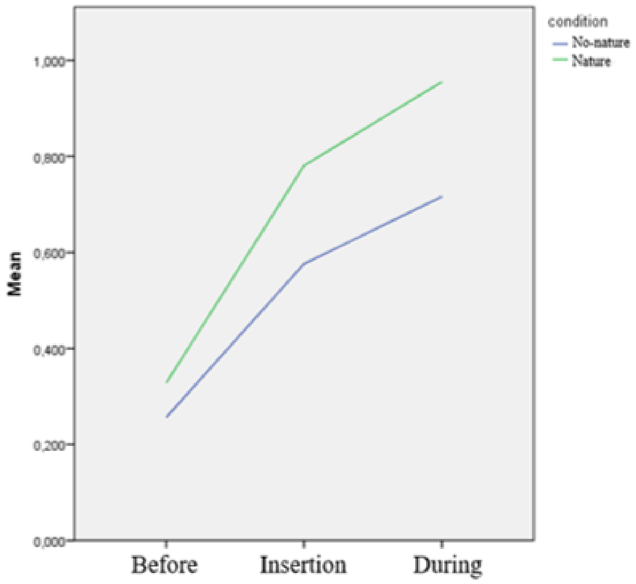

Figure 2: Visual representation of AMP between the two groups

Lastly, figure 3 shows that the no-nature group has a higher level of SCL than the nature group. Although there is an observed difference, this difference is clearly non-significant. Both groups show an increase in during insertion and a decline after insertion. In accordance with table 1, a significant difference is shown in time and no significant difference is seen between the groups.

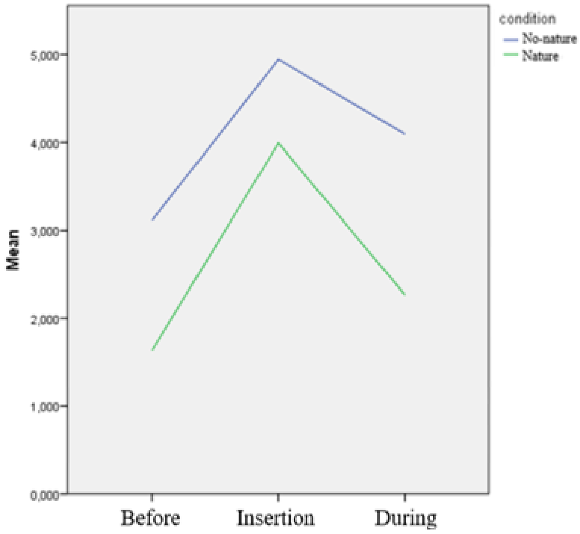

Figure 3: Visual representation of SCL between the two groups

<u>Single-case analysis</u>

Visual representations of proportionate patients are shown in figure 4 until 7. The patients in figure 4 and 5 hardly show an increase in SCL, while the patients in figure 6 and 7 do show a significant increase in SCL. A difference that can be seen in both comparisons, is the spikes per minute between the intervention and the control group. The nature exposed group shows a greater number of spikes per minute than the control group. In accordance with the line graph in figure 2, both show a higher level of AMP in the nature condition. These findings show that participants of the nature condition have a higher level of AMP than the participants of the no-nature condition. In the figures, no clear differences can be seen in the SCR or SCL between the groups.

