The Effect of Social Desirability on Memory and Hedonic Evaluation

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Abstract

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Author statement: The present study was an independent research project where all data were collected and analyzed by the author under the guidance of the supervisors.

The mystery of attractiveness has puzzled and inspired individuals for centuries. Several factors are known to affect physical attractiveness, and social status is one of them. Previous studies have shown how individuals of a higher social status are considered more attractive compared to lower status individuals, indicating that social status can increase the rewarding value of attractiveness. However, what is not known is if manipulation of social status, i.e., salary level, can change subjective hedonic evaluations of facial attractiveness, induce phasic changes in pupil size or whether it can alone or together with facial attractiveness affect memory performance, and whether salary level, alone or combined with attractiveness, as indices of social rewards, could influence individuals' memory, psychophysiological responses (e.g., pupillary responses) and eye fixations.

To investigate these questions, the study presented to 60 participants, 18 pre-rated faces split into three attractiveness levels. The faces were shown both before and after reading some facts about the people in the photos, including their salary level. In this way, one could investigate if the salary level (induced social status) would subsequently affect the attractiveness ratings. Pupillometry was applied throughout the experiment to index increased arousal due to any of the manipulated factors. In addition, a memory test was performed at the end of the experiment to assess if the induced social status, i.e., salary level, had affected participants' memory and to what extent. In addition, gender effects were explored.

The results showed no significant effect of salary level on the subjective perception of facial attractiveness, patterns of eye fixations, pupillary changes and memory performance. However, the gender of the face stimuli was shown to affect both perception of facial attractiveness and memory performance. In addition, the gender of the face stimuli showed that female faces induced a larger pupil size, although only for the most attractive faces

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1.0 Introduction

One of the questions that has inspired artists, philosophers, lovers and scientists throughout the human history refers to the mystery of attractiveness, i.e., what attractiveness is, what factors have an influence on it, how we perceive it, if beauty is a subjective value which is in the eyes of the beholder, or an objective characteristic, how and why it can affect emotional, social, and cognitive aspects of our life.

Being physically attractive comes with several benefits such as being perceived as more intelligent, socially skilled (Dion, Berscheid & Walster), and treated favorably in terms of hiring and promotions (Dipboye, Arvey & Terpstra, 1977; Hosoda, Stone-Romero & Coats, 2003). The perks given to attractive people in the labor market is known under the so-called "beauty premium" and is well documented (Hamermesh, 2011). For example, previous experiments have shown that beauty is rewarded, so that the more the facial attractiveness is, the higher the wage becomes (e.g., Mobius & Rosenblat, 2006 & Fletcher, 2009; Hamermesh & Biddle, 1994, Andreoni & Petrie, 2008). Moreover, opposite to female job applicants, attractive male applicants have a significantly higher call-back rate (Ruffle & Schtudiner, 2015).

However, the effect of attractiveness also depends on the context as attractiveness is not always a benefit. Seemingly, there exists a penalization towards attractive females in the job domain. For example, for women applying to stereotypically masculine jobs (e.g., leadership, construction work), beauty can be a disadvantage (Heilman & Saruwatari, 1979; Heilman & Stopeck, 1985). Studies have shown that individuals who are more androgynous or masculine looking, are preferred over more feminine applicants in male dominated jobs (Jackson, 1983). Similarly, attractiveness was considered a benefit for more stereotypically feminine jobs (e.g., nurse or secretary).

In addition to making more money, physically attractive people are judged as more helpful despite not necessarily investing more effort, being more cooperative or working harder (Andreoni & Petrie, 2008). These beliefs also affect children, as attractive children receive less punishment by adults and receive more attention (Langlois, Ritter, Casey, & Sawin, 1995).

On the other hand, according to research, individuals with a higher social status are thought to be more attractive than individuals with a lower social status (Webster & Driskell, 1983). Indeed, social status is seen as an important part of attractiveness, particularly in men, and has been shown to be important for women when selecting a mate (Buss & Schmitt,

1993; Wiederman & Dubois, 1998). For example, men of higher status marry more attractive females, compared to lower status males (Von Rueden, Gurven & Kaplan, 2010), and are deemed as more desirable and attractive as compared to lower status males (e.g., Sundie, Kenrick, Griskevicius, Tybur, Kathleen, Vohs & Beal, 2011). Similarly, assigning fictional attractive abilities (e.g., academic or athletic) has been shown to make individuals appear more attractive in comparison to their less able counterparts (Felson & Bohnrstedt, 1979), indicating that abilities could predict attractiveness despite previous attractiveness levels. In fact, the positive effects of attractiveness are likely to be stronger when they are the only information to base a judgement on, and this effect can be buffered by merely presenting additional information to even out the judgement-making process (Buck & Tiene, 1989). However, when no additional information is presented, or the information is hard to find, faces are used to extract information, leading to an altered perception of the individual (Hassin & Trope, 2000; Lawson, Lenz, Baker & Myers, 2010).

In addition to the effect of facial attractiveness on individuals' subjective judgements, professional decisions and preferences (Little, Jones & DeBruine, 2011), previous findings have provided evidence that facial attractiveness can change other cognitive processes like perception and attention through behavioral measures (Ro, Friggel & Lavie, 2007).

Based on this literature, both social status, e.g., level of salary, and facial attractiveness, can have a strong rewarding value and affects many aspects of daily living. However not much is known about whether manipulation of social desirability, i.e., salary level, can change our subjective evaluations on facial attractiveness, specifically in societies with well-established social welfare systems. Moreover, it is not known if social desirability can, in addition to or independent from subjective hedonic evaluations, induce significant phasic changes in pupil size, as an index of how intensively attentional processes are involved. Furthermore, considering the rewarding value of social status, whether alone or in an interaction with facial attractiveness, can affect memory.

1.1 Individual and gender differences in evaluation of facial attractiveness

There exists a general agreement on what makes a face attractive, both within and across different cultures and genders, indicating that facial attractiveness and beauty is not just an individual matter, but rather a universal matter when it comes to attractive features (Langlois, Kalakanis, Rubenstein, Larson, Hallam & Smoot, 2000; Hamermesh, 2011). For example, **s**ymmetry, averageness and non-average sexually dimorphic features are considered

universally attractive features. While symmetric faces have been linked to presumed good health (Fink, Neave, Manning & Grammer, 2006) and a possibly increased ability to deal with environmental stress and challenges (e.g., Grammer, Fink, Møller & Thornhill, 2003), average faces have been rated as more attractive than distinctive faces (Morris & Wickham, 2001), likely due to its relevance to the mean population.

Such a general agreement on facial attractiveness was found to be even stronger for people within close relations or people within the same culture, such as spouses, siblings or friends, compared to strangers (Bronstad & Russel, 2007). In addition, people about the same age agree more, indicating that, in addition to those mentioned objective physical factors, there are several social standards of facial attractiveness (Bronstad & Russel, 2007).

However, sex-dependent preferences for facial attractiveness exists. Evolutionary psychologists have suggested that the attraction and fascination of beauty stems from psychological adaptations and preferences when choosing a mate (Fink & Penton-Voak, 2002). Indeed, women's ratings of male facial attractiveness vary with the menstrual cycle and if the rating is for a long-term or a short-term partner (Thornhill & Gangestad, 1999). In fact, women tend to rate masculine faces (e.g., large jaw and prominent brow ridges) as more attractive when choosing a short-term partner but will pick a more feminine face for a long-term partner (Little, Jones, Penton-Voak, Burt & Perret, 2002; Penton-Voak, Jacobson & Trivers, 2004). However, women's preferences for facial attractiveness seems to not be affected by the sex of the face they are judging (Marcus & Miller, 2003).

On the other hand, men show more consistency in the preference for female faces (Thornill & Gangestad, 1999; Penton-Voak, 2002), showing that typical female facial characteristics such as small jaws and full lips, appear to be universally preferred. In addition, men show a higher level of consensus when rating the attractiveness of female faces as opposed to male faces (Marcus & Miller, 2003). In general, men value physical attractiveness more than women (Li & Kenrick, 2006). A similar pattern is found with homosexual men, who are also shown to value attractiveness the most (Ha, Van den Berg, Rutger, Engels & Lichtwarck-Aschoff, 2012).

In general, attractive faces have a high rewarding value (Aharon, Etcoff, Ariely, Chabris, Connor, & Breiter, 2001), something that has also been found for momentary rewards such as salary (Elliott, Newman, Longe, & Deakin, 2003; O'Doherty, 2004). Due to presence of gender differences as reviewed above, the current study will also test the interacting effect of this factor on the relationship between salary level and attractiveness

ratings.

1.2 The gender-dependent relationship between facial attractiveness and social status

Social status has shown to be particularly important for women when selecting a mate, possibly due to their high parental investment in case of a pregnancy, and because a high social status (i.e high salary, wealth) will give access to immediate resources (e.g., Buss & Schmitt, 1993, Wiederman & Dubois, 1998). However, attractiveness preferences between women have been shown to vary depending on what a specific woman is currently interested in, in term of relationships. That is, women interested in a short-term partner (e.g., a one-night stand) value physical attractiveness more, while a woman looking for a long term-partner (e.g., marriage) values the male's earning potential in addition to physical attractiveness (Buss & Schmitt, 1993). Later studies have lent support to this theory, by demonstrating how attractive men with indicators of higher income and status (e.g., expensive car) would more easily acquire phone numbers compared to lower status males (Guèguen & Lamy, 2012). Women also rate men as more desirable when the male seems to be of a high status and income (Sundie et al., 2011). Thus, these results indicate that women value 'status/income' important when selecting a possible mate, placing attractiveness in a secondary place.

Moreover, a recent study has shown that highly valuable rewards (i.e., salary or status) can affect the subjective perception of facial attractiveness when the face is already highly rewarding (Chelnokova, Laeng, Eikemo, Riegels, Løseth, Maurud, Willoch & Leknes, 2014).

On the other hand, social status does not seem to strongly affect the 'dating desire' among adolescent boys and girls (Ha, Overbeek, Rutger & Engels, 2010), possibly since during that age, most individuals are not necessarily looking for a long-term partner. It is however not clear if social status can implicitly change memory or psychophysiological responses without changing our evaluations.

1.3 The effect of social desirability and facial attractiveness on memory

It has been theorized that the perceived social status of an individual, can decide if it's worth investing attention to an individual or not (Fiske, 1993). Social status is thought to motivate memorizing (Fiske, 1993), as remembering a high-status individual could be more important, considering the power that often come with a high status, making people more motivated to attend to and remember high status individuals. Indeed, this theory has been lent support through empirical research, showing that participants exhibited superior face and

location memory to high status faces, compared to lower status ones (Ratcliff, Hugenberg, Shriver & Bernstein, 2011).

Previous studies have shown that both social status and attractiveness influence memory (Tsukiura & Cabeza, 2011; Ratcliff, Hugenberg, Shriver & Bernstein, 2011). For example, faces considered of a high-status were shown to be remembered better, compared to "low-status" faces (Tsukiura & Cabeza, 2011). In addition, attractive faces are remembered better than unattractive faces (Marzi & Viggiano, 2010).

