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The Effects of Aromatherapy on Stress in a University Population

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THE EFFECTS OF AROMATHERAPY ON STRESS IN A UNIVERSITY POPULATION

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Abstract

The purpose of the present study was to determine whether aromatherapy has an effect on stress responses in a population of undergraduate university students at a liberal arts college. To do this, participants were brought to a laboratory room and asked to complete a task designed to increase feelings of stress and anxiety by having participants perform a song in front of the researcher. During this, either water vapor infused with a small quantity of lavender oil or unadulterated water vapour was diffusing into the room. To measure stress, participants wore a heart rate monitor throughout the duration of the study, and were asked to complete a self-report measure of stress directly after completing the task. This study found a connection between the singing task and stress, in that heart rates were highest while the participant was performing the task than at any previous time point; but, ultimately, aroma was found to have no effect on stress, with no difference in heart rate between lavender and water diffusion conditions. These results may be due to factors like having conducted the experiment in a laboratory setting rather than a natural or clinical one, variance in levels of stress due to having tested during different parts of the school year, failure to manipulate placebo effects or concentration of lavender oil, or the absence of a direct association between lavender aroma and stress. Ultimately, additional research will need to be done in order to determine the relationship between aromatherapy and stress, if one exists.

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Introduction

It is easy to find claims on the internet of the various effects of aromas on physical and mental health. For instance, Aromatherapy.com (2010) lists a variety of essential oils obtained from various plants which can be diluted to provide relief from a range of ailments when inhaled – each scent with its own healing properties. However, these websites rarely, if ever, cite any scholarly research to support these claims, often relying on anecdotal evidence or traditional cultural medicinal beliefs. There is also a plethora of available products for sale to the public which claim to contain scented oils that will aid in sleep, stress relief, or concentration. Although there is some government regulation with respect to the effectiveness of these types of claims, at least in Canada (Government of Canada, 2016) and the United States (U.S. Food & Drug Administration, 2014), details concerning the implementation of these regulations is unclear.

Aromatherapy has been defined as: "the use of essential oils for the treatment of physical and psychological health" (Goldstein, 2009, p 63). Essential oils are extracts from various plants in highly concentrated form that are mixed with some type of oil base (usually vegetable oil). They are generally then diluted with water and inhaled, but can also be diluted and spread on the skin like perfume. The actual word "aromatherapy" was first used by Rene-Maurice Gattefosse in the early 20th century (Goldstein, 2009). Gattefosse was a French chemist who began studying essential oils after he suffered an accident which caused severe burns to his hand; he accidentally doused the burn in lavender oil and discovered that his burn subsequently healed more quickly than he had anticipated (Goldstein, 2009). However, the practice of using scented plant-derived oils existed long before Gattefosse; their use has been present for centuries in the form of folk-healing in numerous different cultures and countries (Classen, Howes, & Synnott, 1994).

Clinical use of essential oils can be traced back to Florence Nightingale, who served as a

nurse during the Crimean war c. 1855. Nightingale found that when lavender essential oil was applied to the bodies of soldiers, they exhibited behaviours reflecting a calmer mental state (Gnatta, Kurebayashi, Turini, & Silva, 2016). After Nightingale, Marguerite Maury introduced the notion that medical practitioners could mix various essential oils to create a specific prescription unique to the patients' individual ailments. Maury went on to conduct her own case study based research on how aromas can influence the human nervous system and set up the first clinics for aromatherapy in London, Switzerland, and France (Gnatta et al., 2016).

Despite the prevalence of beliefs supporting aromatherapy in modern popular culture, it is only recently that people have begun conducting scientific research into the legitimacy of its effectiveness. Since many of the claims seem to be surrounding stress relief (with practitioners of aromatherapy claiming that various essential oils such as lavender, sweet orange, peppermint, bergamot, etc.) possess stress-relieving properties, most of the research addresses this hypothesis. As well, since many aromatherapy practitioners make use of essential oils in concert with other forms of therapy, like massage and meditation, much of the research conducted studies its effectiveness in these situations, often confounded together. For instance, a study conducted by Chen, Chou, Yang, Tsai, Chang, & Liaw (2017) examined the effectiveness of aromatherapy massage on the stress responses of pregnant women. The participants were 62 pregnant women, who were randomly assigned to either an aromatherapy massage group (in which they were given a 60-minute massage using lavender oil biweekly for a total of 10 sessions) or a control group (in which they were given standard pre-natal attention). Saliva was collected from all women at 16-weeks gestation, and again after each laboratory session (10 minutes after the massage for the experimental group) to determine stress levels by the presence of the hormone cortisol. At the very first saliva sampling, there was no difference in stress levels

between the groups, which provided a baseline level of stress. For the control group, stress levels were much higher at 32 weeks gestation compared to the first sampling at 16 weeks, but the experimental group displayed no difference in stress levels during any of the 10 further samplings.

