AN INVESTIGATION OF MENSTRUAL CYCLE EFFECTS ON THE PERCEPTION OF FACIAL ATTRACTIVENESS

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ABSTRACT

The present study, performed within the framework of evolutionary psychology, is an examination of the influence of hormonal fluctuations, associated with the phases of the menstrual cycle, on judgements of male and female facial attractiveness. It was hypothesized that women in the peri-ovulatory phase would be more discriminating in rating male facial attractiveness than women in the early follicular phase, due to an increased likelihood of conceiving. Alternatively, if peri-ovulatory women are too selective, they may not find a mate; therefore, women in the peri-ovulatory phase could be more discriminating than women in the early-follicular phase. Judgements of female facial attractiveness were also examined as it may be associated with same sex competition. Lastly, salivary testosterone was analyzed in order to investigate the relationship between attractiveness ratings and testosterone levels, as testosterone is linked to women's libido and sexuality. To test these hypotheses, 129 undergraduate females who had regular and normally cycling menstrual cycles rated male and female facial attractiveness twice, once during the peri-ovulatory phase and again during the early-follicular phase. Menstrual phase had no significant influence on judgements of facial attractiveness of male and female faces. Female faces

were rated as more attractive than male faces independent of phase, and the ratings were more variable for the female faces than the male faces. There was no difference in levels of salivary testosterone during the peri-ovulatory and the early follicular phase, and no significant correlations were obtained to support the hypothesis of a relationship between judgements of attractiveness and testosterone.

"La théorie, c'est bon, mais ça n'empeche pas d'exister"

Jean-Martin Charcot (1825-1893)

1:59 pm, August 11, 1999: *Done at last!* There are many people I should thank, both at McMaster and at York, but I know that I will inevitably forget someone if I list names. Therefore, I will simply say thank you to all the faculty members, supervisors, committee members, experimental subjects, and professors who have helped me get to this stage in my life. As for friends and peers, I am grateful for the handful of amazing people who have supported and encouraged me throughout my academic adventures - these include Belinda, Emily, Erie, Kathy and Lisa. And thanks to my family, as strange as you all are, because you were a part of this process. Lastly, the person I want to thank the most is Tony, my love, my listener, my friend. I will never forget sitting up at three in the morning eating rice pudding and listening to you edit this thesis.

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INTRODUCTION

This thesis is an attempt to integrate research on hormonal fluctuations corresponding with menstrual phase with theories of evolutionary psychology. The literature pertaining to evolutionary psychology demonstrates that the perception of facial attractiveness has a significant impact on an individual's reproductive behavior, and therefore, it was selected as the area to be examined by this study. Evolutionary psychology research has provided evidence that attractiveness affects mate choice and that it is correlated with good health, youth, fertility, and possibly quality genes (Buss, 1994). Individuals of both sexes express a preference for, and form interpersonal relationships with, people who are physically attractive (Berscheid & Walster, 1974). Due to the importance of attractiveness in mate choice and the formation of interpersonal relationships, it is possible that during the process of evolution, traits linked to detecting attractiveness have been naturally selected. The process of evolution requires the transmission of high quality, as opposed to deleterious and poor quality, genetic material, and the results of this process should be apparent when a female selects a potential mate. For facial attractiveness to be a useful criterion, it must be capable of indicating that a potential mate possesses high quality genes. If a male has a face without evidence of physical insult, it is likely that he has a history of good health, nutrition, and economic stability (Gangestad & Thornhill, 1997b; Gangestad, Thornhill, & Yeo, 1994). Therefore, his genetic quality is theoretically higher than that of an individual who has endured physical insults as a consequence of poor health, genetic disorders, malnutrition, and/or lower economic welfare (Gangestad & Thornhill, 1997b; Gangestad, Thornhill, & Yeo, 1994).

By using the parental investment model (Trivers, 1972; 1985), it is possible to relate menstrual cycle phase with the perception of male facial attractiveness for the purpose of mate selection. In contrast to men, women have a relatively small number of gametes that are energetically costly and involve substantial time to produce. Additionally, the minimal physical investment for a female involves a nine-month gestation period, parturition, and lactation. Thus, the investment of a female in her children is more significant than that of her male partner, whose minimal physical investment is a few moments of sexual intercourse culminating in a single ejaculate. In theory, this differential in minimum parental investment should have selected for more choosy females and less choosy males (Trivers, 1972). In many species, including humans, males compete more aggressively and intensely for sexual access to females, than females compete for males (Trivers, 1972). As a consequence, a woman must be discriminative in order to choose from the abundance of males competing to be her mate. When selecting a potential mate, a woman in the peri-ovulatory phase might be choosier than a woman in any other phase due to her increased chances of conception. This is a result of wanting to select the best mate possible at the time when her chance of conceiving is highest. Since facial attractiveness is an important selection criterion it is possible that the perception of attractiveness varies in association with fertility. Therefore, the women in the peri-ovulatory phase may be more discriminative, that is, demonstrate a higher variability in ratings of facial attractiveness, than women in other phases.

A second hypothesis, in opposition to the first, is that women are less discriminating when in the peri-ovulatory phase than when in other phases. Since the human female has a finite number of gametes and a time limited reproductive age span, it is in her best interests to conceive when the opportunity arises. Therefore, to maximize the possibility of conception, women in the peri-ovulatory phase may be the least selective in judging the quality of potential mates. If this were the case, women in the peri-ovulatory phase would demonstrate the least amount of variation in their ratings of male facial attractiveness, compared with women in the least fertile state, that of the early follicular phase, who would demonstrate the most variation in their ratings. In this thesis, these hypotheses were investigated by asking females to rate the attractiveness of 50 male faces when in the peri-ovulatory and the early-follicular phase.

Female faces were also included in this investigation as the perception of female facial attractiveness may be influenced by the rater's fertility. When females are attempting to select a potential mate, it is possible that they are aware of the same sex competition for these mates. This awareness could result in women being highly discriminative of female facial attractiveness. This would be most apparent during the peri-ovulatory phase as women in this phase probably compete the most intensely for a mate. Another hypothesis is that if women are more discriminating in rating the attractiveness of male faces, they show a similar increase in their discrimination of female faces as a result of generalization. If there is a shift in discriminative ability due to hormonal fluctuation, this could be observed for both male and female faces. It could also be the case that females are more attentive to the facial features of other women than to those of men. This would lead to a higher level of variance for ratings of female facial attractiveness, in comparison to male faces, regardless of menstrual phase. A third possibility is that the ratings of female facial attractiveness are unaffected by the menstrual cycle since females cannot conceive offspring together. To identify which of these hypotheses is valid, females were asked to rate the attractiveness of female faces while in the peri-ovulatory and the early-follicular phase. Lastly, the relationship between testosterone and facial attractiveness judgements was investigated. Previous studies (e.g., Cashdan, 1995; Kaplan & Owett, 1993) have demonstrated that testosterone is related to female sexuality and libido, and thus, it is possible that testosterone may relate to the perception of facial attractiveness.

This thesis begins with a review of theories and research from the field of evolutionary psychology. These are examined to explore the role of facial attractiveness judgements and hormonal fluctuations in mate selection. In order to understand the underlying biological processes of the hormonal fluctuations associated with menstrual phase, a brief review of the physiology of the menstrual cycle is provided. This is followed by a review of the menstrual cycle literature which suggests that ovarian hormones may influence cognitive and behavioral responses. A summary of the research on testosterone in women is presented and hypotheses derived about the possible relationship between testosterone and the perception of male attractiveness. In the last sections, a review of the physical and facial attractiveness literature is given in order to examine factors that influence the perception of attractiveness in addition to any effect of fertility, and hence might override the effect of menstrual phase.

EVOLUTIONARY PSYCHOLOGY AND MATE SELECTION

One influence on mate selection is physical appearance. Appearance is evolutionarily adaptive if it signals to a potential mate information concerning traits such as health, gene quality, or earning capacity. The importance of each of these characteristics is discussed in the following sections. In theory, physical attractiveness is indicative of good past and current health, as well as a decreased likelihood of disease transmission due to the absence of noticeable indicators of infection (Buss, 1994; Gangestad & Thornhill, 1997a; Gangestad & Thornhill, 1997b; Gangestad & Thornhill, in press; Gangestad, Thornhill, & Yeo, 1994; Shackelford & Larsen, 1999; Thornhill & Gangestad, 1994; Thornhill & Gangestad, 1993; Thornhill, Gangestad, & Comer, 1995). Furthermore, since attractive individuals are perceived as healthier than their unattractive peers, they may consequently have greater reproductive success since they may be selected more frequently as a mate (Buss, 1994). Attractive women are more likely to engage in sexual activity and report a larger number of partners than women of average attractiveness (Stelzer, Desmond, & Price, 1987), a finding which indicates the potential for a high level of reproductive success.

Shackelford and Larsen (1999) have verified the assumption that attractive people are healthy. They found that facially attractive people are physically healthier, and perceived as such, in comparison to unattractive individuals. There is a sex difference in the relationship between attractiveness and health, however, as high levels of fluctuating asymmetry (which is inversely related to attractiveness) are a better signal of poor health in males than in females (Shackelford & Larsen, 1997). Males and females with high levels of fluctuating asymmetry (FA) experience problems such as muscle cramps, headaches, gastrointestinal upset, insomnia, and lower cardiovascular fitness than those with lower levels of FA (Shackelford & Larsen, 1997).

However, the concept that attractive individuals are healthier than their unattractive peers has been challenged in a recent investigation. Using photographs and longitudinal health data, Kalick, Zebrowitz, Langlois, and Johnson (1998) concluded that attractive people are not healthier, and that attractive adolescents are mistakenly considered healthier, than their peers. For example, when raters judged the health of faces that were either previously rated as extremely attractive or extremely unattractive, raters were not accurate in ascertaining the health of these individuals. When judging faces of moderate attractiveness health was accurately determined by the raters. This may have important implications for evolutionary theories of attractiveness as attractiveness may not reliably signal good health. This result needs to be replicated as all other studies reviewed support the relationship between attractiveness and good health (Buss, 1994; Gangestad & Thornhill, 1997a; Gangestad & Thornhill, 1997b; Gangestad & Thornhill, in press; Gangestad, Thornhill, & Yeo, 1994; Shackelford & Larsen, 1999; Thornhill & Gangestad, 1994; Thornhill & Gangestad, 1993; Thornhill, Gangestad, & Comer, 1995).

FLUCTUATING ASYMMETRY

The perception of attractiveness is important if it signals a genetically based trait, such as health or survivability, to a potential mate. Thus, attractiveness possibly provides information about the quality of an individual's genes. This concept has recently been explored by researchers utilizing the theory of fluctuating asymmetry. As part of the pathogen theory of mate selection, it is currently the leading theory regarding the sexual selection of quality genes. Host-parasite co-evolution maintains heritable pathogen resistance and viability in the host population. Due to this, sexual selection favors preferences for mates possessing honest indicators of pathogen resistance (Thornhill, Gangestad & Comer, 1995). Since mates pass genetic material to offspring, and pathogen resistance assists in the survival of offspring, pathogen resistance is a quality one would want in a mate. One such indicator of pathogen resistance is symmetry, and an indicator of a lack of resistance is fluctuating asymmetry. Fluctuating asymmetry (FA) is the asymmetry of the two sides of bilateral features (such as feet and eyes) for which the differences between the two sides have a population mean of zero and are normally distributed. Fluctuating asymmetry is typically most pronounced in secondary sexual characteristics, and there is more variance in FA levels in these characteristics than in any other body area (Møller & Pomiankowski, 1993). There are two main sources of FA; one is the environment and the other is genetic endowment. Environmental stressors can take the form of extreme temperatures, the presence of various genetically harmful chemicals, food deficiencies as measured by quality or quantity, nutrient deprivation, pathogens, disease, and miscellaneous parasites. Genetic stressors may be present as a result of inbreeding which increases the homozygosity of genes and leads in some cases to the exposure of deleterious alleles. Since both sides of a bilateral feature are regulated by the same gene, FA represents developmental instabilities present in the individual (VanValen, 1962). An individual's level of FA is the result of deviations which accumulated during his or her development, and thus, FA is a measure of fitness in terms of developmental stability (Manning, Scutt, Whitehouse, Leinster, & Walton, 1996). Therefore, the averageness of feature symmetry, representing a low level of FA, indicates high fitness of an individual (Shackelford & Larsen, 1997; Thornhill & Gangestad, 1993).

Measures of FA vary widely within a population, and the presence of FA inversely relates to fecundity, growth rate, and survival in both sexes (Mitton & Grant, 1984; Thornhill, Gangestad, & Comer, 1995). For both men and women, high FA is strongly correlated with decreased numbers of lifetime sexual partners (Thornhill & Gangestad, 1994). With regards to males exclusively, there are several articles which provide evidence that FA is an indicator of human male mating success, and that men with low FA are judged as more attractive by females than those with higher levels of FA (Gangestad & Thornhill, 1997b; Grammer & Thornhill, 1994; Thornhill & Gangestad, 1994; Thornhill, Gangestad & Comer, 1995). Similarly, Gangestad and Thornhill (1997a) found that the number of extra-pair copulations for men correlates negatively with their FA.

