# AGE AND GENDER'S EFFECTS ON "OLFACTORY IDENTIFICATION AND MEMORY" & "VISUAL IDENTIFICATION AND MEMORY"

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## Introduction

"Olfaction" (adverbial form: "olfactory") is described as the sense of smell.[1] Among all of our senses; touch, sight, hearing, taste and smell, our sense of smell is probably the most epicurean and rudimentary. Due to the hedonistic psychological nature of the human being, we tend to avoid unfavorable smells such as rancid food or strong chemical odorants and tend to approach more favorable smells such as a fragrant perfume or a fresh baked chocolate cake.

The olfactory system itself is very interesting and different from the other sensory systems because it does not follow the "regular neurological path" when conveying a signal. Any sensory system but the olfactory system goes through the thalamus, whereas the olfactory system uses the olfactory bulb, a structure which transmits the "smell information" from the nose to the brain. Located in the inferior (bottom) brain the olfactory bulb is integral to the olfactory system.

The development of the olfactory system is also, indeed, very intriguing. Granule cells, which are the most common type of interneurons in the olfactory bulb[2] ,are mainly generated after birth and continue forming during the adult period[3]. It also differs from other sensory systems because some parts of the olfactory system, such as the vomeronasal organ, does not grow[4].

The activity of "smelling" takes place in the nasal cavity, but what we perceive as an odor is the "interpretation" of the brain. Specialized receptor cells of the olfactory epithelium detect and recognize smells.[5] The olfactory receptor neurons are a broadly tuned small group of neurons, meaning that we do not have a huge number of specialized olfactory nerves for different odors, but rather a relatively smaller number of broadly tuned neurons. The stimuli, or the odorant molecule, binds to a specific set of neurons which then translate this to nerve signals in various frequencies for various odors. The nerve impulse then travels through the axon, reaching the olfactory bulb which send the impulse to the brain where it is interpreted as a smell.

Odor identification occurs because different odorants (substances that stimulate the nerves in the nasal cavity) bind to different receptors and stimulate them differently. Every different odor is encoded with a different frequency, and that, is how we categorize different odors.

However, the research is not only concerned with odor identification, another aspect of the research is olfactory memory (short-term). In Dr. Nicole Klutky's research on "Sex differences in memory performance for odors, tone sequences and colors", **a significant advantage in female olfactory memory was observed while optical memory scores showed no such differences**[6]. The research was done on 60 women and 40 men.

Although it exemplifies the olfactory long-term memory, the famous "Proustian experience" is probably the best epitome for the olfactory memory. In his novel Marcel Proust describes the proustian experience as an incident where he was eating tea soaked cake, and a childhood memory of eating tea soaked cake with his aunt was "revealed" to him[7]. The "proustian experience" however, is an example of involuntary memory.

In order to have a good olfactory memory, one must have very good odor identification. Clinical research tells us that olfactory memory is generally associated with language (a phenomenon that was also observed during my research and experimenting). The ability of humans to verbally identify odors is very restricted despite the ability to differentiate hundreds of odors. It is also hypothesized that such poor odor identification performance is due to a weak link between odors and language[8].

The reason why there is such a poor level of odor identification is not because of the limitations of the human olfactory system (given that olfactory neurons are directly stimulated by the odorant) but, **by the way odors are gradually learned** and because no formal education exists for the naming of odors **as does for visually identifiable stimuli**[8].It is also known that age plays a huge role in memorizing/learning new materials, both in the olfactory and the visual/optical system.

## Hypothesis

Given that odors are learned gradually, whereas identifying colors can be learned in the epoch of preschool years ,and that generally memory improves with age (until a certain age - a research done in Europe has shown that memory can start to fade by the age of 45[9]), it was hypothesized that **odor identification and memory and visual memory would improve with age and females would be dominant in olfactory memory and identification and visual memory over males while there would be no effect of age or gender on color identification.**

## Method & Development

The aim of this research was to observe the effect of gender and age on identification and short-term memory of olfactory and visual system. In order to be able to achieve an observation one must prepare a proper system where such an effect (if it exists) can be observed.

At first, the method seemed pretty straightforward. I decided to range my research between the ages of 6 and 17 inclusive. This range was precise for observing the age effect. For a precise calculation I had to get a large number of participants from my school; TED Ankara College. 15 participants from each gender at each age (30, 6 year-old participants, 30, 7 year-old participants...) would yield in a number of 360 participants, which was a large-enough sample number for a considerably precise calculation.

I also needed some kind of "device" to measure odor identification, hence testing the general short-term memory and color identification was quite straightforward. The main problem of measuring odor identification was that it had to be equal for every participant, meaning that there should not have been odors that were too rare, or too vague. To overcome this problem, I had to use simple, common, household odors. The odors also had to be substantially distinct from one another.

Soon, I came to the verdict that I would use rose ,cocoa, mint, banana and lemon -in that particular order- as the five very common and very distinct odors. The next step was to decide on the colors. I followed two main rules while determining which colors were to be used in the experiment: The colors were not supposed to remind the participant of their odorant (e.g: A green card could have been reminiscent of the *Mentha spicata*, the mint plant, to the participant so the green color was not supposed to be the according/corresponding color of the mint odor - furthermore, that would have been the domain of Synesthesia).Furthermore, just like the odorant, the color had to be simple and common enough for a 6 year-old to identify. Therefore, I used black ,pink, red, green and white - in that order - as my color samples.