Another study, this one conducted by Redstone (2015), aimed to determine whether mindfulness meditation in combination with aromatherapy would improve feelings of stress in psychiatric inpatients hospitalized for some type of mood disorder. Participants consisted of 32 patients who were given group therapy in mindfulness meditation, one hour a week, while a "soothing aroma" (p 192) was released into the room. During the first 15 minutes of the session, participants filled out a questionnaire to report their stress and anxiety levels. Following this, they were guided through a standard mindfulness meditation for half an hour. Finally, there was a 15-minute discussion session during which participants could share feedback on the experience. They were then asked to fill out the stress level questionnaire once more. There was no control group to act as a comparison, but overall, the participants reported experiencing lower levels of stress and anxiety after the sessions, compared with before.

The major problem with these two studies is that neither compared aromatherapy alone to aromatherapy combined with another therapy, and only one employed the use of a control group. This means that it cannot be concluded that the aromatherapy by itself had any effect on the stress relief that was documented. This was especially true in the case of mindfulness meditation, which is a valid therapy technique that has been shown to help control feelings of stress and anxiety in people suffering from anxiety disorders such as Post-Traumatic Stress Disorder (Lang, Strauss, Bomyea, Bormann, Hickman, Good, & Essex, 2012). Therefore, it is important to look for research designed to determine whether exposure to scent alone is enough

to decrease feelings of stress and anxiety. These studies are more difficult to find, but they do exist.

One such study was conducted using sweet orange essential oil in rats to determine whether it would have an effect on stress behaviours. Faturi, Leite, Alves, Canton, & Silva (2010) exposed rats to sweet orange essential oil for 5 minutes (using an inhalation chamber) in four dose amounts ranging from zero to 400 microlitres. These rats were then put into an elevated plus-maze, with equal numbers of closed (covered) and open (uncovered) arms for 5 minutes. The researchers measured anxiety levels in terms of how long the rats remained in an open arm and the number of times they entered an open arm. As a second test, the rats were put into a Perspex® box in which one chamber was completely dark and one completely light; the amount of time spent in the lighted box was used to measure anxiety. Before testing in these scenarios with aromatherapy, the researchers did a pharmacological comparison by having the rats negotiate each test apparatus after having been injected with either diazepam or saline. As expected, the rats given diazepam entered the open arms more frequently and spent longer exploring them and remained in the light chamber significantly more/longer than those given saline. As for the aromatherapy experiment, the rats given 400 and 200 microlitres of the oil spent more time in the open arms and entered them more frequently than those given no oil. In the light/dark situation, the rats given 100 and 400 microlitres spent significantly more time in the light box than those given none. Although these effects were not as strong for aromatherapy as for drug therapy, they were still significant, which suggests an effect of aromatherapy on anxiety.

There has also been similar research done on humans testing aromatherapy alone compared with a control condition, which found similar results. One study, by Chen, Fang, &

Fang (2015) testing 259 nurses working in a Taiwanese hospital had the participants fill out a questionnaire about their job-related stress symptoms. Participants were then randomly assigned to an experimental group, the members of which were given bottles filled with a lavender essential oil solution to wear on their chest, and a control group, the members of which were given a bottle without the oil. The researchers did not state whether the bottle was empty, or instead contained some neutral scented substance such as water or a scentless oil. They were required to wear these bottles from the beginning until the end of their shift for four consecutive shifts, rating their stress at the end of each day. The results revealed a significant reduction in stress symptoms in the experimental group between the pre-test questionnaire and the questionnaires given at the end of their third and fourth shifts, whereas the control group showed no significant differences in stress symptoms during any of the shifts.

A final study gave healthy male participants varying amounts of sweet orange oil, tea tree oil, or water to inhale after putting them in a situation designed to induce feelings of anxiety (Goes, Antunes, Alves, & Teixeira-Silva, 2012). To determine anxiety levels, the participants were asked to fill out the State-Trait Anxiety Inventory-Part II (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and devices measuring heart rate and muscle responses were used. Each measure was taken three times: (1) before; (2) during; and (3) after being put in the anxiety-inducing situation. Their results showed that in the tea tree and water groups, participants' state anxiety increased greatly during the anxiety-inducing situation, relative to those in the sweet orange groups who had been given both the lowest and the highest dose whose state anxiety remained low. Similar effects were shown in the physiological measures.

A meta-analysis of the existing literature, which included 18 studies, showing just how sparse the research is on this subject, revealed that there does seem to be a measurable effect of

aromatherapy on emotional states (Herz, 2009). The author concluded that the scents did not directly cause these changes, but indirectly affected them, as shown by the fact that the specific scent(s) used in the studies mattered less than the participants' personal perception of the scent as pleasant or unpleasant and what memories the scent itself was associated with for that person. However, there was evidence for some scents having more of an effect on the participant's mental states than others, even when these differences in individual perception were considered (Herz, 2009). This suggests that although a scent must be perceived as pleasant to cause emotional and/or physiological changes in the participant, not every pleasant scent will do so.

