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# Can you sense attraction?

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A study of the recognition of voices and personal  
odours with physical attraction as a factor in  
human-beings

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## Abstract

An emotional response usually follows hearing the voice or smelling the odour of a romantic partner. This study attempts to illuminate some of the importance of, as well as the differences between, these reactions by observing how the brain remembers and recognizes the personal smell and voice respectively of an individual with physical attraction as a factor. Peripheral and central pathways of olfactory and auditory input are described as well as the functional aspects of perception in these senses; specifically how input is stored in memory and later recognized. The neurology of memory and attraction are discussed in relation to olfaction and audition. An experiment was carried out on a total of 6 individuals in order to indicate whether the voice or the smell of an individual to whom one is physically attracted is recognized faster, as well as help to indicate other relevant information, such as which variables affect the speed of recognition and whether physical attraction enables, inhibits or has no effect on recognition.

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## Introduction

The purpose of this endeavor is to illuminate the connections between attraction, recognition of an individual and the processing of olfaction and audition sensory input. Through researching these functions separately, as well as attempting to find and analyze the links, several questions can be answered, of which the most valued ones are how we memorize and later recognize an individual's smell/voice, and whether there is a difference in the storing and recalling of memory dependant on whether or not we find them attractive, as well as whether the smell or the voice of an attractive individual is easier to recognize than those of a neutral individual. An experiment has been devised with the main purpose of indicating whether a human recognizes the smell or the voice of an individual they are attracted to fastest.

## Materials and methods

An experiment was carried out which featured two parts. Three couples, each consisting of a male and a female individual, took part in each round of the experiment. In the first part each person stands, one at a time, facing in the opposite direction to three individuals of the opposing sex, at a distance of approximately three metres. The individual being tested hears each person say "hej" in a neutral tone of voice, in an order unknown to them. The time is measured from the moment the word "hej" is pronounced to the moment the person being tested indicates on a sheet of paper in front of them that the voice is "right", meaning that it belongs to their partner, or "wrong" meaning it does not (appendix C). In the second part each individual removes their jumper, cardigan or similar. When tested they keep their eyes firmly closed throughout and are presented with one sweater at a time. In between, they must themselves pinch their nose with one hand in order to avoid being gradually introduced to the odour. The time is measured from when the individual removes their hand and breathes in deeply through their nose. At no point must they touch the fabric before them with any other part of them than the tip of their nose, which is likely to graze it accidentally as they attempt to detect the smell, but should not have lingering contact (appendix A).

The experiment was preceded by the filling out of a questionnaire. The male volunteers filled out one questionnaire and the females another (appendix D, appendix E). A stopwatch, two sheets of paper, one with numbers and one with words (appendix B, appendix C), six human volunteers at a time and an assistant were used.

## Development

### Olfaction

Olfactory sensory input passes from the olfactory cells in the nose directly to the olfactory bulb which is the only part of the brain with nervendings that have direct contact with the outside world<sup>1</sup>. From there the signals are sent various different ways. One of pathways passes through the entorhinal cortex to the hippocampus; another from the piriform cortex to the orbitofrontal neocortical area of the olfactory cortex, often via the thalamus<sup>2</sup>. Research has shown that the thalamus to orbitofrontal pathway is necessary for discriminating odours<sup>3</sup> while the hippocampus is essential to memory formation<sup>4</sup>. One pathway leads directly from the olfactory bulb to the amygdala; this is believed to enable for a connection to be made between an emotion and an odour so that the next time the individual is exposed to that odour, that will react emotionally before they can consciously analyze the sensory input<sup>5</sup>.

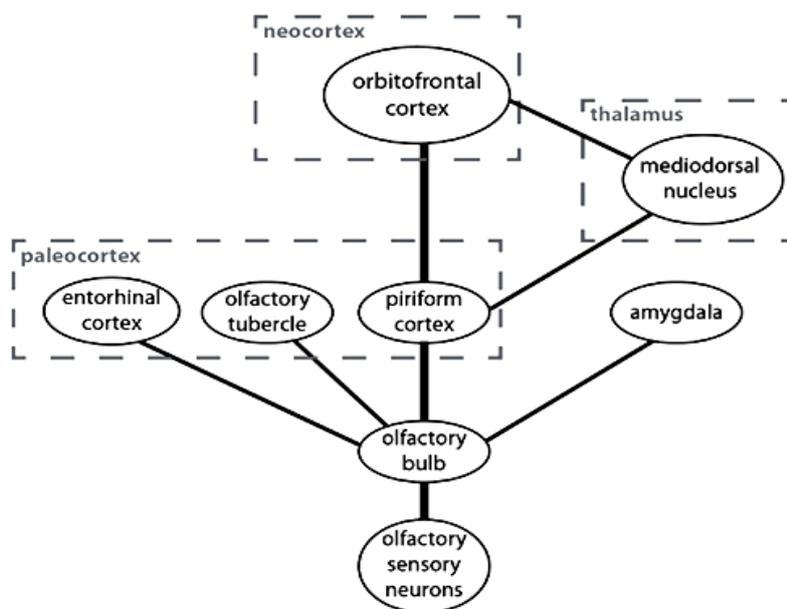


Figure 1: Olfactory pathways through the brain<sup>6</sup>. (Modified).