However, the findings are not always consistent. Some studies have found a positive effect on memory for unattractive faces (e.g., Sarno & Alley, 1997; Light, Hollander & Kayra-Stuart, 1981). A more recent study has added support to the theory that unattractive faces are in fact better remembered than attractive faces, as long as the latter does not have any distinctive features (Wiese, Altmann & Schweinberger, 2014). These authors go on to argue that faces with highly distinctive characteristics, such as unusually shaped or sized facial features, deviate from an average face. Such a distinction may not have been made in previous studies and could therefore be the reason behind the varying results within research on facial attractiveness and memory. Distinctiveness in faces has also previously been recognized as a possible explanation for memory surrounding faces of varying attractiveness. For example, Shepherd & Ellis (1973) argued that very attractive faces and very unattractive faces usually have distinctive characteristics and features which makes them easier to remember compared to the more normal looking faces.

What is not known, though, is whether the level of facial attractiveness mediates the effect of social status on memory. The current study, therefore, manipulates both salary level and attractiveness level to investigate if the manipulation of economic status, i.e., salary level, can induced a change in subjective perception of facial attractiveness, an effect that can also be tracked by psychophysiological markers.

1.4 Processing of rewarding stimuli

Perception and processing of what we perceive can be classified into two processes: Bottom-up and Top-down. The process of having attention directed automatically and unconsciously by a stimulus, is referred to as bottom-up-processing. One example of such a stimulus can be facial attractiveness. The perception of facial attractiveness has been suggested to be automatic and that it captures attention (Chen, Liu, & Nakabayashi, 2012), is processed effortlessly and unconsciously (Van Hooff, Crawford, & Vugt, 2010**)** and can alter

cognitive performance (Olson & Marshuetz, 2005). In fact, human faces are rewarding stimuli that easily attract attention in a seemingly bottom-up way, in comparison to other objects (Langton, Law, Burton & Schweinberger, 2008), and attractive faces hold attention over a longer period (Ro, Friggel & Lavie, 2007). Similarly, faces associated with a higher social status have also been shown to capture attention (Ratcliff, Hugenberg, Shriver & Bernstein, 2011).

On the other hand, situations that require an individual to evaluate options or make decisions based on previous knowledge, goals or plans, may be categorized as top-down processing (Theeuwes, 2010). Thus, the perception of facial attractiveness seems to involve a bottom-up processing, but judgments of facial attractiveness, especially if other types of information are also available, involve a top-down processing.

Moreover, several neuroimaging studies have shown that both facial attractiveness and income are rewarding, similarly to food, odors or pleasant music and they can activate the reward circuit in the brain. For example, attractive faces trigger greater activity in the orbitofrontal cortex (OFC), a region associated with processing rewards, compared to unattractive faces, and even more so for happy attractive faces (e.g., Bray & O'Doherty, 2007; Ishai, 2007; Winston, O'Doherty, Kilner, Perret & Dolan, 2007). The OFC also shows activation for monetary rewards such as salary (Elliott, Newman, Longe, & Deakin, 2003; O'Doherty, 2004). In addition, higher activation in the medial orbitofrontal cortex (mOFC), the anterior cingulate cortex (ACC) and the medial prefrontal cortex (mPFC) were shown during tasks involving judgement of facial attractiveness (Cloutier, Heatherton, Whalen & Kelley, 2008).

Interestingly, the OFC in combination with the ACC has been shown to be interconnected with the locus coeruleus (LC) (Sara, 2009). The LC functions as the main source of norepinephrine (NE), and is responsible for the transmission of NE throughout the brain (Aston-Jones & Cohen, 2005). Moreover, the activity of the LC-NE system has been shown to be involved in several different brain functions, including arousal (Harley, 1987), attention (Kahneman, 1973; Howells, Stein & Russell, 2012), decision-making and reward processing (Aston-jones & Cohen, 2005), and memory (Cahill, McGaugh, 1996). Relevantly for the present study, pupillary changes have previously been attributed to the activity of norepinephrine neurons in the LC (e.g., Beatty, 1982; Cohen, McClure &Yu, 2007). This idea has received support through recent studies, demonstrating the relationship between the release of NE in the LC and changes in pupil size, both in naturally fluctuating sizes and as a

result of external events such as arousing stimuli or decision-making tasks (Murphy, O'connell, O'sullivan, Robertson & Balsters, 2014; Joshi, Li, Kalwani & Gold, 2015; Joshi, Kalwani & Gold, 2016). Moreover, especially the phasic mode of the LC has been related to stimulus or task related pupillary dilations (Beatty, 1982).

In fact, according to one of the most prominent theories of LC function, the adaptive gain theory (Aston-Jones & Cohen, 2005), the LC-NE system plays a part in the exploration and exploitation of rewarding stimuli. The LC shifts between two modes, the phasic mode (response to relevant stimuli) and the tonic mode (distractors) (Aston-jones & Cohen, 2005). The phasic mode is related to the onset of stimuli, resulting in the release of NE, which sharpens attention and increase focus, making it possible to exploit possible rewarding resources from stimulus or task-relevant events (Laeng, Sirois & Gredebäck, 2012).

1.5 Eye-tracking and pupillometry

The tools and methods used to measure eye movements and pupillometry have changed over the years, improving in accuracy. Nonetheless, the goal from using eye tracking and pupillometry remains the same: to investigate the underlying psycho-physiological markers of ongoing cognitive processes.

In general, eye tracking differs between eye fixations (dwelling gaze), saccades (rapid eye movement from one location to another) and blinks, which gives us information about cognitive processes (e.g., Rayner, 1977; Liversedge & Findlay, 2000). Eye-fixations have previously been related to the allocation of attention (Underwood & Foulsham, 2006) and eye-tracking research on attractive faces have shown that attractive faces elicit longer eye fixations in comparison to unattractive faces (Leder, Tinio, Fuchs & Bohrn, 2010). In fact, the eyes in the attractive faces across several studies have been shown to elicit the longest eye fixations (e.g., Kita, Gunji, Sakihara, Inagaki, Kaga, Nakagawa & Hosokawa, 2010; Hickman, Firestone, Beck & Speer, 2010). Moreover, a direct gaze seemingly increases the attractiveness of a face (Ewing, Rhodes & Pellicano, 2010), possibly leading to an impression that the direct gaze establishes eye contact (Kloth, Altmann & Schweinberger, 2011).

In addition to eye tracking, pupillometry has been frequently used within the field of cognitive neuroscience as a psychophysiological indicator of arousal (Janisse, 1973; Bradley, Miccoli, Escriq & Lang, 2008), effort during task performance (Kahneman & Beatty, 1967) and cognitive load, ever since Kahneman (1973) presented the theory of attention. However, the use of pupillometry within psychological research can be traced as far back as Hess & Polt

(1960) who measured the pupillary response to show the effect of emotional/arousal stimuli.

The pupil diameter can vary from anywhere between 1.5 to 9mm, and its reaction time is as low as 200ms (Lowenstein & Loewenfeld, 1962, in Sirois & Brisson, 2014). This dilation and constriction regulation of the pupil size is controlled by two muscles located in the iris; the constrictor and the dilator and is controlled by the sympathetic nervous system (Sirois & Brisson, 2014). Moreover, it is agreed upon that pupil dilation is an automatic and involuntary response to stimulation and variation in the environment such as luminance. In general, non-luminance changes in pupil size has become a commonly used marker for arousal and cognitive effort within cognitive neuroscience.

Surprisingly, there seems to be little research done on the effect of facial attractiveness on pupil size. One exception is the study done by Winston et al., (2007) on brain systems involved in assessing facial attractiveness, where they aimed to measure the pupillary responses in addition to fMRI. The results showed increased pupil dilation in male participants in response to the attractive faces. Moreover, a more recent study was also able to tie aesthetic (attractive) human faces to a linear relationship between pupil size of the participants and the pleasantness (aesthetic) ratings of human faces (Blackburn & Schirillo, 2012).

Previous research on pupil size has mostly focused on the attractiveness and pleasantness of objects. For instance, researchers have shown that the pupil diameter increased when individuals were shown pleasant and unpleasant pictures (Steinhauer, Boller, Zubin & Pearlman, 1983), naked individuals (Aboyoun & Dabbs, 1998) and also in response to items generally seen as beautiful, such as beautiful paintings and images (Kuchinke, Trapp, Jacobs & Leder, 2009; Johnson, Muday & Schirillo, 2010), the design of wine bottles (Laeng, Suegami & Aminihajibashi, 2016) and beautiful car designs (Carbon, Hutziler & Minge, 2006), relating pupillary dilations, as an indirect index of LC-NE activity, to aesthetic/hedonic processing.

As reviewed earlier, rewarding stimuli taps into the LC which plays a role in regulating pupil size, making pupillometry an especially viable tool to investigate our research questions surrounding social desirability induced by salary level in a non-invasive and relatively in-expensive way.

1.6 The current study & hypotheses

The current study will investigate if social status, i.e., salary level, can influence individuals' subjective hedonic evaluations on facial attractiveness. That is, we hypothesized that attributing the less attractive faces with a higher social status in terms of a higher salary, would result in an increase in their attractiveness rating. Especially, the attractive male faces would be expected to be perceived as less attractive when a lower social status were allocated to them. More importantly, we wondered if salary level, alone or combined with attractiveness, as indices of social rewards, could influence individuals' memory and psychophysiological responses (e.g., pupillary responses). We would also expect that these influences would act in a similar direction for individuals' subjective hedonic evaluations. In other words, the current study will investigate whether behavioral and psycho-physiological (i.e., pupillary and eye movements) responses can provide evidence for the effect of social priming on individuals' memory and hedonic evaluations.

Based on the reviewed literature, we specifically hypothesized that:

1. Manipulation of economic status, i.e., salary level, induces a change in subjective perception of facial attractiveness. More specifically, assigning a high or low salary to the pre-rated faces, respectively, increases or decreases the participants´ attractiveness ratings for those faces.

2. Considering that cues of high social status modulate especially desirability of males (Guèguen & Lamy, 2012; Sundie et al., 2011), we expect to find gender related effects on the dependent variables.

3. Considering that individuals of a higher status, i.e., salary level, are paid more attention (Fiske, 1993), we expect the faces with higher salary to be remembered more often, especially if they are also very attractive.

4. Due to the rewarding value of social status and facial attractiveness, we expect the most rewarding faces to induce a larger pupil size.

5. Considering that previous studies on eye fixation have shown that the eyes in attractive faces elicit the longest fixations (Kita et al., 2010; Hickman, Firestone, Beck & Speer, 2010), and that status (i.e., salary level) can increase attractiveness (Chelnokova et al., 2014), we expect the longest fixations to be in the eye area of the faces with the highest salary.

There currently exists a broad literature on the effect of social desirability on perceived attractiveness (e.g., Sundie et al., 2011; Guèguen & Lamy, 2012). However, to our knowledge this will be the first study to investigate the effect of social desirability (salary level) on pupil size as an indicator of arousal, when also considering their (objective) attractiveness level. In addition, this study will also be the first to investigate the effect of social status on semantic memory for human faces of differing attractiveness level.

2.0 Methods

2.1 Participants

Sixty students (46 females; mean age, 23.88 years; SD, 3.575) from the University of Oslo participated and were rewarded a gift card worth 100 Norwegian NOK for participating. All participants had normal or corrected-to-normal vision with aid from contact lenses. A consent form was required to be read and signed prior the start of the experiment, and no information regarding the main purpose of the study was revealed until after testing was completed. Under quality check of the acquired data, four participants were removed due to not looking at the faces during the eye tracking parts of the experiment, leaving us with a total of fifty-six participants (45 females; mean age, 23,98 years; SD 3,621) for analysis.
Data were stored anonymously by allocating number codes to each subject. All subjects were informed about the general procedure and about their right to withdraw from the experiment at any time. In addition, participants were required to read and sign a consent form before starting the experiment. The study was also ethically approved by the local IRB. .