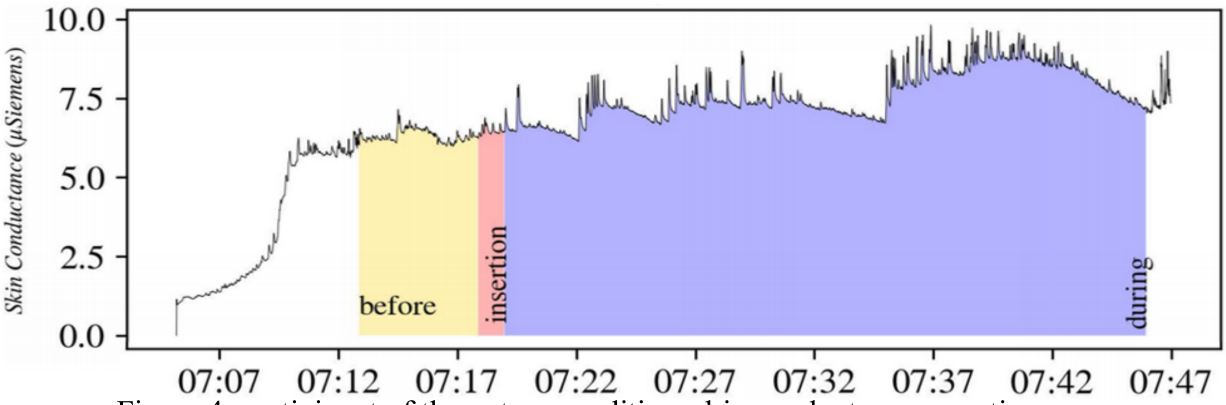

Figure 4: participant of the nature condition: skin conductance over time

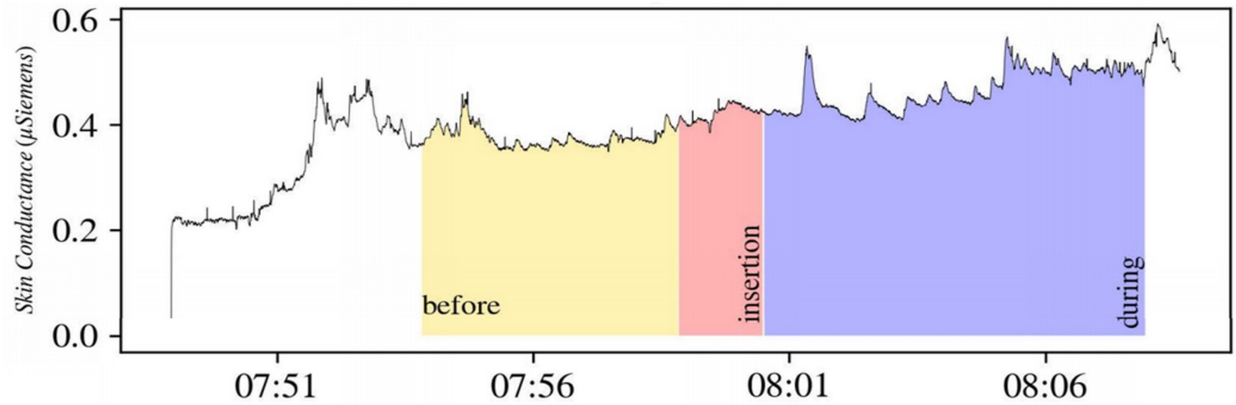

Figure 5: participant of the no-nature condition: skin conductance over time

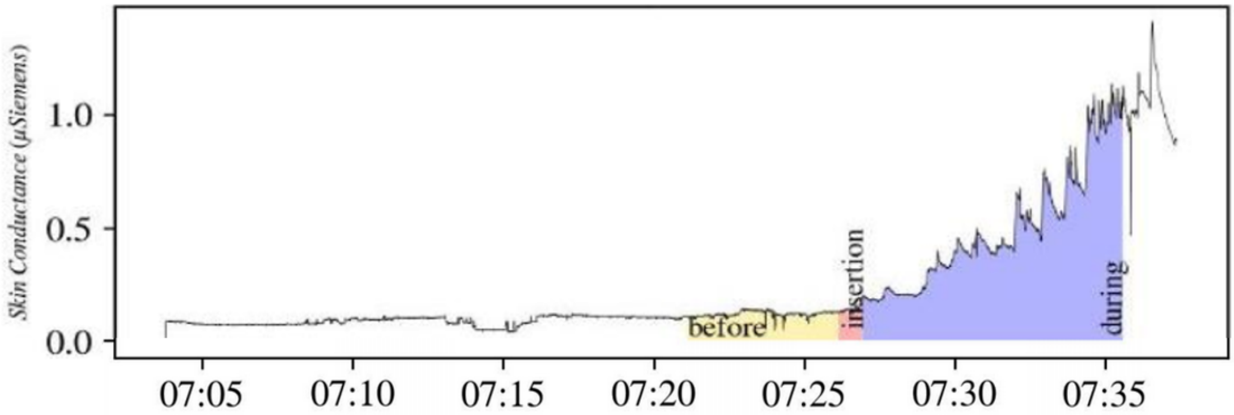

Figure 6: Participant of the nature condition: skin conductance over time

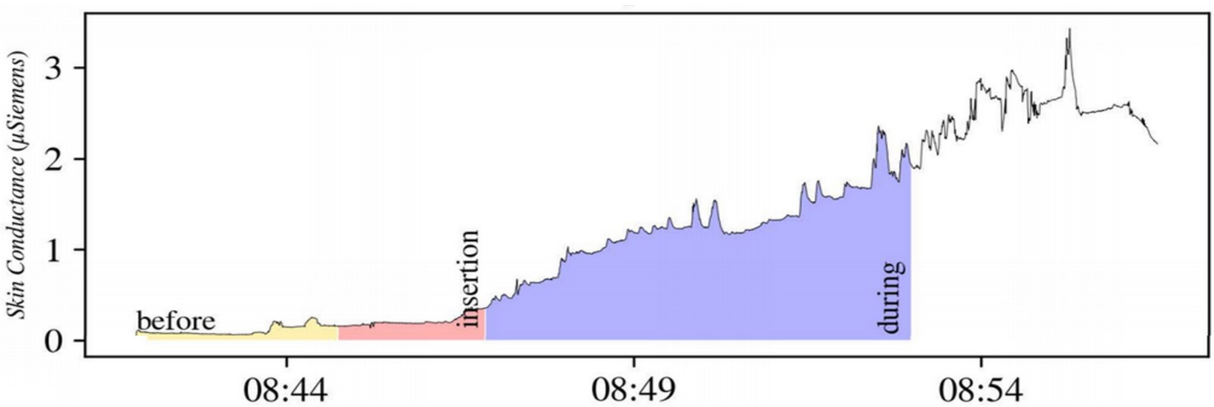

Figure 7: participant of the no-nature condition: skin conductance over time

Analysis of the questionnaires

In total, 20 participants completed all questionnaires and 12 patients did not complete all of the questionnaires. In the control group, 1 participant declined to fill in the questionnaire right after the bronchoscopy and 1 participant did not fill in the follow-up questionnaire. In the nature group, nonresponse followed by 10 participants in the follow-up questionnaire. The questionnaires that these 12 participants completed, were considered in the results.

Prior to analysing data, a histogram was made to observe whether the data was normally distributed. As result, it is shown that the effectiveness of the sedation (second questionnaire) and the dread for another bronchoscopy (follow-up) were unequally distributed. The mean, median and skewness are presented in table 2. To correct for the abnormal distribution, a nonparametric test was implemented to test whether these items were significant between the two conditions. The Mann Whitney U test shows that U=128.5, p = .562 for effectiveness of the sedation and U=42.0, p = .422 for dread for another bronchoscopy.