There is another pathway for olfaction sensory input passing into the brain. This pathway is via the vomeronasal organ<sup>7</sup>. This organ is located in the nasal septum and sends

<sup>1</sup> Atkinson ad. al., 1990, p. 144

<sup>2</sup> Rouby, 2002, p. 335

<sup>3</sup> Møller, 2003, p. 441

<sup>4</sup> Squire ad. al., 1990

<sup>5</sup> Brodal, 1998, p. 565

<sup>6</sup> [www.frontiersin.org/consciousness\\_research/10.3389/fpsyg.2011.00380/full](http://www.frontiersin.org/consciousness_research/10.3389/fpsyg.2011.00380/full)

<sup>7</sup> Watson, 1999, p. 8

sensory input through the accessory olfactory bulb to the amygdala, sending it finally to the hypothalamus. This input never reaches the olfactory cortex or the frontal lobe, and is therefore beyond the grasp of consciousness<sup>8</sup>. The vomeronasal organ responds to air-borne molecules such as pheromones and often to molecules that are odourless. The definition of a pheromone is disputed but it could be stated to mean an odour signal produced by one individual and received by another which invokes a specific reaction. Pheromones do not have to be species-specific and studies have shown that female humans react to pheromones<sup>9</sup>. The vomeronasal organ can relay information about another individual as widely encompassing as sex, fertility, hormonal status, blood relations and more<sup>10</sup>.

On the epithelium in the nose, volatile molecules are detected and an electric signal is produced, which passes through the neurons to the olfactory bulbs. The cells of the olfactory epithelium differentiate between an estimated 10 000 individual molecules<sup>11</sup>, but the cortex, through a number of processes, translates the information into a single percept, such as “coffee” or “carrot”<sup>12</sup>. The cells of the epithelium are partially specialized and react to certain features of volatiles. When adaption occurs there will therefore be a reduced responsiveness to all molecules with that feature<sup>13</sup>. Studies show that different odours presented together will converge in time so that for example coffee and chocolate can come to be associated even when separated if they have been perceived together in the past<sup>14</sup>. Convergence of components into so-called odour-objects allow for an individual’s smell to be perceived as one single percept, despite its wide range of separate chemical combinations.

These combinations can be divided into two major groups: artificial and natural. Which artificial odours are present, as well as their chemical composition, would depend on the individual but may include deodorant, shampoo, perfume and other odorous chemicals, often related to personal hygiene. Clothes would of course also contain odours which depend upon fabric, exposure to environment, washing powder and other factors. Natural odours are exuded by the body and include sweat, secretions from sebaceous glands, secretions from apocrine glands and various volatiles which result from metabolism and other bodily

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<sup>8</sup> Møller, 2003, p. 441

<sup>9</sup> Watson, 1999, p 92

<sup>10</sup> Ibid., p. 43ff

<sup>11</sup> Wilson ad. al., p. 6

<sup>12</sup> Smith ad. al., p. 688

<sup>13</sup> Ibid., p. 702

<sup>14</sup> Wilson ad. al., p. 20

processes<sup>15</sup>. Human-beings are naturally more odorant than any other mammals<sup>16</sup>, but we make a great deal of effort to remove those smells and/or disguise them with artificial ones.

When repeatedly presented with the same or similar input, connections form in both the periphery and central olfactory processing line. This ability of the brain to form new connections in order to adapt to circumstances is known as plasticity. Synaptic plasticity allows cortical maps to be formed upon experience, resulting in familiar smells being easier to differentiate between and easier to recognize, even when the quality of the stimuli input is poor. This means that recognizing a familiar smell is a faster process than recognizing a foreign one<sup>17</sup>. Familiar odours are also easier to recognize and distinguish in a mixture, even when they are of poor quality or very similar to other odours<sup>18</sup>.

### **Audition**

Auditory sensory input passes from the ear to the inferior colliculus in the midbrain. From there the input typically passes through the thalamus to the primary auditory cortex<sup>19</sup>. The inferior colliculus is believed to receive input from the amygdala and other areas of the limbic system. An alternative pathway passes from the thalamus directly to the amygdala, without passing the cortex. This pathway may be the passage that enables us to react emotionally to a sound before consciously perceiving its meaning, similar to the case of olfaction<sup>20</sup>. Signals are sent downwards in the ascending pathways. Some of these signals reach the reticular formation, which can cause a “startle response” upon the hearing of a loud, sudden or otherwise disturbing sound<sup>21</sup>. It is possible that this occurs when the voice of an individual one finds attractive is heard at a distance, for instance in a crowd. It is unlikely however that this would happen in the controlled form of the experiment when the test persons are aware that they will hear their partners voice.