2.2 Materials and apparatus

Eighteen close-up face images of differing attractiveness were used in the current study chosen among the ~200 faces of young men and women in the Oslo Face Database (https://sirileknes.com/oslo-face-database/; e.g., Chelnokova et al., 2014). Only models' images with a frontal view and gaze were selected for the present study. The original faces were divided in attractiveness sets, based on "objective" or "normative scores" collected independently with 80 participants (40 females) at the University of Oslo; age range = 18-45) who viewed, previously and independently from the present experiment, each face separately in random order. Only 18 faces were used to limit the amount of information the participants would have to memorize later in the memory test. These 18 faces had been previously rated on attractiveness by a group of 41 participants (21 female, mean age 24.7, SD = 9.2). The

portraits were divided into three levels of attractiveness: High (mean: 5.25), medium (mean: 3.37) and low (mean: 2.40), where male and female faces were represented three times per level of attractiveness. To manipulate the salary level, three levels (low, medium and high) based on typical and current Norwegian yearly incomes were used.

Moreover, in each salary level, an equal number of male and female faces from each attractiveness level were represented.

To avoid any changes in pupil sizes to be due to ambient luminance, luminance-adjusted image slides were used prior to each of the face images as illustrated in (Figure 1).

In every trial, the first image was a gray luminance-adjusted rectangle presented for 1000 ms, where the luminance was equal the averages of the other images, giving the pupil time to return to an average rest level. The second photo served as a baseline and had the same luminance as the target (face) image, with a yellow fixation cross located in one of the four corners of the screen to prevent gaze bias towards the middle, where the stimuli would be presented afterwards. The third slide was identical to the baseline slide, but now a trigger area was defined around the fixation cross. The participant had to look at the fixation cross for 1000ms before it would move on to the main stimuli.

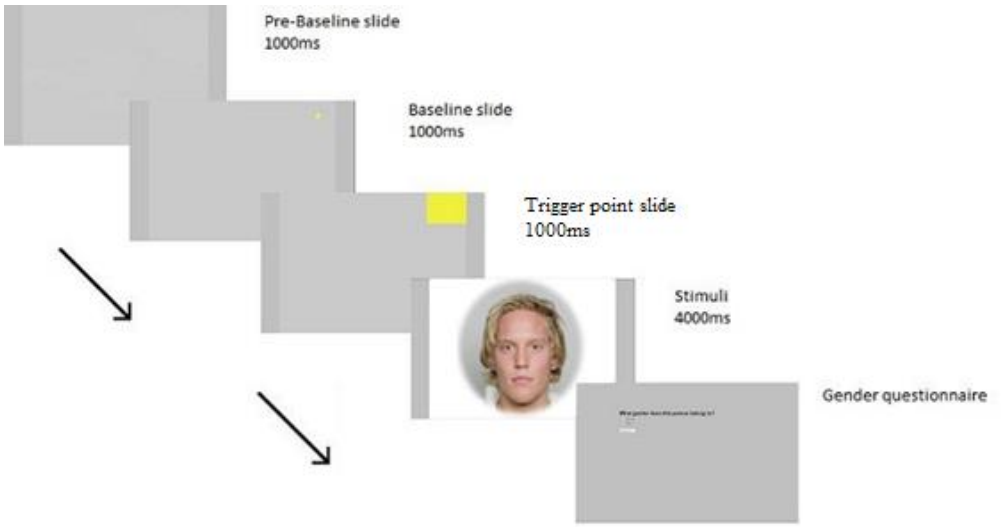

Figure 1. Outline of trials for experiment part 1.

A remote eye tracking device (SMI-SensoMotoric Instruments, Teltow, Germany) using infra-red lighting, with a sampling rate of 60Hz were used to record the eye movements

and fixations in addition to pupillary responses in this study. The experiment was presented on a flat, color LCD monitor, and was ran and monitored on a separate laptop, where the experiment was created.

In addition, the experiment was run in a room with no windows, where the only source of light during all experiment runs was a fluorescent ceiling lamp, providing the same environmental luminance for all participants throughout.

2.3 Procedure

The experiment consisted of two parts, and at the beginning of each part, the participant first had to undergo a calibration procedure in the eye tracker. First the participant read instructions explaining the calibration process, where they were asked to follow a red dot within a moving white circle, stopping at five different fixed positions on the screen. In addition, after the calibration, a validation procedure like the calibration was performed to get an estimate of the precision of the gaze.

After the calibration and validation, new instructions about the task ahead appeared on the screen, which was the same for all participants.

2.3.1 First part of the experiment.

First, baseline data. i.e., average pupil changes when viewing the faces without any information presented, was collected. To do so, the participants were seated at a 55cm distance from the screen and asked to read the instruction of the task ahead which was “look at the faces and decide if the face is male or female”. At the end of each trial, a questionnaire slide was presented for an unlimited time, where participants had to click on either “male” or “female” to identify the gender of the face. This task allowed us to measure the effect of level of attractiveness on pupil size, without being influenced by any other information. The answers were not used for analysis later. All 18 faces were shown in a randomized order for a duration of 4000 ms per stimuli to all participants, following a within subject design.

2.3.2 Second part of the experiment.

The participants were then divided into three different groups (unknown to the participants) according to the order they signed up for the experiment, to ensure counterbalancing. Participants were now given an information pamphlet (see appendix) consisting of some facts regarding each of the 18 individuals (faces) that they had just seen in part one of the experiment. They were informed that they would be given 10 minutes to read and memorize as much information as possible. The pamphlet contained five pieces of

various information; i.e., favorite food, favorite music, birth place, work place and how much he/she makes per year. Salary level was split into three different levels based on yearly income: Low (400 000 NOK), medium (550 000 NOK) and high (700 000 NOK). Each salary level had one male and one female face from each of the three attractiveness levels (low, medium & high) represented.

After reading the information sheet for 10 minutes, the participants were placed back into the eye tracker and were instructed to first rate the attractiveness of the faces by clicking on a Likert scale from 1 (not attractive) to 7 (very attractive). After rating all the faces, the participants were asked to write any information they remembered about the faces in the form of an electronical memory test. The memory test was presented on a separate laptop using PowerPoint software (Figure 2). Instructions were given both oral and in written format on the test itself, simply asking the participant to fill out the following slides and to avoid guessing while doing so. If they failed to remember a piece of information, they were asked to move on to the next field. The test slide was a copy of the information pamphlet they had been asked to read earlier, but without the information, so the participant had to fill in the missing information.

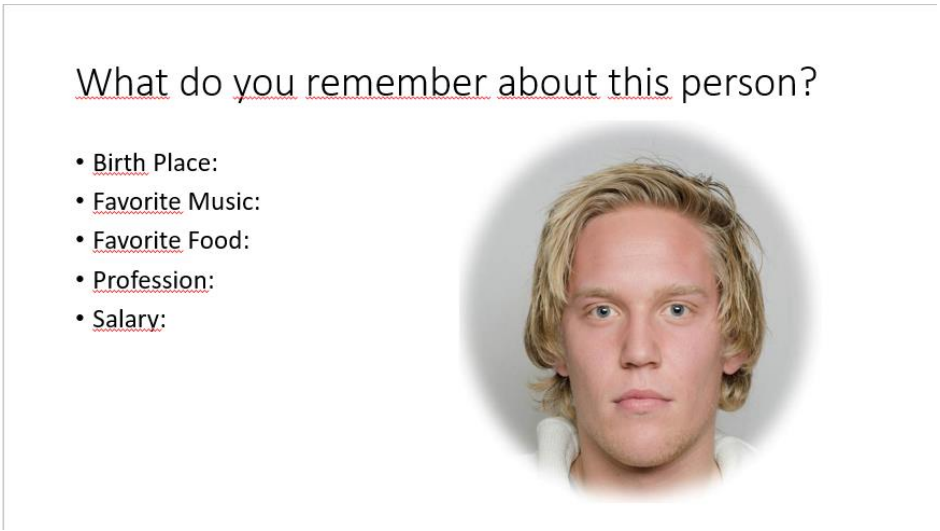

Figure 2. Example slide from the PowerPoint memory test.

Participants were given an unlimited amount of time to fill out the memory test.

The experiment followed a within-subjects design, presenting all stimuli to all participants, with the salary levels as the only changing variable between participants.

2.4. Data processing and analysis

Prior to analyzing the data, violations of ANOVA testing were checked for. Any violations of sphericity were reported and corrected throughout the results section.

2.4.1 preprocessing and calculation of pupillary data.

To calculate the mean change in pupil size, the average pupil changes during the 4000 ms presentation of the face stimuli, and during the 1000 ms corresponding baseline image, were computed for each trial and participant. The differences between these two were then calculated, by subtracting the baseline data from the average pupillary change from the face stimuli, yielding a mean baseline-corrected 'pupillary change'. The subtraction method for baseline correction was used, as it is considered the recommended method (Mathot, Fabius, Van Heusden & Van Der Stigchel, 2018). Finally, the average baseline corrected pupillary change was computed for each of the factors; Attractiveness level, Salary level and Gender of face for the stimulus.

Pupil data were analyzed, checking for significant changes in pupil size from the first exposure when participants only looked at faces and determined the gender of each face (as baseline pupil size) and during the rating of attractiveness after reading the information sheet for the portraits.

2.4.2 Calculation and analysis of Area of interest (AOI).

Analysis of Areas of interest (AOI) was also performed to investigate if any areas of the face drew more attention after being exposed to the experimental factors. The AOIs were chosen based on the "bar code" approach by Dakin & Watt (2009), who proposed that bar codes stem from the reflectance properties of the human face, with exposed skin (e.g., Cheeks and forehead) making shiny surfaces and the more dark and matte parts of a human face (e.g., Eyebrows and the shadow in the eye sockets). These bar codes are highly resistant to variability in facial features and consistently correspond to the different parts of the face. The AOIs for this experiment all followed the same template, but the sizing for the AOIs over different faces were manually adjusted for each picture.

To be able to study participant's pattern of fixations on the faces while undergoing the experiment, four different AOIs were created for each face, using the AOI Editor tool in SMI BeGaze software. The AOIs were all made equal in size for area covered on the face and were defined as follows: Forehead, eyes, nose and mouth (Figure 3).

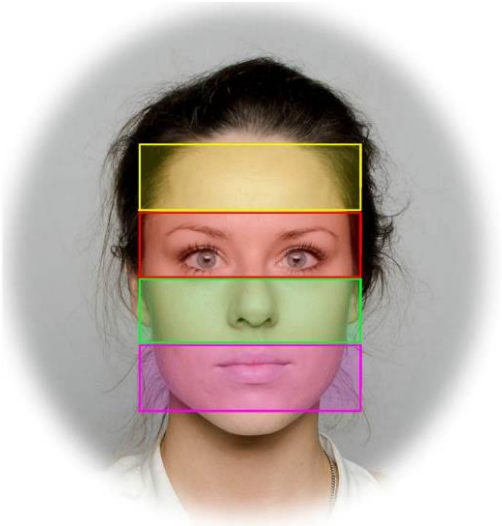

Figure 3. The setup for the four AOIs constructed for each face; Forehead, eyes, nose and mouth.