Table 2: mean, median and skewness per item

Item	Mean(SD)	Median	Skewness
Nature condition			
Effectiveness of sedation	7.1(2.5)	8.00	-.441
Dread for another bronchoscopy	3.3(1.6)	3.00	.717
No-nature condition			
Effectiveness of sedation	7.6(2.4)	8.00	-.552
Dread for another bronchoscopy	3.0(2.6)	1.75	.868

A repeated measure is implemented for the questions concerning feelings and arousal, due to three moments of measurement in each group. Sphericity is not assumed for both items. For the interaction between time and condition, Wilks' Lambda for mood-feelings is $F(2, 17) = .745$, $p = .490$ and for mood-arousal $F(2, 17) = .884$, $p = .431$. No significant difference between the nature and the no-nature condition across the time stages was observed. 'Time' also had no significant effects: $F(2, 17) = 998$, $p = .389$ for mood-feelings and $F(2,17) = 3{,}554$, $p = .051$ and mood-arousal ($p = .051$), however mood-arousal was close to significant. Lastly, the condition did not turn out to be significant: $F(1, 18)= .033$, $p = .859$ for mood-feelings and $F(1, 18) = .003$, $p = .955$ for mood-arousal.

Mood-feelings and mood-arousal are represented visually in figure 8 and 9. Figure 8 shows no significant difference in time, condition and time * condition. The close-to-significant line of 'time' can be seen in figure 9: an improvement in mood-arousal is followed by a steep decline of the good mood. The lowest amount of arousal is seen right after the bronchoscopy and increases by time. The no-nature condition is more responsive for this change: A higher decline is followed by a steeper increase. No significant difference can be seen between the two groups. Two GLM measures were implemented to test whether a difference can be found in the second phase of mood-feelings (from right after until follow-up) or the first phase (before until right after) of mood-arousal. The results show that mood-feelings has $F(1,18) = 2.0$, $p = .176$ for 'time', $F(1,18) = .2$, $p = .679$ for 'condition' and $F(1,18) = .9$ $p = .352$ for 'time * condition'. Also, mood-arousal showed $F(1, 29) = 2.3$, $p = .141$ for 'time', $F(1, 29) = 1.2$, $p = .292$ for 'condition' $F(1, 29) = 1.3$, $p = .263$ for 'time * condition'. No significant differences were found for the second phase of mood-feelings or the first phase of mood-arousal.

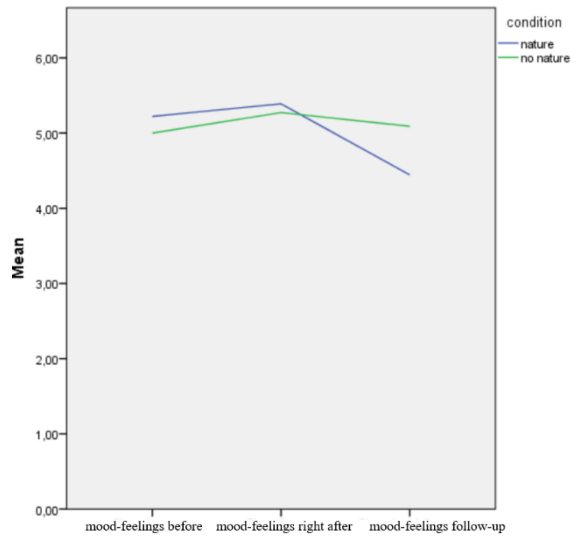

Figure 8: visual representation of mood-feelings between the two groups

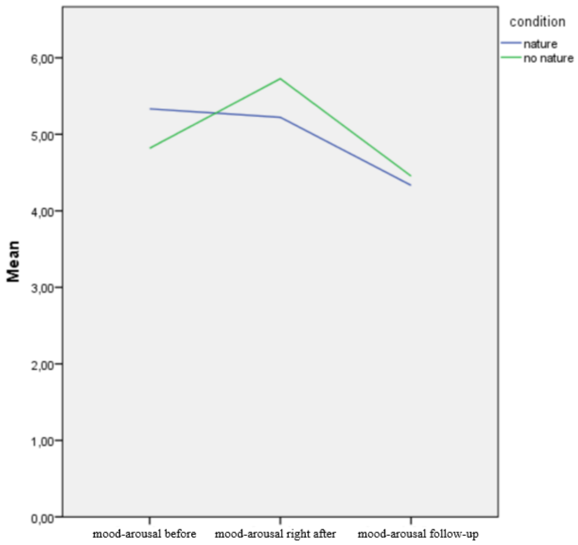

Figure 9: visual representation of mood-arousal between the two groups

For the items that had a normal distribution and two measurements, an independent-samples F-test and a paired-samples F-test were implemented to perceive whether there is a significant difference between the nature- and no-nature group and whether a significant difference is present within the groups, between the time moments. The independent-sample F-test is shown in table 3. There is a significant difference ($p < .05$) in the working of anaesthesia during the bronchoscopy (follow-up, $p = .016$). To perceive the direction of the significant differences, the means were compared between the two conditions. In table 3 is shown that the nature exposed condition had a higher amount of pain than the control condition. In the remaining items, no significant differences were found between the conditions. Still, comfort at continuation of the bronchoscopy ($p = .075$) and comfort at insertion of the bronchoscope (follow-up: $p = .051$) are close to significant, with the control group showing a higher perceived discomfort than the nature exposed condition. The paired-samples F-test does not show any significant effect in both groups for 'comfort insertion bronchoscope', 'comfort continuation bronchoscope' and 'effectiveness of sedation', between the different time periods.