These studies, although supporting the notion that specific aromas can have an influence on stress and anxiety, provide relatively weak support. Aside from the obvious problems with the studies which measure aromatherapy concurrently with another form of therapy and provide no control comparison, even the studies testing aromatherapy alone did not show consistent decreases in stress in the essential oil conditions. For instance, in the Chen et al. (2015) study, the nurses given aromatherapy only reported a decrease in stress symptoms during the final two sessions, but not during the two preceding ones. Further, in Goes et al. (2012), the participants given both the lowest and highest dose of sweet orange oil experienced no difference in stress levels from baseline, but the medium dose experienced stress levels similar to the participants given water or tea tree oil. Therefore, despite the support shown, more research needs to be done to fully understand the relationship between aromatherapy and stress or anxiety levels.

The current experiment was designed to add to the existing literature by determining whether the inhalation of lavender oil will mitigate feelings of stress brought about by a task designed to elicit stress reactions. This research question will be tested only on university and college students, after determining the overall level of general stress caused by their role as a

student. This population was chosen because students are generally accepted to experience more long-term stress than other populations – for instance, Stallman and Hurst (2016) surveyed 2,596 students and found that nearly 60% of them reported experiencing amounts of stress rated at a clinical level. It is hypothesized that students exposed to water vapour infused with lavender essential oil will experience less stress during and after the manufactured stressful situation. It is also hypothesized that students who report the general experience of being a student as less stressful than other students will be less affected by the stressful situation regardless of aromatherapy. Finally, it is hypothesized that students who rate feeling more stressed after being subjected to the stressful situation will also show heightened physiological responses.

Method

Participants

Participants were 30 undergraduate students at Huron University College at the University of Western Ontario, some being drawn from and introductory psychology course participant pool, and the rest from among friends and family of the researcher. Participants consisted of 20 women, 9 men, and one participant identifying as other, who ranged in age from 18 to 27 (M = 20.40, SD = 2.42). Those collected from the undergraduate pool were awarded a research credit for participating.

Materials and Apparatus

Measuring devices used in this study were a basic demographic questionnaire designed by the researcher (Appendix A), and the Stress Rating Questionnaire (SRQ; Edwards, Edwards & Lyvers, 2015). The demographics questionnaire included a question regarding whether or not the participants had any food or scent allergies (and if “yes”, to list them), as well as a measure

of long-term stress, determined by having participants rate how stressful they perceive their overall university experience to be on a scale of 1 to 10. In order to manipulate stress, a five-slide Power-Point presentation was created by the researcher following the guidelines of the Sing-A-Song Stress Test (SSST; Appendix A), designed by Brouwer and Hogervorst (2014).

The study involved the use of a scent diffuser manufactured by the company Victsing, which contained either 300 ml of water (measured using a plastic measuring cup provided by the manufacturer of the diffuser) or 300 ml of water plus three drops of lavender (Lavandula angustifolia) oil made by the company Essential Oil Labs. This amount was the amount recommended by the company which manufactured the oil. Finally, as a secondary measure of stress, a wrist-mounted heart monitor was used in the form of an exercise watch designed by the company Mio Global (Model Mio Fuse). The watch connected to a smart phone via Bluetooth, which showed live heart rate data (in beats per minute; bpm) plus a timer, and saved second-by-second heart rate data which could be exported to e-mail through a Microsoft Excel document. Participants were tested in a room (18.5 X 20 X 8 ft) which is connected to a ventilation system that runs 22 fresh air changes per hour. Participants were also never tested within 2 hours of each other, to allow the room to properly air out between conditions, and the diffuser was cleaned with scent-free soap twice following each lavender session to ensure no build-up of lavender (which may otherwise have created an increased dose at the next lavender session), and no lingering lavender scent between experimental and control.

Procedure

Participants were brought to the test room located at Huron University College. After informing the participant about relevant details of the study and obtaining written consent, the demographic questionnaire was presented for the participant to complete. Following completion

of the questionnaire, and after confirming that the participant reported no relevant food or scent allergies, the diffuser was turned on. Once the diffuser was on, the researcher secured the heart rate monitor to the participant's wrist, and instructed him/her that s/he was about to watch a slideshow which was five slides long, with each slide being shown for 60-seconds. They were told that during the fifth slide they would be given a task to carry out, and that they were to wait until the 60-second timer timing the fifth slide finished counting down before beginning the task. The researcher then began the slideshow, making note of the time (in minutes and seconds) since the heart rate recording began. When the participant was prompted with the task (to sing a song), their start time was recorded in minutes and seconds since the beginning of the slide show. If the participant did not start singing within 30 seconds, he or she was prompted again verbally by the researcher. Once the participant had finished singing, he or she was handed the SRQ (with the researcher once again recording the time since the beginning of the slide show). Following the completion of this questionnaire, the heart rate monitor was removed, and the participant debriefed. There was a selection of candy items placed on a nearby table, and participants were offered one, and then sent on their way.