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<sup>15</sup> Watson, 1999, chap 4

<sup>16</sup> Ibid., p. 85

<sup>17</sup> Smith, 2008, ad. al., p 689

<sup>18</sup> Wilson, 2006, ad. al., p 6

<sup>19</sup> Møller, 2003, p. 306

<sup>20</sup> Ibid., p. 355

<sup>21</sup> Brodal, 1998, p. 294

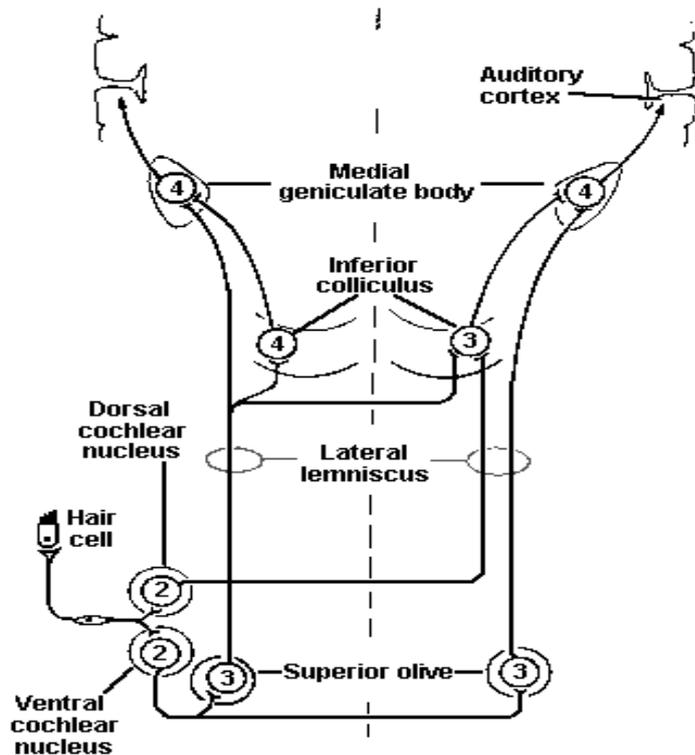


Figure 2: Auditory pathways through brain<sup>22</sup>.

Plasticity features in audition as well as olfaction<sup>23</sup>, although no over sense retains plasticity and neurodevelopment to the extent of olfaction throughout life<sup>24</sup>.

### Attraction

The “sexual brain” is complex and wide-spread. The limbic system plays an important part; in particular the hypothalamus<sup>25</sup>. Studies have shown that arousal of any kind is simply experienced as “general arousal” before the signals reach the cortex of the frontal lobe and the emotional state is identified as being for instance fear or attraction. This means that an increase in fear generally causes an increase in perceived attraction<sup>26</sup>

### Memory and recognition

Storage of memories takes place mostly in the limbic system, in particular the Hippocampus. It is plausible that the Hippocampus plays a part only in short-term memory storage

<sup>22</sup> [www.unmc.edu/physiology/Mann/mann8.html](http://www.unmc.edu/physiology/Mann/mann8.html)

<sup>23</sup> Møller, 2003, p. 356

<sup>24</sup> Turetsky ad. al., 2009

<sup>25</sup> LeVay, 1993, chap 5

<sup>26</sup> Atkinson ad. al., 1990, p. 718

however<sup>27</sup>. Experiences that stimulate arousal, if the arousal is coupled with the release of adrenaline and/or other stress hormones, are remembered in the amygdala. These memories are more acute and long-lasting than other memories<sup>28</sup>. Sexual arousal could reasonably trigger this form of memory storage. Studies on monkeys have shown that after lesions limited within reason to the amygdala leave them unable to grasp the meaning of an object, for instance whether or not it was associated with a reward. This strengthens the theory that the amygdala is vital in the pairing of emotion and sensory input during memory storage<sup>29</sup>.

### **Experimental data**

The experiment was designed to limit multisensory experience as much as possible, in order to isolate auditory and olfactory processing. In part one the availability of vision and somatic sensation were considered irrelevant as no input deriving from the individuals who were meant to be evaluated and recognized was made available to these senses during this part. In part two the same is considered of audition and somatosensation. In order to limit the effects of expectation, the majority of persons being tested had little or no knowledge of what plausible results would be based on research and/or previous experiment rounds. The word “hej”, meaning “hello” in Swedish, was adopted as it was taken to be a neutral word. As it is monosyllabic there is no room for differences in intonation. It was considered more emotionally neutral than for example a name or the word “no” which could evoke a negative response. It was also found preferable to a meaningless sound such as “hon” as that could both increase the chances of differences in pronunciation and stimulate the person being tested to analyze the meaning of the sound, hence involving other parts of the cerebral cortex instead of simply reacting to the voice, as the word “hej” being so familiar would reasonably require no cortical analysis.