Based on experimental results, some researchers have concluded that symmetrical faces are considered more attractive than asymmetrical faces, and that the relationship between physical attractiveness and FA is the same as that between facial attractiveness and FA (Gangestad & Thornhill, 1997a; 1997b; Thornhill & Gangestad, 1993; 1994; Watson & Thornhill, 1994). Mealey, Bridgstock, and Townsend (1999) studied monozygotic twins, who are genetically identical, but may have different experiences during development, to examine the influence of FA on facial attractiveness. Raters judged the twin with the lower FA as more attractive, and the difference in asymmetry was directly related to the magnitude of difference in perceived attractiveness. Since the difference in symmetry is highly correlated with the difference in attractiveness ratings for monozygotic twins, there must be developmental stability in FA, otherwise the difference in FA would be greater or less than the difference in the attractiveness ratings. This is supported by data from a longitudinal study conducted by Alley (1993) who reported a significant degree of stability in FA measurements.

There are, however, temporary fluctuations in levels of fluctuating asymmetry. Manning and colleagues (1996) investigated temporary within-subject changes in asymmetry in relation to menstrual cycle phase. They found that both sexually selected traits (such as breast size) and non-sexually selected traits (such as ear size), composed at least partially of soft tissue, revealed cyclical asymmetry. This asymmetry was maximal during phases of low fertility and minimal during the ovulatory phase. Therefore, women should reach maximal attractiveness, resulting from minimal temporary cyclic FA, when she is most fertile. This is not surprising in terms of mate selection as women would be predicted to be most attractive to a potential mate when they are most fertile.

Another aspect of FA that is apparent in mate selection was recently demonstrated by Gangestad and Thornhill (in press). In normally cycling women, during their ovulatory phase, there is a preference for the scent of shirts worn by symmetrical men. In contrast, women in the low fertility phases, as well as those using oral contraceptives, do not show a preference for the scent of symmetrical or asymmetrical men. Therefore, when it is most important to judge the gene quality of a potential mate, ovulating women are capable of accurately assessing the symmetry of a male.

Fluctuating asymmetry is of interest to the current study as it relates to the perception of the attractiveness of a potential mate. If FA is a reliable indicator of attractiveness, then the perception of attractiveness could be influenced by hormonal fluctuations in females because women theoretically judge the genetic quality of a mate when the chances of conception are high. It is important to note, though, that a number of studies have not supported the hypothesis that FA of faces is related to attractiveness. Certainly, when people are assessing attractiveness, symmetry is involved to an extent as a very asymmetrical face is considered abnormal. However, Langlois, Roggman, and Musselman (1994) found that symmetry does not, by itself, predict the perceived attractiveness of a face. In this study, attractiveness ratings of photographs did not correlate significantly with FA measurements. The relationship between FA and attractiveness was not supported by the cross-cultural investigation by Jones and Hill (1993) mentioned below. Similarly, Swaddle and Cuthill (1995) documented that as faces increased in symmetry, adults rated them as less attractive. A comparable result was obtained by Kowner (1998) as high symmetry had a negative, albeit slight, effect on attractiveness ratings given by children and young adults. Renaud (1997) determined that FA was unrelated to attractiveness, although in his study only the eyes, nose, and mouth areas were manipulated and made symmetrical in order to preserve as much as possible of the natural appearance of the face. Lastly, Waynforth (1999) reported that facially attractive males in rural Belize spent their leisure time seeking sexual access, while unattractive males spent it in acts of nepotism, with FA not being a predictor of attractiveness or of differences of time use. Although the theory of fluctuating asymmetry has spurred much recent research in the area of attractiveness, a consensus has not yet been reached regarding the validity of the theory.

GENERALITY OF ATTRACTIVENESS RATINGS

Since attractiveness is theoretically linked to gene quality and possibly health, correlation of attractiveness judgements between separate individuals would be expected. Four studies have attained statistically significant levels of inter-judge agreement. Stelzer, Desmond, and Price (1987) reported complete agreement by three male subjects on 88 attractiveness judgements of 101 undergraduate females. Berscheid and Walster (1974) reported a lower yet statistically significant result (Pearson's correlation equal to 0.5) for two subjects' attractiveness judgements. Cunningham, Druen, and Barbee (1997) found a higher correlation (r=.80) among heterosexuals and among homosexuals, of both sexes, rating a set of faces. Agreement across age has been observed by Samuels, Butterworth, Roberts, Graupner, and Hole (1994), who found that infants of different ages look longer at faces rated as attractive by adult viewers. In summary, when determining the attractiveness of faces, there is moderate to high agreement among individuals.

If attractiveness is linked to gene quality, the perception of attractiveness should be relatively similar cross-culturally. Jones and Hill (1993) examined the opinions of people from Michigan, Salvador, Ache villages in Paraguay, Moscow, and Hiwi villages in Venezuela in their study on attractiveness. They reported a small, but significant, correlation ($r= .13$) for all five populations' judgements of attractiveness. Interestingly, the correlation for attractiveness judgements was strong and statistically significant ($r= .64$) among the Russians, Brazilian, and American raters. A much larger correlation ($r=.93$) was attained by Cunningham and colleagues (1995) who asked recent immigrants of Asian and Hispanic origins, as well as Americans of European decent, to rate the attractiveness of photographs of Asian, Hispanic, Caucasian, and African women. Similarly, Bernstein, Lin, and McClellan (1983) found that Americans of Chinese, European and African decent did not differ significantly in ratings of attractiveness of yearbook photographs, regardless of the ethnicity of the viewer or the image. Even infants show the preference for attractive faces regardless of ethnic history of the child or the facial image (Langlois, Ritter, Roggman, & Vaughn, 1991).

OTHER FACTORS INFLUENCING ATTRACTIVENESS RATINGS

Judgements of physical attractiveness are not based solely upon natural physical endowment but are also affected by the type and duration of the potential relationship. For example, Hill and associates (1987) determined that male ratings of female physical attractiveness are influenced by the accentuation of physique. When women wear clothes that expose or emphasize body shape, it increases their attractiveness scores by men considering them as sexual and dating partners, but not as marital partners. Women prefer minimal exposure of males' physique in all contexts, with the most highly rated males being those with indicators of high status and low exposure of physique.

The expected or desired duration of a relationship also generates a difference in ratings of attractiveness. If males perceive themselves as successful, attractive, and possessing high earning potential, they tend to prefer and select short-term mating instead of committed relationships (Landolt, Roggman, & Musselman, 1994). As well, males are less choosy about the physical attractiveness of females if the relationship is expected to be short in duration. Since relatively few women are willing to establish a brief, and mainly sexual, relationship, males must lower their standards in order to increase their chances of attaining a mate (Wiederman, 1993).

The aforementioned studies are based primarily on individuals not currently involved in a relationship. Simpson, Gangestad, and Lerma (1990) examined individuals who were committed in their relationships and found that they consciously derogated the interpersonal characteristics of attractive people who were not their spouse. Committed individuals rated the physical and sexual attractiveness of young opposite-sexed persons lower than did uncommitted individuals. This can be seen as a tool for maintaining the relationship once it is established and investments have been made.

One last factor that must be considered is the wealth of a potential mate. Signs of wealth or status have a significant influence on females' judgements of male attractiveness (Buss, 1994; Cunningham, Barbee, & Pike, 1990; Landolt, Lalumire, & Quinsey, 1995), and in specific instances, influence males' attractiveness ratings of females (Townsend, 1993). Males typically regard physical attractiveness as the most important attribute when selecting a partner, and females usually consider nonphysical characteristics (such as ambition, status, dominance) to be most crucial (Townsend & Wasserman, 1998). Investigations of personal advertisements and occupational success provide evidence of these preferences. In personal advertisements, males tend to list available resources and seek youthful and attractive females, while females frequently document youth and attractiveness and seek males with a wealth of resources (Thiessen, Young, & Burroughs, 1993; Wiederman, 1993). In terms of occupational success, facially attractive individuals typically are promoted to higher status positions faster and attain higher income levels than less attractive co-workers (Broxtermann,1997; Dickey-Bryant, Lautenschlager, Mendoza & Abrahams, 1986; Frieze, Olson, & Russell, 1991). With respect to selecting a wealthy mate, the more attractive females (as determined by yearbook photographs) were more apt to be married and to have mates with higher socio-economic status than less attractive females attractiveness (Jackson, 1992). Townsend (1993) reported that less affluent males emphasize the socio-economic status as well as the physical appearance of females, whereas highly affluent males emphasize only the appearance of a female. These results were not supported by Landolt and colleagues (1995) who found no influence of earning potential on males' views of female attractiveness.

For women, the influence of wealth on facial attractiveness ratings is logical since historically, women have spent the majority of their time raising offspring, a role which decreases their ability to earn and collect resources in comparison to men. Therefore, women have typically relied on men to provide sufficient resources to support them and their children. Gangestad (1993) hypothesized that women have evolved to prefer mates who are likely going to invest in future offspring, who accrue and control material resources, and who display a willingness to invest resources into the relationship. Theoretically, this leads females to use a strategy whereby they wait to see evidence of resources and commitment before consenting to sexual activity, ensuring that they have provisions available for themselves and their potential offspring.

PHYSIOLOGY OF THE MENSTRUAL CYCLE

Since the experiment reported in this thesis relies heavily on the delineation of the menstrual cycle into hormonally dichotomous phases, it is important to understand the biological processes underlying this decomposition. When the menstrual cycle is delineated according to hormonal fluctuations, the five resulting phases are: early follicular, mid-late follicular, peri-ovulatory, early luteal, and late luteal. In the early follicular phase (usually days 1 to 5), menses occurs and the thick functionalis layer of the uterine endometrium detaches from the uterine wall, resulting in menstrual bleeding for three to five days. During this phase, gonadotropin releasing hormone (GnRH) stimulates the anterior pituitary to produce follicle stimulating hormone (FSH), which in turn promotes the development of an ovarian follicle, and induces the ovary to secrete estrogens. The second phase, mid-late follicular (typically days 6 to 11), is marked by an increase in levels of estrogen which promote the regrowth of the endometrium and induce the synthesis of progesterone receptors in the endometrial cells, readying them for interaction with progesterone. As well, the normally thick cervical mucus is thinned by rising estrogen levels, creating channels that facilitate the passage of sperm to the uterus. Days 12 to 15 typically compose the peri-ovulatory phase signified by the occurrence of ovulation in response to the release of pulsatile luteinizing hormone (LH) from the anterior pituitary. The ovum is released from the mature Graafian follicle and is pushed through the peritoneal cavity, and the now empty follicle changes into the corpus luteum which secretes estrogens and progesterone into the bloodstream. During the early luteal phase (usually days 16 to 21), levels of progesterone produced by the corpus luteum increase and reach a maximal peak, while estrogen levels reach a secondary peak. Progesterone acts on the estrogen-primed endometrium and causes the cervical mucus to thicken and subsequently serve as a cervical plug, blocking sperm entry. If fertilization has not occurred, the corpus luteum degenerates and LH blood levels decline. In the late luteal phase (typically days 22 to 28) progesterone levels fall, depriving the endometrium of hormonal support, and the endometrial cells begin to degenerate. Menses is precipitated by the sudden dilation of arteries supplying the endometrium on the last day of the cycle, usually day 28, and blood flushes into the weakened capillary beds which then fragment, causing the functionalis layer to deteriorate (Fielding & Bosanko, 1984; Guyton, 1976).

Similar to the study presented in this thesis, most studies of the menstrual cycle include only normally cycling women; that is, women not using oral contraceptives and possessing a natural cycle in terms of hormone levels and cycle length. This is logical since oral contraceptives contain moderate amounts of estrogen and progestin (similar to progesterone) that cause the hypothalamus-pituitary axis to remain dormant due to the relatively constant blood levels of ovarian hormones. A similar state occurs in the event of pregnancy. During oral contraceptive pill use, ovarian follicles do not develop and ovulation does not occur. As well, the endometrium continues to proliferate, albeit slightly, and is sloughed off monthly during placebo pill days or non-pill days, resulting in a reduced menstrual flow.

Physiological stress such as exercise and extreme dieting can shorten the length of the cycle and increase the frequency of anovulation (Bullen, Skrinar, & Beitins, 1985), partly through the reduction of progesterone (Ellison & Lager, 1986). Psychological stress also has an effect as it tends to lengthen the cycle. Sexual activity also influences the menstrual cycle as Burleson and associates (1995) found that intermediate levels (approximately three episodes per week) of sexual activity significantly increased the frequency of regular cycles. Cycle length can also be influenced by the presence of other females. McClintock (1971) found that within college dormitories, menstrual cycles of roommates tend to synchronize after approximately three months as a function of the amount of time spent together.

MENSTRUAL CYCLE EFFECTS ON COGNITION

Many of the hypotheses of this thesis are related in that they predict a difference in discrimination ability due to fluctuations in the levels of ovarian hormones. This predicted difference stemmed from the cognitive literature that indicates that, during high estrogen phases, females exhibit superior performance in articulation, complex manual action, verbal fluency, and specific perceptual speed tasks, in comparison to their performance during low estrogen phases (Kimura & Hampson, 1993). Kimura and Hampson (1993) also report that spatial ability and deductive reasoning are inversely related to estrogen: as estrogen increases, performance on tasks involving spatial ability and reasoning ability decreases. In a related study, Phillips and Sherwin (1992) reported significantly lower visual memory scores on delayed tasks during the early follicular phase in comparison to the luteal phase, but did not observe a difference in a digit span task, paired association task, or paragraph recall. They concluded that the decreased visual memory scores correlated with decreased progesterone and estradiol. A possible explanation for the lack of a difference found by Phillips and Sherwin between the phases for some of the tasks is provided by Bernstein (1977). She has theorized that the insignificant difference in performance is due to the fact that women exert a compensatory effort during the early follicular phase in order to prevent poor performance on standard intelligence tests.