Results

Figure 1 shows mean heart rates for both conditions at each slide and during the stress task. General impressions from this data are that there was little difference in heart rates between the Lavender condition and the Control group, with heart rates at most time points actually being slightly higher in the Lavender condition. As well, there does not appear to be a large difference between each of the time points for heart rate, except for those that were quite far apart, like Slide 1 and the Stress Task. A 2 (Condition) X 6 (Time) Mixed Analysis of Variance was conducted to determine the relationship between lavender oil and the stress manipulation on

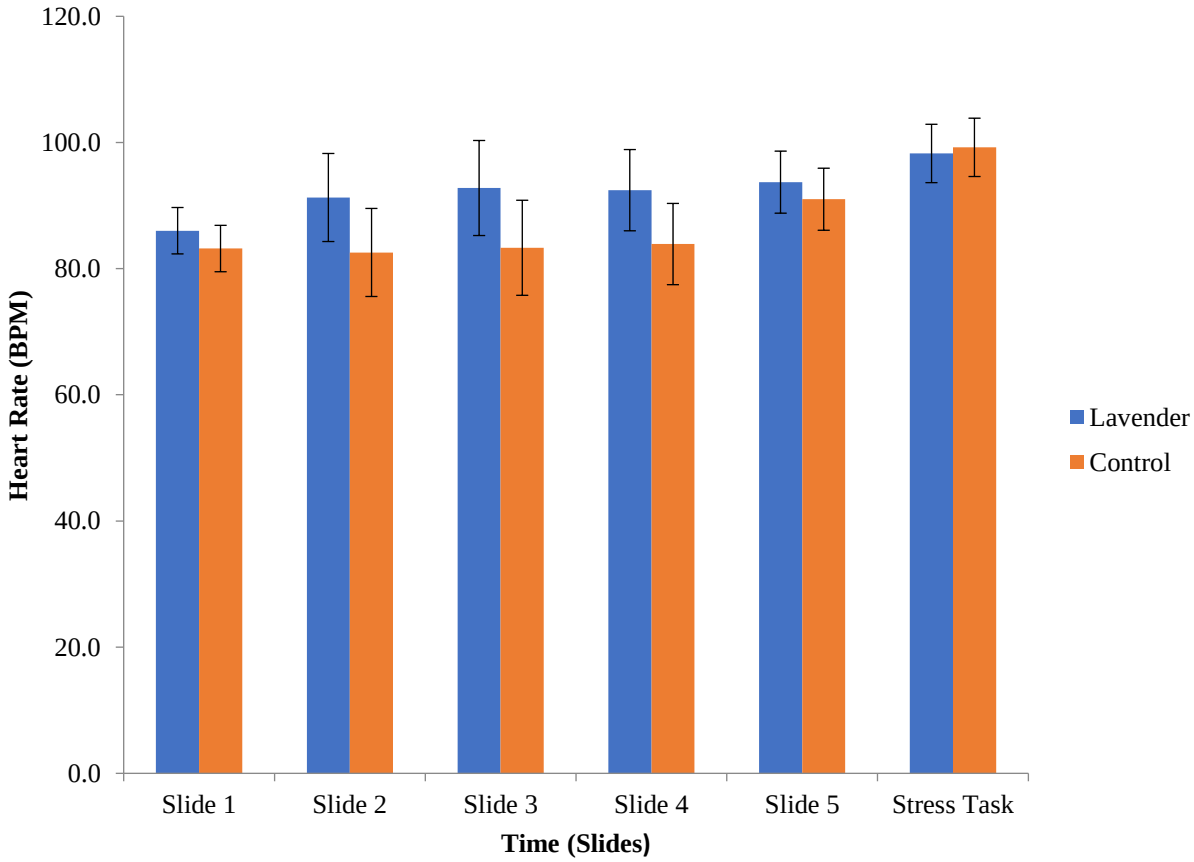

Figure 1. Mean heart rate per condition for each slide and during stress task. Error bars reflect Standard Error of the Mean.

heart rate. The Condition variable distinguished heart rate between the Lavender and Control conditions, whereas Time distinguished heart rate during Slides 1 to 5 of the SSST slideshow and through the completion of the singing task. There was a main effect found for Time, $F(2.54,65.94) = 9.11$, $p < .05$, partial $\eta^2 = 0.26$, but no main effect found for Condition, $F(1,26) = 0.98$, $p > .05$, partial $\eta^2 = 0.04$, and no interaction between Condition and Time, $F(2.54,65.94) = 2.36$, $p > .05$, partial $\eta^2 = 0.08$. Mauchly's test of Sphericity was significant, meaning sphericity was not assumed, and so values used above are ones from Greenhouse-Geisser (Appendix B).

To determine which of the time periods differed with regard to heart rate, follow-up Paired-Samples T-tests were conducted using a Bonferroni corrected p-value of 0.006, which found that heart rates during the stress task were significantly higher than during any of the 5 slides. Significant differences were also found between Slides 1 and 5. No differences were found in heart rates between Slides 2 and 5 or Slides 4 and 5. Figure 2 shows the main effect for time, using average heart rates per slide collapsed over condition.

Three separate Pearson Correlation Coefficients were conducted in order to test the final two hypotheses. These revealed no significant relationship between heart rate during the stress task and participants' long-term stress, $r(26) = -0.04$, $p > .05$; moreover, scores on the SRQ were not correlated with heart rate during the stress task, $r(26) = 0.17$, $p > .05$, or even with heart rate during the period in which participants were filling out the SRQ, $r(26) = -0.08$, $p > .05$.