The average fixation time (in %) for each area was found by first extracting the data from SMI BeGaze and organized in Microsoft Excel before calculating the mean average of fixation duration for each AOI within each facial stimulus, and then allocated accordingly to the experimental factors; Salary level and Attractiveness level and split into Gender of face. Repeated measures analysis of variance (ANOVA) was mainly used for analyzing the acquired data through SPSS software.

2.4.3 Calculation of behavioral data.

The mean attractiveness ratings were calculated for faces in each salary group, attractiveness level, and by gender of the face. The mean attractiveness rating was first extracted from SMI BeGaze and further organized in Microsoft Excel. Considering that the salary level for each face would vary between each participant group, the stimulus and participants had to be organized according to what group the participant belonged to. The mean attractiveness score was then calculated and allocated accordingly to the correct Salary levels and split into Gender of face.

Finally, to calculate the memory scores, they were split into two sets: “Correct facts remembered” and “Correct salary remembered”. “Correct facts remembered” was calculated by adding together the amount of correct facts each participant had remembered about the faces, across each salary level, attractiveness level and gender of the face. “Correct salary” was calculated by adding together the amount of times the correct salary was remembered for each salary level, attractiveness level and Gender of face. Finally, the memory scores were converted into percentage scores in Microsoft Excel.

3.0 Results

Before testing the effect of salary level on the dependent variables, i.e., attractiveness ratings, memory scores, pupillary changes, and duration of eye fixations, participants were split into two groups, based on their scores from the memory test. Considering that participants with a better memory for salary scores would remember the correct salary levels more often, this method made it possible to take also the effect of memory into consideration when assessing the effect of salary level on dependent variables. Median split was calculated by summing up memory score, i.e., the total amount of correct facts that were remembered about all faces, for each participant, giving them a total score. SPSS was then used to find the median, and the participants were split into two groups; those with high memory score (memory score over median value; 33.50) and low memory score.

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3.1 Effect of Salary level on behavioral responses

3.1.1 Salary level and gender effects on attractiveness ratings. A three-way repeated measures ANOVA was performed with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Memory group (low, high) and sex of participant (males, females) as between-subject factor, and Attractiveness ratings as dependent variable. The analysis did not show any significant main effect of Salary level $F(2, 108) = 0.87$, $p = .917$. However, the results revealed a significant main effect of Gender of Face, $F(1, 54) = 28.721$, $p = .000$, $\eta p^2 = .347$, and a significant interaction between Gender of face and Memory group $F(1.54) = 7.414$, $p = .002$, $\eta p^2 = .121$,

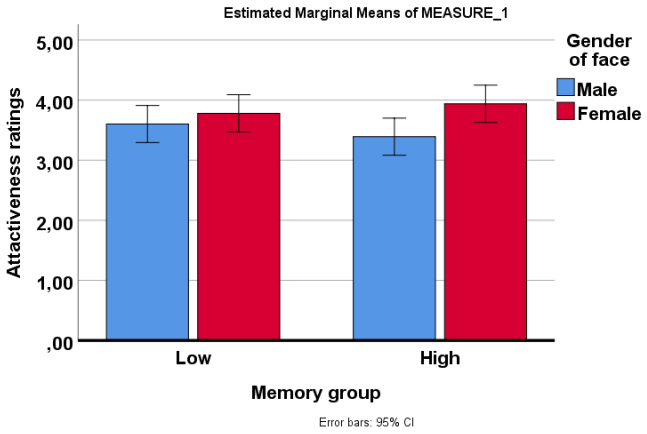

Figure 4. Significant interaction between Gender of face and Memory group. Error bars indicate a 95% confidence interval.

	Memory group		Sex of participant	
	Low	High	Female	Male
Conditions	Mean rating	Mean rating	Mean rating	Mean rating
Salary level 1 Male faces	3,57	3,32	3,49	3,27
Salary level 1 Female faces	3,77	4,01	3,86	4,00
Salary level 2 Male faces	3,55	3,47	3,61	3,12
Salary level 2 Female faces	3,82	3,84	3,84	3,82
Salary level 3 Male faces	3,69	3,38	3,59	3,30
Salary level 3 Female faces	3,75	3,96	3,90	3,67

Table 1. Mean attractiveness ratings for all salary conditions.

(Figure 4), showing that the high memory group rated female faces as more attractive than the low memory group. No other significant interactions were found. Mean attractiveness ratings from all salary conditions are presented in Table 1.

Salary level on attractiveness ratings from highly attractive faces. Since we in the previous analysis did not find any effect of Salary level on Attractiveness ratings, we reanalyzed the data using only ratings of faces with a high level of attractiveness to further investigate if salary level plays a role only when the attractiveness level of faces are very rewarding (Chelnokova et al., 2014). We therefore ran a three-way repeated measures ANOVA for attractive faces only, with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Memory group (low, high) and Sex of participant (males, females) as between-subject factor, and Attractiveness ratings as dependent variable. Results did not show any significant effect of Salary level on attractiveness ratings $F(2, 112) = 0.636$, $p = .584$, $\eta p^2 = .011$, nor any significant main effect from Gender of face $F(1, 56) = .245$, $p = .435$, $\eta p^2 = .004$. However, the results revealed a significant interaction effect between Gender of face and the Sex of the participants $F(1, 56) = 18.663$, $p = .000$, $\eta p^2 = .250$, showing that participants rated the opposite sex as more attractive (Figure 5). No other significant interaction effects were found. Mean attractiveness ratings for all salary conditions in highly attractive faces are presented in Table 2.

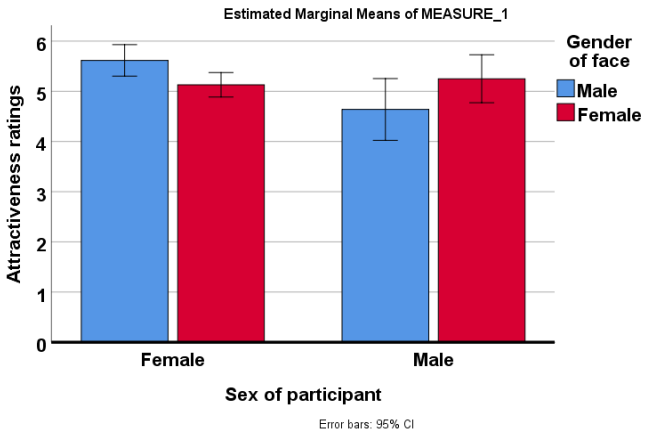

Figure 5. Significant interaction effect between Gender of face and Sex of participant. Error bars indicate a 95% confidence interval.

	Memory group		Sex of participant	
	Low	High	Female	Male
	Mean rating	Mean rating	Mean rating	Mean rating
Salary level 1 Male faces	5,59	5,22	5,58	4,55
Salary level 1 Female faces	5,26	5,22	5,13	5,55
Salary level 2 Male faces	5,37	5,37	5,62	4,27
Salary level 2 Female faces	5,11	5,22	5,22	5,09
Salary level 3 Male faces	5,44	5,41	5,60	4,64
Salary level 3 Female faces	4,85	5,00	4,98	4,91

Table 2. Mean attractiveness ratings for all Salary conditions in highly attractive faces.

3.1.2 Salary level and gender effects on memory

Salary level and gender effects on the amount of correct facts remembered. A three-way repeated measures ANOVA was performed with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Memory group (low, high) and Sex of participant (males, females) as between-subject factor, and Amount of correct facts as dependent variable. Results did not show any significant effect of Salary level on the Amount of correct facts remembered $F(2, 108) = 0.484$, $p = .617$, $\eta p^2 = .009$, nor any significant main effect from gender of face $F(1, 54) = 2.998$, $p = .089$, $\eta p^2 = .055$. No significant interaction effects were found. The mean amount of correct facts remembered for all salary conditions are presented in Table 3.

	Memory group		Sex of participant	
	Low	High	Female	Male
Conditions	Mean amount of correct facts remembered	Mean amount of correct facts remembered	Mean amount of correct facts remembered	Mean amount of correct facts remembered
Salary level 1 Male faces	28%	47%	37%	41%
Salary level 1 Female faces	26%	44%	33%	44%
Salary level 2 Male faces	27%	46%	35%	43%
Salary level 2 Female faces	25%	45%	36%	31%
Salary level 3 Male faces	28%	49%	38%	38%
Salary level 3 Female faces	28%	47%	38%	32%

Table 2. Mean amount of correct facts remembered for all Salary conditions.

Amount of correct facts remembered from highly attractive faces. Since we did not find any significant effect of Salary level on the Amount of correct facts remembered, we reanalyzed the data using memory scores of only faces with a high level of attractiveness, to further investigate if Salary level plays a role for the amount of facts remembered, when the attractiveness level of faces are very rewarding.

A three-way repeated measures ANOVA for attractive faces only was performed with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Sex of participant (males, females) as between-subject factor, and Amount of Correct facts remembered as dependent variable. Mauchly's test indicated that the assumption of sphericity had been violated for both the Salary factor (x^2

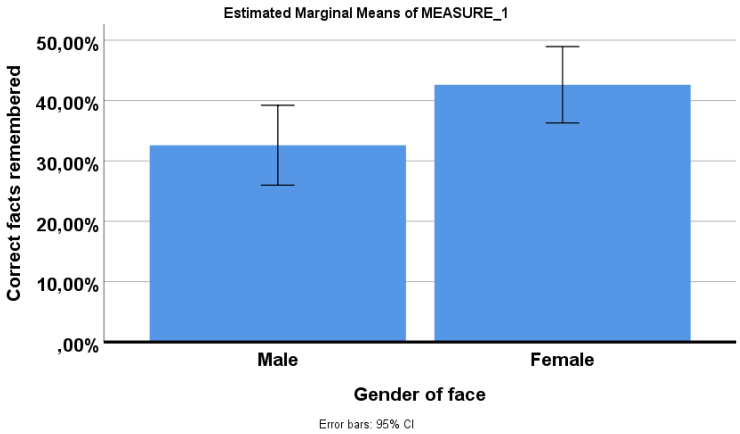

Figure 6. Significant main effect from Gender of face. Error bars indicate a 95% confidence interval.

= 21.602, p = .000) and the Salary level x Gender of face interaction (x^2 = 23.612, p = .000), therefore the Greenhouse Geisser correction, (ε = 0.749) and (ε = 0.736) respectively, was applied. The results did not show any significant effect of Salary level on the Amount of correct facts remembered F(1.498, 80.914) = 1.963, p = .708, ηp^2 = .035. However, a significant main effect of Gender of face was revealed F(1, 54) = 9.045 p = .004 ηp^2 = .143, showing that overall more facts were remembered about female faces (Figure 6). No significant interaction effects were found. The mean amount of correct facts remembered for all salary conditions for highly attractive faces only, are presented in Table 4.

	Memory group		Sex of participant	
	Low	High	Female	Male
Conditions	Mean amount of correct facts remembered	Mean amount of correct facts remembered	Mean amount of correct facts remembered	Mean amount of correct facts remembered
Salary level 1 Male faces	21%	37%	26%	40%
Salary level 1 Female faces	26%	57%	39%	55%
Salary level 2 Male faces	21%	48%	34%	36%
Salary level 2 Female faces	34%	52%	46%	33%
Salary level 3 Male faces	24%	38%	32%	27%
Salary leve- 3 Female faces	33%	54%	44%	40%

Table 4. Mean amount of correct facts remembered in percentage for all salary conditions for highly attractive faces only.