So the final corresponding odorant-color scheme was like this:

Table 1:

| ODORANT | ROSE | COCOA | MINT | BANANA | LEMON |
|---|---|---|---|---|---|
| COLOR | BLACK | PINK | RED | GREEN | WHITE |

Table 1: The corresponding colors and odors in the experiment

After which color should match with which odorant, I had to find the odorant chemicals. Through research I found out about merchants in Istanbul selling "aromatic oils" with different fragrances, and because the odorants I chose were not of the scarcest source, it was easy to find them.

To create an "odorant bottle" I had to procure five glass bottles and some blotting paper, both of which were quite easy to find. The blotting paper was cut so that it would fit inside the glass bottle. After placing a layer of blotting paper, using a laboratory pipette, I dropped five droplets of each odorant- using a different pipette for each odorant- into five different glass bottles. Then, I put another layer of blotting paper to enclose the "odorant oil" between the two layers of paper. The glass bottles that were used in the experiment had several plastic claps that would safely and tightly secure the lid onto the glass bottle, so that the system stayed hermetic until the lid was opened either by the experimenter or the participant.

The "experiment", was rather simple: At each age group I would experiment on the male students first, and the female students second. Each individual, in his/her test time, was allowed to smell only one odor, identify it, and identify the colored card underneath it. Then after a thirty second pause the participant would smell the second odorant, identify it, and identify the color underneath it, until all five odorants and all five colors were identified. The participant would also get awarded if he/she used terms like lemon cologne, a fragrance that is very popular in the Turkish household, instead of lemon, or mint-flavored gum instead of mint. These steps all took part in a very well ventilated room, where the previous odorant wouldn't affect the participants next identification. Between every odorant identification there was a twenty second pause before starting the next one so that the participant wouldn't be affected by the last odorant. After the last guess of the participant I would pause for fifteen minutes -or carry on with the next participant- and invite the participant to another room where he/she couldn't see the bottles or the color cards. In the room I would ask the participant if he/she could remember the odorants and the colors, in no particular order.

I made sure that all the participants who were taking the "odor-color identification test", had no allergies or were not sick at test time. Also, before the test I would ask the participant if he/she had previous knowledge of the odorants that were being used in the test. None of the participants had prior knowledge of odorants and/or colors.

My initial plan was to start from age 6, the students who attended pre-school, and to gradually increase the age of participants, while holding the number of female and male participants the same. However, due to the complex exam schedule there were times where I had to skip an age group and come back again. However, the biggest conundrum was the school's "safety regulations". To overcome the problem I had to ask for a written permit from the parents saying that they allowed their children to partake in the experiment.

# Data Collection

The following data values were collected:

(It should be noted that a single age and gender group's data values are displayed ,for demonstrational purposes, because demonstration of all 360 data values takes over more than 20 pages)

Table 2.A

| | 17 YEAR OLD MALES | | | | | | |
|---|---|---|---|---|---|---|---|
| STUDENTS | ROSE(R) | COCOA(C) | MINT(M) | BANANA(B) | LEMON(L) | MEMORY | OOS (/5) |
| S1 | 0 | 1 | 1 | 1 | 1 | C,M,B,L | 4 |
| S2 | 0 | 0 | 1 | 0 | 0 | M | 1 |
| S3 | 1 | 1 | 1 | 0 | 1 | R,M,L | 4 |
| S4 | 1 | 0 | 1 | 0 | 1 | R,M,L | 3 |
| S5 | 1 | 1 | 1 | 1 | 1 | ALL | 5 |
| S6 | 0 | 0 | 1 | 0 | 1 | M | 2 |
| S7 | 0 | 0 | 1 | 0 | 0 | M | 1 |
| S8 | 0 | 1 | 1 | 1 | 1 | C,M,B,L | 4 |
| S9 | 1 | 0 | 1 | 1 | 1 | R,M,L | 4 |
| S10 | 0 | 1 | 1 | 1 | 0 | C,M,B | 3 |
| S11 | 1 | 0 | 1 | 1 | 1 | R,M,B,L | 4 |
| S12 | 1 | 0 | 1 | 0 | 1 | R,M,L | 3 |
| S13 | 1 | 0 | 1 | 1 | 1 | R,M,B,L | 4 |
| S14 | 1 | 1 | 1 | 0 | 1 | R,C,M,L | 4 |
| S15 | 1 | 0 | 1 | 0 | 1 | R,M,L | 3 |

Table 2.A: "The Overall Olfaction Score" (OOS) values of 17 year old male participants.

For each odor the participant identified, he/she would get one point, the highest score being a perfect five. The same system was used for color identification. However, for the memory variable a percentage system was used. (See "Table 2.B")

For the calculation of the percentages a simple proportion system was used:

$$\frac{nx100}{a}$$

where "a" was the number of odors/colors that were correctly identified by the participant, and "n" was the number of odors/colors that the participant had remembered.