All of the data below are the results of three rounds of experiments with a total of 6 partakers, of which 3 were male and 3 female.

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<sup>27</sup> Squire ad. al., 1990

<sup>28</sup> Squire, 2009

<sup>29</sup> Brodal, 1998, p. 565

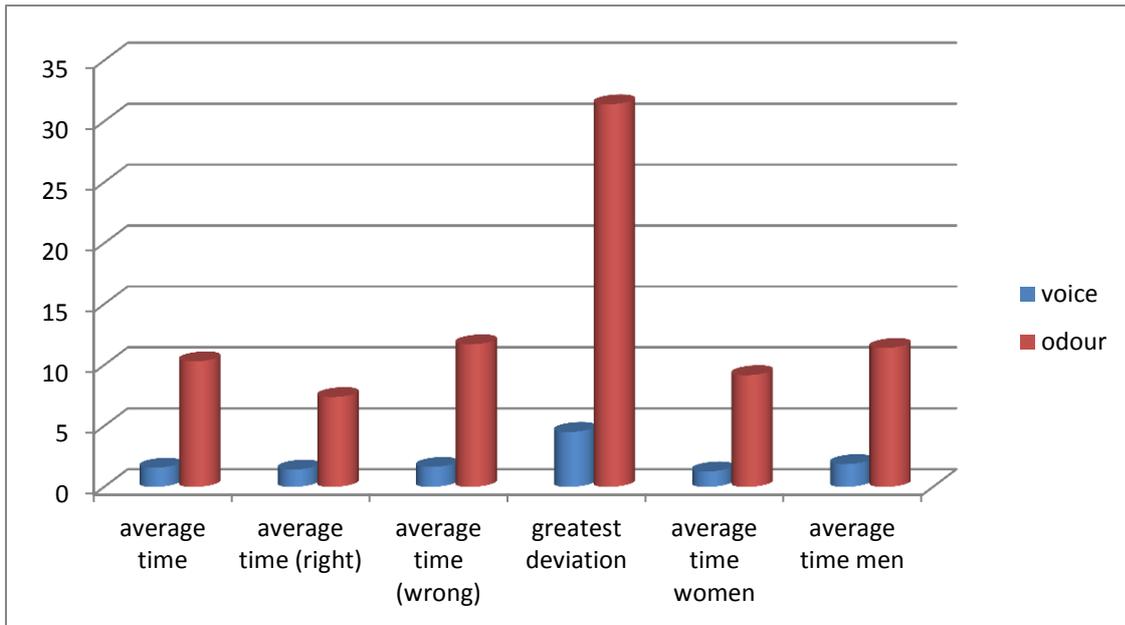


Figure 3: Average times in seconds. Right refers to the time it took to answer when the voice/odour belonged to their partner. Wrong refers to the time it took to answer when the voice/odour belonged to one of the other two individuals.