Discussion

The present experiment revealed no evidence of a relationship between aromatherapy and heart rate. It can be said with confidence that this is not due to the failure of the stress manipulation: as the ANOVA and follow-up t-tests showed, heart rates were significantly higher

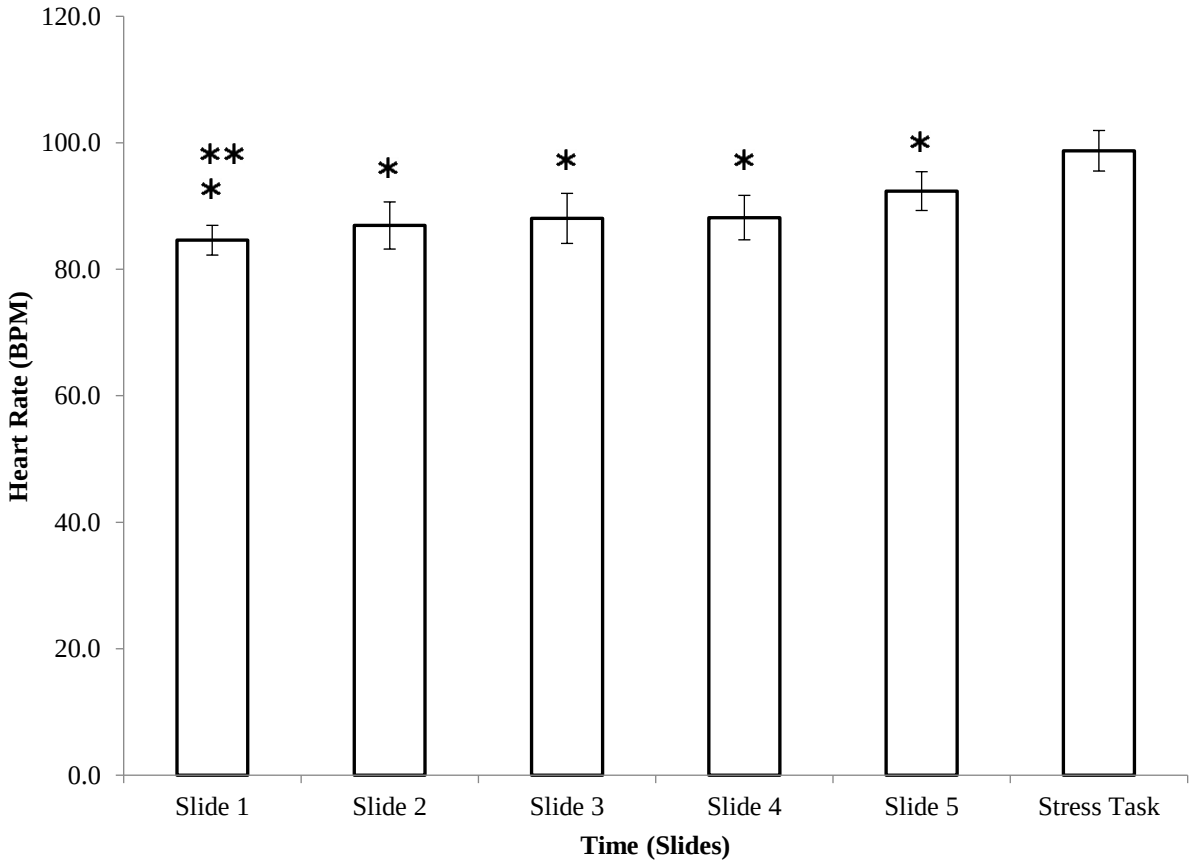

Figure 2. Overall mean heart rate per slide collapsed over conditions (Lavender and Control). Error bars reflect Standard Error of the Mean. Values with * are significantly different from Stress Task; values with ** are significantly different from Slide 5.

during the stress task than at any previous time, despite the baseline heart rate being relatively high (mean heart rate before the slideshow began being 83.1 bpm, and mean heart rate for all time-points before the stress task began being 87.21 bpm). As mentioned, the self-report measure of stress did not corroborate the heart rate data, with the average level of stress reported as 16.92 (on a possible scale of 5 to 35), and no relationship found between SRQ scores and heart rate during the stress task, all of which questions the validity of the stress manipulation. However, biological measures are generally considered more reliable than self-report, as it is considerably more difficult to be deceptive on a measure of your autonomic responses, therefore it is more likely that heart rate is a more accurate measure of stress than the SRQ, and this is strong evidence ultimately supporting the validity of the manipulation.

There are some limitations of the study which could have contributed to the lack of significant results. The first is the failure to manipulate placebo effects: participants were not told that the scent released in the room would lead them to experience decreased stress, which is what most often happens in real-life use of aromatherapy. Manufacturers of essential oils and diffusers claim publicly that their lavender oil products will result in decreased stress symptoms; therefore people who use such products in their home do so with the expectation that this will be the case. Further, in clinical settings, clients come into the aromatherapy session because they are experiencing symptoms of stress and anxiety, and are there for treatment of these symptoms; thus they have the expectation (or at least the hope) that it will decrease their symptoms. If the mechanism underlying the effectiveness of aromatherapy is the expectation that it will decrease stress, then this would explain why the aromatherapy manipulation did not work in this experiment. Instead, participants (who were aware that the study involved the use of aerosolized particles) saw and heard the researcher turn on a diffuser, and, in the experimental condition,

then experienced a change of scent in the room. This may have led to the newly-introduced scent having arousing rather than relaxing effects.