For example if the participant had identified five colors, which was the case in the experiment, and remembered only four they would get :

$$\frac{4x100}{5} = 80$$

80 percent (80%)

Table 2.B:

| | 17 YEAR OLD MALES | |
|---|---|---|
| | OOMP | OCMP |
| S1 | 100 | 100 |
| S2 | 100 | 100 |
| S3 | 100 | 100 |
| S4 | 100 | 100 |
| S5 | 100 | 100 |
| S6 | 50 | 100 |
| S7 | 100 | 100 |
| S8 | 100 | 100 |
| S9 | 75 | 100 |
| S10 | 100 | 100 |
| S11 | 100 | 100 |
| S12 | 100 | 100 |
| S13 | 100 | 100 |
| S14 | 100 | 100 |
| S15 | 100 | 100 |

Table 2.B: The "Overall  Olfaction Memory Percentage" (OOMP) and "Overall Color Memory Percentage" (OCMP) values of 17 year old males.

After an age group's data was fully recorded, the average of odorant and color scores were taken. The same average was taken for the memory percentages as well.

# Data Analysis

The averages (arithmetical means) were calculated using the formula:

$$A := \frac{1}{n}\sum_{i=1}^{n} a_i$$

Where "A" represents the mathematical mean

"n" represents the number of data values

and "$a_i$"" represents the initial value

Each average value determined the "overall score" and "overall percentage" values (e.g: "Overall Olfaction Score", "Overall Color Score", "Overall Olfaction Memory Percentage (%)" and "Overall Color Memory Percentage(%)").

Table 3.A:

| MALES | | | | |
|---|---|---|---|---|
| AGE | OOS | OOMP | OCS | OCMP |
| 6 | 1,1 | 53 | 5 | 60 |
| 7 | 1,2 | 63 | 5 | 60 |
| 8 | 1,4 | 76 | 5 | 72 |
| 9 | 1,6 | 80 | 5 | 78 |
| 10 | 1,6 | 76 | 5 | 81 |
| 11 | 1,7 | 78 | 5 | 80 |
| 12 | 2,2 | 75 | 5 | 88 |
| 13 | 2,5 | 79 | 5 | 92 |
| 14 | 2 | 78 | 5 | 96 |
| 15 | 2,4 | 92 | 5 | 98 |
| 16 | 2,4 | 86 | 5 | 98 |
| 17 | 3,26 | 95 | 5 | 100 |

Table 3.A: The mean values of male participants' "OOS", "OOMP", "OCS", "OCMP" values

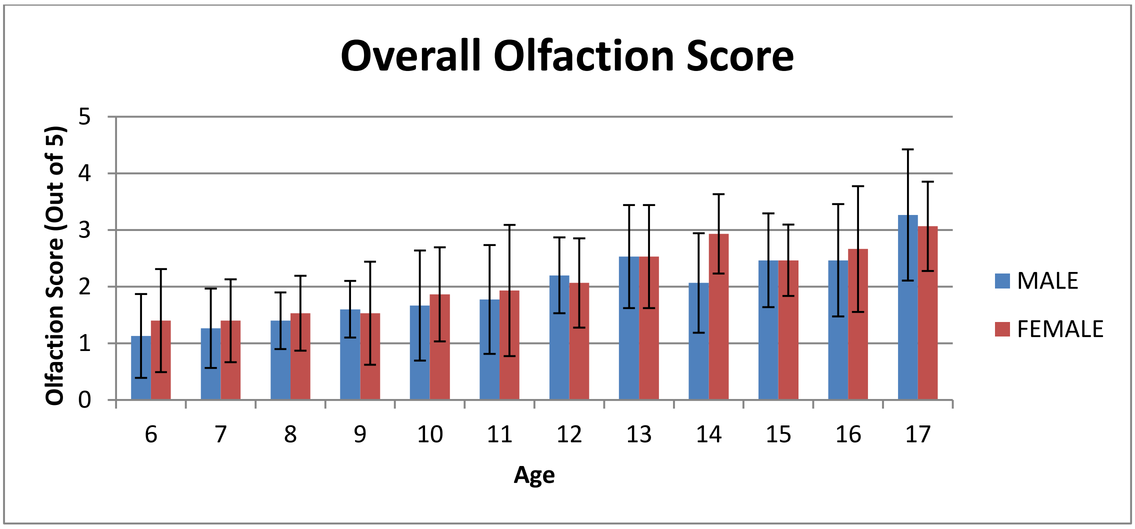
Table 3.B:

| FEMALE | | | | |
|---|---|---|---|---|
| AGE | OOS | OOMP | OCS | OCMP |
| 6 | 1,4 | 64 | 5 | 77 |
| 7 | 1,4 | 74 | 5 | 77 |
| 8 | 1,5 | 77 | 5 | 75 |
| 9 | 1,5 | 85 | 5 | 80 |
| 10 | 1,8 | 75 | 5 | 82 |
| 11 | 1,9 | 54 | 5 | 81 |
| 12 | 2 | 74 | 5 | 90 |
| 13 | 2,5 | 89 | 5 | 93 |
| 14 | 2,9 | 92 | 5 | 96 |
| 15 | 2,4 | 82 | 5 | 97 |
| 16 | 2,6 | 83 | 5 | 98 |
| 17 | 3 | 85 | 5 | 100 |

Table 3.B: The mean values of female participants' "OOS", "OOMP", "OCS", "OCMP" values

After the averages were calculated, the calculated average values were used to create the following bar graphics.

