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Is preference for ovulatory female's faces associated with men's testosterone levels?

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ABSTRACT

Women's ovulation is perceivable with different senses. Already subtle face shape differences are enough to trigger men's preference for the ovulatory female. The aim of the present study is to investigate if men's testosterone level can be linked to their preference for the ovulatory female. Thirty-nine heterosexual participants were shown face pairs of which one of them was transformed to the shape of a prototype face of a woman in her luteal cycle phase and the other was transformed to the shape of a prototype face of an ovulatory woman. Participants were asked to choose the face which they perceived as being more attractive (attractiveness task), or the woman with whom they would have better chances to get a date (dating task). In both tasks, the ovulatory female was chosen more often. Testosterone was not predictive for the chosen face; regardless of testosterone level men preferred the ovulatory woman. However testosterone predicted how confident the men were with their choice. Men with lower testosterone levels were more confident with their choice than men with higher testosterone levels.

Introduction

For centuries researchers have debated whether human females have lost oestrus or not. While scientists first had claimed that human ovulation is concealed, recent research has suggested that human females send out various cues to ovulation which can be perceived with different senses (for a review see Haselton and Gildersleeve, 2011). Several studies have shown that women's odour is rated as more attractive if gathered near ovulation (e.g. Gildersleeve et al., 2012; Havlicek et al., 2006; Kuukasjarvi et al., 2004; Singh and Bronstad, 2001; Thornhill et al., 2003). Furthermore women's voices sound more attractive when recorded near ovulation (Fischer et al., 2011; Pipitone and Gallup, 2008). Bryant and Haselton (2009) found that women's intonation of an introductory sentence was different when recorded during their fertile days compared to other cycle phases. Specifically their voices had a higher pitch during ovulation. For single vowels, no such difference was found. This is in line with the study of Fischer et al. (2011), who reported that sentences were judged as more attractive when recorded during ovulation but did not find such an effect when a single vowel was presented.

Cues to ovulation are also revealed by a woman's face and body, and even by her behaviour. During ovulation women's bodies were found to be more symmetrical (Scutt and Manning, 1996) and the waist-to-hip ratio (WHR) to be lower (Kirchengast and Gartner, 2002). We note that these changes were measured objectively; hence it remains unclear whether changes in body shape are actually perceivable by the naked eye. Women have been shown to dance and walk differently depending on the menstrual cycle phase. Videos of dance and gait were rated as more attractive when they were recorded during fertile days compared to during non-fertile days (Fink et al., 2012; but see Provost et al., 2008). Various studies found that women dress differently during ovulation. Haselton et al. (2007) for example showed that women seemingly make a bigger effort to look more attractive when photographed during ovulation compared to during the luteal phase. In contrast, Durante et al. (2008) found no cycle difference in rated sexiness of the clothes the women were wearing when they came to the lab. However, when asked to draw a picture of the dress they wanted to wear at a fictive party that night the outfits were rated sexier when drawn during the fertile phase. Another study found evidence that women were more likely to wear red or pink when conception risk was high (Beall and Tracy, 2013). Subtle cues that may signal fertility are also sent out by the face alone: Portraits taken during the fertile phase were rated as more attractive than pictures taken during the luteal phase (Oberzaucher et al., 2012; Roberts et al., 2004; Samson et al., 2011; but see Bleske-Rechek et al., 2011). Thereby, subtle differences in face shape seem to be enough to trigger this preference in men (Bobst and Lobmaier, 2012). The menstrual cycle also influences women's voting behaviour (Durante et al., 2013), consumer behaviour (Saad and Stenstrom, 2012) or product choice (Durante et al., 2011) to name just

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a few. The studies reviewed above clearly suggest that human oestrus is not completely concealed. Instead women seem to send out subtle but perceivable cues that signal fecundity.

Women close to ovulation are not only perceived as being more attractive, they also prefer different characteristics in men. Again, different senses are affected. Women in the late follicular cycle phase have been shown to have a stronger preference for masculinity. This was shown for male voices (Feinberg et al., 2006; Puts, 2005, 2006), bodies (Little et al., 2007; but see Peters et al., 2009) and faces (Johnston et al., 2001; Penton-Voak and Perrett, 2000; Penton-Voak et al., 1999). Furthermore, the preference for faces of men with higher testosterone levels was stronger around ovulation compared to other cycle phases (Roney and Simmons, 2008). Higher testosterone levels have been linked to more masculine facial features (Penton-Voak and Chen, 2004; Roney et al., 2006; but see Peters et al., 2008), hence facial masculinity might be understood as an indicator for higher testosterone levels.

If men with higher testosterone levels are preferred during ovulation, then the reverse might also be true: men with higher testosterone levels might show a stronger preference for ovulatory females than men with lower testosterone levels. Testosterone level has been associated with several mating outcomes: Men with higher testosterone levels were found to have a higher number of opposite sex partners than men with lower testosterone levels (Peters et al., 2008; Pollet et al., 2011), but they were less successful than men with lower testosterone levels in mate poaching (Sunderani et al., 2013). Men with higher testosterone levels are less likely to be married and more likely to be divorced (Booth and Dabbs, 1993). Those who are married report to spend less time with their wives (Gray et al., 2002). Furthermore, fatherhood has been shown to affect testosterone levels. Fathers typically have lower testosterone levels than single men (Gray et al., 2002; Pollet et al., 2013). Testosterone levels decline after the birth of own children and are lower in fathers who spend a lot of time with their children than in fathers who spend little time with their children (Gettler et al., 2011). However, fathers with higher testosterone levels have more children than fathers with lower testosterone levels irrespective of the number of sex partners (Pollet et al., 2013).

