Does Environmental Scent Influence Attraction and Mood?

Alexis Rose

Hanover College

Abstract

The purpose of this study was to test what role environmental scents and mood had on interpersonal attraction. Scent has an effect on people by allowing them to associate scent with emotional aspects of their life. Lemon has been found to have the strongest effect on positive emotions and energy to produce improved moods. Mood was also tested because research suggested that mood affects attraction and scent affects mood; this study attempts to clarify the relationship between scent, mood, and attraction. Half of the participants were given a riddle followed by positive reinforcement to improve mood. Then, all participants ($N = 31$) were shown black and white photographs of 41 mundane objects interspersed with neutral faces: 21 males and 21 females. There were four conditions to test the two independent variables (mood improved or not, scent present or not). A 2x2 ANOVA unexpectedly revealed a main effect such that participants in the scent condition rated the female faces as less attractive. The study's hypotheses were not confirmed. These results are discussed in terms of the complexity of scent, mood, and attraction. Theoretical and procedural changes are recommended for future research.

For years many successful retailers have been manipulating the scent of their stores to improve the moods of the customers with the hopes that the products will become more attractive to them (Spangenberg, Crowley, & Henderson, 1996). This study showed that there is a psychological effect of scent on humans; when one is in the presence of a pleasant scent the scent is able to improve the mood. Another study by Fullbright (1998) showed that there are physical effects of scent on humans by having those influenced by scent undergo a magnetic resonance imaging (MRI). An MRI was used to map the regions of the brain that were active. It was found that there was activity in the frontal regions caused by positive as well as negative scents which can be linked to brain processes in the olfactory networks (Fulbright, et al., 1998). Based on these two studies, it is clear that something is happening in the brains of individuals when they are in the presence of scent. Certain areas of the brain are triggered and certain associations are the result. However, it is unclear what influence these regions of the brain and associations have on other aspects of daily life.

Effect of Scent on Mood

How environmental scents impact mood and aspects of mood is the topic of the present study. Scent seems to affect people by allowing them to associate scent with emotional aspects of their life. Retail stores have had success with the manipulation of environmental scent when using pleasant scents, especially ambient scents or scents that are not associated with a particular object, to produce interest and thus changes one's perception of the store and its products (Spangenberg, Crowley, & Henderson, 1996). The key is that when one could not associate a scent with a product as in ambient scents, it was associated with every product. Also this scent being positive is shown to influence the mood in a positive direction by the association made from the positive scent. Spangenberg et al. (1996) found that of all the scents used, lemon had

the strongest effect on positive emotions and energy to produce the best outcome. When a pleasant scent in the environment was present, measurements showed that mood improved. This confirmed that there was an effect of scent on mood.

One study tested the effects of scent on mood by presenting a pleasant, unpleasant, or neutral scent to each participant. Then a memory was primed. By primed, it is meant that a situation was brought up and the participant free associated one of their own memories. It was found that subjects in pleasant conditions produced a significantly greater percentage of happy memories than did subjects in unpleasant scent conditions (Ehrlichman & Halpern, 1988). Smell in this study showed a dramatic impact on one's emotions and memories. It influenced how the subjects thought about something that had already occurred. The participants' opinions of their memories were influence by the scent. There is no known limit as to what effect scent from the environment can have on one's state. But to be clear, scent can simply impact the behavior states because they are associated with, not only positive emotions, but with threat, food, and sometimes sex (Gottfried, O'Doherty, & Dolan, 2002).

Effects of Scent on Attraction

Smell is a tremendous help for recognition of a potential mate, for humans as well as other animals. When a person is attracted to another person, the scent can influence the degree of continuing attraction to that person. If a person finds another person attractive interpersonally, scent has the potential to influence the interpersonal attraction by increasing it with a pleasant scent or decreasing it with an unpleasant scent. In humans, the more liking of scent that is associated with another person, the more likely positive emotional aspects that are associated with that person (Wrzeniewski, McCauley, & Rozin, 1999). When someone was in the presence of a positive scent, he or she reported the company he or she was with as more attractive than

others who were in a neutral scent condition and negative scent condition. Humans find different things attractive and there little research to explain why humans find the things they do attractive, but two fundamental elements of interpersonal attraction are average facial features and symmetrical faces (Rhodes & Zebrowitz, 2002). This is interpreted from evolutionary psychology perspective as based on natural selection. It assumed that these features are the indication of healthy genes since these faces have "everything in the right place."