Table 3: F-test and significance level per item between groups				
Variables	Mean (SD)		F	p
	N.C.	N.N.		
Posttest				
POMS average	1.3(0.9)	1.9(1.3)	1.9	.147
POMS total	8.0(5.5)	11.5(7.7)	1.9	.144
Comfort insertion bronchoscope	3.6(2.1)	4.5(3.1)	6.3	.357
Comfort at continuation of the bronchoscopy	4.0(1.9)	5.7(2.8)	4.4	.075
Follow-up				
Comfort insertion bronchoscope	2.9(2.3)	5.3(2.9)	.7	.051
Comfort continuation bronchoscope	3.8(2.3)	5.3(2.6)	.2	.162
Effectiveness of sedation	5.7(2.2)	8.0(1.0)	15.7	.016

Conclusion

A study was implemented to research whether nature has a restorative effect on bronchoscopy patients. By positive results and additional research, the bronchoscopy procedure can become more comfortable in the long run. Physiological and psychological data were collected and conclusions can be drawn from the results.

Physiological data. When looking at the results of the physiological data, it can be seen that there is a significant difference between the three stages of the bronchoscopy (before, insertion and during) within the groups *(time),* in SCR (p = .027), AMP (p = .015) and SCL (p = .039). This represents a significant change in skin conductance when the bronchoscopy progresses. During insertion of the bronchoscope, all three measurements increase significantly. Then, a decline takes place for SCR and SCL, while AMP continues the increase, but declines in steepness.

In contrast, no significant difference was found in these stages between the nature and the no-nature condition. The differences in SCR (p = .289), AMP (p = .879) and SCL (.696) are not significant between the two groups. Table 1 and two of the line graphs show a non-significant difference, in favour of the nature exposed condition. The line graph in figure two shows the opposite: a higher level of AMP was found in the no-nature condition. Lastly, the single-case analysis showed a higher magnitude than the control group.

Perceived Anxiety. The experienced anxiety of the participants did not show a significant difference between the nature exposed group and the control group in several items. Still, a significant difference is found in the follow-up of the effectiveness of sedation during the bronchoscopy (follow-up). Comfort at continuation of the bronchoscopy (posttest) and comfort insertion bronchoscope (follow-up) are close to significant. The control group recalls a lower experience of pain and a close-to-significant reduction in discomfort during the continuation of the bronchoscopy. Next to this, the follow-up of the insertion of the bronchoscope is more stressful for the participants in the nature condition.

Support of the research question Taking all aspects together, mixed results were found for the research question 'Do patients who have to undergo a bronchoscopy show a reduction in self-reported and physiological anxiety, measured by questionnaires and stress reduction measured by SCL, when viewing a nature video with sounds, in comparison with people who do not view this video?'. First, physiological results of AMP between the conditions and the interactions (time*condition) are not in support of the beneficial effects of nature exposure. These findings were further supported by the single-case analysis and figure two, in which the nature condition showed a higher magnitude than the control group. In concordance to this, the effectiveness of sedation (follow-up), comfort at continuation of the bronchoscopy (post-test) and comfort of insertion of the bronchoscope (follow-up) show a difference in contrast with the research question.

Despite these findings, several items support the expectation. Figure 1 and 3, the line graphs of SCR and SCL support the expectation. Additionally, table 3 represents these results for SCR and SCL. Furthermore, although not significant, the POMS suggest an effect in favour of the nature exposed condition. Due to inconclusive results, more research needs to be done to draw more reliable conclusions about the research question with more power.

When finding a justification for the outcomes, different theories can be considered. In this research, the Affective Response Theory is of main interest in this research. This theory declares that people have a different response and different preferences to the view of nature (Ulrich, 1983). It is important to explore what kind of preference a patient has in the natural environment, to optimally reduce the amount of stress by showing a natural environment. In this research, the inability to decide which video had their preference can cause a different amount of stress reduction in patients. This, in combination with the unexpected event that video glasses had to be worn, can be a possible explanation for the finding that the nature condition experienced more stress than the control condition. Participants did not watch a video tailored to their preferences, which made that some of them did not experience the relaxation effect maximally. A possibility to optimize the reduction of arousal is to select several videos. Before the bronchoscopy, the participant can decide what video is preferred. The video is tailored to the participants' individual preferences and the best possible outcome in the relaxation effect can occur.

Another theory explained is the Attention Restoration Theory. This theory has as argument that the restoration of attention occurs after the perception of nature. The Attention Restoration Theory can explain the (close-to-)significant stress reduction in the follow-up report. Participants in the nature condition report a decline in discomfort during insertion and pain, a week after the bronchoscopy. Furthermore, an improvement in the experienced feelings was reported. In addition to this, Brooks et al. (2017) shows that a persons' mood changes immediately when perceiving nature, so the nature video should have a direct influence on the mood of the patient.

Strong points and limitations. Several strong points can be noticed about this research. At first, the study of Rupert (2018) is mainly replicated. The risk to obtain different outcomes due to differences in methods between the studies is reduced. In this way, internal validity is improved. Next to this, the study is measured with both perceived and physiological arousal and experiences, to increase the validity of the outcome. Furthermore, the research implemented was not invasive for the patients and did not cost much effort, which lead all the patients to agree to participate. This reduces the likelihood of occurrence of attrition bias and increases the generalisation of the research.

Next to the strong points, limitations can be found. At first, the amount of stress between patients can be differing, due to two factors. First, doctors and assistants have different protocols and communication styles towards the patient, which can influence the level of stress experienced by patients (Ono, Fujiha & Yamada, 2009). Therefore, patients with different doctors can experience a different stress level during the bronchoscopy, while the treatment is implemented identically. In addition to this, the procedure can progress differently per patient, which causes different 'before' stages. For instance, one patient receives sedatives before the 5 minutes, while the other got local anaesthesia in those five minutes. Furthermore, the doctor can be absent or present and complications can occur, such as allergic reactions to the anaesthesia. Due to these differences, results can be biased and unknown confounders can occur, without taking them into account in this research.