The results from the cognitive investigations are often contradictory, and it is not possible to produce general conclusions. An example of the discrepant findings comes from Gordon and Lee (1993) who had subjects perform two tasks used by Kimura and Hampson (1993). They found no difference in performance related to menstrual phase, whereas Kimura and Hampson (1993) reported a significant difference in performance between phases. There are four reasons which might explain why the reported effects of menstrual phase on cognitive task performance are not stronger and are inconsistent. The first explanation is that subjects may erroneously determine their location in their menstrual cycle. Subjects have difficulty accurately recollecting their last day of menstruation, the duration of menstruation, and the average length of their menstrual cycle (Kimura & Hampson, 1993). A second reason for the lack of significant and consistent results may be related to the frequency of anovulation among subjects. Among normally cycling healthy women, there is a high likelihood of anovulation due to factors such as physical and psychological stress (Bullen, Skrinar, & Beitins, 1985; Ellison & Lager, 1986). The third possible explanation for the lack of strong and reliable results may concern the different techniques used by researchers to delineate the menstrual cycle. Some investigators divide the menstrual cycle into the two components of menses and non-menses (Silverman & Phillips, 1998) while others divide it into five phases (Ablanalp, Livingston, Rose, & Sandwisch, 1977).

A fourth reason for the lack of robust findings was offered by Sommer (1982) who reviewed 82 performance tests in 35 independent studies of menstrual cycle effects and found that 14 found evidence for premenstrual or menstrual decreases in ability. She concluded that higher level intellectual functioning in healthy, normally cycling women seems free of menstrual cycle effect. However, within individuals, hormonal fluctuations associated with menstrual phase are more likely to affect abilities that are highly variable in performance, such as sensory motor response, than abilities that are less variable in performance. It appears that performance on specific tasks fluctuates with menstrual hormones; however, broad generalizations about the relationship between menstrual phase and cognitive ability are not possible.

THE MENSTRUAL CYCLE AND SEXUAL BEHAVIOR

In contrast to the relationship between menstrual phase and cognitive abilities, the association between menstrual phase and sexual behavior is relatively well established. Sexual interest is affected by menstrual phase, but there is contradictory evidence as to whether it is highest during the peri-ovulatory phase (Laessle, Tuschl, Schweiger, & Pirke, 1990) or during other phases (Schreiner-Engel, Schiavi, Smith, & White, 1981). Gangestad and Thornhill (in press) reported a higher numbers of extra-pair copulations occurring during the ovulatory phase, whereas copulations between two spouses were consistent across the menstrual cycle. This suggests that women in the ovulatory phase are attempting to select a better mate when there is a high likelihood of conception. A recent study on rape by Chavanne and Gallup (1998) demonstrated that risk-taking behavior was linked to menstrual phase. When in the ovulatory phase, subjects were more prone to engage in activities for which the perceived chance of rape (the perceived consequence of risky behavior) was decreased than to participate in other, more risky activities.

It is difficult to conclude, with confidence, that hormonal fluctuations have general and widespread effects on cognition and behavior. However, there are demonstrated effects on specific behaviors, and the examination of these behaviors should be chosen for theoretical reasons.

TESTOSTERONE AND FEMALE SEXUALITY

In the last two decades, many researchers have explored testosterone in women. One aspect, which has not yet been investigated, is the association between testosterone concentrations and judgements of attractiveness. It has been well established, as explained below, that testosterone levels correlate with women's libido and therefore, may relate to female mate selection. A brief review of the physiology of testosterone production is provided, followed by a review of studies on libido and female sexuality in terms of arousal, fantasies, and desire.

At puberty, the ovaries of women begin to secrete increasing levels of testosterone, and this results in an increase in the sensitivity of body areas, libido, and sexual responsiveness (Kaplan & Owett, 1993; Waxenberg, Drellich, & Sutherland, 1958). With respect to the menstrual cycle, researchers have reported a mid-cycle peak in testosterone close to the time of ovulation (Bancroft, Sander, Davidson, & Warner, 1983; Morris, Urdy, Khan-Dawood, & Dawood, 1987; Persky, Lief, Strauss, Miller, & O'Brien, 1978), despite the daily circadian rhythm of this hormone (Marieb, 1989). There are significant differences among individuals in testosterone levels which makes the examination of this hormone difficult, and it has been proposed that changes in testosterone levels are more important than absolute levels (Sherwin, 1988).

In experiments on hormonal replacement therapy, postmenopausal women and women who have had their ovaries or uterus removed received androgens which included testosterone or testosterone precursors. These women reported an increase in their sex drive, desire, arousal, frequency of intercourse, orgasmic responses, fantasies, and libido in comparison to women receiving estrogen or placebo therapy (Davis, McCloud, Strauss, & Burger, 1995; Sherwin & Gelfand, 1985; Sherwin, Gelfand, & Brender, 1985). Using absolute measures of testosterone levels, a study preformed on normally cycling pre-menopausal women indicated that individuals with extremely low testosterone (30 ng/ml or less), in comparison to those with higher levels (30 ng/ml or more), reported significantly less sexual desire, an absence of fantasies, and fewer orgasms (Kaplan & Owett, 1993). Testosterone levels are also positively correlated with the frequency of masturbation (Bancroft et al., 1983; Myers, 1990) and the number of sexual partners (Cashdan, 1995). It should be noted that not all researchers have found support for the relationship between sexuality and testosterone: Cawood and Bancroft (1996) found that testosterone levels in 141 postmenopausal women with an intact uterus did not predict sexual desire, mood, or general libido.

ATTRACTIVENESS

Overall physical attractiveness ratings are positively related to facial attractiveness ratings (Brown, Cash & Noles, 1986). Due to the relationship between physical and facial attractiveness, experiments pertaining to physical attractiveness are reviewed, followed by an examination of the literature specifically related to facial attractiveness.

Investigations of physical attractiveness have shown that adults rate attractive individuals as more desirable as a romantic partner (Berscheid, Dion, Walster, & Walster, 1971), and more likely to have an extramarital affair (Dermer & Thiel, 1975) than less attractive individuals. Furthermore, as Dion and collaborators (1972) have remarked, initial evaluations of attractiveness can affect judgements of other interpersonal characteristics, with physically attractive people being perceived as having more desirable personalities, happier marriages, and better jobs. These findings are not surprising as one expects an attractive person to be perceived as more desirable, for example, if attractiveness is linked to high quality genes and good health.

THE IMPORTANCE OF FACIAL ATTRACTIVENESS

Judging the attractiveness of a face has many components, some of which have been reviewed in the previous sections. One aspect which has not been mentioned is the difference in ratings given to male and female faces. In all cultures, the physical appearance of females is given much more attention than the physical appearance of males (Ford & Beach, 1951), with individuals of both sexes rating female faces as more attractive than male faces (Bernstein, Lin & McClellan, 1982; Geldart, Maurer, & Henderson, in press; Jackson, 1992; Maret, 1983).

The majority of facial attractiveness research exclusively focuses on the concept that female faces are considered more attractive than male faces. Since the topic of the current experiment is to investigate male facial attractiveness, it is crucial to note that male facial attractiveness is considered an important area of investigation by some researchers (Barber, 1995; Gangestad, 1993; Weisfeld, Russell, Weisfeld, & Wells, 1992). Weisfeld and colleagues (1992) state that female mammals, in theory, must be attentive to the genetic quality of potential mates due to the females high level of parental investment and limited number of gametes. It is the opinion of these researchers that women's interest in male attractiveness has been systematically underestimated due to women being reluctant to acknowledge it, especially to male ethnographers.

Several researchers have investigated male facial attractiveness and found that indicators of dominance (defined as able to get their way in conflicts of interest) are typically considered a desirable trait for men to possess (Grammer & Thornhill, 1994; Graziano, Jensen-Campbell, Todd, & Finch, 1997; Schubert, Curran, & Strungarv, 1998; Weisfeld, Russell, Weisfeld, & Wells, 1992; Zuckerman, Miyake, & Elkin, 1995). Dominant male faces are ones that contain large secondary sexual characteristics, such as a pronounced lower jaw, broad face shape, large nose, and wide mouth (Grammer & Thornhill, 1994). Although both men and women rate highly dominant faces as more attractive than less dominant faces, the effect is much larger for women than for men (Graziano, Jensen-Campbell, Todd, & Finch, 1997). Facial FA, which relates inversely with attractiveness, correlates negatively with male and female observer ratings of dominance (Grammer & Thornhill, 1994). Therefore, dominant male faces are considered more attractive, as well as more sexy and healthy, as compared to less dominant faces, by viewers of both sexes (Grammer & Thornhill, 1994).

ATTRIBUTES OF ATTRACTIVE FACES

For both sexes, the oral region is rated the most important determinant of facial attractiveness, followed, in order, by the eyes, face structure, hair, and nose (Terry & Davis, 1976). However, there are significant differences in the importance of these features for male and female faces. For example, a small nose is preferred for female faces, possibly due to the preference for neoteny (youthfulness) discussed below, while nose size is not important in accessing the attractiveness of male faces (Barber, 1995).

Much of the facial attractiveness research has focused on elucidating the specific features which together comprise a "beautiful face." Cunningham (1986) found two arrangements of facial features for females were admired significantly more than any other arrangements. The first is that of the neonate face possessing higher and wider eyes with greater distance between them than average, accompanied by a small chin and nose. Equally attractive was the mature adult face, with prominent cheekbones widely spaced yet narrowly defined. Jones and Hill (1993) have suggested that the features elucidated by Cunningham are favored because they are traits which easily differentiate a male face from a female face. Another possibility is that a neotenous face signals youth and fertility, two desirable traits to males, and the mature face indicates the presence of high estrogen levels, which is also related to fertility. Another experiment which provides support for the finding that neotenous faces are attractive was conducted by Johnson and Franklin (1993). They utilized a computer program simulating natural selection, and asked subjects to create the most beautiful female face possible. Subjects were presented with faces and asked to simulate evolution of particular aspects of the face, such as the area around the eyes. As evolution progressed, so did the age that the features represented. The mean age for the most beautiful face was 24.8 years, with the proportion of lip height to width typical of a 14 year old, and eye to chin distance typical of an 11 year old.

There are far fewer studies on the attributes considered attractive for male faces. One study found that females rate males with the combinations of large eyes, prominent cheekbones, and a large smile, indicating neoteny, maturity, and expressiveness respectively, as more attractive than other male faces (Cunningham et al., 1990). Females rate males with mature faces as intermediate in terms of attractiveness, possibly because they prefer a blend of maturity and neoteny (Cunningham et al., 1990).

Judgements of facial attractiveness can be influenced by features in close proximity to the face, and by manipulations to facial features. That is, grooming may enhance or diminish features indicating successful adaptation and fitness. Cosmetics used by women typically smooth the skin, increase the size of the eyes, and increase the prominence of cheekbones, all of which may be associated with a neotenous and yet mature face. In females, blond hair is preferred to brown hair by male and female raters, perhaps because it is associated with neoteny (Barber, 1995). In males, however, the preference is reversed, as maturity is considered attractive by raters of both sexes (Cunningham et al., 1997). Other types of manipulations to one's beauty can take the form of clothing, jewelry use, tattooing, teeth form, suntanning, and body weight, all of which may convey group status, as well as general health or level of adaptation. Some researchers (Cunningham et al., 1997) have suggested that grooming may be used as a communication device to indicate that the person belongs to a group that the perceiver may value.

ATTRACTIVENESS OF AVERAGE FACES

According to evolutionary theory, it is logical that statistically average faces would be considered the most attractive as they provide evidence of developmental stability, good genetic material, and a lack of physical insult or genetic idiosyncrasies. It has been documented that average faces, as created through composite photographs, are rated more attractive by males and females than the individual faces used to create the composites in most instances (Langlois & Roggman, 1990). As well, there is a strong linear trend between the attractiveness ratings of composite faces and the number of individual faces added to create the composite (Langlois & Roggman, 1990). Grammer and Thornhill (1994) reported that female composites were rated as more attractive and sexier than individual female faces. However, in comparison to composite male faces, individual male faces were rated more dominant, healthier, and sexier, but there was no difference in judgements of attractiveness (Grammer & Thornhill, 1994). Rhodes and Tremewan (1996) asked undergraduates to rate the attractiveness of caricatures, anticaricatures, and undistorted faces, and asked a second group of undergraduates to rate the attractiveness of photographs. The results of both test groups show that attractiveness increased with averageness and correlated negatively with distinctiveness (the inverse to averageness). Relatedly, Sarno and Alley (1997) found that there tends to be a negative relationship between memorability and attractiveness and that atypical faces are more memorable. This leads to the conclusion that average faces were considered attractive in their study.

In contrast, several studies have supported the conclusion that average faces are not, in general, considered attractive (Grammer & Thornhill, 1994; Keating, 1985; Perrett et al., 1998; Perrett, May, & Yoshikawa, 1994). Supporting the hypothesis of the attractiveness of atypical faces, Grammer and Thornhill (1994) found that females found male faces most attractive when they contained exaggerated secondary sexual features (such as pronounced jaw and brow ridge), rather than average male features (see also Keating, 1985). Similarly, Perrett, May, and Yoshikawa (1994) documented that attractive average composites can be made more attractive by exaggerating the face shape so that the end result is further from the average population face shape. Using color composites, Perrett and associates (1994) discovered that subjects of both sexes rate composites created with attractive faces more attractive than composites constructed with average faces. This indicates that averageness is not the only characteristic causing a face to be considered attractive; there must be other aspects that influence a face's attractiveness. One such aspect may be the shape of a face. Perrett and colleagues (1998) found that enhancing the sexual dimorphism of faces increased attractiveness ratings by males and females as feminized female faces were preferred to average shaped female faces, and masculinized faces were preferred to average male faces. A recent investigation by Penton-Voak, Perrett, Castles, Kobayashi, Burt, Murray, and Minamisawa (1999) elaborated on this finding with respect to the male faces, and how the preference for a masculinized male face related to the phases of the menstrual cycle. They found that normally cycling women favored more masculinized faces when in the phase which follows menses and includes ovulation. Penton-Voak et al. explained this effect as a result of women preferring men with superior immunocompetance and quality genes when the probability of conception is high.