Welling et al. (2008) investigated whether men's salivary testosterone levels are associated with the preference for femininity in female faces. In two test sessions separated by two weeks male participants were presented with pairs of feminized and masculinized female faces and were asked to choose the face that seemed more attractive to them. In the test session in which they had higher testosterone levels participants showed a stronger preference for the more feminine female face than in the session with lower testosterone levels. However, this effect was only found on an intra-individual level. No correlation between average testosterone level and femininity preference was found.

The current study aims at unravelling the association between testosterone levels in men and their preferences for the ovulatory female. We investigated whether the preference for the face that has been transformed towards the prototype face of an ovulatory woman is modulated by testosterone levels in male observers.

Method

Participants

Forty heterosexual male participants took part in this study. Due to the exclusion of one participant with an extremely low testosterone level (see Results) analyses are based on 39 participants. Participants were aged between 19 and 31 (Mean $\pm$ SD $= 23.4 \pm 3.0$). Eighteen participants stated to be in a relationship; none reported to have children. Participants received either course credits or a financial compensation in return for their attendance. They were naive regarding the purpose of the experiment and were fully debriefed at the end of the study. The research was approved by the ethics committee of the Faculty of Human Sciences of the University of Bern and participants were treated according to *The Code of Ethics of the World Medical Association* (*Declaration of Helsinki*).

Materials

Stimuli

Prototypes. First, two prototypes were created from pictures of women who had taken part in an unrelated experiment investigating the interrelationship between cycle phase and social perception. Twenty-five of these women consented to being photographed twice, once during their late follicular cycle phase (ovulation) and once during their luteal cycle phase. None of the women was using hormonal contraception. Photographs were taken not later than 24 h after the peak of the *luteinizing hormone* (*LH*) and then again 7 days later in the luteal cycle phase. LH surge was determined by WH Ovultell™ ovulation test strips. To further confirm that the women actually were in the corresponding cycle phase, they provided saliva samples at both sessions using a commercially available sampling device (Salivette; Sarstedt, Rommelsdorf, Germany). Saliva samples were stored at −20 °C and were analysed by an independent laboratory (Dresden Lab Service GmbH, Dresden, Germany) using commercially available radioimmunoassay kits adopted for the analysis of salivary estradiol and progesterone (IBL International, Hamburg, Germany). The sensitivity of the progesterone assay is 2.8 pg/ml, and the sensitivity of the estradiol assay is 0.3 pg/ml. Inter- and intra-assay variances are <8% for progesterone and <10% for estradiol.

Photographs of seven women were excluded from further processing because their hormone profile did not conform to the alleged cycle phases (e.g., higher progesterone levels during ovulation than during the luteal phase). Hence, a total of 18 women were used for the prototypes. The progesterone level of these 18 women was significantly lower at ovulation than during the luteal phase (ovulation: 25.63 ± 13.36 pg/ml, luteal phase: 51.86 ± 24.91 pg/ml; $t = -4.90$ $p < .001$, $d_z = -1.16$), estradiol levels however did not differ (ovulation: 3.76 ± 1.55 pg/ml, luteal phase: 3.95 ± 1.84 pg/ml; $p = .42$). Prototypes were made using PsychoMorph computer graphics software (Tiddeman et al., 2001). Shape and facial features of each face were manually defined with 179 facial landmarks. In a next step, all the pictures that were taken in one phase were morphed (i.e., averaged). In the resulting prototype, the position of each facial landmark is defined by the averaged position of the landmarks of the initial 18 pictures; hence the prototype of the woman in the luteal phase is the average of the individual 18 faces photographed in the luteal cycle phase, and the prototype of the ovulatory woman is the average of the individual 18 faces photographed in the late follicular phase. Importantly, each prototype (see Fig. 1) consisted of 18 pictures of the same 18 women taken in different cycle phases (see Supplementary materials).

Stimulus transformation. Twenty (new) frontal portraits of female faces showing a neutral expression were selected from the LongevityFaceDatabase (Minear and Park, 2004). These pictures are, at this stage, completely unrelated to the pictures used for the prototypes. Each face from the database, henceforth referred to as "stimulus face", was transformed (i.e. assimilated) in two steps (50% and 100%) towards the prototype of the female in the luteal phase and the prototype of the ovulatory female. In order to do this, for each stimulus face again the 179 facial landmarks were manually defined, just as it had been done for the pictures that were used for the prototypes. In the actual transformation process, landmark points' coordinates of the stimulus face were shifted towards the coordinates of the two prototypes by adding 50% (100%) of the linear 2D differences between the two prototypes to the stimulus faces (for similar procedures see Bobst and Lobmaier, 2012). For each stimulus face we thus obtained two versions that were parametrically transformed towards the shape of the prototype of the woman in the luteal phase and two versions that were parametrically