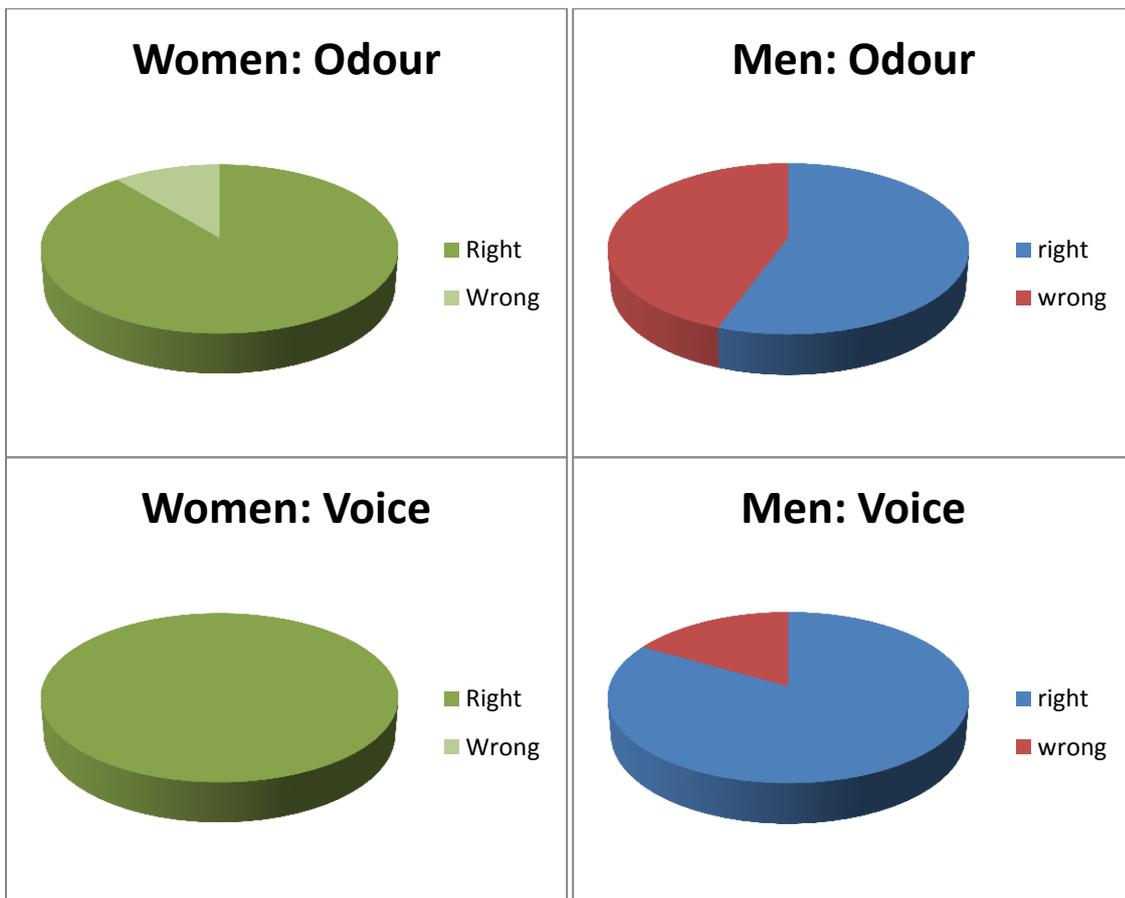


Figure 4: Percentages of right/wrong answers.

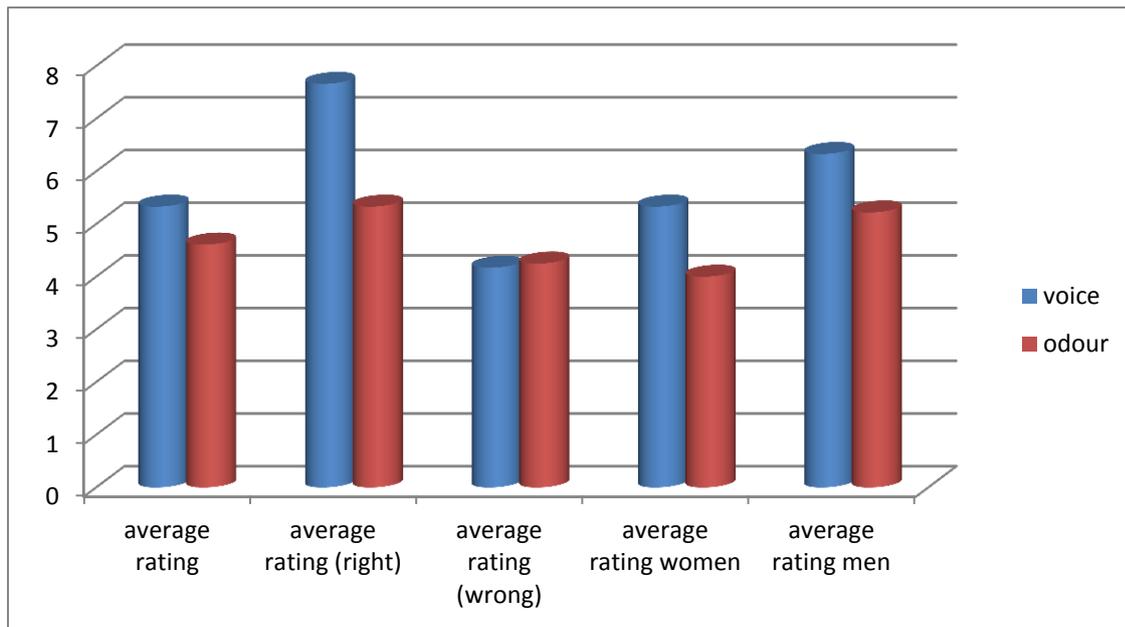


Figure 5: Average ratings of the strength of attraction, or a positive, physical reaction.

The results show a difference in the average time it took to identify the voice and the smell respectively. It also shows that the voice and odour of the partner were recognized faster and with greater accuracy than those who belonged to someone else, indicating that both the emotional arousal and the familiarity could play a role.

The questionnaires that were filled in previously to the experiment were intended to illuminate the relevance and effect of certain variables, for example what the test persons had eaten. As only 6 people answered, no conclusions could be drawn. The majority of the questions were related to possible changes in personal odours, caused by for instance use of a new shampoo or other factors known to affect how we smell<sup>30</sup>.