However, it is difficult to explain the evolutionary benefits of deviations from averageness with regards to facial attractiveness. Perhaps atypicality in facial features represents increased diversity in the individual's genetic material which would be beneficial in terms of parasite and pathogen resistance. Alley and Cunningham (1991) found that composites are usually symmetrical and free of blemishes or idiosyncratic facial irregularities, and thus, averageness may not be the key component to attractiveness. It should be noted that these factors were addressed in an article by Langlois, Roggman, and Musselman (1994). In this article, Langlois et al. reported that these characteristics were controlled for in an earlier study (Langlois & Roggman, 1990) that found composite faces were rated as most attractive.

Another argument which has been made by researchers (Alley & Cunningham, 1991; Grammer & Thornhill, 1994) is that very attractive faces are usually regarded as atypical in some aspect; for example, the most sexually attractive male faces contain extreme features that perhaps serve as dominance indicators. These features may have been selected for by females since females tend to prefer males who can compete successfully for resources and protect offspring. Therefore, females may favor dominance features and not average features. Similarly, males tend to prefer females that appear youthful, and thus, not average in appearance.

In sum, there are many characteristics which contribute to making a face attractive. These features depend on several factors, such as the sex of the viewer and possibly the perceived dominance and averageness of the face.

CURRENT RESEARCH

The literature reviewed suggests that women's judgements of male and female facial attractiveness may be influenced by menstrual phase. Cognitive research has in some cases found a difference in performance due to menstrual phase. The perception of facial attractiveness may be one task which is influenced by phase since it can be used to assess the quality of a potential mate. With regard to female attractiveness, perhaps women attend to others of the same sex to determine the attractiveness of competitors. The literature on female attractiveness has not explored this possibility.

The goal of the current study is to examine the influence of hormonal fluctuations, associated with phases of the menstrual cycle, on ratings of facial attractiveness. The first hypothesis was that women in the peri-ovulatory phase would be the most discriminating in rating the attractiveness of male faces. This is due to the need for careful selection of the best mate available by the female when she has the maximum likelihood of conception. One selection strategy would be to appraise the facial attractiveness of potential males, as facial attractiveness is related to earning potential, health, and possibly gene quality. The second, and equally plausible hypothesis, was that women in the peri-ovulatory phase would be the least discriminating in rating male facial attractiveness. An explanation for this is that since the opportunities for a female to conceive are limited, she must not jeopardize her ability to find a mate by being overly selective.

Another aspect of this study examined women's attractiveness ratings of other females. If fluctuating hormone levels relate to the perception of male facial attractiveness, it is possible that female facial attractiveness ratings will vary in the same direction. That is, if a higher variance in the ratings of male faces is observed during the peri-ovulatory phase, then a higher variance in the ratings of female faces would be observed during this phase. This could be a byproduct of increased sensitivity to the task of perceiving and discriminating male attractiveness. Alternatively, there could be an awareness of same-sex competitors, and thus, it might be beneficial to carefully examine the attractiveness of other females. This would be characterized by increased discrimination during the peri-ovulatory phase. Lastly, there may be an absence of phase effect on judgements of female attractiveness since women do not conceive offspring together.

A third aspect of the current investigation was the examination of testosterone and women's judgements of facial attractiveness. It has been previously documented that testosterone is directly related to female sexuality and therefore it is possible that the perception of facial attractiveness is associated with concentrations of this hormone.

METHODS

To test the above hypotheses, 129 normally cycling women between the ages of 18 and 25 were tested twice using customized computer software displaying male and female faces. Sixty-five of the subjects attended their first session while experiencing menses, and the remaining 64 subjects attended their first session while in the peri-ovulatory phase, as determined by the length of their individual cycles. The subjects attended their second session approximately two weeks after their first session. During each session subjects were asked to use a five point Likert scale to rate the attractiveness of male and female faces in a timed 10 second exposure condition, and an untimed (no exposure limit) condition. A questionnaire pertaining to their menstrual cycle was administered by the computer after the ratings, and two saliva samples were collected for measurements of testosterone.

SUBJECTS

The final sample consisted of 129 subjects who were normally cycling female undergraduate students enrolled in an introductory psychology course at McMaster University. Potential subjects were recruited by flyers located in the psychology building (Appendix A). The study was described as an investigation of attractiveness, and stated that only non-pregnant women, between the ages of 18 and 25, could participate. The study involved the subject attending two sessions, with the subject receiving course credit for their participation. Interested women called, emailed, or visited with the researcher in the testing room. The subjects were asked several potentially embarrassing questions after being informed that they did not have to answer the questions if they felt uncomfortable. These questions (Appendix B) served as the exclusion criteria and were selected to reject those individuals who demonstrated a condition or activity that has been documented to cause abnormal hormonal levels or fluctuations. Due to their responses to the interview questions, 35 people were not included in the study because they were male (3), did not meet the age requirements (8), were currently using oral contraceptives (or used them within the previous three months) (18), or did not consider themselves heterosexuals (6). The data of thirteen additional women were excluded because they indicated on the computer-administered questionnaire following testing that they did not meet the age requirements (3), had used oral contraceptives within the last three months (8), or did not consider themselves heterosexuals (2). Another four subjects were excluded because they did not complete both sessions.

The final sample consisted of 129 women, all of who believed that they were not pregnant, who had not used oral contraceptives in at least three months, and who possessed regular menstrual cycles. The average reported menstrual cycle length was 28.16 days, with a standard deviation of ± 2.84 days. When subjects completed the menstruating session they reported an average length of 28.31 days, with a standard deviation of ± 8.77 days, and when in the non-menstruating session, an average cycle length of 28.01 days, with a standard deviation of ±2.80 days. The average age of the subjects was 19 years and four months, with the youngest subject 18 years and one month of age, and the oldest subject 21 years and 11 months.

STIMULI

The images used in this experiment were derived from photographs of male and female undergraduates who attended the University of Toronto several years prior to this study (Geldart, Maurer, & Henderson, in press). The models were asked to remove any jewelry, glasses, and hats, and wore a black cape to cover their clothing. As well, all models were told to display a neutral expression. The images were transferred from the original negative to Kodak's proprietary photo CD format (pcd). Of the 141 images, 53 were randomly selected (26 male, 27 females) for use in this study and integrated into a customized computer program (Cox, 1998).

Within the computer program, the images were scaled down to a resolution of 578 by 385 pixels, with a color depth of 24 bits, and stored using the joint professional graphics engineers (jpeg) format. The images were shown on a 14 inch diagonal CRT monitor (non-interlaced Acerview 34U) with a dot pitch of .28mm configured by the operating system to a resolution of 600 by 800 pixels. The images were the maximum size that could be displayed while maintaining their aspect ratio of 3:2 (height to width proportion). The image height yielded 25.2 visual degrees and a width of 18.87 visual degrees viewed from 40 to 45 centimeters. An image of 385 by 578 pixels is the maximum size, that when the title bar is added, fits on a 600 by 800 pixel screen with the aspect ratio maintained. Although the operating system used to create this program is capable of driving the monitor at more than 600 by 800 pixels, doing so would significantly increase the time required to transfer each image to the video memory. The size used was close to the maximum size that could be transferred within the ten seconds of the previous experimental trial. Larger images with increased resolution could have been produced, but there would have been pauses between the images. Using images of this size and resolution allowed a new image to immediately replace the previous image.

The computer was an Intel 486 with a clock speed of 66 MHz and 1 Mb of video memory. Subjects used the mouse to record their ratings of the images and the mouse and keyboard to complete the questionnaire. While completing the attractiveness ratings, subjects could not alter a score as only first responses were recorded. As well, in the timed condition, if subjects could not complete a rating for a face within the ten second interval, no response was recorded.

The images were presented in a random order and in two conditions: timed (Test One) and untimed (Test Two). It is necessary to consider exposure duration as there is a complex relationship between judgements of facial attractiveness and the time provided to make these ratings. One group of researchers has found a high reliability between facial ratings made with unlimited viewing time and those made in 150 milliseconds (Goldstein & Papageorge, 1980). In complete opposition, Landolt and colleagues (1994) reported a linear relationship between viewing time and ratings of attractiveness. It has been established that viewing time correlates with ratings of sexual attractiveness, although this relationship is stronger for men than for women (Quinsey, Ketsetzis, Earls & Karamanoukian, 1996).

Therefore, the timed condition was used to obtain first impressions of the attractiveness of the presented faces. The untimed condition was used in order to allow subject more time to complete the ratings in the event that the exposure duration affected judgements of attractiveness. Test One exposed the face for ten seconds and then proceeded to the next face, regardless of whether or not the subject rated the face. Test Two exposed the same faces, in a different random order, with no limit on viewing time. A new image appeared only when the previous face had been rated. Prior to test, three faces (two female and one male) were displayed as practice images in order to demonstrate the rating procedure. Every subject viewed the same three sample images. The remaining 50 faces were the trials for the experiment.

PROCEDURE

To counterbalance the effects of familiarity, this study utilized a crossover design which allows for both a between-subject comparison as well as a within-subject analysis. To clarify, half of the subjects were tested first during the early follicular phase and again during the peri-ovulatory phase. The remaining half of the subjects were tested in the reverse sequence, so that between subjects comparisons could be made with the order of testing controlled.

During each session, subjects completed 50 ratings of male (24) and female (26) facial attractiveness in both a timed and an untimed condition. The subjects used a five-point Likert rating scale to evaluate the images, with 1 representing "very attractive" and 5 representing "very unattractive". After the ratings were completed, subjects completed a questionnaire, also on the computer, inquiring as to their menstrual status. In order to maintain the anonymity of responses, subjects were assigned participation numbers during their first session. When the subjects returned for their second session, they entered their participant number into the computer so that the data from both sessions could be compared.

For each subject, the experimenter asked the subject about the length of, and her location within, her menstrual cycle. The first session was booked at a mutually convenient time between the hours of 10am and 4pm. For 65 of the subjects, the first session occurred during their menstruation while they were in the early follicular phase. For the remaining 64 women, the first session occurred during their peri-ovulatory phase. The subjects in the early follicular phase were identified as belonging to group one, and those in the peri-ovulatory phase as group two. Every effort was made to schedule the subjects so that the appropriate session occurred during the appropriate menstrual phase. Therefore, if the overall menstrual cycle length was 30 days, the appointment was scheduled for the 15th day after menstruation ended. If the female's menstrual cycle was shorter, for example, 24 days, the peri-ovulatory session was scheduled for the 12th day since menstruation ended. All subjects were informed as to how to calculate their cycle length and determine phase location. The experimenter confirmed this by asking questions related to various events, for example, "It seems that your period began the day before Thanksgiving weekend and ended on the Monday. Is this correct?" In many cases, the subject's responses changed due to the experimenter asking the questions in this manner. If there was doubt as to when the woman had her most recent menstruation, the session was not scheduled, and instead the subject was asked to contact the researcher on the first day of her next menses. The sessions occurring during menses were identical to those occurring during the peri-ovulatory phase.

In the first session, the subject was reminded that the study concerned facial attractiveness and related factors. She was notified of the structure of the session and given detailed instructions on how to perform the attractiveness ratings. After the subject was told about the complete structure of the test session, she was asked if she had any questions. Then she was asked to complete the consent form, as approved by the McMaster University Human Ethics Committee (Appendix C). After signing the form, she was assigned a participant number, which was recorded along with the date and time of the second session and given to the subject. The subject was told that this was the only method of linking the two sessions and that she must remember the assigned participant number.

The subject was then asked to sit directly in front of the computer screen and to adjust the screen for comfortable viewing of the images. The viewing distance from the computer screen to the subject varied slightly between 40 to 45 centimeters. After the subject entered her participant number into the computer, she was presented with three sample faces, which she was to rate within ten seconds. The sample images were shown in order to let her practice using the rating software and get accustomed to the presentation of the faces. The rating scale ranged from 1 (very unattractive) to 5 (very attractive), and was displayed to the right of the face, with the textual descriptors under the numbers (Appendix D). If one of the images was not rated in the ten second fixed interval, the image disappeared and was replaced by another. The subject had been informed that if she did not rate the face before the next appeared, this was acceptable, but that she should attempt to rate all of the faces.

Test One was identical to the practice with the sample images, except that the subject's responses were recorded, and there were 50 faces instead of three. After completing Test One, the subject completed Test Two, which was the same as Test One except there was no time limit. Upon completing both tests, the subject completed a computer-administered questionnaire (Appendix E).