It is possible given the low scores on the SRQ that the heart rate measure reflected participants' level of arousal rather than stress. However, the SRQ, although claiming to measure stress level, seems to be measuring something closer to anxiety instead, with items reflecting anxiousness, fearfulness, and worry. This leads to a further limitation of this study: there was a failure to distinguish between anxiety, stress, and arousal. This study attempted to manipulate stress, following the definition of Hans Selye: a physiological reaction in response to a particular stressor (Szabo, Tache, & Somogyi, 2012). In this case, the stressor was psychological – having to perform a song in front of a stranger – as opposed to physical (e.g., heat) or chemical (e.g., sedatives). Anxiety differs from stress in that it is a person's cognitive interpretation of their stress response and can occur on its own without a stressor (Anxiety and Depression Association of America, 2016; APA, 2018), meaning that two people experiencing the same amount of stress can differ in the level of anxiety they experience as a result, which may explain the lack of the relationship between SRQ scores and heart rate in this study. Arousal refers solely to the physiological changes and can happen in response to any event, regardless of stress or anxiety.

Another limitation was the failure to control for perceived pleasantness of the scent. As mentioned previously, aromatherapy was found in past research only to be effective if the participant found the scent to be pleasant (Hertz, 2009). Because participants were not asked about their perception of the scent regarding its pleasantness, it is possible that the majority of them found the scent to be unpleasant or aversive, and so did not find it relaxing, or even found that it increased their stress levels. It was also impossible to control for amount of time spent in the room, which may have had an effect on results, such that participants who remained in the

room for a longer amount of time may have experienced heightened feelings of stress or arousal, reflected in their heart rate, compared to others. This was impossible to manipulate because participants varied in how long it took them to think of a song, the song they chose to sing, how long they took to sing it, how long they waited before beginning their song, and any questions they may have asked the researcher throughout the study regarding the instructions. Therefore, time in the room is a variable which may confound with slides to get the main effect.

Further, due to time constraints, it was not possible to manipulate time of year. There are many time periods during the university school year during which stress levels are likely to be higher than at others. For instance, at periods of time just after or before a break, during warmer weather, or at the beginning of a semester when there are minimal exams or assignments due, stress levels are likely to be low overall. Conversely, during time periods in the colder seasons (fall/winter), during mid-term or final examinations, or in the last month of the semester when students are more likely to have a number of large assignments due, stress levels are likely to be quite high. Participants were tested at every time during the school year indiscriminately, whenever they were available and willing to participate. This fact may have influenced their reaction to the stress task more strongly than the scent manipulation, such that those who were tested in a more relaxed time of the school year may have been less affected by being asked to sing, and so were calmer.

Finally, the sample over-represented women (67% of participants). Moreover, I tested only university students, meaning that non-university students were not represented. Also, there was no low-stress comparison, as the students were found to have fairly high long-term stress: mean stress was 7.32 out of 10 (SD = 1.24), with a score of 1 indicating that their overall university experience has caused them no stress at all, and 10 indicating it as the most stressful

thing they have ever experienced. As well, participants were tested in a laboratory setting, rather than in a natural or clinical venue. Generally, when people self-administer aromatherapy, it is at their home where they have likely settled themselves into a comfortable position on a soft surface (like a couch or bed), perhaps putting on soothing music, and have prepared themselves for relaxation, all of which may enhance the effects of aromatherapy. Similarly, in a clinical setting, people are also likely to be situated in a comfortable position, and being given other aids like mindfulness meditation, massage, or soothing music to assist in the decrease of stress. These three factors, taken together, suggest that findings are not generalizable to the general population, or to the settings in which aromatherapy would ordinarily be administered.

Limitations aside, another possible reason for this study failing to produce significant results may be that aromatherapy is simply not effective in people who experience high amounts of long-term stress. As has been established, participants were collected from a group of people who experience higher than normal stress levels. Further, participants were aware coming into the study that it may cause them to experience feelings of stress and anxiety (they were told they may experiences levels of stress similar to public speaking), which may have also influenced their baseline heart rates. More research needs to be done in order to determine whether it is the case that aromatherapy is less effective in these populations, but if it is, then this has strong implications for the effectiveness of aromatherapy as a treatment for stress in clinical populations: specifically, it implies that aromatherapy may not be a viable therapy technique for more serious anxiety and stress-related issues. Finally, it could be the case that aromatherapy is not effective at all in reducing stress, in which case this also has obvious implications for its use in a clinical setting.