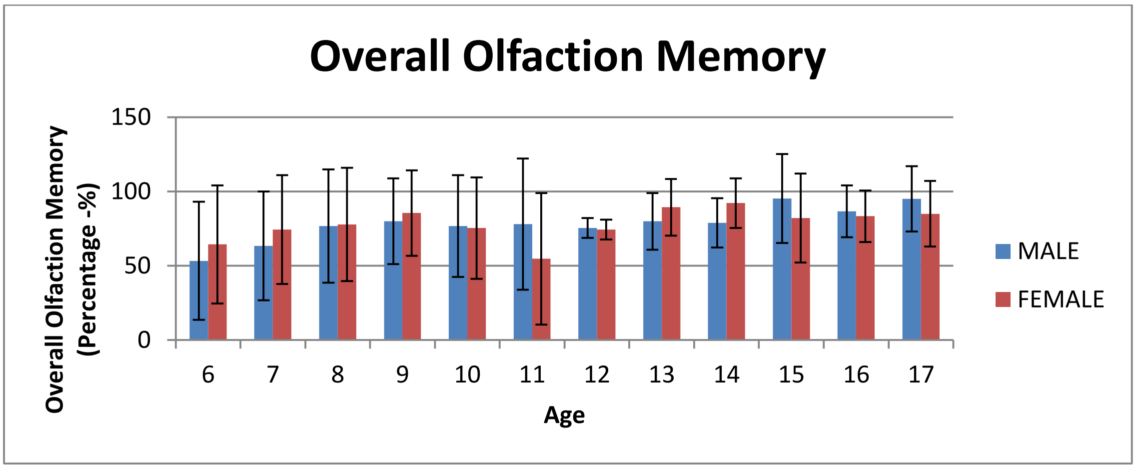
Graph 1.A:




Graph 1.A: The overall olfaction score (Out of 5) of participants who are of increasing age and different gender groups.

When "Graph 1.A" is observed it can clearly be seen that the overall olfaction score (although there are some exceptions such as the 14 year old male participants) increases gradually by age. One can also observe that female participants were more successful at identifying colors.

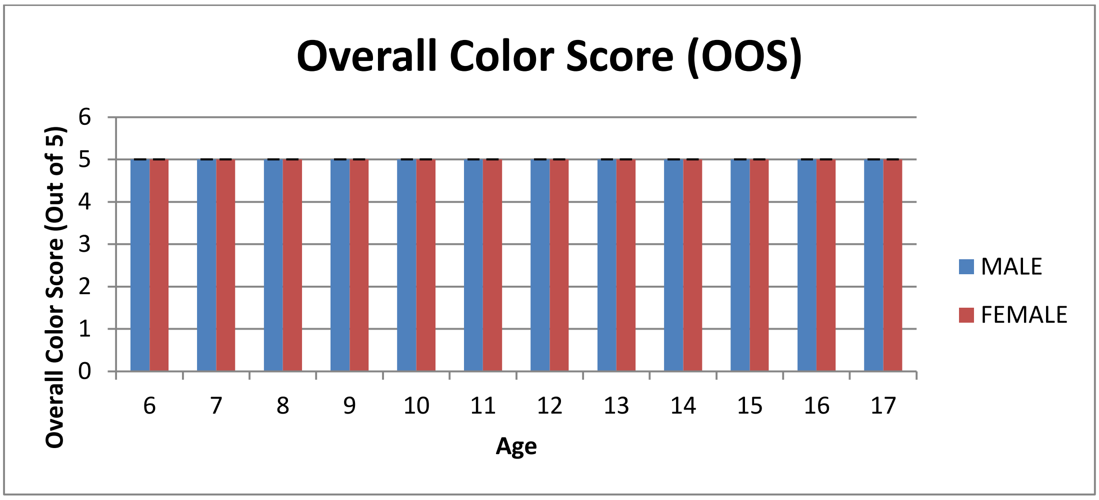
Graph 1.B:




Graph 1.B: The overall olfaction memories (%) of participants who are of increasing age and different gender groups.

When "Graph 1.B" is observed it can be seen that overall olfaction memory generally increases with age, with, again, some exceptions such as 11 year-old female participants. Although female participants surpassed male participants of same age, 6 times, whereas male participants only surpassed female participants of same age, only 5 times. Therefore with only a slight dominance one can say that females were more successful, short-term memory-wise, at memorizing odorants.

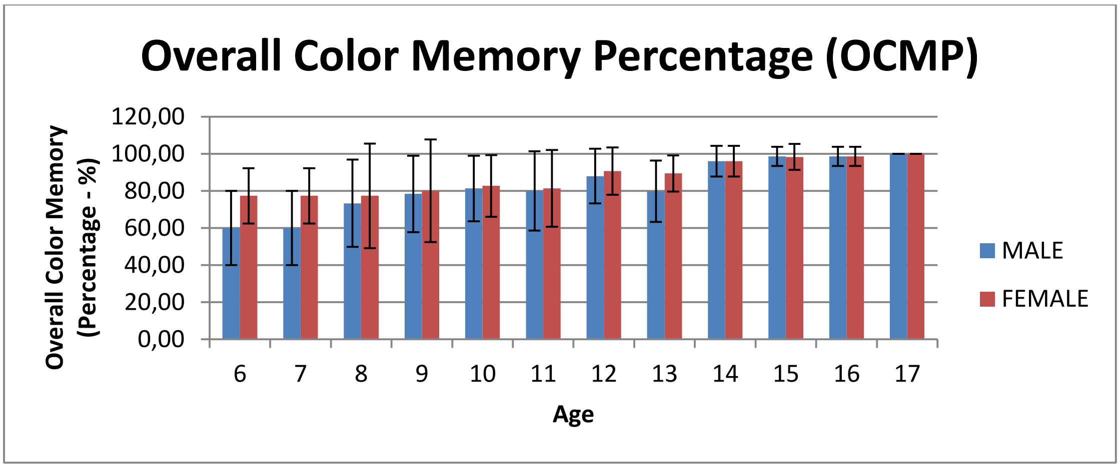
Graph 1.C:




Graph 1.C: The overall color score (Out of 5) of participants who are of increasing age and different gender groups.