Salary level and gender effects on the amount of correct salary remembered. A three-way repeated measures ANOVA was performed with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Memory group (low, high) and Sex of participant (males, females) as between-subject factor, and Amount of correct salary as dependent variable. The results did not show any significant main effect of Salary level on the amount of Correct salary remembered F(2, 104) = 1.743, p = .180, ηp^2 = .032. However, a significant main effect of Gender of

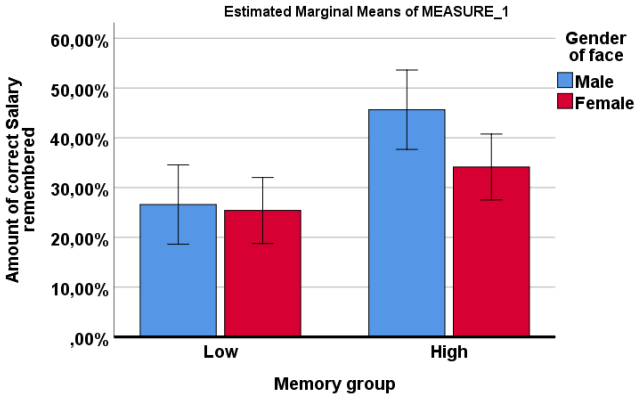

Figure 7. Significant interaction between Gender of face and Memory group. Error bars indicate a 95% confidence interval.

	Memory group		Sex of participant	
	Low	High	Female	Male
Conditions	Mean amount of correct salary remembered	Mean amount of correct salary remembered	Mean amount of correct salary remembered	Mean amount of correct salary remembered
Salary level 1 Male faces	20%	39%	29%	33%
Salary level 1 Female faces	21%	31%	25%	30%
Salary level 2 Male faces	30%	46%	36%	45%
Salary level 2 Female faces	25%	33%	28%	33%
Salary level 3 Male faces	30%	51%	39%	45%
Salary level 3 Female faces	30%	38%	36%	27%

Table 5. Mean amount of correct salary remembered for all salary conditions.

face was found $F(1, 52) = 7.748$, $p = .007$, $\eta p^2 = .130$, and a significant interaction effect between Gender of face and Memory group $F(1, 52) = 6.452$, $p = .014$, $\eta p^2 = .110$, showing that the correct salary was remembered more often for the male faces by the high memory group (Figure 7). No other significant interaction effects were found. The mean amount of how many correct salaries were remembered, are presented in Table 5.

Amount of correct salary remembered from highly attractive faces. As in previous sections, we reanalyzed the data using only the memory scores of faces with a high level of attractiveness. Therefore, we ran a three-way repeated measures ANOVA for attractive faces with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Sex of participant (males, females) as between-subject factor, and Correct salary remembered as dependent variable. Mauchly's test indicated that the assumption of sphericity had been violated for both the Salary factor ($x^2 = 9.749$, $p = .008$) and the Salary x Gender of face interaction ($x^2 = 6.240$, $p = .044$), therefore the Greenhouse Geisser correction ($\varepsilon = 0.856$) and ($\varepsilon = 0.900$) respectively, was applied.

	Memory group		Sex of participant	
	Low	High	Female	Male
Conditions	Mean amount of correct salary remembered	Mean amount of correct salary remembered	Mean amount of correct salary remembered	Mean amount of correct salary remembered
Salary level 1 Male faces	11%	25%	16%	27%
Salary level 1 Female faces	21%	46%	31%	45%
Salary level 2 Male faces	25%	50%	38%	36%
Salary level 2 Female faces	29%	36%	31%	36%
Salary level 3 Male faces	18%	29%	24%	18%
Salary level 3 Female faces	29%	43%	40%	18%

Table 6. Mean amount of correct salary remembered in percentage for all salary conditions for highly attractive faces only

The results did not show any significant effect of Salary level on the Amount of correct salary remembered $F(1.713, 92.475) = 1.002$, $p = .361$, $\eta p^2 = .018$, nor any significant effect from Gender of face: $F(1, 54) = 1.550$, $p = .218$, $\eta p^2 = .028$. In addition, no significant interaction effects were found. The mean amount of how many correct salaries were remembered for highly attractive faces, are presented in Table 6.

3.2 Salary level and pupil size

3.2.1 Salary level and gender effects on pupillary change A three-way repeated measure ANOVA was performed with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Memory group (low, high) as between-subject factor, and Pupillary change as dependent variable. Mauchly's test indicated that the assumption of sphericity had been violated for the salary factor ($x^2 = 7.418$, $p = .024$), therefore the Greenhouse Geisser correction ($\varepsilon = 0.884$) was applied for Salary. The results did not show any significant effect of salary level on pupillary change in any of the memory groups $F(1.77, 95.52) = 1.1614$, $p = .207$, $\eta p^2 = .029$. Similarly, no significant main effect of Gender of face was found $F(1, 54) = .053$, $p = .819$, $\eta p^2 = .001$, nor any other significant interaction effects. The mean amount of Pupillary change for all salary conditions, are presented in Table 7.

	Memory group	
	Low memory	High memory
Conditions	Mean pupillary change (mm)	Mean pupillary change (mm)
Salary level 1 Male faces	,34	,38
Salary level 1 Female faces	,40	,31
Salary level 2 Male faces	,36	,46
Salary level 2 Female faces	,45	,39
Salary level 3 Male faces	,35	,33
Salary level 3 Female faces	,26	,36

Table 7. Mean pupillary change in mm for all salary conditions.

Salary level on pupillary changes in high memory participants. Since we did not find any significant effect of Salary level on Pupillary change, we reanalyzed the data using only the pupil data from participants in the high memory group, as these participants were more likely to have remembered the correct salary, and therefore increase the chance of eliciting a pupillary response to salary level if there is one. We therefore ran a three-way repeated measures ANOVA with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Sex of participant (males, females) as between-subject factor and Pupillary change as dependent variable. The results did not show any significant effect of Salary level on Pupillary change $F(2, 52) = 0.080$, $p = .923$, $\eta p^2 = .003$, nor any significant effect of Gender of face $F(1, 26) = 1.522$, $p = .228$, $\eta p^2 = .055$. In addition, no significant interaction

	Sex of participant	
	Female	Male
Conditions	Mean pupillary change (mm)	Mean pupillary change (mm)
Salary level 1 Male faces	,31	,72
Salary level 1 Female faces	,29	,39
Salary level 2 Male faces	,45	,47
Salary level 2 Female faces	,39	,40
Salary level 3 Male faces	,27	,64
Salary level 3 Female faces	,30	,63

Table 8. Mean pupillary change in high memory individuals over all salary conditions.

effects were found. Mean Pupillary change for all salary conditions in high memory individuals, are presented in Table 8.

Salary level and gender effects on pupillary changes from highly attractive faces. Considering that we found no effect of Salary level on pupil size in the high memory group either, we decided to reanalyze the pupil data from the highly attractive faces to further investigate if salary plays a role when the attractiveness level of faces are very rewarding. We therefore ran a three-way repeated measures ANOVA for attractive faces with Salary level (low, medium, high) and Gender of face (male, female) as within-subject factors, Sex of participant (males, females) as between-subject factor, and Pupillary change as dependent variable. Mauchly's test indicated that the assumption of sphericity had been violated for the Salary factor (x^2 = 6.192, *p* = .028), therefore the Greenhouse Geisser correction (ε = 0.894) was applied. The results did not show any significant effect from Salary level on Pupillary change $F(1.789, 100.170) = 0.075$, $p = .910$, $\eta p^2 = .001$.

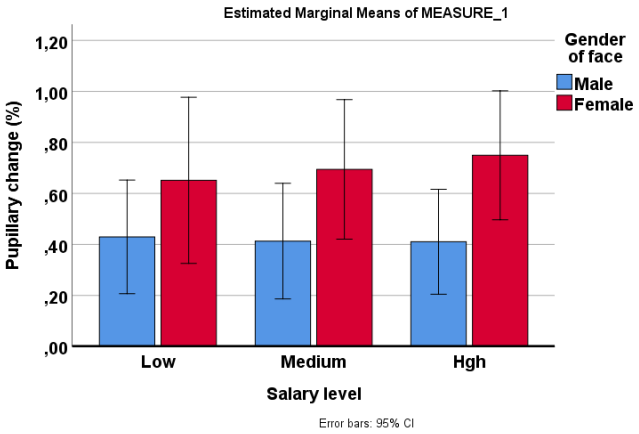

Figure 8. Significant main effect of Gender of face. Error bars indicate a 95% confidence interval.

	Sex of participant	
	Female	Male
Conditions	Mean pupillary change (mm)	Mean pupillary change (mm)
Salary level 1 Male faces	,28	,58
Salary level 1 Female faces	,48	,83
Salary level 2 Male faces	,44	,38
Salary level 2 Female faces	,59	,80
Salary level 3 Male faces	,27	,56
Salary level 3 Female faces	,55	,95

Table 9. Mean pupillary change in mm for all Salary conditions for highly attractive faces only.

However, the results showed a significant main effect of Gender of face $F(1, 56) = 11.415$ $p = .006$, $\eta p^2 = .169$, showing that female faces of highest attractiveness induced the largest pupil size overall, no matter the salary level (Figure 8). No significant interaction effects were found. The mean Pupillary change for all salary conditions from highly attractive faces only, are presented in Table 9.

3.3 Salary level on eye movement results

3.3.1 Salary level on Areas of interest (AOI). A three-way repeated measures ANOVA was performed with Salary level (low, medium, high), as within subject factor, and Memory group (low, high) as between-subject factor on the average Fixation duration (AOI) as dependent variable. Mauchly's test indicated that the assumption of sphericity had been violated for the AOI factor (x^2 = 193.556, *p* = .000), and the Salary x AOI interaction (x^2 = 160.395, *p* = .000) therefore the Greenhouse Geisser correction, (ε = 0.437 and (ε = 0.588) respectively, was applied. The results did not show any significant effect of salary level on fixation duration *F*(2, 108) = .247, *p* = .782. However, the results showed a significant main effect of AOI *F*(1.311, 70.773) = 140.183 *p* = .000, ηp^2 = .722, showing that the eyes were the most attended area (Figure 9). The mean fixation duration for all salary conditions are presented in Table 10.

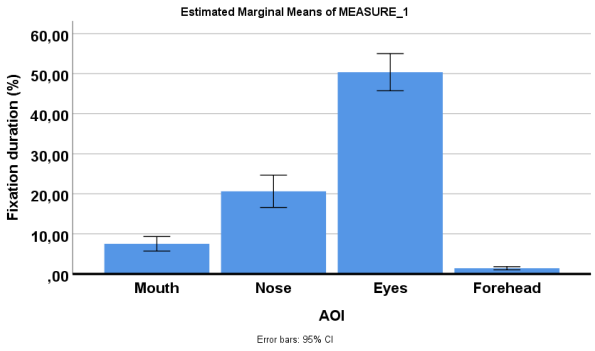

Figure 9. Significant main effect of AOI. Error bars indicate a 95% confidence interval.