There are many other factors that influence attraction among humans. Scent can only influence what evolution has put into place. It can influence how strongly one would feel interpersonally attracted to someone with these facial features. For example, one study found that a pleasant scent of a person greatly increases their attractiveness even when the person is dressed informally. The appearance of cleanliness influenced one's thinking and produced many positive shifts of the ratings of the target's attitude, attire, and education (Baron, 1981). This is an example of how scent influences appearance. It was shown that for a woman as the rater, the influences are even greater towards the target (Herz and Inzlicht, 2002).

Effects of Scent on Behavior

The perception of scent has two main behavioral effects: avoidance or approach. Unpleasant scents produce avoidance, while pleasant scents produced approach. Both leave lasting effects on the person's liking or disliking of a person, place, or thing (Fulbright, Skudlarski, Lacadie, Warrenburg, Bowers, Gore, & Wexler, 1998). Unpleasant scent produced avoidance and led to the disliking of a person, place, or thing. Positive moods produced more interpersonal attraction (Clark and Waddell, 1983). When one is provoked in a manner which leads to discomfort and negative moods, interpersonal attraction decreases (Griffit and Veitch,

1971). It appears that mood affects attraction and scent affects mood, however it may be that scent is affecting mood only and not necessarily attraction.

Research Question

The weight of evidence from past literature suggests that if scent is present, behaviors will be influenced more by mood than they will be influenced by the scent. These behaviors could be mood and that the scent provokes positive or negative emotions based on whether one associates the scent as pleasant or unpleasant. However, both scent and mood are highly complex factors. Most of this research is based on assumptions. The researcher assumed that positive scent positively influences mood and attraction. The researcher went on to assume that positive mood positively influences attraction. The research in these areas is tricky because even the most positive scent can cause negative associations if too strong. Even if someone claims to be in a good mood, there are many different emotional aspect and many different associations that relate to being in good mood. Testing this area requires many factors to reduce the confounding variables associated with the relationship between mood and scent.

To test the effect that environmental scents have on interpersonal attraction, Kirk-Smith and Booth (1987) showed that is it best to allow the scent to influence someone on his or her own terms. Minimal intrusions are the best and this means that one should not make the participants overly aware of the scent. When one is aware that he or she is being tested on the scent, he or she is more aware of the scent and it has less ability to influence their cognitive thought processes.

Based on past research, it was predicted that a scent in the environment would influence how participants perceived objects and faces. Also, mood plays a role in what humans find attractive. Scent, mood, and attraction interconnect on some level. It is predicted that scent

influences attraction by influencing the mood the individual experiences with the scent. It is also predicted that because scent influences interpersonal attraction through mood, there should be little to no different between the mood of the participants in the scent condition and in the mood condition. Those participants who experience an increase in mood and are in the presence of the lemon scent should have the highest ratings of interpersonal attraction. Those in the control should have the lowest.

<div align="center">Method</div>

Participants

At a liberal arts college in the Midwest, 32 undergraduate participants (females $N = 29$) volunteered in this study. All participants were white and between the ages of 18 and 22. Some of the participants received extra credit for their participation and others were asked to participate from the experimenter. None of participants had difficulty with their sense of smell or have any medical conditions or allergies. One of the participants had to be dropped for refusal to do the neutral cognitive task leaving the total number of completed participants at 31 (females $N = 28$).

Materials

The variables examined were mood and scent. The scent used was lemon, based on Spangenberg, Crowley, & Henderson (1996) study. This study showed that lemon had the highest positive mood outcome without loss of energy. Many smells, like many of the pleasant woods, showed a decrease in energy level which would hinder the participant's ability to perform the activity. To ensure control, lemon in pure oil form was added to water and allowed to evaporate over a flame. Thirteen drops placed in one ounce of water using a clay oil diffuser.

The apparatus was placed in the center of the table and allowed to sit for ten minutes before the study began to allow the scent to diffuse throughout the test area.