At the end of the session, the subject was asked to donate two samples of saliva, using the salivette procedure. The subject drank water, moved the water around her mouth and expelled it, and drank water a second time. This was done in order to remove food particles and chemicals from such things as gum, coffee, cigarettes, and toothpaste, which could affect the hormonal analysis of the saliva. The subject was given two salivettes labeled with her participant number, the date, and her menstrual status. The experimenter demonstrated the procedure using a salivette designated for this purpose. Subjects opened the vial, placed the cotton swab into their mouths without touching, and chewed for 30 seconds. Following this, subjects moved the swab in a circular motion around their mouths for an additional 2.5 minutes, which allowed saliva to be absorbed by the swab. Upon completion, the subject placed the swab in the vial without touching it and donated a second sample. A second sample was collected in case the first sample was destroyed during storage in the freezer. All samples were frozen at -70 degrees Celsius until the analyses could be performed. The testosterone content was analyzed via radioimmunoassay using Coat-a-Count kits (Diagnostic Products, Los Angeles) in the laboratory of Dr. Meir Steiner, St. Joseph's Hospital in Hamilton, Ontario.

The second session was identical to the first, except that the subject was only briefly reminded of the structure of the session and there was no consent form presented. Upon the conclusion of the second session, the subject was debriefed (Appendix F). As much as possible, within the constraints of the subject's availability, the second session was scheduled for the same time of day as the first session in order to eliminate the effect of daily variations in hormonal concentrations.

RESULTS

For each subject in each phase and condition (timed or untimed), the mean attractiveness rating and variance was calculated separately for male and female faces. Mean ratings were examined as well as the variance of ratings to explore the possibility that there may be a shift with menstrual phase in the mean rating rather than an increase or decrease in variance. Thus, the data consisted of sixteen values for each subject: the mean attractiveness rating and variance for male faces and for female faces, in each case for both the timed and the untimed condition, and performed during both the peri-ovulatory phase and the early follicular phase. These ratings were entered into the four analyses of variance (ANOVAs) discussed below, analyzing the effects on mean timed ratings, mean untimed ratings, variance of timed ratings, and variance of untimed ratings. In each case there were one between-subjects factor (order of sessions) and two within-subjects factors (sex of face and menstrual phase).

The mean ratings, and the associated standard errors, for female and male faces shown in the timed exposure condition, during the early-follicular and the peri-ovulatory phase, are given in Table 1.0. Table 2.0 shows the results of an ANOVA conducted on these data. There was a significant main effect for the sex of the stimuli face, as female faces were rated higher on average than male faces. There was also a three-way interaction between order, the sex of the stimuli face, and the menstrual phase. To investigate this interaction two ANOVAs were performed, one for each session, with phase a between-subjects factor and sex of faces as a within-subjects factor. Table 3.0 contains the results of an ANOVA for only the first session for each subject and Table 4.0 contains the results of an ANOVA for the second session for each subject. In each case, the sex of the stimuli face was significant, and there was an interaction between sex of face and menstrual phase when the first sessions were examined. A similar interaction is close to significance when the second sessions are examined. Further examination of the significant interaction was conducted, with menstrual phase being compared for female faces, and compared for male faces. The two *t*-tests revealed no significant differences due to menstrual phase; for female images $t\ (118) = -0.035$ with $p > 0.05$, and for male images $t\ (126) = -0.034$ with $p > 0.05$.

Table 5.0 shows the means, and the associated standard errors, of the ratings of female and male faces in the untimed condition. An ANOVA was completed to investigate these data (Table 6.0). The results indicate that only the sex of stimuli face caused a significant difference in the ratings, with female faces rated higher on average than male faces.

The means and standard errors for the variance of the attractiveness ratings of female and male faces, in the timed exposure, are given in Table 7.0. The variance of these ratings was examined with an ANOVA, as displayed in Table 8.0. Similar to the previous analyses of variance, there was a main effect for the sex of the face, and no other comparison was significant. Female faces were rated more variably than male faces by the subjects.

Lastly, the variance of the ratings of female and male faces in the untimed exposure condition was examined. Table 9.0 shows the mean and the standard errors associated with the variance of these ratings. The ANOVA performed on these data yielded a significant result for the sex of the face, with female faces rated with more variance than male faces (Table 10.0).

Table 11.0 displays the differences in the mean attractiveness ratings given to the faces during the early-follicular and the peri-ovulatory phase, collapsed across exposure duration.

The data on testosterone concentrations were available for only 87 of the 129 subjects due to a shortage in materials or damage to the salivettes during storage. To investigate the hypothesis that salivary testosterone levels correlate with attractiveness ratings, Pearson's correlations were conducted separately for each menstrual phase (Table 12.0). In order to determine which of the correlations were significant, *t*-tests were performed to calculate the associated probabilities. The results suggest that testosterone concentration does not correlate significantly with attractiveness judgements.

A second hypothesis regarding testosterone concentration was that testosterone levels would fluctuate significantly between phases, with a highest concentration during the peri-ovulatory phase. However, a paired *t*-test comparing the salivary concentration of testosterone during the peri-ovulatory session to the concentration during the early follicular session was not significant, $t(86)=0.0114$, $p>0.05$.

DISCUSSION

The results indicate that menstrual phase does not affect the perception of male or female facial attractiveness. However, female faces were considered more attractive than male faces by the subjects. Salivary testosterone levels did not correlate with facial attractiveness ratings and testosterone levels were not significantly different in the peri-ovulatory phase and the early follicular phase.

There are several explanations for the lack of significant results. First, it is interesting to note that the male faces were frequently rated as unattractive or below average (Appendix G), and this was supported by incidental reports made by the subjects. Therefore, it may be the case that the images were considered so unattractive that under no condition could they be conceived as anything other than very unattractive. It is possible that the scale did not allow for sufficient gradations in ratings of attractiveness, and thus, the subjects tended to over select the value representing very unattractive. If the images had been average attractiveness, then perhaps there would be a noticeable phase effect.

Another potential explanation for the lack of significant differences between the two menstrual phases is that the subjects may not have been in the peri-ovulatory phase during the session because few women exhibit a 28 day menstrual cycle on which textbooks and scientific articles typically base the expected hormone levels. Therefore, the two sessions may not have occurred at the most hormonally dichotomous time periods in the subject's menstrual cycle. Most women attended the early-follicular session while menstruating, and thus, the hormone levels were likely within the expected range for these sessions. The scheduled peri-ovulatory sessions need to be reconsidered as they possibly did not occur during this phase (i.e.: occurred too early or too late to be the peri-ovulatory phase). It is important that the peri-ovulatory session occur in the midpoint of the subject's cycle since estrogen typically decreases very quickly after this point.

The levels of ovarian hormones may also not have been within the expected ranges due to psychological stress. Some of the subjects were tested during the weeks in which they were writing examinations for university courses and may have been feeling high levels of psychological stress. Dalton (1968) has reported significant menstrual cycle disturbances during college examinations. Due to the stress associated with examinations and adapting to the university environment, some females likely possessed menstrual cycles with unusual hormonal fluctuations, and several subjects presumably experienced anovulation. As well, it is tenable that a small number of the subjects did not have menarche until late adolescence and, therefore, experienced anovulation during the experiment. In approximately the first two years that follow menarche, females typically experience anovulation caused by an insufficient amount of preovulatory luteinizing hormone. During this time the corpus luteum is not formed and as a consequence progesterone is absent during the cycle, and thus, the menstrual cycle is shortened by a few days. It is not until three years past menarche that a regular menstrual cycle is attained (Marieb, 1989; Richardson & Pieters, 1977).

When the cycle lengths for subjects in the peri-ovulatory session were compared to those reported at the early follicular session, the average cycle length remained approximately 28 days, but the standard deviation in cycle length shifted from 2.84 days to 8.77 days. This leads to the conclusion that subjects may be reporting estimations rather than accurate and reliable information. Lastly, the observed variance associated with menstrual cycle length could be due to difficulty in understanding the terminology used to explain the menstrual cycle. Approximately 45% of the subjects requested further clarification when asked about the length of their cycle, the duration of menses, and the date of their last menstruation. Although every effort was made to ensure that the subject reported accurate information, it is likely that errors were made which could account, in part, for the lack of difference in variability of rating male and female faces by menstrual phase.

Aside from unexpected hormonal concentrations and the use of a task which may not demonstrate menstrual cycle effects, it is possible that attractiveness is not an important aspect of mate selection for females. It is well known that attractiveness is more important to men and that indicators of possessed resources, as well as signs of potential income and future resources, are important to women during mate selection (Buss, 1989; 1994). For women, it may be the case that, providing the individual does not display an abnormal physical appearance indicative of poor health or genetic quality, facial attractiveness is not as important as attributes indicating resources. If attractiveness is not used as a primary mate selection criterion, it is not likely to be affected by hormonal fluctuations. However, it is possible that Weisfeld and associates (1992) are correct when they state that the importance of male attractiveness to females has been underestimated. As well, it has been shown that there are occasions when women fail to wait and see evidence of resources, thus indicating that women utilize alternate, and as of yet undetermined, strategies (Gangestad, 1993).

Attractiveness judgements are performed differently when used in the selection of a mate for short term, as opposed to long term, relationships. The structure of this study simulated the conditions for very short term relationships as the subjects had no expectation of forming a long lasting relationship. Within the framework of evolutionary psychology, the examination of long term relationships may be more relevant as humans typically establish long term relationships for mating. As stated by Graziano and collaborators (1997), the simple attempt to deduce specific features in short term encounters, such as seen in this study, may be flawed, as candidates for long term relationships likely require different attributes than those needed to attain positive ratings of facial attractiveness. This could be true specifically for the female who, according to evolutionary thought, seeks to establish a bond in order to have an influx of resources and shared parental care of offspring.

Lastly, although the studies reviewed have found moderate to high levels of cross-cultural agreement for the perception of attractiveness, it is possible that beauty is influenced to some extent by cultural standards and stereotypes. The depiction of women throughout the centuries in artistic masterpieces provides evidence that cultural standards of attractiveness have changed over time, yet, in some respects have remained similar. It is likely that there is an interaction between evolutionary advantageous features and cultural standards which together influence the perception of attractiveness. Future work is needed to examine this relationship, and the similarities and differences in cultural views of attractiveness.

In this study, female faces were consistently rated as more attractive than male faces. This is not surprising as other studies on attractiveness have reported this result (Bernstein, Lin & McClellan, 1982; Ford & Beach, 1951; Geldart, Maurer, & Henderson, in press; Jackson, 1992; Maret, 1983). It may be the case that women are capable of distinguishing finer details of female faces since they are exposed to the appearance of their own face frequently. Another possibility is that women are attending to their same-sex competition for potential mates. Perhaps women need to assess the attractiveness of others in relation to their own attractiveness to determine the value of a mate they could acquire. If an individual was to spend all of her time and efforts attempting to attract a mate who far exceeded her relative theoretical worth, she may not experience reproductive success. One last explanation for the preference for female faces is that the majority of the male faces presented to the subject could have been very unattractive. However, this does not account for the robustness of this finding in previous studies.

The results of this study did not support the hypothesis of a difference in the perception of male and female facial attractiveness due to hormone fluctuations of the menstrual cycle. However, this finding needs to be replicated using improved measures of attractiveness, and with improved procedures for determining the hormonal location of an individual in her menstrual cycle. One method of examining attractiveness would be to have the subject select the most attractive face from an array of faces which are similar, and to see if selection time, as well as the face selected, varies over the menstrual cycle. This would force the subject to be more active in the attractiveness ratings, and if the attractiveness of the images varied systematically, the variance of the ratings could be easily measured.

Mealey and associates (1996) have reported that faces, accompanied with salient character descriptions, are remembered after several days, and this could be used to further investigate the role of resources in determining male attractiveness. If women are not interested in male attractiveness, and instead attend to indicators of resources and potential earnings, it is possible that there is a difference in facial recognition ability according to menstrual phase. To clarify, perhaps women in the peri-ovulatory phase are more sensitive to information about resources than women in the early-follicular phase, and thus, would remember the faces which are associated with high levels of resources in a superior fashion. It is also possible that facial recognition ability is decreased during the early-follicular phase as indicated by the finding that visual memory performance is decreased during menstruation (Kimura & Hampson, 1993; Phillips & Sherwin, 1992). This would directly test the relationship between male facial attractiveness and resources.

Relatedly, future research should also examine instances where females have resources and are attempting to select a potential mate. It has been proposed that when women have access to sufficient resources of their own, as is frequently the case in modern western society, they will select a mate solely on physical appearance (Gangestad, 1993). That is, these women may be more discriminating of male facial attractiveness, and hence genetic quality, as they are not concerned with a mate's earning capacity. Alternatively, these women may be no different than females without resources and utilize the same mate selection strategies.

Another area of research which needs to be addressed concerns possible framing effects on attractiveness ratings. Kenrick and associates (1994; see also Wade & Abetz, 1997) found that, when presented with images of women who are either more or less attractive than the rater, the rater will increase or decrease her rating of self attractiveness. Although controlled for in this study by the random administration of the images, it would be interesting to observe framing effects on judgements of attractiveness, and to investigate the possibility that the strength of the effect could vary with menstrual phase, perhaps in relation to same sex competition.

There are many experiments which could be conducted in order to further investigate the relationship between fertility and facial attractiveness. For example, ratings of facial attractiveness may differ between pregnant women and women who are not pregnant as pregnant individuals are not fertile and, therefore, might not be as discriminating as other women. A similar experiment could utilize pre-menopausal and postmenopausal women as the latter are no longer fertile.