## Discussion

Audition and olfaction play very different roles in human interaction. Audition is a major social tool, holding great importance for humans, possibly due to the importance of communication through speech for our species. Through evolution audition, together with vision, has developed together with our intellect<sup>31</sup>. Audition's importance socially and the availability of input makes voice recognition a common way of differentiating between individuals. Olfaction is a more primal sense not used as often in social interaction. Its close connection with the limbic system, and its usual bypassing of the thalamus, or in the case of

<sup>30</sup> Wedekind ad. al., 1995

<sup>31</sup> Watson, 1999, p. 177

the vomeronasal organ a complete lack of filtering, make olfaction a sense that can awaken a great deal of emotion and arousal, as well as powerful memory recall. Through the vomeronasal organ humans can differentiate between other humans, and be affected by them, on a purely subconscious level. Through stimulation from the vomeronasal organ alone the hypothalamus can initiate sexual arousal. Judging by the information above it would be reasonable to suspect that olfactory input would cause a greater sense of attraction and emotional reaction, whereas audition would lead to a faster, conscious recognition of identity. The experiment shows that the physical reaction to odors on average was ranked lower than the reaction to voices, and that the discrepancy between the ranking of the partner and one of the two other subjects was smaller. This could be an indication that human evolution and society has led us so far away from a time when olfaction was a key part of relations, as it is with other mammals, that we now have little conscious control of it, or indeed use for it. This however, does not seem likely given the countless examples of how affected we are by olfaction. An alternative explanation is that we mask our smells so well that little of an individual's natural odour reached those who took part in the experiment. The results of the experiment could be misleading, as the statistical basis is so small.

It is feasible that one actually can recognize attraction through olfaction as this sense is proven to reawaken emotions and sensations felt when the stimuli was last encountered. Indeed, it is more feasible to recognize attraction through olfaction than an individual as odors are difficult for humans to define or assign logical shape or meaning. Audition has a link to the amygdala similar to that of olfaction, and should therefore also induce an emotional reaction, but as it is a "concrete" sense, that as stated on the previous page evolved together with our intellect, and can be analyzed thoroughly and put into words, it could reasonably be more suited to recognizing identity rather than an abstract emotion or experience such as attraction.

The experimental data showed a difference in the speed of recognition between women and men. There could be several reasons for this which could include something as simple as women paying more attention, or placing more weight in the voice and smell of their partner. A study has shown however that the areas of the brain that are activated by sound recognition are significantly larger in woman than in men: perhaps the difference does have a neurological explanation<sup>32</sup>.

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<sup>32</sup> Rouby, 2002, p. 335

There are several sources of error in the experiment. Many of these were covered by the questionnaires and are discussed on page 11. Taken in chronological order the most apparent remaining ones are:

- The test persons come into contact with each other before the experiment starts and are therefore exposed to their respective voices and smells, forming a link between them and the situation, previous experience, emotions and other factors. Some of the individuals being tested were acquainted across relationship barriers before the experiment and therefore had more or less extensive knowledge of each other's odours and voices even previous to the time of testing. As it is easier to discriminate between sensory inputs when you are familiar with what you are sensing, this could change the speed of recognition.
- The timing of reaction speed is dependent upon both the experiment-leader's ability to start and stop the stop watch as instantly as possible, and the subject's ability to indicate on the sheet of paper whether the voice was "right" or "wrong" as soon as they perceive it to be so.
- It is possible that the entire experiment situation be experienced by the subject as stressful, which could affect the results in various ways which are difficult to discern.
- The rating of the strength of the physical reaction is dependent on the interpretation of the subject being tested of the phrasing. One person could for instance rate sexual arousal and another simply a sense of "pleasantness". As the importance is the relative strength of the emotional or physical reaction stimulated by the different inputs however, this may not be relevant.
- The item of clothing presented to the subject to smell is a cardigan, jumper or similar and has therefore not come into direct contact with a very large part of the owner's skin. The items were worn by the owners for varying amounts of time and therefore would have varying intensities in smell.

## Conclusion

One reasonable conclusion which could be drawn from this research is that the voice of an individual is recognized faster than the smell when they are perceived by a second individual with physical attraction as a factor. Another reasonable conclusion is that the attraction is likely to increase the speed of reaction as it both evokes an emotional response at the time of exposure and would have caused the data regarding the voice/smell of the object of attraction to be stored in memory as having emotional importance, possibly with the involvement of the amygdala, making the recall of the memory both more intense and more

effective. It would appear that women recognize voices and smells with greater accuracy and speed than men, although further investigation would be necessary. The statistical basis of the study is too narrow for much else to be discerned.

It is suggested that further rounds of the experiment described in this study be carried out, as well new studies to analyze the difference in recognition speed when the test subjects have other relationships than physical ones, for instance mother-child, colleague-colleague or friend-friend relationships. Based on the findings of this research personal odours should be easier to discriminate between in mother-child relationships than for instance friend-friend relationships, as a blood relation is detected by the vomeronasal organ and also because smell is more strongly associated with emotional attachment and memories from for example childhood than sound, whereas there may prove to be a smaller discrepancy in audition reaction times.

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# Can you sense attraction?