Another argument for unrealistic results in the participants' arousal is that the participants of the nature group could have overestimated the suffering of the bronchoscopy. Patients were asked to wear glasses, while already being in a state of insecurity due to the treatment as an unpredictable event (Mayoclinic, 2019). Then, an unfamiliar trigger, the question to wear the glasses, is added, which increases awareness of a threat. Due to this, people can adapt their beliefs and start believing that the procedure must be stressful, if glasses are necessary to reduce discomfort. In this way, the participant can create a state of mind in which suggestibility becomes prominent (Sidis, 1898). Due to this, the nocebo effect can occur as a possible confounder, by reaching a more negative outcome than without the glasses as stimuli (Benedetti, Lanotte, Lopiano & Colloca, 2007).

A practical constraint of this research is the operation procedure of the Empatica E4. The researchers frequently tested how the Empatica functioned during the bronchoscopy. At some moments during the bronchoscopy, the Empatica did not show any SCL at all for a short time span. This can occur when the Electrodes do not contact the skin properly or when a persons' skin is too dry (Garbarino, Lai, Bender, Picard & Tognetti, 2014). The response also depends on which wrist the Empatica is applied, depending per person which wrist provides the best result. This can also be noticed at some images of the physiological data (such as an immediate steep drop in skin conductance, followed by a steep incline). The Empatica is made in a way that it fills up gaps (McCarthy et al., 2014), so in general this is not necessarily a problem. However, when this happens during a noticeable moment such as the insertion of the bronchoscope, a distorted measurement can occur. Despite this risk, the outcomes of the data seem reliable by reason of consistent outcomes in both physiological and psychological data. Furthermore, little abnormal deviations can be observed in the visual representation of the data.

Lastly, there is a difference in participation in the follow-up questionnaire between the groups. In the nature exposed group, 9 of the 19 participants filled in the questionnaire, while 12 of the 13 patients participated in the control condition. A risk of selection bias can give a difference in outcome due to a selective dropout (Wolke, Waylen, Samara, Steer, Goodman, Ford & Lamberts, 2009). For instance, people who had a negative experience with the bronchoscopy, do not want to recall the situation and were less willing to respond to the questionnaire. On the telephone, the contact is more personal. In this way, people will be more likely to respond on the questions, because they prefer to behave socially desirable (Joinson, 1999).

Future research. This research gave some significant results concerning the research question. Still, not enough evidence is found to state that the research question can be accepted. Additional research is needed to draw a conclusion. With additional research, comfort of bronchoscopy patients can be improved and the use of medicines can be reduced. A main point of interest is to implement a research with a larger target group and in more hospitals, preferably in a larger region. In this way, data can be compared, generalizability is increased and a more reliable conclusion can be drawn about the findings. Next to this, different methods can be used to increase the reliability of the outcome. For example, a retrospective follow-up research can be done, to receive a larger target population and to analyse more comparable patients. Lastly, the gathering of the physiological data can be improved by adding a second Empatica on the other wrist. By doing this, possible gaps in the data can be discovered and an even more reliable image of the physiological data can be obtained. More research is needed to answer the research question with confidence.

References

Adorama Learning Center. (2018). *The top 5 mountain ranges to photograph in the United States.* Retrieved from https://www.adorama.com/alc/the-top-5-mountain-ranges-to-photograph-in-the-united-states

Alvarsson, J. J., Wiens, S., & Nilsson, M. E. (2010). Stress recovery during exposure to nature sound and environmental noise. *International Journal of Environmental Research and Public Health, 7*(3). 1036-1046. Doi: 10.3390/ijerph7031036

Baguley, T. (2004). *An introduction to Sphericity.* Retrieved from http://homepages.gold.ac.uk/aphome/spheric.html

Barati, F., Nasiri, A., Akbari, N., & Sharifzadeh, G. (2016). The effect of aromatherapy on anxiety in patients. *Nephro-Urology Monthly, 8*(5). Doi: 10.5812/numonthly.38347

Benedetti, F., Lanotte, M., Lopiano, L., & Colloca, L. (2007). When words are painful: unraveling the mechanisms of the nocebo effect. *Neuroscience*, *147*(2), 260-271. Doi: https://doi.org/10.1016/j.neuroscience.2007.02.020

Beter door Beeld. (2018). *Specificaties RelaxMaker*. Retrieved from https://relaxmaker.com/specificaties

Beyer, K., Kaltenbach, A., Szabo, A., Bogar, S., Nieto, F., & Malecki, K. (2014). Exposure to neighborhood green space and mental health: evidence from the survey of the health of Wisconsin. *International journal of environmental research and public health*, *11*(3), 3453-3472. Doi: https://doi.org/10.3390/ijerph110303453

Blackwell Science Ltd. (2000). Defining and assessing competence: issues and debates. *Journal of Clinical Nursing, 9.* 369-381. Retrieved from http://www.blackwellpublishing.com/specialarticles/jcn_9_381.pdf

Boekel, I. (2018). *Psychological and physiological effects of virtual nature environments on well-being of bronchoscopy patients.* Retrieved from https://essay.utwente.nl/75170/

Braithwaite, J. J., Watson, D. G., Jones, R., & Rowe, M. (2013). A guide for analysing electrodermal activity (EDA) & skin conductance responses (SCRs) for psychological experiments. *Psychophysiology*, *49*(1), 1017-1034. Retrieved from https://www.biopac.com/wp-content/uploads/EDA-SCR-Analysis.pdf