In conclusion, this study investigated the effects of menstrual phase on the perception of male and female facial attractiveness. Several hypotheses were generated in order to predict this relationship. It was found that menstrual phase does not appear to influence judgements of facial attractiveness. Women tended to rate the female faces as more attractive than the male faces which suggests that women can discriminate female facial attractiveness better than the facial attractiveness of males. The male facial stimuli need to be reconsidered as the faces were typically rated as unattractive which might have caused a lack of variance in the ratings, masking any menstrual phase effects. If the face was judged as very unattractive in one session, it is unlikely that it would be rated differently in the second. The concentration of salivary testosterone was examined in order to explore the hypothesis that it would fluctuate with menstrual phase and that it could influence facial attractiveness ratings. These hypotheses were not supported. Perhaps testosterone was not assayed correctly, or that the measures of attractiveness were not sensitive enough to be influenced by levels of this hormone.

REFERENCES

Ablanalp, J.M., Livingston, L., Rose, R.M., & Sandwisch, D. (1977). Cortisol and growth hormone responses to psychological stress during the menstrual cycle. *Psychosomatic Medicine, 39,* 158-176.

Alley, T.R. (1993). The developmental stability of facial attractiveness: New longitudinal data and a review. *Merrill Palmer Quarterly, 39* (2), 265-278.

Alley, T.R., & Cunningham, M.R. (1991). Averaged faces are attractive, but very attractive faces are not average. *Psychological Science, 2* (2), 123-125.

Bancroft, J., Sanders, D., Davidson, D., & Warner, P. (1983). Mood, sexuality, hormones, and the menstrual cycle. III. Sexuality and the role of androgens. *Psychosomatic Medicine, 45* (6), 509-516.

Barber, N. (1995). The evolutionary psychology of physical attractiveness: Sexual selection and human morphology. *Ethology and Sociobiology, 16,* 395-424.

Bernstein, B.E. (1977). Effect of menstruation on academic performance among college women. *Archives of Sexual Behavior, 6* (4), 289-296.

Bernstein, I.H., Lin, T., & McClellan, P. (1982). Cross-vs. within-racial judgements of attractiveness. *Perception and Psychophysics, 32* (6), 495-503.

Berscheid, E., Dion, K.K., Walster, E., & Walster, G. (1971). Physical attractiveness and dating choice: A test of the matching hypothesis. *Journal of Experimental and Social Psychology, 7,* 163-189.

Berscheid, E., & Walster, E. (1974). Physical attractiveness. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 7, pp. 157-215). New York: Academic.

Brown, T.A., Cash, T.F., & Noles, S.W. (1986). Perceptions of physical attractiveness among college students: Selected determinants and methodological matters. *Journal of Social Psychology, 126* (3), 305-316.

Broxtermann, T.J. (1997). The relationship of facial attractiveness to the occupational success of female police officers at the San Diego police department. *Dissertations Abstracts International, 57* (12), 7763B.

Bullen, B.A., Skrinar, G.S., & Beitins, I.Z. (1985). Induction of menstrual disorders by strenuous exercise in untrained women. *New England Journal of Medicine, 312,* 1349-1353.

Burleson, M.H., Gregory, W.L., & Trevathan, W.R. (1995). Heterosexual activity: Relationship with ovarian function. *Psychoneuroendocrinology, 20* (4), 405-421.

Buss, D.M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences, 12,* 1-49.

Buss, D.M. (1994). *The evolution of desire.* New York, NY: HarperCollins Publishers Inc.

Cashdan, E. (1995). Hormones, sex, and status in women. *Hormones and Behavior, 29,* 354-366.

Cawood, E.H.H., & Bancroft, J. (1996). Steroid hormones, the menopause, sexuality and well being of women. *Psychological Medicine, 26,* 925-936.

Chavanne, T.J., & Gallup, G.G. (1998). Variations in risk taking behavior among female college students as a function of the menstrual cycle. *Evolution and Human Behavior, 19* (1), 27-32.

Cox, A.M. (1998). Facial Attractiveness Image Rater (Version 1.0) [Computer software]. Waterloo, ON: Author.

Cunnigham, M.R. (1986). Measuring the physical in physical attractiveness: Quasi-experiments on the sociobiology of female facial beauty. *Journal of Personality and Social Psychology, 50* (5), 925-935.

Cunningham, M.R., Barbee, A.P., & Pike, C.L. (1990). What do women want? Facialmetric assessment of multiple motives in the perception of male facial physical attractiveness. *Journal of Personality and Social Psychology, 59* (1), 61-72.

Cunningham, M.R., Druen, P.B., & Barbee, A.P. (1997). Angels, mentors, and friends: Trade-offs among evolutionary, social, and individual variables in physical appearance. In J.A. Simpson & D.T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 109-113). Mahwah, NJ: Lawrence Erlbaum.

Cunningham, M.R., Roberts, A.R., Wu, C., Barbee, A.P., & Druen, P.B. (1995). Their ideas of beauty are, on the whole, the same as ours: Consistency and variability in the cross-cultural perception of female physical attractiveness. *Journal of Personality and Social Psychology, 68* (2), 261-279.

Dalton, K. (1968). Menstruation and examinations. *Lancet, 2,* 1386-1388.

Davis, S.R., McCloud, P., Strauss, B.J.G., & Burger, H. (1995). Testosterone enhances estradiol's effects on postmenopausal bone density and sexuality. *Maturitas, 21,* 227-236.

Dermer, M., & Thiel, D.L. (1975). When beauty may fail. *Journal of Personality and Social Psychology, 31,* 1168-1176.

Dickey-Bryant, L., Lautenschlager, G.J., Mendoza, J.L., & Abrahams, N. (1986). Facial attractiveness and its relation to occupational success. *Journal of Applied Psychology, 71* (1), 16-19.

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

Ellison, P.T. & Lager, C. (1986). Moderate recreational running is associated with lowered salivary progesterone profiles in women. *American Journal of Obstetrics and Genecology, 154* (5), 1000-1003.

Fielding, D., & Bonsanko, C. (1984). Psychological aspects of the menstruum and the premenstruum. In A. Broome & L. Wallace (Eds.), *Psychology and gynecological problems* (pp. 211-242). London, UK: Tavistock and Routledge.

Frieze, I.H., Olson, J.E., & Russell, J. (1991). Attractiveness and income for men and women in management. *Journal of Applied Social Psychology, 21* (13), 1039-1057.

Ford, C.S., & Beach, F. A. (1951). *Patterns of Sexual Behavior.* New York, NY: Harper.

Gangestad, S.W. (1993). Sexual selection and physical attractiveness: Implications for mating dynamics. *Human Nature, 4* (3), 205-235.

Gangestad, S.W., & Thornhill, R. (1997a). The evolutionary psychology of extrapair sex: The role of fluctuating asymmetry. *Evolution and Human Behavior, 18,* 69-88.

Gangestad, S.W., & Thornhill, R. (1997b). Human sexual selection and developmental stability. In J.A. Simpson & D.T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 169-195). Mahwah, NJ: Lawrence Erlbaum Associates Inc.

Gangestad, S.W., & Thornhill, R. (in press). Menstrual cycle variations in women's preferences for the scent of symmetrical men. *Proceedings of the Royal Society of London.*

Gangestad, S.W., Thornhill, R., & Yeo, R.A. (1994). Facial attractiveness, developmental stability, and fluctuating asymmetry. *Ethology and Sociobiology, 15* (2), 73-85.

Geldart, S., Maurer, D., & Henderson, H. (in press). Effects of the height of faces internal features on adults aesthetic ratings and 5-month-olds behavioral preferences. *Perception.*

Goldstein, A.G., & Papageorge, J. (1980). Judgements of facial attractiveness in the absence of eye movements. *Bulletin of the Psychonomic Society, 15* (4), 269-270.

Gordon, H.W., & Lee, P.L. (1993). No difference in cognitive performance between phases of the menstrual cycle. *Psychoneuroendocrinology, 18* (7), 521-531.

Grammer, K., & Thornhill, R. (1994). Human (*Homo sapiens*) facial attractiveness and sexual selection: The role of symmetry and averageness. *Journal of Comparative Psychology, 108* (3), 233-242.

Graziano, W.G., Jensen-Campbell, L.A., Todd, M., & Finch, J.F. (1997). Interpersonal attraction from an evolutionary psychology perspective: Women's reactions to dominant and prosocial men. In J.A. Simpson & D.T. Kenrick (Eds.), *Evolutionary social psychology* (pp. 141-167). Mahwah, N.J.: Lawrence Erlbaum Associates.

Guyton, A.C. (1976). Sexual functions in the female and the female hormones. *Textbook of medical physiology* (pp.1086-1103). Toronto: W.B. Saunders Co.

Hill, E.M., Nocks, E.S., & Gardner, L. (1987). Physical attractiveness: Manipulations by physique and status displays. *Ethology and Sociobiology, 8,* 143-154.

Jackson, L.A. (1992). *Physical appearance and gender: Sociobiological and sociocultural perspectives.* Albany, NY: State University of New York Press.

Johnston, V.S., & Franklin, M. (1993). Is beauty in the eye of the beholder? *Ethology and Sociobiology, 14,* 183-199.

Jones, D., & Hill, K. (1993). Criteria of facial attractiveness in five populations. *Human Nature, 4* (3), 271-296.

Kalick, S.M., Zebrowitz, L.A., Langlois, J.H., & Johnson, R.M. (1998). Does human facial attractiveness honestly advertise health? Longitudinal data on an evolutionary qusetion. *Psychological Science, 9* (1), 8-13.

Kaplan, H.S., & Owett, T. (1993). The female androgen deficiency syndrome. *Journal of Sex and Marital Therapy, 19* (1), 3-25.

Keating, C.F. (1985). Gender and the physiogamy of dominance and attractiveness. *Social Psychology Quarterly, 48,* 61-70.

Kenealy, P., Gleeson, K., Frude, N., & Shaw, W. (1991). The importance of the individual in the causal relationship between attractiveness and self-esteem. *Journal of Community and Applied Social Psychology, 1* (1), 45-56.

Kenrick, D.T., Neuberg, S.L., Zierk, K.L., & Krones, J.M. (1994). Evolution and social cognition: Contrast effects as a function of sex, dominance, and physical attractiveness. *Personality and Social Psychology Bulletin, 20* (2), 210-217.

Kimura, D., & Hampson, E. (1993). Neural and hormonal mechanisms mediating sex differences in cognition. In P.A. Vernon (Ed.), *Biological approaches to the study of human intelligence* (pp. 375-397). New Jersey: Ablex.

Kowner, R. (1998). Effects of social deviance labels on judgements of facial attractiveness: A comparison of labeling procedures using Japanese raters. *International Journal of Psychology, 33* (1), 1-16.

Laessle, R.G., Tuschl, R.J., Schweiger, U., & Pirke, K.M. (1990). Mood changes and physical complaints during the normal menstrual cycle in healthy young women. *Psychoneuroendocrinology, 15* (2), 131-138.

Landolt, M.A., Lalumire, M.L., & Quinsey, V.L. (1995). Sex differences in intra-sex variations in human mating tactics: An evolutionary approach. *Ethology and Sociobiology, 16,* 3-23.

Langlois, J.H., Ritter, J.M., Roggman, L.A., & Vaughn, L.S. (1991). Facial diversity and infant preferences for attractive faces. *Developmental Psychology, 27* (1), 79-84.

Langlois, J.H., & Roggman, L.A. (1990). Attractive faces are only average. *Psychological Science, 1* (2), 115-121.

Langlois, J.H., Roggman, L.A., & Musselman, L. (1994). What is average and what is not average about attractive faces? *Psychological Science, 5* (4), 214-220.

Manning, J.T., Scutt, D., Whitehouse, G.H., Leinster, S.J., & Walton, J.M. (1996). Asymmetry and the menstrual cycle in women. *Ethology and Sociobiology, 17,* 129-143.

Maret, S.M. (1983). Attractiveness ratings of photographs of Blacks by Cruzans and Americans. *Journal of Psychology, 115,* 113-116.

Marieb, E.N. (1989). *Human anatomy and physiology*. Redwood City, CA: Benjamin/Cummings Publishing Co.

McClintock, M.K. (1971). Menstrual synchrony and suppression. *Nature, 229,* 244-245.

Mealey, L., Bridgstock, R., & Townsend, G.C. (1999). *Symmetry and perceived facial attractiveness: A monozygotic co-twin comparison.* Manuscript submitted for publication.

Mealey, L., Daood, C., & Krage, M. (1996). Enhanced memory for the faces of cheaters. *Ethology and Sociobiology, 17,* 119-128.

Mitton, J.B., & Grant, M.C. (1984). Associations among protein heterozygosity, growth rate, and developmental homeostasis. *Annual Review of Ecological Systems, 15,* 497-499.

Møller, A.P., & Pomiankowski, A. (1993). Fluctuating asymmetry and sexual selection. *Genetica, 89,* 267-279.

Morris, N.M., Urdy, J.R., Khan-Dawood, F., & Dawood, M.Y. (1987). Marital sex frequency and mid-cycle female testosterone. *Archives of Sexual Behavior, 16* (1), 27-37.

Myers, L. (1990). Effects of estrogen, androgen, and progestin on sexual psychophysiology and behavior in postmenopausal women: A 10 week double blind study. *Journal of Clinical Endocrinology and Metabolism, 70,* 1124-1136.

Penton-Voak, I.S., Perrett, D.I., Castles, D.L., Kobayashi, T., Burt, D.M., Murray, L.K., & Minamisawa, R. (1999). Menstrual cycle alters face preference. *Nature, 399*, 741-742.

