# Reality or Imagination: The Effects of Pleasant and Unpleasant Odors on Mood and Stress Levels

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Paper submitted in partial fulfilment of the requirements for Psychology 4105 (Honours Thesis), Algoma University, Sault Ste. Marie, Ontario, Canada
The author wishes to thank Robert Baron for providing the Current Feelings Mood Scale and the Word/Letter test

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Aromatherapists promote products which they assert ameliorate psychophysical conditions such as stress and headaches. They have suggested that essential oils and artificial scents provide physical and psychological therapy to their patients (Beart, 1995). The use of aromatherapy has become popular in the city of Tokyo, Japan. There, some health clubs provide "aroma-cocktails", scented phone booths telephone books have been placed in shopping malls, and some businesses have scent-enhanced air-conditioning systems that emit various scents during a day. The present review attempts to evaluate the comparative effects of odor, and suggestion of odor.

## Odor, and The Brain

Lorig, and Schwartz (1988) used EEG to measure the effects of odor administration. Nine subjects participated in their experiment. Each subject was told the nature of the experiment, signed consent forms, and had electrodes placed on their heads. The subjects smelled the contents of spiced apple, eucalyptus, and lavender. The odors were placed five centimeters from the subjects nose, for one minute. The room was ventilated during the three minute between odor presentations. The odors were embedded in a series of mental tasks, and the subjects were asked to complete a 17-item questionnaire assessing patterns of emotions between the odor, the imagery trials. Questions relating to the pleasantness of and memories associated with the odors were also given to the subjects. Results of the ANOVA, for theta activity, indicated a significant difference in the amount of EEG theta activity produced by smelling different ordors compared with smelling no odors. Also, spiced apple and eucalyptus were associated with reports of significantly less anxiety and less tension. The data indicates that pleasant odors, such as spiced apple, and eucalyptus, changes EEG patterns by decreasing theta waves, in turn, decreasing

tension.

Schwartz and his colleagues (as cited in Hall, 1988) also noted that when we savor pleasant fragrances, we take deeper and slower breaths, relaxing our respiratory pattern. This is similar to what is done during meditation. It was also indicated than an odor might serve as a distractor, focusing our attention by inducing positive memories and emotions.

An internet article, posted by the Olfactory Connection (1996) states that nerves are a direct extension to our brain's limbic system, therefore, smell recognition is immediate. Stimulation of the olfactory bulb triggers the release of a series of neurochemicals in the brain. Since the olfactory pathway projects onto the limbic system structures that subserve memory, olfactory stimuli can elicit good memories.

Lorig and Schwartz (1988-1989) also found that the imagination of food, especially one's favorite desert, can elicit a relaxed state as indicated by an individuals EEG pattern and self-report. Nine participants were affixed with electrodes to their scalps. Four groups of two tasks were administered to the subjects and the subjects were instructed to smell a variety of odors. The subjects participated in the task for one minute and the data were collected in three ten-second epoches at the beginning, middle, and the end of the one-minute periods. The tasks included, number subtractions, imagining their first bike ride, imagining the earliest car ride, imagining one's favorite main course, and imagining one's favourite desert, and subjects were also instructed to concentrate on a word as they inhaled and exhaled. The results indicated that imagery of food, especially one's favourite desserts, has a relaxing effect, apparent in EEG and self-reports.

In sum, it has been found that pleasant fragrances produce a pattern of EEG that indicates

a relaxed, wakeful state (Lorig and Schwartz, 1988), and the olfactory pathway is linked to the limbic system that subserves memory (Olfactory Connection, 1996). Therefore, pleasant fragrances may induce positive memories and emotions (as cited by Hall, 1988), and imagining one's favourite food induces a relaxing state (Lorig, & Schwartz 1988-1989). It is possible that pleasant fragrances that induce relaxation in an individual do so by having an hedonic quality, and by inducing pleasant memories.