	Memory group	
	Low	High
Conditions	Mean fixation %	Mean fixation %
Salary level 1 Mouth	8,50	6,63
Salary level 1 Nose	24,39	17,79
Salary level 1 Eyes	45,14	54,02
Salary level 1 Forehead	1,60	1,35
Salary level 2 Mouth	9,31	6,76
Salary level 2 Nose	22,92	16,49
Salary level 2 Eyes	46,38	55,49
Salary level 2 Forehead	1,58	1,45
Salary level 3 Mouth	8,44	5,52
Salary level 3 Nose	23,86	18,37
Salary level 3 Eyes	46,01	55,18
Salary level 3 Forehead	1,05	1,54

Table 10. Mean fixation duration in percentage for all salary conditions.

4.0 Discussion

The main purpose of this study was to investigate if manipulating information about the economic status of an individual, i.e., by specifying a person's salary level, would induce a change in subjective perception of facial attractiveness, this also indexed by pupillary changes, and affect the memorability of the faces. Based on the literature reviewed in the Introduction, we hypothesized that:

1) Manipulation of economic status, i.e., salary level, could induce a change in subjective perception of facial attractiveness. More specifically, assigning a high or low salary to the pre-rated faces might, respectively, increase or decrease the participants´ attractiveness ratings for those faces.

2) Considering that cues of high social status could be especially relevant for making other males as more desirable (Guèguen & Lamy, 2012; Sundie et al., 2011**),** we expect to find gender related effects on the dependent variables.

3) Considering that one may pay more attention to individuals of a higher status, i.e salary level, (Fiske, 1993), we expected that the faces with higher salary will be remembered more often, especially if they are also very attractive.

4) Due to the rewarding value of social status and facial attractiveness, we expect the most rewarding faces to induce a larger pupil size.

5) Considering that previous studies on fixation have shown that the eyes in attractive faces elicit the longest fixations (Kita et al., 2010; Hickman, Firestone, Beck & Speer, 2010), and that status (i.e salary level) can increase attractiveness (Chelnokova et al., 2014), we expect the longest fixations to be in the eye area of the faces with the highest salary.

4.1 Behavioral findings

No significant effect from salary level on behavioral responses disconfirms our hypothesis. Previous studies have shown that increased status in the form of wealth such as expensive items makes especially males more attractive (Sundie et al., 2011; Guèguen & Lamy, 2012). According to Sundie et al., (2011), males who exhibit status by purchasing expensive items are preferred as short-term mates. We hypothesized that by inducing a higher or lower social status, participants subjective perception of facial attractiveness would either increase or decrease respectively. However, our results did not show any significant effect of social status (i.e., salary level) in any of the memory groups (low / high) nor the highly

attractive faces.

One possible explanation is participant age, which has previously been shown to affect attractiveness (Ha, Overbeek, Rutger & Engels, 2010). The participants in the current study were mainly young adults/adolescent who might not value status in the form of a high salary as much. Indeed, as reviewed in the introduction, previous research has shown that social status does not matter as much to adolescents (Ha, Overbeek, Rutger & Engels, 2010). This is particularly relevant because we had no information surrounding what the participants judged the attractiveness from, e.g., if the participants rated based on long-term partner preferences or a short-term partner, or just based on facial characteristics. Indeed, we found a significant high correlation ($r(54) = .941$, $p = .000$) between the current attractiveness ratings and the existent ratings as mentioned in method sections, attractiveness of faces were previously rated by another group of participants. This may indicate that the facial features that we find attractive can overpower the effect of social status (i.e., salary level), at least when the evaluation was done in the lab and it did not have any real effect on participants´ life. This seems to be a plausible explanation when considering that salary level did not lead to higher attractiveness ratings in participants who had over median memory scores.

The significant effect of Gender of face, in part supports our hypothesis. Based on existing literature surrounding gender dependent effects of social status showing that males status deems especially males as more desirable, we expected to find gender related effects across our dependent variables. Considering that a significant effect from the gender of faces was found, showing that the female faces were rated as more attractive, we find partial support for our hypothesis, as a gender dependent effect was found, but in the opposite direction of what we expected. This effect from female faces is in line with previous research, demonstrating that more feminine female faces are consistently rated as attractive, as opposed to masculine male faces (Penton-Voak, Jacobson & Trivers, 2004). This effect is even stronger in groups of people who share similar culture or social standards (Bronstad & Russel, 2007), such as students belonging to the same university or campus, similarly to most of the participants in the current study. However, attractiveness ratings for the attractive faces, revealed the expected interaction effect between the gender of face of the stimuli and the sex of the participants, showing that both male and female participants rated the opposite sex as more attractive. This result could be explained by increased arousal from the rewarding effect of looking at attractive faces as reviewed earlier.

4.2 Memory findings

A lack of effect from salary level on memory performance disconfirms our hypothesis. In contrast to our hypothesis concerning the memorability of high status and highly attractive faces, we did in general not find any effect of Salary level on memory performance in neither the high or low memory group. This finding is in contrast with previous research. As reviewed earlier, faces presented with indications of a high social status (such as salary or profession) are given more attention and therefore improves facial memory and the location of a high-status face (Ratcliff, Hugenberg, Shriver & Bernstein, 2011). However, in our experiment memory was not related to facial memory or location, but rather semantic memory. It is possible that the participants did not pay special attention about the salary level of the faces presented or found the other pieces of information more interesting. Previous theories have suggested that remembering high status faces is of great importance, as a high status often comes with power (Fiske, 1993). We did however not find this effect in our study.

Another possible explanation is that facial distinctiveness has been shown to be more important to memorability as compared to attractiveness. Indeed, previous studies have shown that faces with distinct facial features are more often remembered, compared to normal looking faces (Shepherd & Ellis, 1973; Wiese, Altmann & Schweinberger, 2014).

An insignificant effect of salary level on the amount of how many correct salaries participants remembered, disconfirms our hypothesis. Previous research has shown that high status individuals are remembered more often as compared to their lower status counterparts. (Tsukiura & Cabeza, 2011). In contrast, our results showed that Salary level had no significant effect on participants' memory performance.

S**ignificant effects of Gender of face on memory scores supports our hypothesis surrounding gender dependent effects.** The results showed a significant interaction between gender of face and memory. Specifically, the salary for male faces were remembered correctly more often within the high memory group of the participants. Indeed, this supports both our hypothesis and previous findings showing that especially the males' earning potential and status is considered important as it would give immediate resources if needed in terms of pregnancy or off-spring (Wiederman & Dubois, 1998; Buss & Schmitt, 1993).

Significant effect of Gender of face on memory scores for highly attractive faces partially supports our hypothesis. In addition, a significant gender dependent effect was found for the most attractive faces, showing that overall more facts were remembered

about very attractive female faces. This lends partial support to our hypothesis, as we expected gender dependent effects, but especially directed towards male faces. This finding also reflects the result from the attractiveness ratings, which showed that the high memory group rated the female faces as more attractive.

One possible explanation for the unexpected female related gender effect, could be that (feminine) female faces are usually considered more attractive in comparison to more masculine faces (Penton-Voak, Jacobson & Trivers, 2004). Indeed, attractive faces draw more attention (Chen, Liu, & Nakabayashi, 2012) making the very attractive female faces more memorable. In fact, these presented results, along with other further analysis that we ran using the attractiveness level as the within subject factor, indicated that the level of facial attractiveness, rather than the level of salary, was the influential factor for both hedonic evaluations, memory and pupillary changes.

4.2 Pupillary findings

Lack of effect from salary level on pupil size disconfirms our hypothesis. Based on the existing literature reviewed earlier on the rewarding effect of attractive faces and objects, we hypothesized that due to the rewarding value of social status and facial attractiveness, faces allocated a higher salary would induce larger pupil dilations as the induced status would increase the perceived facial attractiveness. Previous studies found that the OFC, a region related to the reward circuit, responds also to monetary rewards (Elliott, Newman, Longe, & Deakin, 2003; O'Doherty, 2004), such as salary. However, our results showed no significant effect of salary level on pupil size, not even for the highly attractive faces. In addition, despite being more likely to remember the high salary levels correctly more often, no significant change in pupil size as a result of salary level was found for the high memory group.

A possible explanation for this lack of finding could be that the salary levels were not sufficiently rewarding, i.e., that the highest salary presented was not high enough. On the other hand, the low and medium salary level provided could have been too high, and therefore making all salary levels equally rewarding, especially considering that most of the participants were students and therefore likely did not have a high income. Another important point to consider, is that most studies investigating the effect of the rewarding effect of monetary rewards, is that there have been direct indications of a reward to the participant. For example, in the neuroimaging study performed by Elliott, Newman, Longe & Deakin (2003), a constant indicator of the amount of prize money to be won from correct answers during a

target detection task, was present. In our study however, the salary was not directly related to the participant as the salaries in question were allocated to strangers and might therefore not affect the reward circuitry sufficiently or at all. In addition, a lack of interest in the salary levels presented and/ or the overriding effect of objective facial features as the main factor to influence the attention, the evaluations and the pupil responses could explain our non-significant findings.

Significant effect of Gender of face on pupil size as a response to highly attractive faces only, partially confirms our hypothesis surrounding gender effects. As previously reviewed, a high social status has been demonstrated to be especially important for the attractiveness of men, in the eyes of women (e.g., Guèguen & Lamy, 2012). In contrast, our data shows that the female faces, and not the male faces, induced the largest pupil size overall, no matter the salary level. Moreover, it has previously been demonstrated sex-independent increases in pupil size for participants due to arousal from viewing naked bodies of the opposite and same sex (Aboyoun & Dabbs, 1998). This is similar to our findings, as we found that the attractive female faces induced the largest pupil size in both male and female participants although for attractive faces instead of naked bodies. This is not surprising as attractive faces are also arousing. As earlier in our results, the gender dependent effect was again the opposite of our expectations.

A possible explanation for this opposite finding, is that similarly to the explanation for the findings in attractiveness ratings and memory performance have its basis in the fact that female faces are often rated as overall more attractive, as more feminine faces are usually preferred (Penton-Voak, Jacobson & Trivers, 2004). Interestingly, Winston et al (2007) fMRI study showed an increase in pupil size for male participants when looking at faces of both sexes, indicating a gender difference in arousal for attractive faces. All though our results show the opposite, it still indicates a possible gender difference in arousal for attractive faces, lending partially support to our hypothesis of gender dependent effects on the dependent variable (here; pupillary change).

4.3 AOI findings

A preference for the eye region in part supports our hypothesis. For the AOIs we hypothesized that the faces with the highest salary would be considered as more attractive and therefore would would elicit the longest fixations in the eye area. However, we did not find any effect of salary level on fixation duration, nor any gender differences. However, the

results showed that participants fixated longer at the eye area. This in part supports our hypothesis as we did expect the longest fixations to be in the eye region, but as a result of Salary level.

This preference for the eyes is in line with previous studies, showing that the eyes tend to be the most attended to area when looking at human faces (Kita et al., 2010; Hickman, Firestone, Beck & Speer, 2010).

5.0 Limitations and recommendations for future research

This study had several limitations. For example, the study only presented a rather limited set of faces (N= 18) with only one female and one male face within each attractiveness level and each of the salary conditions. When analyzing the attractive faces alone, there were only two faces per salary condition (e.g., one female and one male face in the category with high level of attractiveness and high level of salary).