A slide show (see Appendix F) was viewed that consisted of 21 male faces (1 Hispanic, 10 black, and 10 white) and 21 females (3 Asian, 8 black, and 9 white). The faces were taken out of a database of pre-rated faces which were black and white. All faces had neutral expressions. The objects photos, also black and white, were everyday items like a pen or ball. Care was taken to make the objects as neutral as possible to prevent confounding variables.

A skilled task with positive reinforcement (see Appendix C) was used to improve mood without making one feel lucky. This was a riddle of skill to allow the participant to feel smarter and not a riddle of chance to make the participant feel luckier (Hill and Ward, 1989). After the skilled task was given, the participants received the positive reinforcement.

Procedure

A 2 x 2 x 3 mixed-subjects design was employed with the independent variables being scent (lemon or no scent), mood (positive mood or mood not altered), and picture (male, female, and object). The four conditions would be no scent and no skilled task with positive reinforcement, no scent and skilled task with positive reinforcement, lemon scent and no skilled task with positive reinforcement, and lemon scent and skilled task with positive reinforcement (See Table 1.).

Upon walking in, the participant received a neutral cognitive task which was a simple word search (see Appendix B) to allow their mood to settle and to be influenced by the lemon scent if the scent was being manipulated. If the mood was being manipulated, a riddle which promoted positive emotions was given out. They were asked to write the answer down and the researcher collected the information. Because there were a limited number of participants in

every round it was easy for the researcher to quickly go through these. No matter what the answer was, the researcher provided positive reinforcement which was intended to improve mood. After the activity, the slide show was presented. The participants were asked to rate how much they found the picture attractive using the seven-point Likert Scale with 1 being the least attractive and 7 being the most attractive. Mood was measured after the slide show using the Positive and Negative Attitude Scale (PANAS, see Appendix D) to track the improvement. This was to measure different characteristic of mood (strong, upset, or jittery) to get an overall picture of mood. It used a 5-point Likert scale with 1 not at all and 5 strongly feel.

Results

Photos were rated on a 1 to 7 Likert Scale and then were averaged for each participant for the male photos, female photos, and object photos. The data collected was consolidated into three categories of male faces, female faces, and object. The reliability coefficients of this data were male photos = 0.91, female photos = 0.92, and object photos = 0.95. Two of the male faces had to be removed to obtain the reliability coefficient. The ratings of these two were unreliable because of the inconsistencies of the ratings. Using a 2 x 2 between-subjects analysis of variance test there was not a main effect of mood on ratings of the objects, $F(1,27) = 0.131$, $p = .49$. Similarly, there was not a main effect of scent on ratings of the objects, $F(1,27) = 1.239$, $p = .28$. There was not a main effect of mood on ratings of the male faces, $F(1,27) = 0.157$, $p = .70$. Similarly, there was not a main effect of scent on ratings of male faces, $F(1,27) = 0.365$, $p = .55$. There was not a main effect of mood on ratings of the female faces, $F(1,27) = 0.738$, $p = .40$. There was a main effect of scent on ratings of the female faces such that the participants who were exposed to the lemon were more likely to rate the faces lower, $F(1,27) = 4.41$, $p > .05$ (See Table 2, Figure 1). There was no interaction between mood and lemon (See Table 3). The

PANAS was reversed scores on the following traits: distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, and afraid. Thus a single score was derived for each participant when the scores were averaged together. There were no correlations between ratings of male faces, female faces, or objects with the mean mood found using the PANAS (See Table 4).

Discussion

The hypothesis was not supported by this study and this study concluded that scent did not influence interpersonal attraction through mood. This study showed that scent was not a positive influence on interpersonal attraction and that mood did not influence interpersonal attraction. This was concluded because of the ratings of the face did not increase in the presence of the lemon scent and did not significantly increase with the mood intervention. This study showed that scent was not influencing attraction through mood because when mood was manipulated to obtain the results, changes did not occur. With the predicted hypothesis, there should have been positive correlations between the ratings of the male faces, female faces, and objects with the mean of the mood which was found using the PANAS. No such correlations were found using the data collected during this study. All of this concluded that this study did not support the predicted hypothesis.