## Odor and Mood

Pleasant odors have been found to enhance positive affect, decrease stress levels and alter behaviors such as helping. Baron (1995) sought to determine the effects of pleasant odors on social behaviors in a field study.. Baron hypothesized that passersby, in a mall, would report an increase in mood in the presence of a pleasant odor. He measured subjects williness to pick up a dropped pen for a stranger. Subjects in the odor condition were exposed to the ambient odors of baked good and coffee, whereas those in the non-odor condition task were presented with a task while in front of a clothing store. There were two helping tasks involved. In the first task an accomplice drop a pen and the subject was rated on whether he/she picked up the pen, notified the accomplice of the accident, or did nothing. In the second task, an accomplice asked for change and the subject was rated on their attempt to give change (cursory or honestly), or whether they obtained the change. Following the task, another accomplice approached the subject and asked the subject to rate the quality of the air (pleasant or unpleasant) as well as to rate their mood. The results were consistent with the hypothesis: helping was greater in the presence of pleasant odors compared to the odorless condition. Moreover, participants showed greater helping in response to the request for change (high cost) than in the dropped pen

condition (low cost). Subjects exposed to the pleasant odor condition reported a more positive mood on the five point scale (with 1 being very bad and 5 being very good) than individuals not exposed to pleasant odors. Although the data is consistent with Baron's hypothesis and supports the suggestion that pleasant odor increases pleasant mood, Baron did not have a baseline to compare with his findings. Without the baseline, the reader is unaware of whether subjects were in a good mood before exposure to the pleasant odor. Nonetheless, this study suggests that increased levels of mood were due to the nature of the scents to which subjects were exposed.

In another study, Baron (1990) asked his subjects to perform a marketing task which involved smelling either a pleasant or a neutral odor from a bottle. Pleasant odors used were perfumes and colognes and neutral odors consisted of Wood-workers Glue, Sting Eze and Soy Sauce. In the second task, subjects coded products and determined the price of each product by looking through a coding book. Self-efficacy ratings as well as estimates of performance were gathered from the subjects. The subjects were then paired with an accomplice and asked to negotiate on how the surplus budget should be divided and what position cuts should be made throughout the company. The results indicated that the subjects in the positive scent condition set higher goals on the clerical task, were more likely to adopt an efficient strategy for performing a complex task involving coding operations, showed enhanced reported self-efficacy, reported higher monetary goals, expected more favorable outcomes from negotiations and made more concessions with respect to both the division of available funds and position cuts. These results suggest that positive affect, induced by exposure to pleasant artificial scents, can influence several aspects of behavior.

## Odor and Stress

Stress plays a big role in our daily, hectic lives, but do aromas reduce stress in an individual? Baron and Bronfen (1994) conducted a study on whether fragrances can influence task performance under stressful conditions. Subjects were placed either in a no fragrance condition or a in a pleasant fragrance condition. Subjects were informed that the project was concerned with factors affecting performance on work related tasks. They completed a questionnaire, worked on a word construction task and completed a brief measure of current affect (for example, sad/happy, negative/positive, pleasant/unpleasant). For the high stress condition, a large, ticking timer was placed in the room, the subjects were informed that 8-9 items were usually completed on the task in a five minute period (when on average about three items were completed), and the experimenter remained in the room, carefully watching the subjects behavior. In the low stress condition, no timer was present, the subjects were told the correct number of items generally completed on the task in a five minute period, and the experimenter left the room. The subjects were told that a marketing class was using scented products for a survey concerned with scented products. Thus, an attempt was made for the presence of the fragrance to be disassociated from the current research. The same remark was made to all participants, whether they were exposed to the fragrance or not. This was done partly to maintain uniformity of procedures across fragrance and no-fragrance conditions and to help equate possible demand characteristics. Subjects rated the room as pleasant or unpleasant, rated the quality of air in the room, the difficulty of word construction task, and the level of stress experienced while performing the task. Participants who worked on the word construction task in the presence of pleasant fragrances completed significantly more items than those not exposed to the fragrance. This was true in both stress conditions.