## Överenskommelse om sekretess och experimentets format – grupp 1

Du har anmält dig för att delta i ett experiment vars syfte är att samla in experimentell data till mitt (Lottie Phillips) projektarbete. Experimentet består av två delar.

### Del 1: Röst

Du får ställa dig vänd mot en vägg med ryggen vänd mot tre personer av motsats kön som alla står på lika långt avstånd ifrån dig. De är vända mot väggen mittemot. Du får höra en röst i taget. När en person talar startar jag ett tidtagarur som stoppas när du pekar på en ruta på pappret som jag håller framför dig, inom räckhåll. Pappret har två rutor: i den ena står det ”rätt”, i den andra ”fel”. ”Rätt” anger att personen är din pojkvän/flickvän, och ”fel” att det är någon av de resterande två personerna. Du får sedan tid att peka på en av tio rutor på pappret jag då räcker fram. Där står en siffra mellan 1 och 10 i varje ruta i växande skala. Du ska ange på skalan hur fysiskt attraherad du känner dig av rösten (hur stark den positiva fysiska reaktionen är), där ett anger inte alls och tio att du upplever en mycket kraftig reaktion. Du kommer själv att stå och tala i tre omgångar. Du står i mitten av rummet tills personen som ska testas har ställt sig med ryggen mot. Då flyttar jag dig dit du ska stå. När min assistent, som är vänd mot dig, tittar dig i ögonen och sedan höjer handen ska du säga ”hej” i naturligt tonläge och utan känsla eller särskild betoning.

### Del 2: Lukt

Du får vara själv i ett rum med mig. Du kommer att behöva blunda under hela tiden. Jag kommer be dig att hålla ett grepp om näsan med ena handen så att du inte luktar på din omgivning. Jag kommer att hålla fram en tröja i taget. Varje tröja tillhör en av de tre personer vars röster du fick höra i del 1. När jag säger ”nu” ska du ta bort handen och andas in djupt genom näsan för att känna lukten av tröjan. När jag säger ”nu” startar jag tidtagaruren. Jag stannar tiden när ni säger ”rätt” eller ”fel” högt. Även i det här fallet anger ”rätt” att det är er pojkvän/flickvän, och ”fel” att det är någon annan. Sedan får du säga en siffra, mellan 1 och 10, högt, för att ange hur fysiskt attraherad du kände dig av lukten. Du kommer att få ta av dig tröjan när de av motsats kön ska testas, och ge den till mig, medan du väntar utanför rummet.

Du kommer strax fylla i ett formulär där du ska ange information om bl a din relation och dina vanor. Alla frågor är relevanta för den här undersökningen. Dina svar på de frågorna, samt om du anger rätt eller fel för olika röster/lukter, hur fort du svarar och vilken siffra du väljer på skalan för alla de röster/lukter du får höra/lukta, kommer ingen annan än jag ha tillgång till vid något tillfälle. Ditt namn kommer inte finnas med någonstans i min rapport.

- Jag är medveten om vad undersökningen går ut på och kommer att följa projektledarens (Lottie Phillips) instruktioner. Jag kommer reagera ärligt, direkt och intuitivt efter bästa förmåga på alla intryck jag får medan jag testas.

Signatur: \_\_\_\_\_

- Jag är medveten om att ingen annan än Lottie Phillips kommer ha tillgång till det data som samlas in innan och under undersökningen, samt att jag inte kommer kunna begära tillgång till vad jag själv eller någon annan svarade.

Signatur: \_\_\_\_\_

Appendix B

Rätt

Fel

Appendix C

1

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2

7

3

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## Appendix D

# Can you sense attraction?

## Formulär inför deltagande i experiment – manlig deltagare

Svara på frågorna nedan så ärligt och exakt som möjligt.

1. Hur länge har du varit i ett förhållande med din flickvän?

\_\_\_\_\_ månader.

2. När duschade du senast?

\_\_\_\_\_ timmar sedan.

3. Använde du nytt schampo/balsam eller en ny duschkräm när du duschade senast?

Ja:

Nej:

4. Har du en diagnos som innebär att du har nedsatt hörsel eller försämrat luktsinne?

Ja:

Nej:

5. Har du de senaste två dygnet gjort något av följande (kryssa för om ja):

- druckit alkohol
- tagit droger
- ätit kryddstark mat
- rökt cigaretter eller cigarrer
- använt en deodorant, raklödder eller liknande som du inte brukar
- tränat hårt och inte sedan dess duschat
- sovit ihop med någon annan än din pojkvän (inkluderar män, barn, etc.)

6. Har du under den senaste veckan varit tillfälligt sjuk, exempelvis haft en förkylning, eller varit magsjuk?

Ja:

Nej:

7. Är din tröja nyköpt och inte tvättad eller tvättad med tvättmedel som du inte brukar använda?

Ja:

Nej:

## Can you sense attraction?

### Formulär inför deltagande i experiment – kvinnlig deltagare

Svara på frågorna nedan så ärligt och exakt som möjligt.