This study showed that when in the presence of lemon scent female faces are perceived as less attractive. There could be for a number of reasons, but the simplest could be the confounding variables associated with lemon. Lemon is a highly positive scent (Spangenberg al et., 1996), yet there are many associations with lemon that could explain the decrease in the ratings of the female faces. For example, lemon is associated with cleaning and baking. These are two highly stereotyped female activities. The participants in this study were educated and

could have looked down on traditional female roles. Kane (1995) found that education encouraged change in how females saw their lesser group's status. The lemon smell could have triggered these associations and the participants could have rated them as less attractive based on these associations. This study does not enable one to conclude that lemon scent affected the mood of the individuals in the scent conditions. Therefore there can be no assumption made about the relationships between mood, lemon scent, and attraction.

Implications

Environmental scent research focuses heavily on retail stores using the scent to improve customers' trips to these stores (Spangenberg al et., 1996). Although this study showed an increase in the ratings of objects when in the presence of the lemon scent, this rating was not significant and the ratings of females were significantly lower than without the lemon scent. This implied that there could be a positive influence on the objects being bought. Yet if the scent the store is using has confounding associations like the lemon scent does, it could cause negative judgment among the customers. This would lead to a negative shopping experience which the stores do not want. This lemon scent caused negative judgment towards the female faces. This could mean that stereotyping of females in their traditional roles is still occurring.

The lemon oil could have caused confounding variables and led to association with females about their role in society. This stereotyping is making them appear less attractive and more open to negative associations. However because traditional roles' assumptions can not be made based on the data collected in this study, all that can be concluded is that lemon scent made females appear less attractive which could led to negative associations in a store towards female shoppers if the lemon scent is present. However, this study was not done in a retail store, but in a lab, therefore no conclusions about the implications that could happen in an environment outside

a lab can be made. All that can be concluded is that environmental scents in this study did have an effect on attraction and thus environmental scents do influence people.

Limitations

The main limitation of this study was the lack of diversity in the participant pool. No minorities were represented, the age range was narrow, and the individuals were educated having attended college in order to complete this study. Other limitations were that both scent and mood, which have a complex relationship, produced more questions than answers. There was no way of knowing if the mood intervention improved mood as the research suggests (Hill & Ward, 1989) or if lemon was having a positive affect on the participants (Spangenberg al et., 1996). There were no baselines taken to ensure that what was collected was in the correct direction.

Future Research

Mood and scent are both highly complex factors. For future research it would be wise to do more with mood such as do a PANAS right after the neutral cognitive task. This would not only give a baseline to see if mood improved, but also it would show which emotions or characteristics are being influenced. By doing this, it would allow one to compare areas of mood that are being influenced or not being influence to add support. In the case of the female face results, it would be interesting to see if characteristics like strong or proud are being influence which would better support the notion that female traditional roles were being associated with the lemon scent. Dutton (1974) studied mood and attraction to find that heightened anxiety led to an increase in attraction in males for females. When someone has more anxiety their mood is not improved but in this case interpersonal attraction increased. For the future other moods would need to be studied to see the affects on attraction.

Similar future research could be done with the scent intervention. Only one scent was used in this study. This scent was lemon and as stated before there are many confounding variables associated with lemon. Other scents like lavender could be used to have the positive effect without the stereotyped gender roles involved. Also, negative scent should be used to see what influence they have on ratings of attraction. Research has made that assumption that negative smells led to negative associations with attraction (Wrzesniewski, McCauley, & Rozin, 1999).

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Table 1

Conditions

	No Cognitive Task, No Reinforcement	Cognitive Task, Reinforcement
Pleasant Scent		
No Scent		

Table 2

Means and Standard Error for Group Means of Condition and Photo Type for all Participants

	Mean	Standard Error
Male Photos		
Scent	3.128	.228
No Scent	3.303	.180
Improved	3.273	.232
Neutral	3.158	.174
Female Photos		
Scent	3.346	.237*
No Scent	3.979	.187
Improved	3.792	.241
Neutral	3.533	.181
Object Photos		
Scent	2.762	.280
No Scent	3.160	.221
Improved	2.896	.286
Neutral	3.026	.214

*Note * equals p <.05*

Table 3

Means and Standard Error for Conditions

	Mean	Standard Error
Males Photos		
No Scent Neutral	3.416	.240
No Scent Improved	3.191	.268
Scent Neutral	2.901	.253
Scent Improved	3.355	.379
Females Photos		
No Scent Neutral	3.838	.249
No Scent Improved	4.119	.278
Scent Neutral	3.228	.262
Scent Improved	3.464	.394
Objects Photos		
No Scent Neutral	3.100	.295
No Scent Improved	3.220	.330
Scent Neutral	2.951	.311
Scent Improved	2.573	.466