Instead of placing subjects in pleasant and unpleasant or no odor fragrance conditions, Knasko (1995) took a different approach. She placed congruent pictures with congruent scents (for example, pictures of chocolate bars in a chocolate scented condition). She investigated the ability of ambient odors to influence the number of minor health symptoms individuals reported while either in a no odor or a pleasant odor condition. The two pleasant scents used were baby-powder and chocolate. Subjects were shown 24 slides presented randomly, 6 were of chocolate, 6 were of babies and 12 were control slides (neutral slides, incongruent with the scent) of trees, lakes, mountains and the orient. The slides were viewed for a second time and ranked on a 9 point scale. Subjects completed various questionnaires. The first dealt with mood. Subjects were given a 9-point scale from the Semantic Differential Measures of Emotional State questionnaire. Other questionnaires given were a 9-point scale rating health symptoms such as irritated eyes, headaches, fatigue/malaise and stuffy/runny nose, and a 9-point scale rating the environmental quality of the testing room such as noise, lighting, temperature and odor. Subjects in the pleasant room scent spent more time viewing the slides. All 3 groups reported a positive mood although the pleasant scent condition reported a significantly more pleasant mood and those in the chocolate condition reported greater arousal. These findings support the hypothesis that pleasant environments can improve mood and increase various types of approach behavior. If a person were to smell a pleasant product, they would be more likely to approach that product. They also suggest that items placed with a congruent pleasant odor increase lingering time and elevate mood.

The previous four studies have indicated that pleasant odors induce pleasant moods, feelings, and positive behaviors. What would happen if a subject was placed in a malodor setting?

Would an unpleasant odor induce an unpleasant mood? Knasko (1993) tested performance on simple and complex tasks during exposure to pleasant and unpleasant odors. The subjects sat at a table where they signed consent forms that indicated that there might be odors present in the room that could be considered pleasant or unpleasant. There were three odor conditions, a no odor condition, a pleasant odor condition, and a malodor condition. The subjects were to perform four tasks: a math task and a simple and difficult verbal task. They were asked to work as quickly as possible in a 15 minute period. The number of pages for the task were set so that no individual could finish the task. After the tasks were complete, the subjects were given the Semantic Differential Measures of Emotional State. They also rated pleasure, arousal and control, and completed a health symptoms questionnaire, a hunger and thirst scale and rated the quality of the testing room. The data indicated that subjects in the malodor condition reported that the room odor had a more negative effect on their health and mood, compared with subjects in the other two conditions. Subjects exposed to the malodors believed that their performance on the two simple tasks had been more impaired by the room odor. Subjects in the malodor condition also reported that the room odor had a more negative effect on their multiplication performance than did subjects in the other two conditions. They also believed that their performance on the proofreading task was more impaired than did the subjects in the no odor condition. It was unclear whether Knasko wanted the suggestion of the odor to be fully present or not. She indicated on the consent form that there might be odors present in the room considered pleasant or unpleasant. Eventhough subjects were not explicitly told which condition they were going to be placed into at the time of testing, could the mention of the odor effected the results of the study? This question could be one for future investigation.

These five studies indicated that in scent alters mood, with mood being congruent with the scent. It has also been suggested that scent increases behaviors such as helping, working in a conflicting situation (the negotiation task), increases viewing time, and reduces stress levels, whether high or low.

## Expectancies

But can memories alone produce a decrease in stress or an alteration in mood? What about the products on the market that are advertised as "stress-reducing", "energizing" or "relaxing"? Do they actually reduce stress, energize and relax? Are people influenced by marketed products and respond to their expectations? Placebos, which are non-active products/ingredients, are used in experiments for testing the nonspecific (psychological) effects of receiving an active treatment. Placebos are used often in drug experiments. Beecher's (1955) seminal paper on placebo effects reports that a variety of conditions provide satisfactory efficacy for 35-50% of cases. The effectiveness of a placebo tends to correlate closely with the reputation of effectiveness of the treatments for which the placebo is substituted. Lower placebo response rates are found when placebos are compared to a mild treatment and higher placebo response rates are obtained when compared to strong treatments (Lowinger and Dobie, 1969).

Knowing these results, does this mean that if we suggest an anti-stress relief product to an individual they will feel reduction in stress through mere suggestion? Knasko, Sabini and Gilbert (1990), told their subjects that the study dealt with effects of odor on clerical tasks that required focused attention. Water vapor was sprayed into the air and the subjects were told, depending on the experimental condition, that most people find the scent pleasant, unpleasant or neutral. The task involved finding discount rates associated with the product from a rating sheet. Subjects