Perkins, D.F., & Lerner, R.M. (1995). Single and multiple indicators of physical attractiveness and psychosocial behaviors among young adolescents. *Journal of Early Adolescence, 15* (3), 269-298.

Perrett, D.I., May, K.A., & Yoshikawa, S. (1994). Facial shape and judgements of female attractiveness. *Nature, 368,* 239-242.

Perrett, D.I., Lee, K.J., Penton, V.I., Rowland, D., Yoshikawa, S., Burt, D.M., Henzi, S.P., Castles, D.L., & Akamatsu, S. (1998). Effects of sexual dimorphism on facial attractiveness. *Nature, 394* (6696), 884-887.

Persky, H., Lief, H.I., Strauss, D., Miller, R.W., & O'Brien, C.P. (1978). Plasma testosterone level and sexual behavior of couples. *Archives of Sexual Behavior, 7,* 157-173.

Persky, H., Dreisbach, L., Miller, W.R., O'Brein, C.P., Khan, M.A., Lief, H.I., Charney, N., & Strauss, D. (1982). The relation of plasma androgen levels to sexual behaviors and attitudes of women. *Psychosomatic Medicine, 44* (4), 305-319.

Phillips, S.M., & Sherwin, B.B. (1992). Variations in memory function and sex steriod hormones across the menstrual cycle. *Psychoneuroendocinology, 17* (5), 497-506.

Quinsey, V.L., Ketsetzis, M., Earls, C., & Karamanoukian, A. (1996). Viewing time as a measure of sexual interest. *Ethology and Sociobiology, 17,* 341-354.

Renaud, M. (1998, August). *The effects of fluctuating asymmetry on attractiveness and attention.* Poster session presented at the International Society for Human Ethology, Burnaby, BC.

Rhodes, G., & Tremewan, T. (1996). Averageness, exaggeration, and facial attractiveness. *Psychological Science, 7* (2), 105-110.

Richardson, B.D., & Pieters, L. (1977). Menarche and growth. *The American Journal of Clinical Nutrition, 30,* 2088-2091.

Samuels, C.A., Butterworth, G., Roberts, T., Graupner, L., & Hole, G. (1994). Facial aesthetics: Babies prefer attractiveness to symmetry. *Perception, 23,* 823-831.

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

Schreiner-Engel, P., Schiavi, R.C., Smith, H., White, D. (1981). Sexual arousability and the menstrual cycle. *Psychosomatic Medicine, 43* (3), 199-214.

Schubert, J.N., Curran, M.A., & Strungarv, C. (1998, September). *Physical appearances and viability for male and female candidates.* Paper presented at the 94th Annual meeting of the American Political Science Association, Boston, MA.

Shackelford, T.K., & Larsen, R.J. (1999). Facial attractiveness and physical health. *Evolution and Human Behavior, 20* (1), 71-76.

Shackelford, T.K., & Larsen, R.J. (1997). Facial asymmetry as an indicator of psychological, emotional, and physiological distress. *Journal Personality and Social Psychology, 72* (2), 456-466.

Sherwin, B. B. (1988). A comparative analysis of the role of androgen in human male and female sexual behavior: Behavioral specificity, critical thresholds, and sensitivity. *Psychobiology, 16* (4), 416-425.

Sherwin, B.B., & Gelfand, M.M. (1985). Sex steroids and affect in the surgical menopause: A double-blind, cross-over study. *Psychoneuroendocrinology, 10* (3), 325-335.

Sherwin, B.B., Gelfand, M.M., & Brender, W. (1985). Androgen enhances sexual motivation in females: A prospective, crossover study of sex steroid administration in the surgical menopause. *Psychosomatic Medicine, 47* (4), 339-351.

Silverman, I., & Phillips, K. (1998). The evolutionary psychology of spatial sex differences. In C.B. Crawford, D.L. Krebs, et al. (Eds.), *Handbook of evolutionary psychology: Ideas, issues, and applications* (pp. 595-612). Mahwah, N.J. : Lawrence Erlbaum Associates.

Simpson, J.A., Gangestad, S.W., & Lerma, M. (1990). Perception of physical attractiveness: Mechanisms involved in the maintenance of romantic relationships. *Journal of Personality and Social Psychology, 59* (6), 1192-1201.

Sommer, B. (1982). Cognitive behavior and the menstrual cycle. In R.C. Friedman (Ed.), *Behavior and the Menstrual Cycle* (pp. 101-127). New York, NY: Marcel Dekker Inc.

Stelzer, C., Desmond, S.M., & Price, J.H. (1987). Physical attractiveness and sexual activity of college students. *Psychological Reports, 60,* 567-573.

Swaddle, J.P., & Cuthill, I.C. (1995). Asymmetry and human facial attractiveness: Symmetry may not always be beautiful. *Proceedings of the Royal Society of London, Series B, 261,* 111-116.

Terry, R.L., & Davis, J.S. (1976). Components of facial attractiveness. *Perceptual and Motor Skills, 42* (3), 918.

Thiessen, D., Young, R.K., & Burroughs, R. (1993). Lonely hearts advertisements reflect sexually dimorphic mating strategies. *Ethology and Sociobiology, 14,* 209-229.

Thornhill, R., & Gangestad, S.W. (1994). Human fluctuating asymmetry and sexual behavior. *Psychological Science, 5* (5), 297-302.

Thornhill, R., & Gangestad, S.W. (1993). Human facial beauty: Averageness, symmetry, and parasite resistance. *Human Nature, 4* (3), 237-269.

Thornhill, R., Gangestad, S.W., & Comer, R. (1995). Human female orgasm and mate fluctuating asymmetry. *Animal Behavior, 50* (6), 1601-1615.

Townsend, J.M. (1993). Sexuality and partner selection: Sex differences among college students. *Ethology and Sociobiology, 14,* 305-330.

Townsend, J.M., & Wasserman, T. (1998). Sexual attractiveness: Sex differences in assessment and criteria. *Evolution and Human Behavior, 19,* 171-191.

Trivers, R.L. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man, 1871-1971* (pp. 136-179). Chicago: Aldine de Gruyter.

Trivers, R.L. (1985). *Social evolution.* Menlo Park, CA: Benjamin/Cummings Publishing Co.

Van Valen, L. (1962). A study of fluctuating asymmetry. *Evolution, 16,* (2) 125-142.

Wade, T.J., & Abetz, H. (1997). Social cognition and evolutionary psychology: Physical attractiveness and contrast effects on women's self-perceived body image. *International Journal of Psychology, 32* (1), 35-42.

Watson, P.J., & Thornhill, R. (1994). Fluctuating asymmetry and sexual selection. *Trends in Ecology and Evolution, 9* (1), 21-25.

Waxenberg, S.E., Drellich, M.G., & Sutherland, A.M. (1958). The role of hormones in human behavior. I. Changes in female sexuality after adrenalectomy. *Journal of Clinical Endocrinology and Metabolism, 19,* 193-202.

Waynforth, D. (1999). Differences in time use for mating and nepotistic effort as a function of male attractiveness in rural Belize. *Evolution and Human Behavior, 20* (1), 19-28.

Weisfeld, G.E., Russell, R.J.H., Weisfeld, C.C., Wells, P.A. (1992).

Correlates of satisfaction in British marriages. *Ethology and Sociobiology, 13,* 125-145.

Wiederman, M.W. (1993). Evolved gender differences in mate preferences: Evidence from personal advertisements. *Ethology and Sociobiology, 14,* 331-352.

Wiederman, M.W., & Hurst, S.R. (1998). Body size, physical attractiveness, and body image among young adult women: Relationships to sexual experience and sexual esteem. *Journal of Sex Research, 35* (3), 272-281.

Woods, N.F., Most, A., & Longenecker, G.D. (1985). Major life events, daily stressors, and perimenstrual symptoms. *Nursing Research, 34,* 263-267.

Zuckerman, M., Miyake, K., & Elkin, C.S. (1995). Effects of attractiveness and maturity of face and voice on interpersonal impressions. *Journal of Research in Personality, 29* (2), 253-272.

Tables

Table 1.0

Mean of Timed Ratings of Female and Male Faces				
Order of Session	Sex of Face	Phase	Mean	Standard Error
1	female	ovulatory	2.672	0.068
1	female	follicular	2.727	0.070
1	male	ovulatory	2.161	0.057
1	male	follicular	2.128	0.060
2	female	ovulatory	2.694	0.071
2	female	follicular	2.688	0.052
2	male	ovulatory	2.112	0.066
2	male	follicular	2.170	0.058

Table 2.0

Mean Ratings of Timed Female and Male Faces (ANOVA)			
Source	df	F	Probability
Order	1,127	0.007	0.894
Sex of Face	1,127	386.047	<0.001
Phase	1,127	0.479	0.497
Order X Sex of Face	1,127	0.002	0.951
Order X Phase	1,127	0.065	0.787
Sex of Face X Phase	1,127	0.162	0.690
Order X Sex of Face X Phase	1,127	10.272	0.002

Table 3.0

Mean Timed Rating for Session One			
Source	df	F	Probability
Phase	1,127	0.002	0.961
Sex of Face	1,127	1.763	<0.001
Phase X Sex of Face	1,127	1.058	0.042

Table 4.0

Mean Timed Rating for Session Two			
Source	df	F	Probability
Phase	1,127	0.163	0.687
Sex of Face	1,127	1.853	<0.001
Phase X Sex of Face	1,127	0.998	0.075

Table 5.0

Mean Rating of Untimed Female and Male Faces				
Order of Session	Sex of Face	Phase	Mean	Standard Error
1	female	ovulatory	2.680	0.072
1	female	follicular	2.725	0.076
1	male	ovulatory	2.162	0.064
1	male	follicular	2.150	0.065
2	female	ovulatory	2.665	0.072
2	female	follicular	2.699	0.056
2	male	ovulatory	2.061	0.066
2	male	follicular	2.137	0.062

Table 6.0

Mean Rating of Untimed Female and Male Faces (ANOVA)			
Source	df	F	Probability
Order	1,127	0.205	0.656
Sex of Face	1,127	346.163	<0.001
Phase	1,127	2.036	0.152
Order X Sex of Face	1,127	0.372	0.550
Order X Phase	1,127	0.629	0.434
Sex of Face X Phase	1,127	0.181	0.674
Order X Sex of Face X Phase	1,127	3.331	0.067

Table 7.0

Variance of the Ratings of Timed Female and Male Faces				
Order of Session	Sex of Face	Phase	Mean	Standard Error
1	female	ovulatory	1.071	0.061
1	female	follicular	1.139	0.066
1	male	ovulatory	0.931	0.055
1	male	follicular	0.983	0.066
2	female	ovulatory	1.134	0.067
2	female	follicular	1.076	0.049
2	male	ovulatory	0.927	0.064
2	male	follicular	0.973	0.055

Table 8.0

Variance of Ratings of Timed Female and Male Faces (ANOVA)			
Source	df	F	Probability
Order	1,127	0.003	0.913
Sex of Face	1,127	22.961	<0.001
Phase	1,127	1.243	0.266
Order X Sex of Face	1,127	.011	0.881
Order X Phase	1,127	1.916	0.165
Sex of Face X Phase	1,127	1.104	0.296
Order X Sex of Face X Phase	1,127	2.064	0.194

Table 9.0

Variance of Ratings of Untimed Female and Male Faces				
Order of Session	Sex of Face	Phase	Mean	Standard Error
1	female	ovulatory	1.080	0.067
1	female	follicular	1.178	0.065
1	male	ovulatory	1.007	0.065
1	male	follicular	1.073	0.072
2	female	ovulatory	1.125	0.066
2	female	follicular	1.137	0.059
2	male	ovulatory	0.958	0.066
2	male	follicular	0.944	0.056

Table 10.0

Variance of Ratings of Untimed Female and Male Faces (ANOVA)			
Source	df	F	Probability
Order	1,127	0.326	0.576
Sex of Face	1,127	13.704	<0.001
Phase	1,127	2.264	0.131
Order X Sex of Face	1,127	1.546	0.213
Order X Phase	1,127	2.414	0.119
Sex of Face X Phase	1,127	0.442	0.514
Order X Sex of Face X Phase	1,127	0.004	0.901

Table 11.0

Mean Ratings of Male and Female Facial Attractiveness During Different Menstrual Phases				
	Mean of Early-Follicular Ratings	Standard Error of Early-Follicular Ratings	Mean of Peri-Ovulatory Ratings	Standard Error of Peri-Ovulatory Ratings
Mean Timed Female	2.681	0.557	2.707	1.645
Mean Timed Male	2.138	0.496	2.147	0.469
Variance Timed Female	1.100	0.514	1.112	0.464
Variance Timed Male	0.929	0.478	0.974	0.486
Mean Untimed Female	2.670	0.575	2.712	0.536
Mean Untimed Male	2.115	0.525	2.142	0.510
Variance Untimed Female	1.101	0.530	1.160	0.497
Variance Untimed Male	0.982	0.524	1.004	0.520

Table 12.0

Testosterone Concentrations During the Early-Follicular Phase								
	MRTF	MRTM	VTF	VTM	MRUF	MRUM	VUF	VUM
correlation	-0.02	0.03	-0.05	-0.05	0.05	0.08	-0.04	-0.05
p-value	0.84	0.80	0.68	0.63	0.66	0.50	0.69	0.63
t-test (86)	0.17	0.24	0.42	0.49	0.45	0.69	0.40	0.49

Testosterone Concentrations During the Peri-Ovulatory Phase								
	MRTF	MRTM	VTF	VTM	MRUF	MRUM	VUF	VUM
correlation	-0.04	0.02	-0.09	-0.09	0.05	0.12	-0.14	0.03
p-value	0.70	0.79	0.40	0.44	0.65	0.24	0.18	0.75
t-test (86)	0.37	0.25	0.85	0.80	0.46	1.17	1.33	0.31

MRTF: Mean rating of timed female faces
MRTM: Mean rating of timed male faces
VTF: Variance of the ratings of timed female faces
VTM: Variance of the ratings of timed male faces
MRUF: Mean rating of untimed female faces
MRUM: Mean rating of untimed male faces
VUF: Variance of the ratings of untimed female faces
VUM: Variance of the ratings of untimed male faces

Appendices

Appendix A

FEMALES WANTED!!!