Table 4

Correlations between Mood and the Photograph Types for all Participants

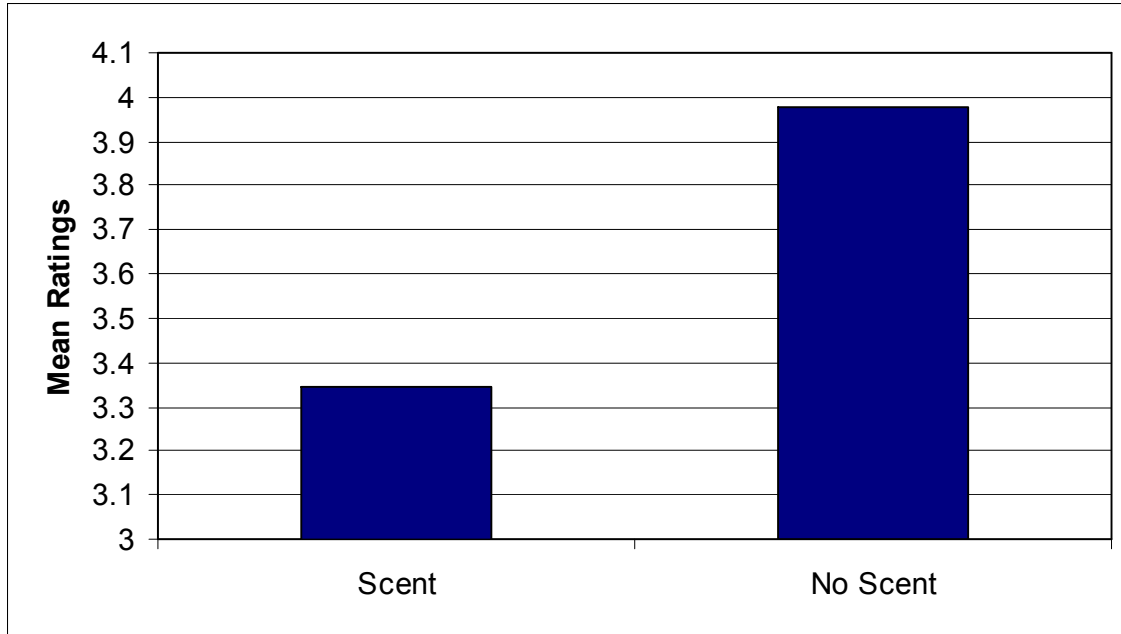|	Male Photos	Female Photos	Object Photos
Mood as measured by PANAS Score	-.004	-.057	-.134

Figure 1. When scent was present, the ratings for the female photos went down.

Appendix A
Understanding Perception of Objects and People

You have volunteered to participate in a research study conducted by Alexis Rose from the Psychology Department of Hanover College. I hope to learn more about perception.

If you decide to participate there are no known risks or discomforts. This experiment should be completed within one half hour and your participation benefits the Psychology Department, as well as potentially increasing our understanding of how people perceive the people and objects around them. However, I cannot guarantee that you personally will receive any benefits from this research. If you are in a class that provides extra credit for your participation, please inform me and I shall sign your form on your way out.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. Your information will not be released to anyone else and only I and my advisor (Dr. Mamberg) will see your answers.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with me, Dr. Mamberg, the psychology department or Hanover College. If you do decide to participate, you are free to withdraw your consent at any time, for any reason. Simply let me know that you wish to discontinue participation and we will end the research session.

If you have any questions, please feel free to contact Alexis Rose (rosea@hanover.edu) or Dr. Mamberg, 866-7239 (mamberg@hanover.edu).

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and that you may discontinue participation without penalty.