were asked how many products they expected to code in 5 minutes. They evaluated how confident they were about their goal, how hard they would work to reach their goal and how able they were to perform the task. A digit deletion task followed the coding task. The number of target digits crossed out were summed to obtain a deletion score. The number of nontarget digits crossed out, and the target digits skipped in each trial were summed to obtain a total error score. Subjects completed the Semantic Differential Measures of Emotional States questionnaire, were given a physical symptomatology questionnaire, and were asked to rate the smell of the room. The results demonstrated that ratings of a non-existent ambient odor can be shifted toward the hedonic quality of the experimental condition. Ambient room odor was rated more pleasant by subjects given a pleasant rather than unpleasant odor suggestion. Positive mood was increased by a positive scent suggestion, and the highest number of negative physical symptoms were rated by subjects given a malodor suggestion than among those given a pleasant or neutral suggestion. Therefore, positive mood was enhanced by the suggestion of a pleasant ambient odor and the subject's preconceptions (whether they were told the water vapor was a pleasant scent or an unpleasant scent) about the effects of odor was consistent with actual increases in mood. However, the studies that presented scent alone, without suggestion, found similar results with increases in mood with exposure to positive scents.

## What's Next?

So, is it the scent or the suggestion of the scent that alters the mood? Could it be both? The present investigation will try to answer the proposed question. The present study will incorporate Baron and Bronfen's (1994) design in conjunction with Knasko, Sabini and Gilbert's (1990) idea of suggestion. Also, incongruent suggestions will be given with incongruent scents,

an idea no yet proposed. It is hypothesized that the results will indicate that both scent and suggestion are strong enough to induce elevation in moods and decrease in stress. This idea will suggest that the mind can be just as powerful as the scent.

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## Abstract

Studies have indicated that pleasant odors tend to improve mood and unpleasant odors tend to produce negative mood. Also, through mere suggestion, the same effect has been found. That is, pleasant mood suggestion increase positive mood and unpleasant mood suggestion decreases positive mood. Subjects were placed in one of three odor conditions (pleasant, neutral, and unpleasant) paired with pleasant odor suggestion, unpleasant odor suggestion and no odor suggestion. There were significant differences found between all conditions, as measured by mood and stress levels. Subjects, in all conditions, were in a better mood before the manipulation was given, and subjects were more stressed after they performed the word/letter task. The decrease in positive mood and increase in stress, after performing the word/letter task, can be attributed to subjects failing to reach their predicted goals.

## Introduction

Aromatherapists promote products which they purport ameliorate psychophysiological conditions such as stress and headaches. They have suggested that essential and artificial fragrances provide physical and psychological relief to their patients (Beart, 1995). Aromatherapy is becoming popular in places like Japan where scented phone booths have been placed in shopping malls and health clubs serve "aroma cocktails" to their members. Also, some businesses have incorporated scent-enhanced air exchange systems that emit different scents during a day. But, is aromatherapy useful? If so, why? Our olfactory sense is connected to the limbic system and various studies have indicated that pleasant fragrances enhance mood and unpleasant fragrances induce negative mood. Is it really the scent, per se, that changes an individual's mood? Or is it the suggestion that the scent is relaxing or stress reducing that changes an individual's mood?

Research indicates that the olfactory pathway is linked to the limbic system that subserves memory (Olfactory Connection, 1996) and that pleasant fragrances produce a pattern of EEG that indicates a relaxed state. Aromatherapists and scientists are concentrating on the role of the olfactory system because of its connection with the limbic system. Stimulation of the olfactory bulb triggers the release of a series of neurochemicals in the brain. Since the olfactory pathway projects onto limbic structures that subserve memory, olfactory stimuli can elicit pleasant and unpleasant memories. The Olfactory Connection (1996) suggests that perhaps when a subject smells a pleasant odor, neurotransmitters are released and pleasant memories are triggered, increasing mood and reducing stress.

Lorig and Schwartz (1988) used EEGs to measure the effect of odor administration.