Bratman, G. N., Hamilton, J. P., Hahn, K. S., Daily, G. C., & Gross, J. J. (2015). Nature experience reduces rumination and subgenual prefrontal cortex activation. *Proceedings of the national academy of sciences*, *112*(28), 8567-8572. Doi: https://doi.org/10.1073/pnas.1510459112

Brooks, A. M., Ottley, K. M., Arbuthnott, K. D., & Sevigny, P. (2017). Nature-related mood effect: season and type of nature contact. *Journal of Environmental Psychology, 54*, 91-102. Doi: https://doi.org/10.1016/j.jenvp.2017.10.004

Cahill, L., Gorski, L., & Le, K. (2003). Enhanced human memory consolidation with post-learning stress: Interaction with the degree of arousal at encoding. *Learning & memory*, *10*(4), 270-274. Doi: 10.1101/lm.62403

Conniff, A., & Craig, T. (2016). A methodological approach to understanding the wellbeing and restorative benefits associated with greenspace. *Urban Forestry & Urban Greening*, *19*, 103-109. Doi: https://doi.org/10.1016/j.ufug.2016.06.019

Critchley, H. D. (2002). Electrodermal Responses: what happens in the brain. *Neurology and Psychiatry, 8*(2): 132-42. Doi: 10.1177/107385840200800209

Dawson, M. E., Schell, A. M., & Filion, D. L. (2009). *The electrodermal system*. In J. T. Cacioppo, L. G. Tassinary and G. G. Berntson (Eds.), Handbook of psychophysiology. 159-18. Doi: 10.1017/CBO9780511546396

Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A., & Rubin, H. R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complementary approach to routine analgesia. *Chest*, *123*(3), 941-948. Doi: https://doi.org/10.1378/chest.123.3.941

Dijkstra, K., Pieterse, M. E., & Pruyn, A. (2006). Physical environmental stimuli that turn healthcare facilities into healing environments through psychologically mediated effects: systematic review. *Leading Global Nursing Research, 56*(2). 166-181. Doi: 10.1111/j.1365-2648.2006.03990.x

Dijkstra, K., Pieterse, M. E., & Pruyn, A. (2008). Stress-reducing effects of indoor plants in the built healthcare environment: the mediating role of perceived attractiveness. *Preventive Medicine, 47*(3). 279-283. Doi: 10.1016/j.ypmed.2008.01.013

Empatica. (2018). *E4 wristband from Empatica*. Retrieved from https://www.empatica.com/research/e4/

Facciolongo, N. et al. (2016, January). Incidence of complications in bronchoscopy. Multiple prospective study of 20,986 bronchoscopies. *Monaldi Archives for Chest Disease, 71*(1). Doi: https://doi.org/10.4081/monaldi.2009.370

Fay, M. P., & Proschan, M. A. (2010). Wilcoxon-Mann-Whitney or t-test? On assumptions for hypothesis tests and multiple interpretations of decision rules. *Statistics surveys*, *4*, 1–39. Doi: 10.1214/09-SS051

Figner, B., & Murphy, R. O. (2011). *Using skin conductance in judgment and decision making research*. Psychology Press: United Kingdom.

Fujimoto, K. et al. (2018). Identification of factors during bronchoscopy that affect patient reluctance to undergo repeat examination: Questionnaire analysis after initial bronchoscopy. *PLOS ONE, 13*(12). Doi: https://doi.org/10.1371/journal.pone.0208495

Garbarino, M., Lai, M., Bender, D., Picard, R. W., & Tognetti, S. (2014). Empatica E3 – a wearable wireless multi-sensor device for real-time computerized biofeedback and data acquisition. Proc. International Conference Wireless Mobile Community. *Healthcare*, 39-42. Doi: 10.4108/icst.mobihealth.2014.25741

Hansson, M., & Jönsson, P. (2006). Estimation of HRV spectrogram using multiple window methods focusing on the high frequency power. *Medical Engineering & Physics, 28*(8), 749-761. Doi: 10.1016/j.medengphy.2005.11.004

Hardy, C. H., & Rejeski, W. J. (1989). Not what, but how one feels: The measurement of affect during exercise. *Journal of Sport and Exercise Psychology, 11*(3), 304-317. Doi: 10.1123/jsep.11.3.304

Hart, A. (2001). Mann-Whitney test is not just a test of medians: differences in spread can be important. *BMJ Publishing Group, 323*(7309), 391-393. Doi: 10.1136/bmj.323.7309.391

Healthline. (2017, 17 March). *Bronchoscopy.* Retrieved from https://www.healthline.com/health/bronchoscopy

Joinson, A. (1999). Social desirability, anonymity, and internet-based questionnaires. *Behavior Research Methods, Instruments, & Computers, 31*(3), 433-438. Doi: https://doi.org/10.3758/BF03200723

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169-182. Doi: 10.1016/0272-4944(95)90001-2

Kaplan, S., & Berman, M. G. (2010). Directed attention as a common resource for executive functioning and self-regulation. *Perspectives on Psychological Science, 5*(43). Doi: 10.1177/1745691609356784

Ketata, W., Ayadi, H., Msaad, S., Feki, W., Bahloul, N., Derbel, A., & Ayoub, A. (2011). Flexible bronchoscopy as it is lived by the patient. *Revue de Pneumologie Clinique, 67*(3), 136-142. Doi: 10.1016/j.pneumo.2010.04.005

Knufinke, M. (2012). The measurement of arousal by the means of electrodermal activity during an actually performed balance beam routine and observational learning of the same routine. *University of Twente.* Retrieved from https://pdfs.semanticscholar.org/73e8/473408fd92208f5ba69b86c4c2680cf49f01.pdf

De Kort, Y. A. W., Meijnders, A. L., Sponselee, A. A. G., & Ijsselsteijn, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of Environmental Psychology, 26(*4), 309-320. Doi: https://doi.org/10.1016/j.jenvp.2006.09.001