Print Name_____

Signature_____

Date_____

Appendix B

COLORS Word Search

```
E  I  V  Y  R  R  E  B  P  S  A  R  E  B  M  U  I  N  A  T  I  T
V  N  A  C  O  B  A  L  T  L  E  T  S  A  P  Y  R  O  V  I  E  V
E  D  D  S  U  R  C  E  T  I  H  W  I  N  E  R  R  E  E  L  B  R
R  I  E  B  M  A  G  E  N  T  A  O  B  A  A  R  L  E  O  Y  O  Q
G  G  H  A  V  T  L  I  G  G  O  L  D  T  C  E  A  I  V  L  N  U
R  O  U  P  U  R  P  L  E  R  U  L  A  S  H  B  V  T  V  L  Y  O
E  V  N  P  A  Q  U  A  A  E  E  E  I  D  T  N  A  S  E  E  I  I
E  I  T  L  I  M  E  N  O  E  N  Y  Q  L  E  A  N  Y  S  K  R  S
N  R  E  E  H  N  G  A  D  N  M  U  S  T  A  R  D  H  E  O  A  E
I  I  R  A  C  E  K  E  R  Y  C  O  R  A  L  C  E  T  P  N  M  K
P  D  Y  K  S  R  C  C  B  E  V  R  A  M  B  E  R  E  D  E  O  O
E  I  O  M  U  S  I  U  A  L  P  A  O  E  A  L  C  M  R  G  F  H
A  A  I  E  F  U  R  P  U  L  R  P  N  W  D  A  E  A  V  I  F  L
C  N  S  S  A  R  B  A  B  Y  B  R  O  W  N  U  L  C  R  E  A  M
K  E  C  A  E  P  U  A  T  E  L  R  A  C  S  D  N  R  U  B  U  A
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WORD LIST

Amber	Coral	Kelly (green)	Orange	Scarlet
Amethyst	Cranberry	Kohl	Pastel	Silver
Apple	Cream	Lavender	Pea	Sky (blue)
Aqua	Ebony	Lilac	Peach	Tan
Auburn	Ecru	Lime	Pecan	Taupe
Baby (blue)	Emerald	Liver	Pine	Teal
Beige	Evergreen	Magenta	Pink	Titanium
Black	Fuchsia	Mauve	Puce	Turquoise
Blue	Gilt	Mink	Purple	Umber
Brass	Gold	Moss	Raspberry	Violet
Brick	Green	Mustard	Red	Viridian
Brown	Grey	Navy	Rose	White
Cobalt	Honey	Nude	Ruby	Wine
Copper	Hunter	Oak	Sable	Yellow
	Ivory	Off (white)	Sand	

Appendix C

Some cogs are tigs
All tigs are bons
Some bons are pabs
Some pabs are tigs
Therefore, cogs are *definitely* pabs—True or False

Appendix D

Positive and Negative Attitude Scale (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answer.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

Appendix E
Understanding Perception of Objects and People

Investigator: Alexis Rose

Debriefing Form

The purpose of this research is to determine whether the presence of a scent or a change in mood enhances interpersonal attraction. It has been demonstrated that environmental scents can alter interpersonal attraction and this experiment was to test if and what affect mood had on this alteration.

In this study we presented you with photos of everyday objects and faces to see if there is a difference in the ratings of the attraction to the pictures in the different conditions (tighten wording). Depending on the condition you were in, we used lemon oil to manipulate the environmental scent and a riddle to manipulate your mood. If there is a difference between participants'' ratings depending on the control versus treatment condition, this could show that environmental scents alter interpersonal attraction by affecting the mood.

Delete or rephrase: This showed that scents did not make one appear more attractive, but it makes others happier and more inclined to be attracted to someone.

If you are interested in this area of research, the following sources are available at the library:

- Baron, R. (1981). Olfaction and human social behavior: Effects of a pleasant scent on attraction and social perception. *Personality and Social Psychology Bulletin, 7(4),* 611-616.
- Ehrlichman, H. & Halpern, J. (1988). Affect and memory: Effects of pleasant and unpleasant odors on retrieval of happy and unhappy memories. *Journal of Personality and Social Psychology, 55(5),* 769-779.

If you have any concerns, or questions about this research, please feel free to ask me now. In future, you can contact me, Alexis Rose (rosea@hanover.edu), or my study advisor, Dr. Mamberg, 866-7239 (mamberg@hanover.edu) at Hanover College. The final results of this study could be found on the psychology department website psych.hanover.edu by this summer.

Finally, thank you again for helping us with this research.

Appendix F