Their results indicated a significant difference in the amount of EEG theta activity produced by smelling odors compared with smelling no fragrance. Spiced apple and eucalyptus odors were associated with reports of significantly less anxiety and tension. The results suggest that pleasant odors change EEG patterns by decreasing theta waves, indicating a reduction in anxiety and tension. Lorig and Schwartz (1988) also found that imagining food, especially one's favorite dessert, can elicit a relaxed state, as indicated by an individual's EEG pattern and self report. Schwartz and his colleagues (as cited in Hall, 1988) noted that when individuals savor pleasant fragrance, they take deeper and slower breaths, relaxing their respiratory pattern. . Thus, pleasant fragrances may induce positive memories and, in turn, enhance mood. It was also noted that odor might serve as a distractor, focusing attention by inducing positive memories

An increase in positive mood may bring about an increased likelihood of helping behavior (Baron, 1995) and may improve approach behavior (Knasko, 1995). Moreover, research has also suggested that pleasant odors have positive effects on task performance. For example, Baron and Bronfen (1994) compared high and low stress conditions to no stress conditions and found subjects completed more items in a word/letter task when they were exposed to ambient pleasant odors than when they were exposed to no ambient odor. The pleasant odor may increase subjects' mood, thus inducing positive subjects moods thus inducing positive subject behavior. Baron (1990) found that subjects in a positive scent condition set higher goals, and were more likely to adopt efficient performance strategies for a complex coding task. On a task requiring the negotiation of conflicts, subjects in a pleasant odor condition made more concessions with respect the division of available funds and position cuts. Subjects also reported weaker, less aggressive ways of handling future conflicts. Subjects exposed to pleasant fragrances experienced increased

moods and were more able to handle their negotiations in a positive manner.

Are the effects of pleasant odors due to active ingredients in the scent or can the instructional setting and positive or negative suggestion influence the effect of such procedures? Efforts used for controlling the nonspecific effects of receiving active treatments are known as placebo procedures. Beecher's (1955) paper on the placebo effect reports that for a variety of conditions, placebos provided satisfactory efficacy for 35-50% of cases. The effectiveness of a placebo tends to correlate closely with the reputation of the effectiveness of the treatments, for which the placebo is substituted with lower placebo response rates, when compared to strong treatments (Lowinger and Dobie, 1969). In other words, placebos responses are closely correlated to the effects of a treatment that has an effectiveness reputation.

Knasko (1993) conducted a study in which performance, mood and health were affected when a malodor suggestion was given. Subjects reported negative effects on mood and said they felt the negative odor affected their performance. Knasko, Gilbert and Sabini (1990) reported that, when there was no odor present in the room, subjects given a suggestion stating that there was a pleasant odor in the room rated the ambient room odor as more pleasant than subjects in the unpleasant odor. Similarly, positive mood was enhanced by the suggestion of a pleasant ambient odor, and subjects' preconceptions about the effects of odor were consistent with actual increases in mood. These findings indicate that the suggestions that accompany procedures may serve as an explanation for the apparent relationship between odor and mood.

The present study is designed to evaluate whether odor, the suggestion of an odor or both the suggestion and the odor will influence mood and stress. A 3X3 factorial design will include pleasant, unpleasant, and no suggestions, and a pleasant, unpleasant, and neutral odor . The

hypothesis states that subjects in the pleasant odor condition and/or pleasant suggestion conditions will experience more positive moods and decrease stress levels; subjects in the unpleasant odor condition and/or unpleasant suggestion condition will experience more negative moods, and an increase in stress levels. The conditions in which the suggestion is incongruent with the odor are unknown as to whether the subject will conform with the suggestion or the odor.

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Insert Table 1 about here

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## Method

### Subjects

Ninety students from Algoma University College in Sault Ste. Marie participated in the experiment. Most were from the Introductory Psychology or the Introductory Human Geography classes in which extra marks were given for participation. Subjects were randomly assigned to one of nine conditions.

### Apparatus

The study was run in a testing laboratory at Algoma University College. The laboratory consisted of three separate small rooms, each containing a ventilating system. Room one was the entering room, and each subject was instructed as to which room to enter. While the experiment was being conducted in one room, the doors to the alternate room was closed and the ventilating system was turned on. This alternation of rooms occurred throughout the experiment, with each

room ventilated in 15 minute cycles, in order for the room to be as odor free as possible before the manipulation was given.

Subjects were placed in one of three odor conditions. The three odor conditions were chosen based on pilot testing. The pleasant odor was Cranberry beads from La Senza, the unpleasant odor was a relaxing Burning Oil in concentration from The Body Shop, and the neutral odor was Kerri Non-Fragrant Hand Cream.