When "Graph 1.C" is observed it can be seen that, quite presumably, every participant in the test could identify the colors of the given color cards. In other words age or gender has no effect on visual identification.

Graph 1.D:




Graph 1.D: The overall color memory of participants who are of increasing age and different gender groups.

One can easily observe that the overall color memory (%) of participants increases with age. The graph also indicates that female participants are more dominant in memorizing colors than male participants.

The error bars on the bar graphs were set by every particular gender and/or age group's standard deviation. Standard deviation values were calculated by the formula:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} a_i^2}{n-1} - \frac{n}{n-1}\left(\frac{\sum_{i=1}^{n} a_i}{n}\right)^2}.$$

Where "$a_i$" represents the initial value

"n" represents the number of values

and " σ" represents the standard deviation

Although it can be clearly seen that the "overall olfaction score" and "overall olfaction memory" generally improve by age, for further correlation analysis, a statistical computer programme called "SPSS" was used o calculate the "Pearson Correlation Coefficient", a coefficient that is described as "a measure of the correlation (linear dependence) between two variables *X* and *Y*, giving a value between +1 and −1 inclusive. It is widely used in the sciences as a measure of the strength of linear dependence between two variables"[10]

The "Pearson Correlation Coefficient" was calculated by the formula :

$$\rho_{X,Y} = \frac{\mathrm{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y}$$

Table 4.A:

**Pearson Correlation Coefficients**

| | | Age | Overall Olfaction Score | Overall Olfaction Memory | Overall Color Score | Overall Color Memory |
|---|---|---|---|---|---|---|
| Age | Pearson Correlation | 1 | **,550(**)** | **,219(**)** | **.(a)** | **,553(**)** |
| | Sig. (2-tailed) | . | ,000 | ,000 | . | ,000 |
| | N (# of participants) | 360 | 360 | 360 | 360 | 360 |
| Overall Olfaction Score | Pearson Correlation | **,550(**)** | 1 | ,208(**) | .(a) | ,357(**) |
| | Sig. (2-tailed) | ,000 | . | ,000 | . | ,000 |
| | N (# of participants) | 360 | 360 | 360 | 360 | 360 |
| Overall Olfaction Memory | Pearson Correlation | **,219(**)** | ,208(**) | 1 | .(a) | ,189(**) |
| | Sig. (2-tailed) | ,000 | ,000 | . | . | ,000 |
| | N (# of participants) | 360 | 360 | 360 | 360 | 360 |
| Overall Color Score | Pearson Correlation | **.(a)** | **.(a)** | **.(a)** | **.(a)** | **.(a)** |
| | Sig. (2-tailed) | . | . | . | . | . |
| | N (# of participants) | 360 | 360 | 360 | 360 | 360 |
| Overall Color Memory | Pearson Correlation | **,553(**)** | ,357(**) | ,189(**) | .(a) | 1 |
| | Sig. (2-tailed) | ,000 | ,000 | ,000 | . | . |
| | N (# of participants) | 360 | 360 | 360 | 360 | 360 |

Table 4.A: Pearson Correlation Coeeficient values of "Age vs. All Four Parametres"
** Correlation is significant at the 0.01 level (2-tailed).
**a Cannot be computed because at least one of the variables is constant.**

The coefficient explanations are shown in" Table 4.B"

Table 4.B:

| Correlation | Negative | Positive |
|---|---|---|
| None | −0.09 to 0.0 | 0.0 to 0.09 |
| Small | −0.3 to −0.1 | 0.1 to 0.3 |
| Medium | −0.5 to −0.3 | 0.3 to 0.5 |
| Strong | −1.0 to −0.5 | 0.5 to 1.0 |

Table 4.B: Table showing correlation levels of different "Pearson Correlation Coefficients"

If we are to evaluate the Pearson Correlation tables ("Table 4.A" - "Table 4.B")

we could do so by stating and accepting/rejecting the hypotheses and the null hypotheses:

H: There is a positive correlation between olfactory identification and age of male participants. **(Accepted) ($R^2$=0,550)**

Ho: There is no correlation between olfactory identification and age of male participants. **(Rejected)**

H: There is a positive correlation between olfactory identification and age of female participants. **(Accepted) ($R^2$=0,550)**

Ho: There is no correlation between olfactory identification and age of female participants. **(Rejected)**

H: There is a positive correlation between olfactory memory and age of male participants. **(Accepted) ($R^2$=0,219)**

Ho: There is no correlation between olfactory memory and male participants. **(Rejected)**

H: There is a positive correlation between olfactory memory and age of female participants.**(Accepted) ($R^2$=0,219)**

Ho: There is no correlation between olfactory memory and female participants.**(Rejected)**

H: There is a positive correlation between visual identification and age of male participants. **(Rejected) ($R^2$=NA)**

Ho: There is no correlation between visual identification and age of male participants. **(Accepted)**