The stimuli set was chosen to be limited to avoid overloading memory with too much information needed to be memorized, and to limit the experiment duration and the effect of probable boredom. However, we cannot rule out the possibility that this may have reduced the impact that factors like memory or attractiveness could have had.

Importantly, the salary levels provided could have been too high, making even the lowest salary level rewarding to the participants. Moreover, to assess the effect of salary level on pupillary responses, we tried to control for the pupillary changes in response to the level of attractiveness by presenting all stimuli twice while keeping all information constant, except for the amount of salary. We presented the faces and measured the pupil size after reading all the information about all 18 faces, because we were interested in testing the effect of social status on the memory for the faces.

Even though the current study did not show any significant effect of salary level on pupil sizes, it may be possible to find this effect if one measures the pupillary responses to the salary level when participants are looking at the faces and receiving the information simultaneously. In addition, the memory test contained information that was originally deemed neutral. However, there is a chance that the "neutral" information also affected participants' judgements, as it is difficult to avoid all stereotypes or prejudice surrounding everyday places, specific preference and items and professions.

In fact, we tested also the effect of profession type on the memory performance and attractiveness ratings. The results showed a significant main effect of profession type on both

dependent variables; indicating that participants remembered more facts and salary information about persons who were attributed to have, respectively, office and industry professions. They also rated individuals in office profession as more attractive. These results were not included in the result section, because we did not have any hypothesis about the effect of profession type and this factor was not manipulated accordingly.

Moreover, we did not control for the sexual orientation of the participants, which could lead to skewed attractiveness measures and pupil sizes, although we did replicate the typical heterosexual pattern that participants rated higher their opposite sex.

Finally, our participants' sample did not consist of an equal amount of male and female participants (46 females), which may be important for finding gender-dependent interactions.

Based on this, future research should use more stimuli across all conditions, aim to have a more balanced sample of participants, control for participants' motivation behind their ratings (e.g., based on long-term or short-term partner) and sexual orientation.

6.0 Conclusion

In conclusion, the results of this study failed to confirm the hypotheses surrounding the effect of social status (i.e., salary level) on facial attractiveness, memory and pupil change. However, partial support for the hypothesis of gender effects was found for both the perception of facial attractiveness and memory performance, showing an overall preference for female faces. In addition, the gender of the face stimuli showed that female faces induced a larger pupil size, although only for the most attractive faces

Moreover, the current study found longer fixations at the eyes in human faces, replicating what previous studies have found.

Further research should be conducted to investigate the effect of social status on subjective perceptions of facial attractiveness, memory and pupillary change.

7.0 References

Aboyoun, D. C., & Dabbs, J. M. (1998). The Hess pupil dilation findings: Sex or novelty? *Social Behavior and Personality: an international journal*, *26*(4), 415-419.

Aharon, I., Etcoff, N., Ariely, D., Chabris, C. F., O'Connor, E., & Breiter, H. C. (2001). Beautiful faces have variable reward value: fMRI and behavioral evidence. *Neuron*, *32*(3), 537-551. doi: 10.1016/S0896-6273(01)00491-3

Andreoni, J., & Petrie, R. (2008). Beauty, gender and stereotypes: Evidence from laboratory experiments. *Journal of Economic Psychology*, *29*(1), 73-93. doi: 10.1016/j.joep.2007.07.008

Aston-Jones, G., & Cohen, J. D. (2005). Adaptive gain and the role of the locus coeruleus–norepinephrine system in optimal performance. *Journal of Comparative Neurology*, *493*(1), 99-110. doi: 10.1002/cne.20723

Beatty, J. (1982). Task-evoked pupillary responses, processing load, and the structure of processing resources. *Psychological bulletin*, *91*(2), 276.

Blackburn, K., & Schirillo, J. (2012). Emotive hemispheric differences measured in real-life portraits using pupil diameter and subjective aesthetic preferences. *Experimental brain research*, *219*(4), 447-455. doi: 10.1007/s00221-012-3091-y

Bradley, M. M., Miccoli, L., Escrig, M. A., & Lang, P. J. (2008). The pupil as a measure of emotional arousal and autonomic activation. *Psychophysiology*, *45*(4), 602-607. doi: 10.1111/j.1469-8986.2008.00654.x

Bray, S., & O'Doherty, J. (2007). Neural coding of reward-prediction error signals during classical conditioning with attractive faces. *Journal of neurophysiology*, *97*(4), 3036-3045. doi: 10.1152/jn.01211.2006

Bronstad, P. M., & Russell, R. (2007). Beauty is in the 'we'of the beholder: Greater agreement on facial attractiveness among close relations. *Perception*, *36*(11), 1674-1681. doi: 10.1068/p5793

Buck, S., & D. Tiene. (1989). 'The Impact of Physical Attractiveness, Gender, and Teaching Philosophy on Teacher Evaluations.' *The Journal of Educational Research*, *82*(3), 172–177.

Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: an evolutionary perspective on human mating. *Psychological review*, *100*(2), 204.

Cahill, L., & McGaugh, J. L. (1996). Modulation of memory storage. *Current opinion in neurobiology*, *6*(2), 237-242.

Carbon, C. C., Hutzler, F., & Minge, M. (2006). Innovativeness in design investigated by eye movements and pupillometry. *Psychology Science*, *48*(2), 173.

Chelnokova, O., Laeng, B., Eikemo, M., Riegels, J., Løseth, G., Maurud, H., Willoch, F., & Leknes, S. (2014). Rewards of beauty: the opioid system mediates social motivation in humans. *Mol. Psychiatry* 19, 746–747. doi: 10.1038/mp.2014.1

Chen, W., Liu, C. H., & Nakabayashi, K. (2012). Beauty hinders attention switch in change detection: the role of facial attractiveness and distinctiveness. *PloS one*, *7*(2), e32897. doi: 10.1371/journal.pone.0032897

Cloutier, J., Heatherton, T. F., Whalen, P. J., & Kelley, W. M. (2008). Are attractive people rewarding? Sex differences in the neural substrates of facial attractiveness. *Journal of cognitive neuroscience*, *20*(6), 941-951. doi: 10.1162/jocn.2008.20062

Cohen, J. D., McClure, S. M., & Angela, J. Y. (2007). Should I stay or should I go? How the human brain manages the trade-off between exploitation and exploration. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *362*(1481), 933-942. doi: 10.1098/rstb.2007.2098

Dakin, S. C., & Watt, R. J. (2009). Biological "bar codes" in human faces. *Journal of Vision*, *9*(4), 2-2. doi: 10.1167/9.4.2

Dion, K., Berscheid, E., & Walster, E. (1972). What is beautiful is good. *Journal of Personality and Social Psychology*, *24*(3), 285–290.

Dipboye, R. L., Arvey, R. D., & Terpstra, D. E. (1977). Sex and physical attractiveness of raters and applicants as determinants of resume evaluations. *Journal of Applied Psychology, 62*(3) ,288–294. doi: 10.1037/0021-9010.62.3.288

Elliott, R., Newman, J. L., Longe, O. A., & Deakin, J. W. (2003). Differential response patterns in the striatum and orbitofrontal cortex to financial reward in humans: a parametric functional magnetic resonance imaging study. *Journal of Neuroscience, 23*(1), 303-307. doi: 10.1523/JNEUROSCI.23-01-00303.2003

Felson, R. B. *and* G. W. Bohrnstedt. 1979. "'Are the Good Beautiful or the Beautiful Good?" The Relationship Between Children's Perceptions of Ability and Perceptions of Physical Attractiveness.*' Social Psychology Quarterly, 42*(4), 386–392. doi: 10.2307/3033808

Fletcher, J. M. 2009. Beauty vs. brains: early labor market outcomes of high school graduates. *Economics Letters, 105*(3), 321–325. doi: 10.1016/j.econlet.2009.09.006

Fink, B., Neave, N., Manning, J. T., & Grammer, K. (2006). Facial symmetry and judgements of attractiveness, health and personality. *Personality and Individual Differences, 41*(3), 491-499. doi: 10.1016/j.paid.2006.01.017

Fink, B., & Penton-Voak, I. (2002). Evolutionary psychology of facial attractiveness. *Current Directions in Psychological Science, 11*(5), 154-158.

Fiske, S. T. (1993). Controlling other people: The impact of power on stereotyping. *American psychologist, 48*(6), 621-628.

Grammer, K., Fink, B., Møller, A. P., & Thornhill, R. (2003). Darwinian aesthetics: sexual selection and the biology of beauty. *Biological Reviews, 78*(3), 385-407. doi: 0.1017/S1464793102006085

Guéguen, N., & Lamy, L. (2012). Men's social status and attractiveness. *Swiss Journal of Psychology, 71*(3), 157-160. doi: 10.1024/1421-0185/a000083

Ha, T., Overbeek, G., & Engels, R. C. (2010). Effects of attractiveness and social status on dating desire in heterosexual adolescents: An experimental study. *Archives of Sexual Behavior, 39*(5), 1063-1071. doi: 10.1007/s10508-009-9561-z

Ha, T., van den Berg, J. E., Rutger, C. M., Engels, R. C., & Lichtwarck-Aschoff, A. (2012). Effects of attractiveness and status in dating desire in homosexual and heterosexual

men and women. *Archives of Sexual Behavior*, *41*(3), 673-682. doi: 10.1007/s10508-011-9855-9

Heilman, M. E., & Saruwatari, L. R. (1979). When beauty is beastly: The effects of appearance and sex on evaluations of job applicants for managerial and nonmanagerial jobs. *Organizational Behavior and Human Performance*, *23*(3), 360-372. doi: 0030-5073/79/030360-13502.00/0

Heilman, M. E., & Stopeck, M. H. (1985). Being attractive, advantage or disadvantage? Performance-based evaluations and recommended personnel actions as a function of appearance, sex, and job type. *Organizational Behavior and Human Decision Processes*, *35*(2), 202-215. doi: 10.1016/0749-5978(85)90035-4

Hess, E. H., & Polt, J. M. (1960). Pupil size as related to interest value of visual stimuli. *Science*, *132*(3423), 349-350. doi: 10.1126/science.132.3423.349

Hamermesh, D. S. (2011). *Beauty pays: Why attractive people are more successful*. Princeton University Press.

Hamermesh, D., & Biddle, J. (1994). Beauty and the labor market. *American Economic Review*, *84*(5), 1174–1194.

Harley, C. W. (1987). A role for norepinephrine in arousal, emotion and learning?: limbic modulation by norepinephrine and the Kety hypothesis. *Progress in Neuro-psychopharmacology and Biological Psychiatry*, *11*(4), 419-458. doi: 10.1016/0278-5846(87)90015-7

Hassin, R., & Trope, Y. (2000). Facing faces: studies on the cognitive aspects of: physiognomy. *Journal of personality and social psychology*, *78*(5), 837. doi: 1O.1037//0O22-3514.78.5.837

Hosoda, M., Stone-Romero, E. F. & Coats, G. (2003) The effects of physical attractiveness on job-related outcomes: A meta-analysis of experimental studies. *Personnel Psychology 56*(2), 431–462.