Procedure and Design

Subjects were tested individually for 15 minute sessions. After signing a consent form, they were asked to rate their mood on a self-report mood scale. Once the report was filled out, subjects were told one of three things. In the first condition, subjects were told, "I am investigating the effect of odors on performance of a word/letter task. Please open up this package and inhale the product. Can you smell it? Most people who smell this product strongly feel it is a pleasant scent. In the presence of such scents, people often find that their mood is enhanced considerably. You know, like when you walk into the house and someone is baking chocolate chip cookies or freshly baked bread. When we are in a good mood, we are able to cope with stress much better, and therefore in the presence of such pleasant scents, we are not only in a good mood, but we cope with stressful tasks much better. For this reason, you are not only expected to feel better but to respond better to the task that I will present to you."

In the second condition, subjects were told, "I am investigating the effect of odors on performance of a word/letter task. Please open up the package and inhale the product. Can you smell it? Most people who smell this product strongly feel it is an unpleasant scent. In the

presence of such scents, people often find that their mood is decreased considerably. You know, like when you are driving on the highway and you go past a farm and the ambient odor makes you roll up the window or cover your nose. When we are in a bad mood, we are less able to cope with stress, and therefore in the presence of such unpleasant scents, we are not only in a bad mood, but we cope with stressful tasks less effectively. For this reason, you are not only expected to feel worse but to respond less effectively to the task I will present to you."

In the third condition, subjects were told, "I am investigating the effect of odors on performance of a world/letter task. Please open up the package and inhale the product. Can you smell it?". If the subject responded no, they were also told, "If you can't smell it, that is OK. Some people can't smell it, just like not everyone can wiggle their ears". These instructions were similar to those used by Knasko, Gilbert, and Sabini (1990).

After the instructions were given, the word/letter task was explained to the subject and a pre-test was performed by the subject. After the task was completed, another mood self-report scale was given to the subjects and they rated their stress levels. Afterward, subjects were told that if they had any questions they could contact me through email or telephone and that I would be glad to discuss the experiment at a later date. They were also invited to the psychology thesis conference.

On the pre-test, subjects rated the product, their confidence in performing the task, and how hard they would work to reach their goal, and they indicated how many words they expected to complete. All rating were based on a 7-point scale.

The performance task was a word/letter task, from a study by Robert Baron ( 1994). Twenty-six words were presented with one letter plus a 6-letter word. The subject had to take

the extra letter , and place it into the 6-letter word by rearranging the letters to make a new 7-letter word. For example, B+RUBBLE = BLUBBER. To create stress during the task, an impossible goal of 8-9 words to be completed in a five minute period was given, most people complete 3-4 in a 5 minute period, a timer with a beeper was placed directly in front of the subject, and the experimenter sat across from the subjects and stared at them while they performed the task.

The 10 item, 7-point mood scale was created and used by Baron (1994). Items included, Bad/Good, Sleepy/Alert, Unpleasant/Pleasant, Sad/Happy, Dull/Alert, Nervous/Calm, Bord/Interested, Tired/Energetic, Negative/Positive, and Tense/Relaxed. On the post-test, subjects rated their success on the task, their stress experienced during and after the task, the difficulty of the task and they rated the product. All scales were 7-point scales.

## Results

*Mood.* Consistent with Baron (1994), responses to the 10-item Current Feelings Scale were summed to arrive at composite measure of current feelings. A 3 (Odor: Pleasant/Unpleasant/Neural) X 3 (Suggestion: Pleasant/Unpleasant/No Suggestion) X 2 (Time: Before/After) analysis of variance (ANOVA) was performed on the composite feelings index. The ANOVA indicated a main effect for Time, $\underline{F}$ (1, 81) = 51.33, $\underline{p}$ <.0001; collapsed across experimental conditions, subjects were in a more positive mood before the experimental treatment ($\underline{M}$ = 52.317, $\underline{SD}$ = 7.21) than after the treatment ($\underline{M}$=44.32, $\underline{SD}$ = 9.92). Contrary to findings of Baron (1990) and Knasko et al. (1990), there was no evidence of a main effect for either Odor, $\underline{F}$ (1, 81) = 1.99, $\underline{p}$ > .05 or Suggestion, $\underline{F}$ (1, 81) = 2.34, $\underline{p}$ > .05, respectively. The two-and-three

interactions were not significant.