H: There is a positive correlation between visual identification and age of female participants. **(Rejected) ($R^2$=NA)**

Ho: There is no correlation between visual identification and age of female participants. **(Accepted)**

H: There is a positive correlation between visual memory and age of male participants. **(Accepted) ($R^2$=0,553)**

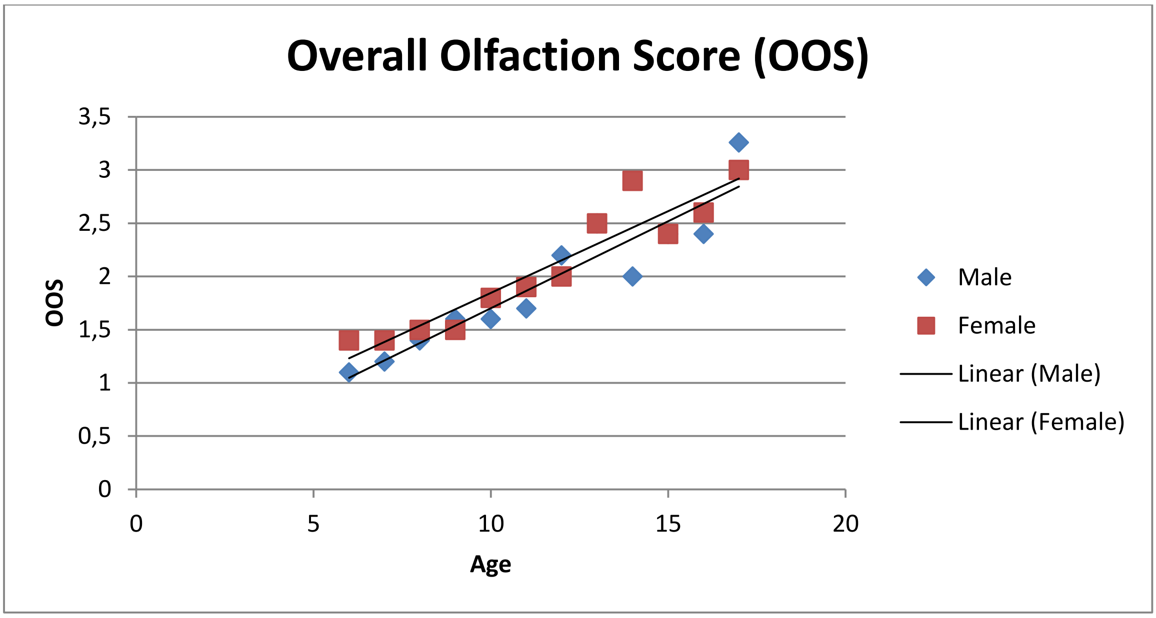
Ho: There is no correlation between visual memory and age of male participants. **(Rejected)**

H: There is a positive correlation between visual memory and age of female participants. **(Accepted) ($R^2$=0,553)**

Ho: There is no correlation between visual memory and age of female participants. **(Rejected)**

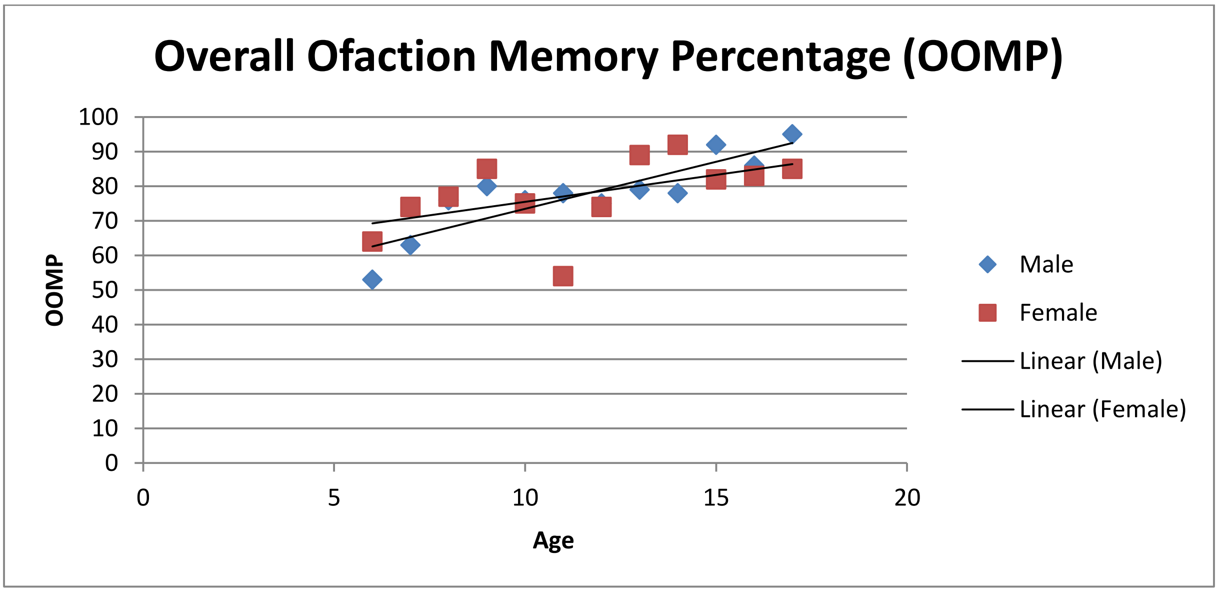
Although the indicated values provide plentiful information about the correlations, one should graph a "scatter plot" to observe the correlation.