To determine to a fuller extent the relationship between aromatherapy and stress (and if

one exists) more research needs to be done on the subject. Specifically, future research could manipulate placebo effects, perhaps using a design in which half of participants are told that the substance diffusing into the air (either water or lavender oil) will reduce their stress levels, and half are not told anything about whether or not the diffuser will reduce stress, with perhaps another level added in which participants are told that the diffuser will have no effect on their stress. Similarly, future researchers should attempt to compare high stress groups with low stress ones, to determine whether aromatherapy has more of an effect on one group than the other, or, if studying students, manipulate time of year to compare the effects of aromatherapy during low-stress time periods compared to high-stress ones (conversely, at least only test participants during one or the other) to ensure that participants are experiencing similar levels of stress outside of the laboratory.

Further, previous research has tested aromatherapy alongside other therapy techniques, but it is difficult to find such studies which also employed the use of a control group. Therefore, future research should be designed to determine whether aromatherapy enhances other forms of therapy, such that the two techniques used together creates a greater decrease in stress than either used independently. Future researchers should also ensure that they include a measure of "pleasantness", in which the participant is asked to report how pleasant or unpleasant they personally find the aroma to be. Finally, future researchers should aim to distinguish between arousal, anxiety, and stress, as well as the different types of stress, to determine if aromatherapy has varying effects on each, or affects one but not the others.

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Appendix A
Materials

Demographics Questionnaire

Do you have any food or scent allergies?

-If YES, specify here: _____

-If NO, write an X on this line: _____

How old are you? ____

What year are you in? ____

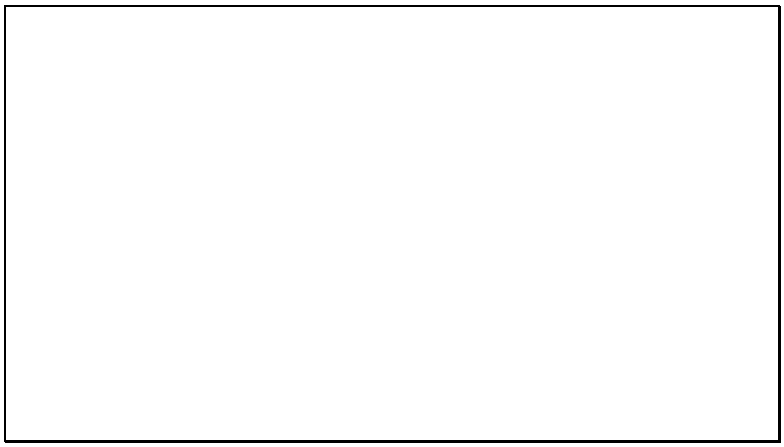
What is your gender? Male Female Other

On a scale of 1 to 10, how stressful would you rate the overall experience of being in University? (With 1 being not at all stressful, and 10 being the most stressful experience of your life).