Laerd Statistics. (2018). *Mann-Whitney U Test Using SPSS Statistics.* Retrieved from https://statistics.laerd.com/spss-tutorials/mann-whitney-u-test-using-spss-statistics.php

Mayoclinic. (2019). *Stress management: know your triggers.* Retrieved from https://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/stress-management/art-20044151

McCarthy, C., Pradhan, N., Redpath, C., & Adler, A. (2016). Validation of the Empatica E4 wristband. *IEEE Explore.* Doi: 10.1109/EMBSISC.2016.7508621

Medisch Spectrum Twente. (n.d.a). *Bronchoscopie.* Retrieved from https://www.mst.nl/p/Onderzoek/bronchoscopie/

Medisch Spectrum Twente. (n.d.b). *Bronchoscopie nazorg*. Retrieved from https://www.mst.nl/p/Onderzoek/bronchoscopie/bronchoscopienazorg/

Medisch Spectrum Twente. (n.d.c). *Bronchoscopie werkwijze.* Retrieved from https://www.mst.nl/p/Onderzoek/bronchoscopie/bronchoscopiewerkwijze/

Merckelbach, H., Nijman, H., Ravelli, H., & Kenemans, L. (1995). Schizofrenie en huidgeleiding: een literatuuroverzicht. *Tijdschrift voor psychiatrie, 6.* Retrieved from http://www.tijdschriftvoorpsychiatrie.nl/assets/articles/articles_982pdf.pdf

National Heart, Lung and Blood Institute (NIH). (n.d.). *Bronchoscopy.* Retrieved from https://www.nhlbi.nih.gov/health-topics/bronchoscopy

Newman, T. (2018). What to know about general Anaesthesia. *Medical News Today.* Retrieved from https://www.medicalnewstoday.com/articles/265592.php

Ono, M., Fujita, M., & Yamada, S. (2009). Physiological and psychological responses to expressions of emotion and empathy in post-stress communication. *Journal of physiological anthropology*, *28*(1), 29-35. Doi: https://doi.org/10.2114/jpa2.28.29

Podsakoff, P. M., & Podsakoff, N. P. (2019). Experimental designs in management and leadership research: strengths, limitations, and recommendations for improving publishability. *The leadership quarterly, 30*(1), 11-33. Doi: https://doi.org/10.1016/j.leaqua.2018.11.002

Poi, P. J. H., Chuah, S. Y., Srinivas, P., & Liam, C. K. (1998). Common fears of patients undergoing bronchoscopy. *European Respiratory Journal, 11*, 1147-1149. Doi: 10.1183/09031936.98.11051147

Pouyesh, V., Amaniyan, S., Haji, M. H. M., Bashiri, Y., Sieloff, C., Griffiths, P., & Vaismoradi, M. (2018). The effects of environmental factors in waiting rooms on anxiety among patients undergoing coronary angiography: a randomized controlled trial. *International Journal of Nursing Practice, 24*(6). Doi: 10.1111/ijn.12682

Putinati, S., Ballerin, L., Corbetta, L., Trevisani, L., & Potena, A. (1999). Patient satisfaction with conscious sedation for bronchoscopy. *Chest, 115*(5), 1437-1440. Doi: https://doi.org/10.1378/chest.115.5.1437

Raafat, H., Abbas, M., & Salem, S. (2014). Comparison between bronchoscopy under general anesthesia during laryngeal mask airway and local anaesthesia with conscious sedation: a patient-centered and operator-centered outcome. *The Egyptian Journal of Bronchoscopy, 8*(2), 128-137. Doi: 10.4103/1687-8426.145707

Relaxmaker. (n.d.). *Relaxmaker: natuurlijke ontspanning voor een beter resultaat.* Retrieved from https://www.relaxmaker.com/

Rupert, K. L. M. (2018). *The effects of nature on physiology and phenomenological experienced stress and anxiety during bronchoscopy: using an HMD.* Retrieved from https://essay.utwente.nl/75133/

Shaffee, N., & Shukor, S. F. A. (2018). The effect of natural settings on stress reduction. *Alam Cipta, 11*(2). 25-33. Retrieved from http://psasir.upm.edu.my/id/eprint/66122/1/20181226170007artikel_04.pdf

Sidis, B. (1898). *The Psychology of Suggestion.* New York: Appleton and Company.

Svebak, S., & Murgatroyd, S. (1985). Metamotivational dominance: A multimethod validation of reversal theory constructs. *Journal of Personality and Social Psychology, 48*(1), 107-116. Doi: 10.1037/0022-3514.48.1.107

Turaçlars, U. T., Erdal, S., Arslan, A., & Yildiz, A. (1999). The effect of acute exercize in skin potential in trained athletes. *Turkish Journal of Medical Sciences, 29*(42), 113-116. Retrieved from https://pdfs.semanticscholar.org/270f/c4fc127ae2e6822bb578dd911ade22d5f306.pdf

Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. *Behavior and the natural environment.* 85-125. Edited by Altman, I., & Wohlwill, J.F. New York: Plenum Press. Doi: 10.1007/978-1-4613-3539-9_4

Wolke, D., Waylen, A., Samara, M., Steer, C., Goodman, R., Ford, T., & Lamberts, K. (2009). Selective drop-out in longitudinal studies and non-biased prediction of behaviour disorders. *The British Journal of Psychiatry*, *195*(3), 249-256. Doi: https://doi.org/10.1192/bjp.bp.108.053751