*Stress Levels.* Recall that subjects supplied retrospective reports on the degree of stress during and following the work/letter task. As above, these stress ratings were analyzed with a 3X3X2 (Odor X Suggestion X Time) ANOVA. The analysis yielded a main effect for Time, $F(1,81) = 80.00$, $p < .001$; subjects reported greater levels of stress following the word letter task ($M$=3.267, $SD$=1.354) than during the task ($M$=4.528, $SD$=1.295). No other main effects or interactions were significant; all F's < 1.

*Performance.* Prior to the task, subjects were required to estimate the number of words they expected to complete during the task. In an effort to evaluate differences between estimated and actual performance, and whether these differences were moderated by the experimental treatments, were conducted on a 3 (Odor: Pleasant/Unpleasant/Neutral) X 3 (Suggestion: Pleasant/Unpleasant/No Suggestion) X 2 (Performance Index: Estimated/Actual) analysis of variance (ANOVA) on the number of task words completed. This analysis indicated a main effect of Index, $F(1,81) = 93.02$, $p < .001$; subjects expected to complete far more words ($M$=7.83, $SD$=3.41) than they actually completed ($M$=3.72, $SD$=2.22).

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Insert Table 2 about here

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## Discussion

The results of the present study do not replicate previous research. Neither suggestion nor scent manipulations had an effect on mood or stress. Mood and stress levels, however, significantly differed across all experimental conditions. That is, subjects in all conditions, were in a more pleasant mood before they were given the manipulations and before they performed the

word/letter task; subjects reported an increase in stress levels after performing the word letter task compared to their stress levels while performing the task.

The findings of the present study may differ from previous research because of the fragrances used. The present study used products chosen from a pilot test. From the products chosen, most subjects found the pleasant odor to be pleasant (Cranberry beads), whereas, not everyone in the unpleasant odor condition found the odor to be unpleasant (Relaxing Burning Oil). Other studies have used scents that are commonly used, and supposedly, more widely accepted as pleasant. For example, Lorig and Schwartz (1988) used spiced apple, lavender, and eucalyptus; Baron and Bronfen (1994) used powder fresh, and spiced apple, and Knasko (1995) used baby powder, and chocolate. One of the problems in finding odors to use was the difficulty finding an unpleasant odor that did not contain an chemicals, in order to comply with experimental ethics.

Suggestions used in the present study were based on suggestions given by Knasko, Gilber, and Sabini (1990). The suggestions for the present study added, and emphasized words, such as unpleasant and pleasant, in order to increase the strength of the suggestion. Subjects from thepresent study may have not responded to the suggestion because the experimenter was a very young-looking, female student who may have not been taken seriously. The experimenter may not have been able to "sell" the product as being pleasant or unpleasant. Knasko, Gilbert, and Sabini (1990) may have had an effect due to the experimenter being male, being a faculty member, and working at a Masters or Ph.D level. Therefore, the experimenter may have had mor influence on the subjects.

An explanation for subjects experiencing increased stress after performing the word/letter

task is falling short of their goal. Before starting the word/letter task, subjects predicted the number of words they thought they could complete. Almost, if not all, subjects fell short of their predicted goal, causing additional stress after the word/letter task was completed.

It seems that scent is a personal and individual choice. It is possible that a scent may induce relaxation, reduce stress, or enhance mood, when an individual wants to experience a positive affect. Other environmental factors, such as the place, warm water (in a bath), or dim lights, may contribute to positive affect. Future investigators are open to exploring and investigating other roots linked to scent and positive affect.

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## Table 1 : Experimental Design

| | PLEASANT SUGGESTION | UNPLEASANT SUGGESTION | NO SUGGESTION |
|---|---|---|---|
| PLEASANT ODOR | | | |
| UNPLEASANT ODOR | | | |
| NO ODOR | | | |

## Table 2 : Analysis of Means and Standard Deviations

| | MEAN (Time 1) | SD (Time 1) | MEAN (Time 2) | SD (Time 2) |
|---|---|---|---|---|
| MOOD | 52.317 | 7.214 | 44.32 | 9.92 |
| STRESS | 3.267 | 1.354 | 4.528 | 1.295 |
| PERFORMANCE | 7.833 | 3.406 | 3.722 | 2.219 |