8. Hur länge har du varit i ett förhållande med din pojkvän?

\_\_\_\_\_ månader.

9. När duschade du senast?

\_\_\_\_\_ timmar sedan.

10. Använde du nytt schampo/balsam eller en ny duschkräm när du duschade senast?

Ja:

Nej:

11. Har du en diagnos som innebär att du har nedsatt hörsel eller försämrat luktsinne?

Ja:

Nej:

12. Har du de senaste två dyggen gjort något av följande (kryssa för om ja):

- druckit alkohol
- tagit droger
- ätit kryddstark mat
- rökt cigaretter eller cigarrer
- använt en deodorant, parfym eller liknande som du inte brukar
- tränat hårt och inte sedan dess duschat
- sovit ihop med någon annan än din pojkvän (inkluderar kvinnor, barn, etc.)

13.Är du gravid?

Ja:

Nej:

14.Tar du p-piller?

Ja:

Nej:

15.Ungefär var i din menstruationscykel befinner du dig?

Strax innan menstruationen  Under menstruationen

Strax efter menstruationen  I mellan menstruationstillfällen

16. Har du under den senaste veckan varit tillfälligt sjuk, exempelvis haft en förkylning, eller varit magsjuk?

Ja:

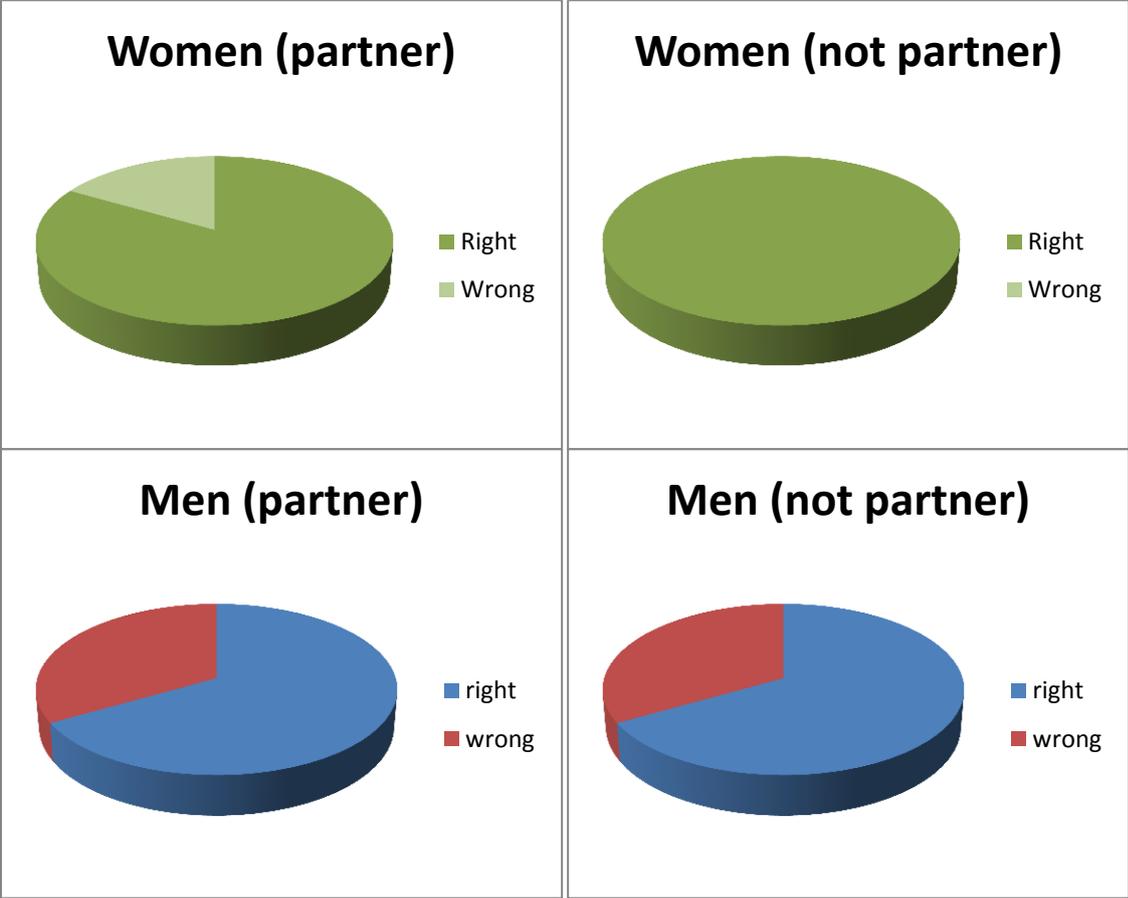
Nej:

17. Är din tröja nyköpt och inte tvättad eller tvättad med tvättmedel som du inte brukar använda?

Ja:

Nej:

**Odour**



## Voice