Xie, D.W. (2017). Effect of remifentanil combined with etomidate on systematic stress reaction during painless fiberoptic bronchoscopy. *Journal of Hainan Medical University, 23*(8), 142-145. Retrieved from http://www.hnykdxxb.com/PDF/201708/34.pdf

Yildirim, F., Özkaya, S., & Yurdakul, A.S. (2017). Factors affecting patients' comfort during fiberoptic bronchoscopy and endobronchial ultrasound. *Journal of Pain Research, 10*, 775-781. Doi: 10.2147/JPR.S118047

Appendix: Questionnaire before, right after and a week after the bronchoscopy

Vragenlijst

MST UNIVERSITEIT TWENTE. Beter door Beeld

Deelnemer code:

Voorafgaand aan de bronchoscopie

Algemene vragen

1. **Wat is uw geslacht?**
   - ❑ Man
   - ❑ Vrouw

2. **Wat is uw geboortedatum?**

   Dag - *Maand* - *Jaar*

Wat is uw stemming op dit moment?
Omcirkel het cijfer dat het best weergeeft hoe uw stemming op dit moment is.

Heel slecht	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Heel goed**

De volgende stelling meet hoe ontspannen/kalm ofwel gespannen/onrustig u zich voelt. Omcirkel het cijfer dat het best weergeeft hoe u zich voelt op dit moment.

Ik voel me op dit moment:

Gespannen, onrustig	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Ontspannen, kalm**

<u>Na de bronchoscopie</u>

Wat is uw stemming op dit moment?
Omcirkel het cijfer dat het best weergeeft hoe uw stemming <u>op dit moment</u> is.

Heel slecht	1	2	3	4	5	6	7	Heel goed

De volgende stelling meet hoe ontspannen/kalm ofwel gespannen/onrustig u zich voelt. Omcirkel het cijfer dat het best weergeeft hoe u zich voelt <u>op dit moment.</u>
Ik voel me op dit moment:

Gespannen, onrustig	1	2	3	4	5	6	7	Ontspannen, kalm

Hoe prettig of onprettig vond u het inbrengen van de bronchoscoop?
Omcirkel het cijfer dat het beste bij uw ervaring past.

Zeer onprettig	1	2	3	4	5	6	7	8	9	10	Zeer prettig

Hoe prettig of onprettig vond u het verloop van de bronchoscopie na het inbrengen van de bronchoscoop?
Omcirkel het cijfer dat het beste bij uw ervaring past.

Zeer onprettig	1	2	3	4	5	6	7	8	9	10	Zeer prettig

Hoe goed of slecht werkte de verdoving die u heeft gekregen tegen pijn tijdens de bronchoscopie?
Omcirkel het cijfer wat het meest van toepassing is voor u.

Zeer slecht, ik vond de procedure erg pijnlijk	1	2	3	4	5	6	7	8	9	10	Zeer goed, ik vond de procedure niet pijnlijk.

Hieronder staat een aantal woorden die verschillende emoties en gevoelens beschrijven.

Geef bij elk woord aan in hoeverre het beschrijft hoe u zich voelde <u>tijdens de bronchoscopie</u>.

Gebruik de volgende schaal en zet het kruisje in het vakje dat van toepassing is.

☐0 = absoluut niet ☐1 = zwak ☐2 = matig ☐3 = sterk ☐4 = heel sterk

1. ZENUWACHTIG

☐0 ☐1 ☐2 ☐3 ☐4

2. PANIEKERIG

☐0 ☐1 ☐2 ☐3 ☐4

3. GESPANNEN

☐0 ☐1 ☐2 ☐3 ☐4

4. RUSTELOOS

☐0 ☐1 ☐2 ☐3 ☐4

5. ANGSTIG

☐0 ☐1 ☐2 ☐3 ☐4

6. ONZEKER

☐0 ☐1 ☐2 ☐3 ☐4

Vragenlijst: een week na de bronchoscopie

Deelnemer code:

Als u nu terugdenkt aan de bronchoscopie, kunt u dan aangeven hoe uw stemming was op dat moment?
Omcirkel het cijfer dat het best weergeeft hoe uw stemming tijdens de bronchoscopie was.

Mijn stemming tijdens de bronchoscopie was:

Heel slecht	1	2	3	4	5	6	7	Heel goed

De volgende stelling meet hoe ontspannen/kalm ofwel gespannen/onrustig u zich voelde. Omcirkel het cijfer dat het best weergeeft hoe u zich tijdens de bronchoscopie voelde.

Ik voelde me tijdens de bronchoscopie:

Gespannen, onrustig	1	2	3	4	5	6	7	Ontspannen, kalm

Stel dat u nogmaals een bronchoscopie zou moeten ondergaan, hoe erg ziet u daar dan tegenop?
Omcirkel het cijfer dat het beste bij uw gevoel past.

Ik zie er heel erg tegenop	1	2	3	4	5	6	7	Ik zie er helemaal niet tegenop

Hoe prettig of onprettig vond u het inbrengen van de bronchoscoop?
Omcirkel het cijfer dat het beste bij uw ervaring past.

Zeer onprettig	1	2	3	4	5	6	7	8	9	10	Zeer prettig

Hoe prettig of onprettig vond u het verloop van de bronchoscopie na het inbrengen van de bronchoscoop?
Omcirkel het cijfer dat het beste bij uw ervaring past.

Zeer onprettig	1	2	3	4	5	6	7	8	9	10	Zeer prettig

Hoe goed of slecht werkte de verdoving die u heeft gekregen tegen pijn tijdens de bronchoscopie?
Omcirkel het cijfer wat het meest van toepassing is voor u.

Zeer slecht, ik vond de procedure erg pijnlijk	1	2	3	4	5	6	7	8	9	10	Zeer goed, ik vond de procedure niet pijnlijk.