Graph 2.A:



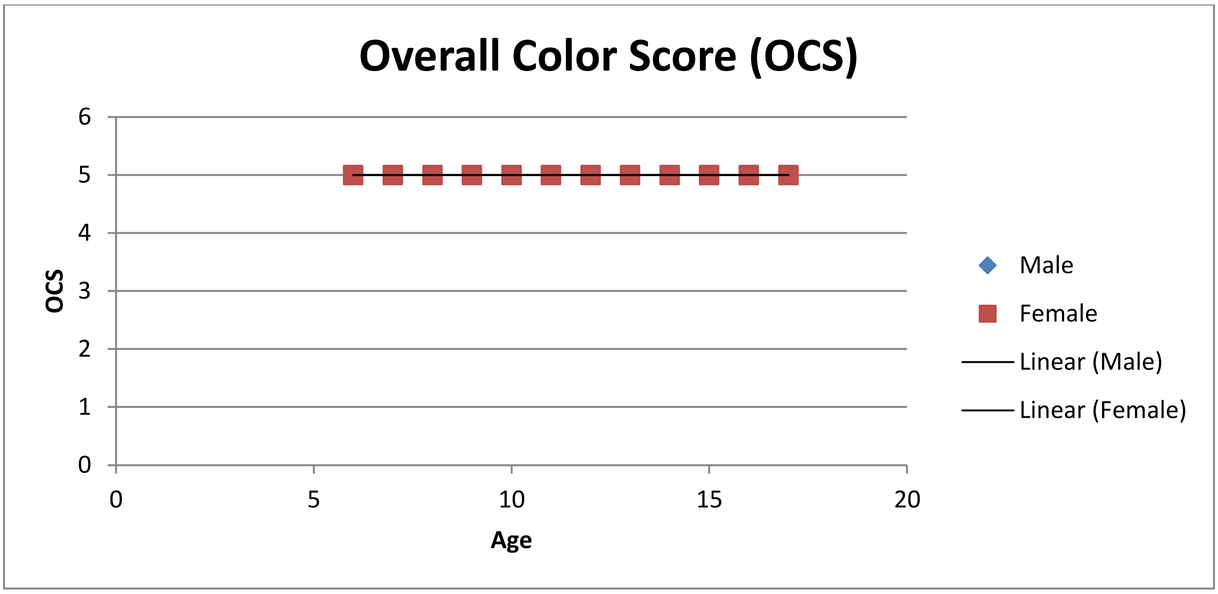

Graph 2.A: The scatter plot graph of male and female participants' OOS

Graph 2.B:



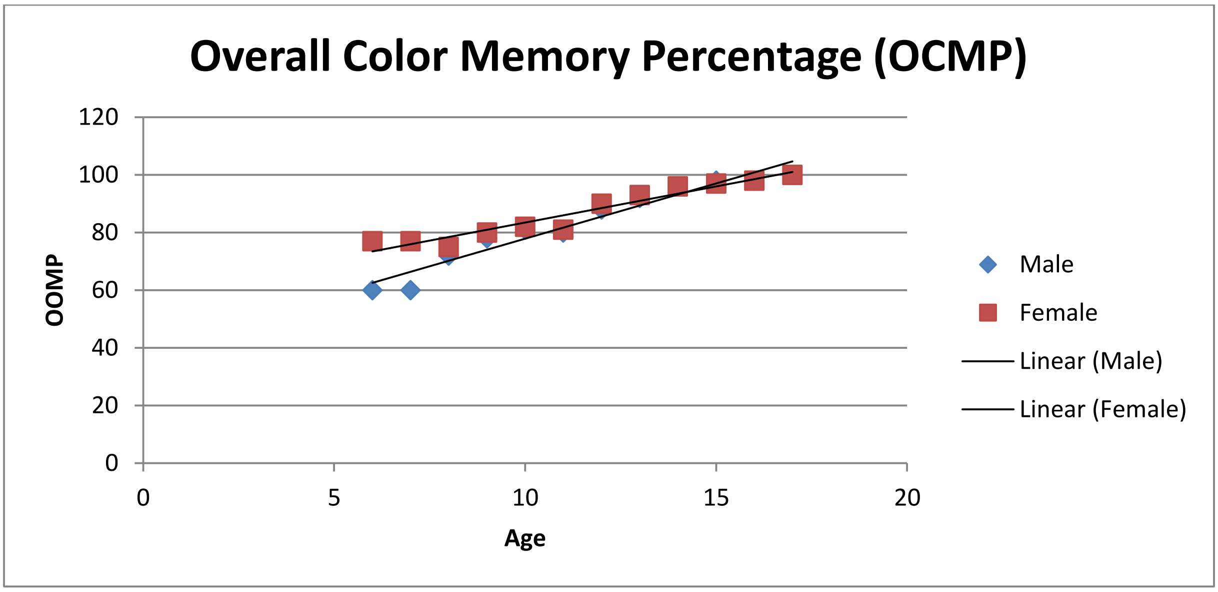

Graph 2.B: The scatter plot graph of male and female participants' OOMP

Graph 2.C:




Graph 2.C: The scatter plot graph of male and female participants' OCS

Graph 2.D:




Graph 2.D: The scatter plot graph of male and female participants' OOMP

## Conclusion and Evaluation

At the beginning of the experiment, 180 male and 180 female, summing at a total of 360 students were chosen.  15 students for each gender group at each age group were selected. This made each age group consist of 30 students, 15 male , 15 female.