1 2 3 4 5 6 7 8 9 10

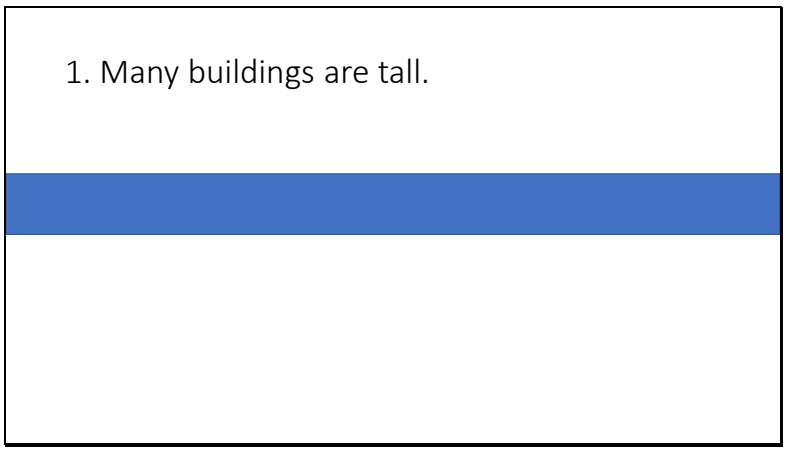
Sing-A-Song Stress Test Slides

Prestart



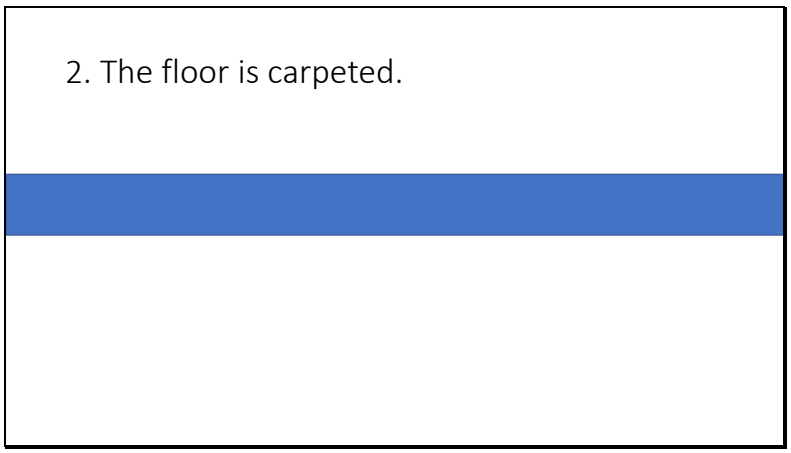
Slide that was seen during instructions

Slide 1

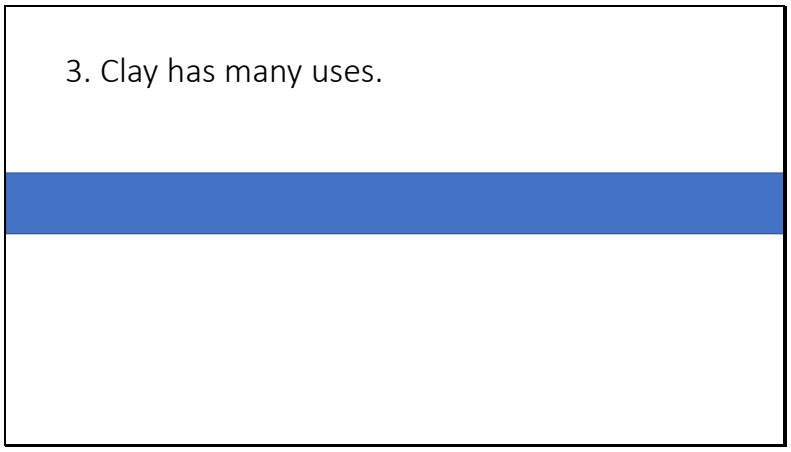


Blue bar is a timer, it would spread across the screen for 59 seconds after which the slide would change to the next one.

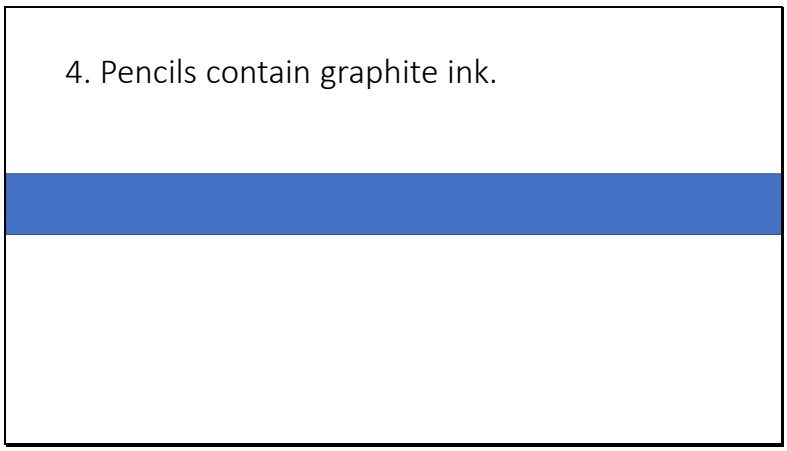
Slide 2



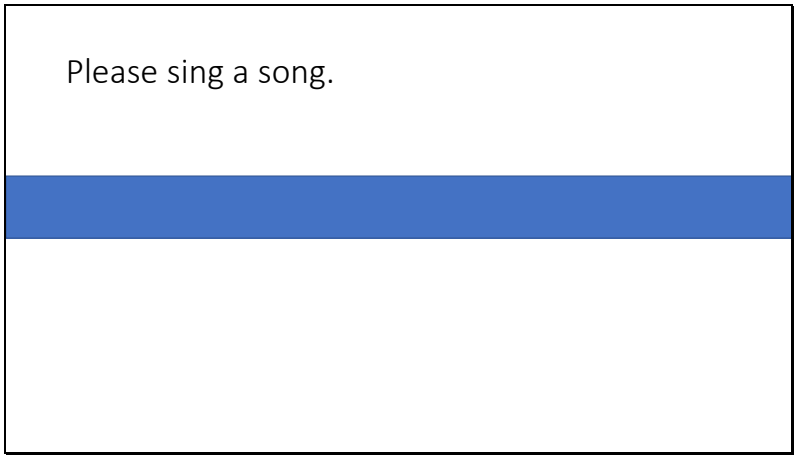
Slide 3



Slide 4



Slide 5



Participants saw this prompt, but were told to wait until the timer completed counting down before beginning the task.

Appendix B
Data: ANOVA Output

Mixed ANOVA of Heart Rate Throughout the Duration of Study by Condition (Lavender or Control)

Heart Rate	df	SS	MS	F	p	partial η^2
Condition	1	1645.38	1645.38	0.98	0.33	0.04
Time(Slides)	2.54	3243.06	1278.72	9.11	0.00	0.26
Interaction	2.54	841.20	331.68	2.36	0.09	0.08

Curriculum Vitae

Name:	Theresa Flagler
Place and Year of Birth:	Kitchener, Canada, 1994
Secondary School Diploma:	Senior Matriculation, St. Peter's Secondary School, Peterborough, Canada
Post Secondary Diploma:	Bachelor of Theology, Huron University College at Western, London, Canada
Publications:	Flagler, T. (2016). The association between need for achievement and religiosity. *Huron University College Journal of Learning and Motivation, 54*, 82-92.
Awards:	Dean's Honour List (2013, 2014, 2015, 2016)