Howells, F. M., Stein, D. J., & Russell, V. A. (2012). Synergistic tonic and phasic activity of the locus coeruleus norepinephrine (LC-NE) arousal system is required for optimal attentional performance. *Metabolic brain disease*, *27*(3), 267-274. doi: 10.1007/s11011-012-9287-9

Ishai, A. (2007). Sex, beauty and the orbitofrontal cortex. *International Journal of Psychophysiology*, *63*(2), 181-185. doi: 10.1016/j.ijpsycho.2006.03.010

Jackson, L. A. (1983). The Influence of Sex, Physical Attractiveness, Sex Role, and Occupational Sex-Linkage on Perceptions of Occupational Suitability. *Journal of Applied Social Psychology*, *13*(1), 31-44. doi: 10.1111/j.1559-1816.1983.tb00885.x

Janisse, M. P. (1973). Pupil size and affect: A critical review of the literature since 1960. *Canadian Psychologist/Psychologie canadienne*, *14*(4), 311-329. doi: 10.1037/h0082230

Johnson, M. G., Muday, J. A., & Schirillo, J. A. (2010). When viewing variations in paintings by Mondrian, aesthetic preferences correlate with pupil size. *Psychology of Aesthetics, Creativity, and the Arts*, *4*(3), 161-167. doi: 10.1037/a0018155

Joshi, S., Li, Y., Kalwani, R. M., & Gold, J. I. (2016). Relationships between pupil diameter and neuronal activity in the locus coeruleus, colliculi, and cingulate cortex. *Neuron*, *89*(1), 221-234. doi: 10.1016/j.neuron.2015.11.028

Kahneman, D. (1973). Attention and effort. Englewood Cliffs. NewJersey: Prentice-Hall.

Kahneman, D., Beatty, J., & Pollack, I. (1967). Perceptual deficit during a mental task. *Science*, *157*(3785), 218-219. doi: 10.1126/science.157.3785.218

Kalwani, R. M., Joshi, S., & Gold, J. I. (2014). Phasic activation of individual neurons in the locus ceruleus/subceruleus complex of monkeys reflects rewarded decisions to go but not stop. *Journal of Neuroscience*, *34*(41), 13656-13669. doi: 10.1523/JNEUROSCI.2566-14.2014

Kuchinke, L., Trapp, S., Jacobs, A. M., & Leder, H. (2009). Pupillary responses in art appreciation: Effects of aesthetic emotions. *Psychology of Aesthetics, Creativity, and the Arts*, *3*(3), 156-163. doi: 0.1037/a0014464

Laeng, B., Sirois, S., & Gredebäck, G. (2012). Pupillometry: a window to the preconscious?. *Perspectives on psychological science*, *7*(1), 18-27. doi: 10.1177/1745691611427305

Laeng, B., Suegami, T., & Aminihajibashi, S. (2016). Wine labels: an eye-tracking and pupillometry study. *International Journal of Wine Business Research*, *28*(4), 327–348. doi: 10.1108/IJWBR-03-2016-0009

Langlois, J. H., Kalakanis, L., Rubenstein, A. J., Larson, A., Hallam, M., & Smoot, M. (2000). Maxims or myths of beauty? A meta-analytic and theoretical review. *Psychological Bulletin, 126*(3), 390–423. doi: 10.1037//0033-2909.126.3.390

Langlois, J. H., Ritter, J. M., Casey, R. J., & Sawin, D. B. (1995). Infant attractiveness predicts maternal behaviors and attitudes. *Developmental Psychology, 31*(3),464–472. doi: 10.1037/0012-1649.31.3.464

Langton, S. R., Law, A. S., Burton, A. M., & Schweinberger, S. R. (2008). Attention capture by faces. *Cognition*, *107*(1), 330-342. doi: 10.1016/j.cognition.2007.07.012

Lawson, C., Lenz, G. S., Baker, A., & Myers, M. (2010). Looking like a winner: Candidate appearance and electoral success in new democracies. *World Politics*, *62*(4), 561-593. doi: 10.1017/S0043887110000195

Li, N. P., & Kenrick, D. T. (2006). Sex similarities and differences in preferences for short-term mates: What, whether and why. *Journal of Personality & Social Psychology*, *90*(3), 468–489. doi: 10.1037/0022-3514.90.3.468

Light, L. L., Hollander, S., & Kayra-Stuart, F. (1981). Why attractive people are harder to remember. *Personality and Social Psychology Bulletin*, *7*(2), 269-276.

Little, A. C., Jones, B. C., & DeBruine, L. M. (2011). Facial attractiveness: evolutionary based research. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1571), 1638-1659. doi: 10.1098/rstb.2010.0404

Little, A. C., Jones, B. C., Penton-Voak, I. S., Burt, D. M., & Perrett, D. I. (2002). Partnership status and the temporal context of relationships influence human female preferences for sexual dimorphism in male face shape. *Proceedings of the Royal Society of London B: Biological Sciences*, *269*(1496), 1095-1100. doi: 0.1098/rspb.2002.1984

Marcus, D. K. & Miller, R. S. (2003). Sex differences in judgments of physical attractiveness: A social relations analysis. *Personality and Social Psychology Bulletin, 29*(3), 325-335.

Marzi, T., & Viggiano, M. P. (2010). When memory meets beauty: Insights from event-related potentials. *Biological psychology*, *84*(2), 192-205. doi: 10.1016/j.biopsycho.2010.01.013

Mathôt, S., Fabius, J., Van Heusden, E., & Van der Stigchel, S. (2018). Safe and sensible preprocessing and baseline correction of pupil-size data. *Behavior research methods, 50*(1), 94-106. doi: 10.3758/s13428-017-1007-2

Mobius, M. M. and Rosenblat, T. S. 2006. Why beauty matters. *American Economic Review, 96*(1), 222–235.

Morris, P. E., & Wickham, L. H. (2001). Typicality and face recognition: A critical re-evaluation of the two factor theory. *The Quarterly Journal of Experimental Psychology Section A, 54*(3), 863-877. doi: 0.1080/02724980042000390

Murphy, P. R., O'connell, R. G., O'sullivan, M., Robertson, I. H., & Balsters, J. H. (2014). Pupil diameter covaries with BOLD activity in human locus coeruleus. *Human brain mapping, 35*(8), 4140-4154. doi: 10.1002/hbm.22466

O'Doherty, J. P. (2004). Reward representations and reward-related learning in the human brain: insights from neuroimaging. *Current opinion in neurobiology, 14*(6), 769-776. doi: 10.1016/j.conb.2004.10.016

Olson, I. R., & Marshuetz, C. (2005). Facial attractiveness is appraised in a glance. *Emotion, 5*(4), 498-502. doi: 0.1037/1528-3542.5.4.498

Penton-Voak, I. S., Jacobson, A., & Trivers, R. (2004). Populational differences in attractiveness judgements of male and female faces: Comparing British and Jamaican samples. *Evolution and Human Behavior, 25*(6), 355-370. doi: 10.1016/j.evolhumbehav.2004.06.002

Ratcliff, N. J., Hugenberg, K., Shriver, E. R., & Bernstein, M. J. (2011). The allure of status: High-status targets are privileged in face processing and memory. *Personality and Social Psychology Bulletin, 37*(8), 1003-1015. doi: 0.1177/0146167211407210

Ro, T., Friggel, A., & Lavie, N. (2007). Attentional biases for faces and body parts. *Visual Cognition, 15*(3), 322-348.

Ruffle, B. J., & Shtudiner, Z. E. (2014). Are good-looking people more employable?. *Management Science, 61*(8), 1760-1776. doi: 10.1287/mnsc.2014.1927

Sara, S. (2009). The locus coeruleus and noradrenergic modulation of cognition. Nature Reviews: Neuroscience, *10*(3), 211–223. doi: 10.1038/nrn2573

Sarno, J. A., & Alley, T. R. (1997). Attractiveness and the memorability of faces: Only a matter of distinctiveness? *The American journal of psychology*, *110*(1), 81-92.

Shepherd, J. W., & Ellis, H. D. (1973). The effect of attractiveness on recognition memory for faces. *The American journal of psychology*, *86*(3), 627-633. doi: 10.2307/1421948

Sirois, S., & Brisson, J. (2014). Pupillometry. *Wiley Interdisciplinary Reviews: Cognitive Science*, *5*(6), 679-692. doi: 10.1002/wcs.1323

Steinhauer SR, Boller F, Zubin J, Pearlman S. (1983) Pupillary dilation to emotional visual stimuli revisited. [Abstract]. *Psychophysiology, 20,* 472.

Sundie, J. M., Kenrick, D. T., Griskevicius, V., Tybur, J. M., Kathleen, D., Vohs, K. D., & Beal, D. J. (2011). Peacocks, Porsches,and Thorstein Veblen: Conspicuous consumption as a sexual signaling system. *Journal of Personality and Social Psychology*, *100*(4), 664–680. doi: 10.1037/a0021669

Theeuwes, J. (2010). Top–down and bottom–up control of visual selection. *Acta psychologica*, *135*(2), 77-99. doi: 10.1016/j.actpsy.2010.02.006

Thornhill, R., & Gangestad, S. W. (1999). Facial attractiveness. *Trends in cognitive sciences*, *3*(12), 452-460. doi: 10.1016/S1364-6613(99)01403-5

Tsukiura, T., & Cabeza, R. (2011). Remembering beauty: roles of orbitofrontal and hippocampal regions in successful memory encoding of attractive faces. *Neuroimage*, *54*(1), 653-660. doi: 10.1016/j.neuroimage.2010.07.046

Underwood, G., & Foulsham, T. (2006). Visual saliency and semantic incongruency influence eye movements when inspecting pictures. *The Quarterly Journal of Experimental Psychology*, *59*, 1931–1949. doi: 10.1080/17470210500416342

Van Hooff, J. C., Crawford, H., & Van Vugt, M. (2010). The wandering mind of men: ERP evidence for gender differences in attention bias towards attractive opposite sex faces. *Social cognitive and affective neuroscience*, *6*(4), 477-485. doi: 10.1093/scan/nsq066

Von Rueden, C., Gurven, M., & Kaplan, H. (2010). Why do men seek status? Fitness payoffs to dominance and prestige. *Proceedings of the Royal Society of London B: Biological Sciences*, rspb20102145. doi: 10.1098/rspb.2010.2145

Webster Jr, M., & Driskell Jr, J. E. (1983). Beauty as status. *American Journal of Sociology, 89*(1), 140-165. doi: 0002-9602/84/890 1-0004$0 1.50

Wiederman, M. W., & Dubois, S. L. (1998). Evolution and sex differences in preferences for short-term mates: Results from a policy capturing study. *Evolution and Human Behavior, 19*(3), 153-170. doi: 10.1016/S1090-5138(98)00006-3

Wiese, H., Altmann, C. S., & Schweinberger, S. R. (2014). Effects of attractiveness on face memory separated from distinctiveness: Evidence from event-related brain potentials. *Neuropsychologia, 56*, 26-36. doi: 10.1016/j.neuropsychologia.2013.12.023

Winston, J. S., O'Doherty, J., Kilner, J. M., Perrett, D. I., & Dolan, R. J. (2007). Brain systems for assessing facial attractiveness. *Neuropsychologia, 45*(1), 195-206. doi: 1 0.1016/j.neuropsychologia.2006.05.009

8.0 Appendices

Appendix I: Example from information pamphlet from participant group 1.

1) Birth Place: Oppland
2) Favorite Music: Rock
3) Favorite Food: Thai
4) Profession: University
5) Salary: 700 000 per year