Each participant was given five different odors and five different colors to identify, on at a time. Then, after a short pause they were asked which odors and colors they remembered. The participants did not have to match the color with the odor.

After the data was recorded, the groups' overall scores were calculated (mean values), and according to these values, graphs were plotted.

After the mean data values were discussed, "Pearson Correlation Test" was conducted for further statistical interpretation. And for further analysis of the Pearson Correlation Test's results, scatter plots were plotted. My aim at conducting this research was to find out if there was any correlation between age, gender and identification and memory of odors.

After the data analysis when the correlation values in "Table 4.B" were observed, it was seen that there was:

- a strong positive correlation between age and "Overall Olfaction Score" (OOS) in males
- a strong positive correlation between age and  OOS in females
- a strong positive correlation between age and "Overall Olfaction Memory Percentage" (OOMP) in males
- a strong positive correlation between age OOMP in females
- no correlation between age and "Overall Color Score" (OCS) in males
- no correlation between age and OCS in females
- a strong positive correlation between age and "Overall Color Memory Percentage" (OCMP) in males
- a strong positive correlation between age and OCMP in females.

Further elaboration on the data can also be done. For example, the discussion of the graphs can be a useful insight on the experiment.

If one observes Graphs "1.A-1.D" they would see that in OOS and OOMP females are generally in front of male participants. However in the data interpretation it was said that both groups had a strong positive correlation for these variables.

Although it is true that both groups have a strong positive correlation, it should be noted that there is a greater development in male participants in OOS and OOMP.

Hence all the graphs except "Graph 2.C" show a positive trend line one would be safe to assume that the statements that are below "Table 4.B" are correct. However different trend line patterns should also be analyzed for further statistical interpretation.

When the graphs(Graph 2.A- 2.B) are observed one would notice that only one graph non-coincidental trend lines, two have coincidental trend lines and, one graph has congruent lines. The pattern and the gradient of the trend lines can have different interpretations.

If "Graph 2.A" is observed, one can see that the trend lines are non-coincidental It was already established that "age" and "OOS" had a positive correlation. However hence female participants scored higher in "OOS", their trend-line is seen above the male participants'.

If "Graph 2.B" and "Graph 2.C" are observed it can be seen that the trend lines are coincidental. However in "Graph 2.C" the lines are fully overlapping which indicates how everyone could identify the given colors but in "Graph 2.B" it can also be seen that male participants' trend lines show a greater gradient. Hence the positive correlation between "age" and "OOMP" and "OCS" was already stated, it would be safe to assume that the gradient difference is caused by, the male participants' greater development in these areas as their age increased.

And finally the trend lines on "Graph 2.D" are congruent, this indicates that there is no correlation between "age"/"gender" and "OCS". This statement also matches with the earlier one below "Table 4.B".

I was able to follow the method quite easily and thus the data collection was quite facilitated. However, if one observes "Graph 1.A" or " Graph 1.B" they can see that the graphs have really high error bars and hence the errors bars represent the standard deviation values, as was stated in "Data Analysis" one could therefore say that the experiments reliability is not really that great. And although the experiment scale was quite large, a greater sample could provide less deviation ( I would assume 30, instead 15 students would yield in a smaller standard deviation value).

I can also say that there were quite a lot of "outliers": students who scored well above or really below average and caused a big spreading of the data which in turn, caused such great standard deviation values (for example "S5" and "S2" in "Table 2.A". Omitting such values would definitely decrease the standard deviation but would also hamper the scale the of the experiment.

**After the statistical interpretation of the data analysis I can say that my hypothesis: "Odor identification and memory and visual memory would improve with age and females would be dominant in olfactory memory and identification and visual memory over males while there would be o effect of age or gender on color identification." is supported.**

I can say that this is essentially true hence females had a higher score in those fields but I believe that the highlight of the experiment is the extrapolation of the increase in male participants' scores.

I also believe that the method was executed really well. I was able to keep the pause time a constant and the data recording part was executed with accuracy and few alternatives to the original method: A different pause time can be kept as a constant, to observe the potency of one's short term visual and olfactory memory.

I should also note that the experiment had some very intriguing parts:

My first intriguing phenomenon occurred during experimenting with 6 and 7 year-old groups. When I asked them to identify odorants they would often answer with phrases like "chocolate cake" instead of "cocoa" or "mint-flavored gum" ( the most popular of alternative answers by the way) instead of "mint". I thought this was pretty enthralling because I would have never guessed that there would be alternative answers. Of course, as stated in "Method & Development" they were awarded points. I should also note that there were no alternatives of banana and rose.

I believe that this was mainly caused by how there is no "formal education of odors" and we learn them through real-life experiences.

The second realization came when I was observing the analysis results. The "SPSS" programme provides the user with a lot of different correlations, one of which was "age vs. every individual odorant" (see "Appendix-A" for the table). Upon observing this table I noticed the data value of "cocoa vs. age" which was less than other odorants'. My first thought was that this was a simple exception but after some contemplation I realized that this value was less because cocoa was a fragrance that was learned/recognized in a relatively early stage of human life and it was identified more frequently with respect to other odors in all age groups and therefore had a lower correlation coefficient.

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