I am seeking female Intro. Psych. students between the ages of 18 and 25 for a fun face perception study. All women must have a normal menstrual cycle, and have not used oral contraceptives in the last three months. Participation counts as two experiment credits as students must be available for 2 sessions lasting 45 minutes each. Please contact Maryanne at ext. 22038, email fisheml@mcmail.mcmaster.ca, or drop by B133 in the basement of the Psych. Building for more information and to schedule a session. Please contact asap as sessions will be full soon.

Appendix B

Exclusion Criteria Interview Questions

Note: The words in brackets represent the desired response.

1) Are you a first year student at McMaster University? (Yes)

2) Are you currently enrolled in the introductory psychology course? (Yes)

3) Are you female? (Yes)

4) Do you consider yourself a heterosexual? (Yes)

5) Do you have any conditions which may influence your reproductive functioning? (No)

6) Are you on the birth control pill, or have you taken it within the last 3 months? (No)

7) Are you taking any other hormones or steroids? (No)

8) Are you pregnant or think you may be? (No)

9) Do you have a mostly regular monthly menstrual cycle? (Yes)

10) Are you between the ages of 18 and 25? (Yes)

11) When did you menstruate last? Or, when do you expect your next period?

12) How long is your menstrual cycle? If you cannot specify an exact length, what is the average length of your cycle? (Between 23 and 35 days in length)

Appendix C

Research Consent Form

Title of research: Facial Attractiveness as a Function of Fertility: An Evolutionary Approach

Researchers: Dr. D. deCatanzaro, (PhD.), Research Supervisor.
Maryanne Fisher, (B.A.), Graduate Student, 525-9140 X22038, email fisheml@mcmail.mcmaster.ca

Sponsor: Natural Sciences and Engineering Research Council

Purpose of research: Current evolutionary theory has focused on the role that attractiveness has played in mate selection. Factors affecting the perception of attractiveness have yet to be fully explored.

Description of research: This study is approximately two sessions lasting approximately 45 minutes. You will be rating the attractiveness of the images on the computer screen in front of you, and then answering some questions on the computer. You will be asked to donate two saliva samples during the session. The salivettes supplied are completely sterilized and are for your use only. Instructions for the proper method of donating saliva are provided near the computer. If, at any time, you wish to discontinue your participation, simply leave the testing area. You have been assigned a participant number, and thus, your confidentiality will be maintained in all phases of the study.

Potential harm: There is no potential physical harm associated with this study. The salivettes are completely sterile and have not been opened or contaminated in any way. The swab is an absorbent collection of cotton fibre which might cause you to experience a dryness of your mouth for approximately three minutes. It is also possible that some of the questions might embarrass you. The study has been designed to minimize embarrassment, and it is asked that you keep your responses confidential.

Potential benefit: You will receive two course credits in the specified undergraduate course at McMaster University upon completing both sessions. This benefit was created so that you would experience directly the procedures used in current psychological testing. In order to further this goal, a full debriefing session will occur immediately after the study, at which time all questions and comments will be addressed. Findings from this study will also benefit the research community by furthering the current knowledge of evolutionary psychology.

Confidentiality: Your responses will be treated confidentially. Data, without participants names, will be stored in a private and locked office. The investigators will make every effort to not know your identity, and thus, there is no possibility of identity disclosure.

Participation: You have the right to refuse to participate in this study, and this right remains with you so that you may discontinue your participation without any negative consequences.

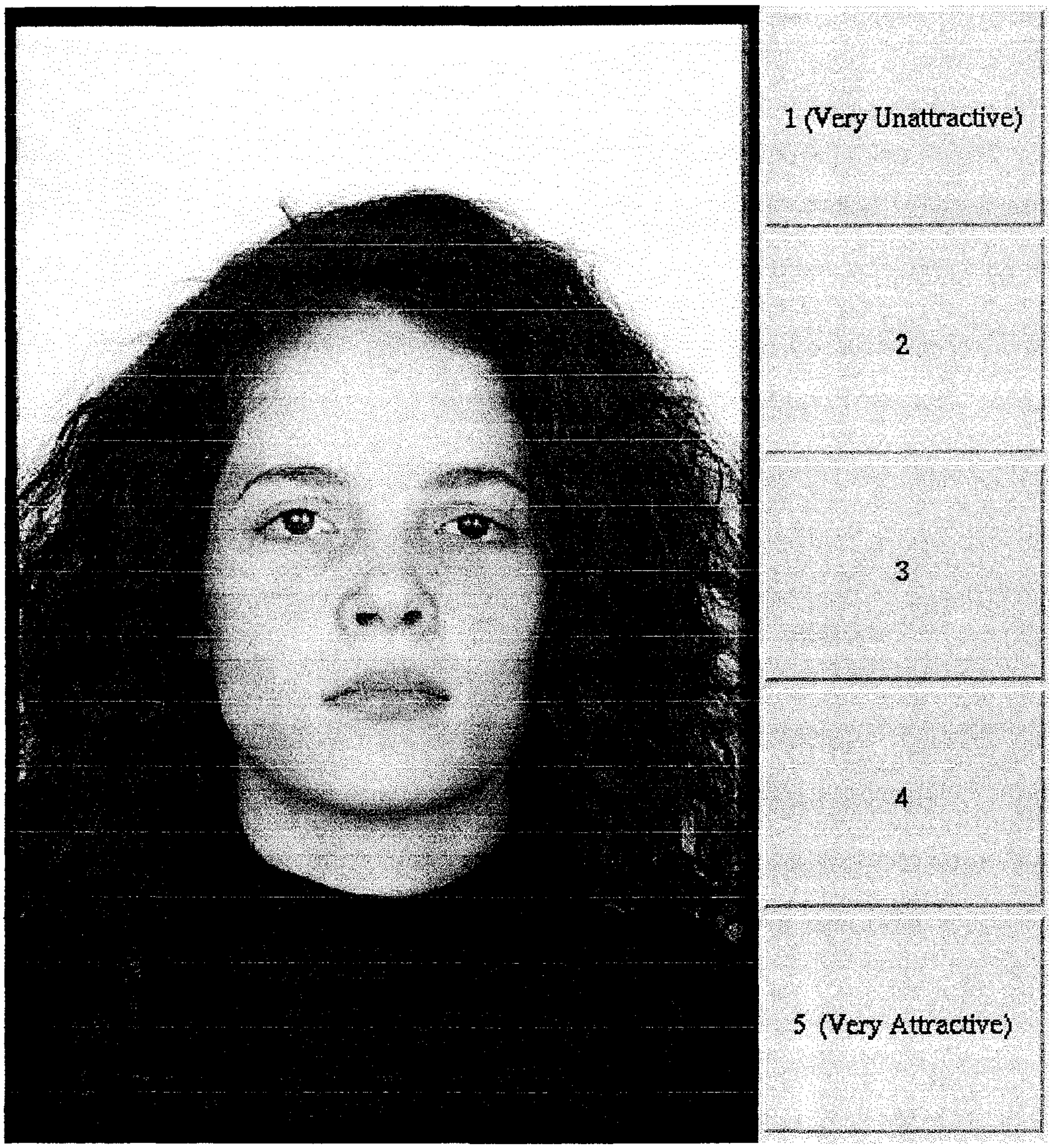
Publication: As a participant, you are invited to address an envelope to yourself and a copy of a manuscript will be forwarded to you. Any publication of the findings will not reveal your identity or distinguishable features. You should know, however, that publication of data from this experiment may take over a year.

Consent: In summary, there is no known physical harm associated with your participation in this study aside from a mild and brief dryness of the mouth. However, there is the possibility of some type of social harm, such as embarrassment, even though every reasonable precaution has been taken to ensure this does not occur. It is hoped by participating you will gain knowledge of general research methods within psychology as well as specific knowledge of the evolutionary approach to psychology.

By signing below you are indicating that you have read and understand the information contained on this form. Remember that your questions will be addressed, either during the study, or in the debriefing session at the end. By signing this consent form, you are indicating free consent to participate in this experiment. This form is current as of September 1998.

Signature of participant: Date:

Appendix D



Appendix E

Exclusion Questions

Have you started menstruating regularly? [yes/no]
Are you pregnant or believe you may be? [yes/no]
Have you used oral contraceptives in the last 3 months? [yes/no]
Are you taking any hormones (medications or muscle enhancing steroids)? [yes/no]
Have you participated in a sexual activity with a female in the past 3 months? [yes/no]
Do you have, or have recently had, a serious medical condition which may affect your reproductive functioning? [yes/no]

Birth Date Data

What is your birth date? (i.e. 75/12/8 for Dec. 8th, 1975)
year [2 digits]: month [2 digits]: day [2 digits]:

Current Menstrual Status Questions

Are you menstruating today? [yes/no]
How long on average, in days (21 to 40), is your menstrual cycle? [2 digits]
What is your current location (the day number) in your cycle? [2 digits]
When did you have your last period? Month: [2 digits] Day: [2 digits]
When did menstruation begin for your last period? Month: [2 digits] Day: [2 digits]
When did menstruation end for your last period? Month: [2 digits] Day: [2 digits]

Appendix F

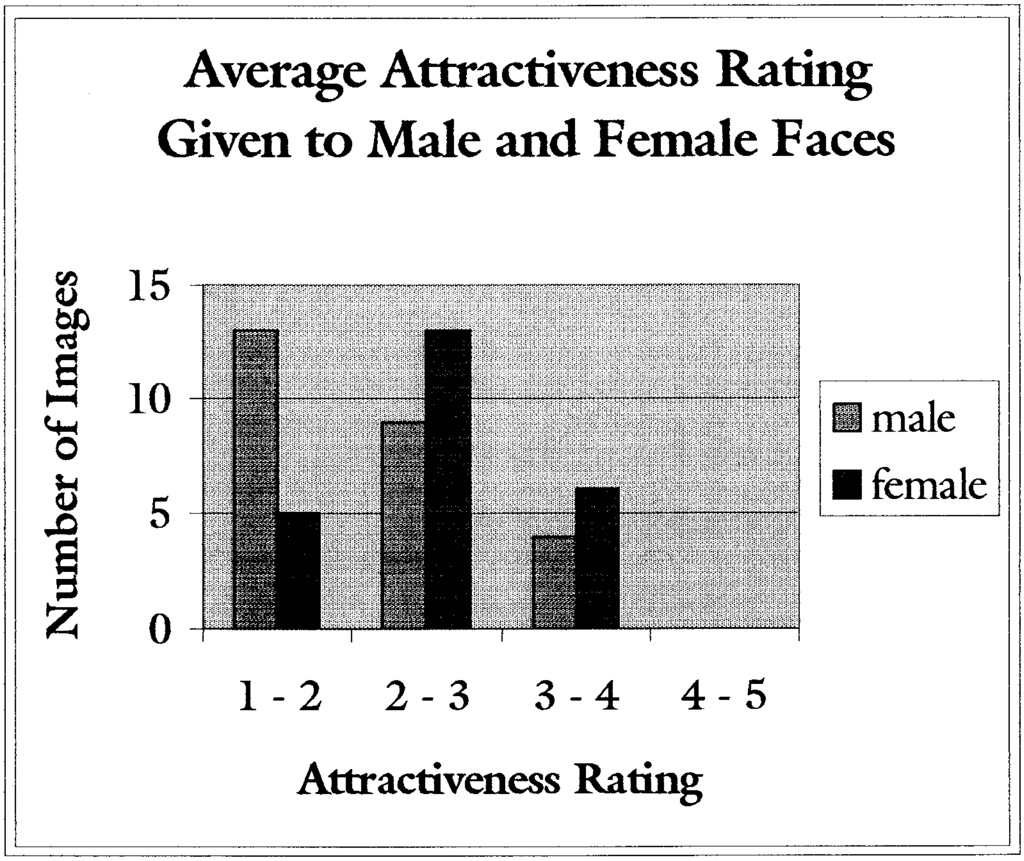
Debriefing Form

Thank you for participating in this experiment. The purpose of this study was to investigate the effects of fertility on the perception of male and female facial attractiveness. You were asked several questions about your menstrual cycle on the computer questionnaire which will enable the experimenter to determine your fertility (approximately) during both sessions. There were several hypotheses generated about the effects of menstrual phase on ratings of attractiveness. Firstly, it was hypothesized that women would show increased variation in their ratings of male faces when in the peri-ovulatory phase (i.e.: day 14 of a 28 day cycle). Due to an increased likelihood of conception women may want to select the most attractive mate available. In contrast, the highest variation in male attractiveness ratings could occur during menstruation as women may want to be the least selective in choosing a mate during the peri-ovulatory phase. That is, since women have a limited number of gametes, the wisest strategy might be for a women to be less selective when she is most fertile.

As for female faces, women may rate these faces equivalently throughout the cycle, as women cannot conceive with each other, or they may rate the faces differently throughout the menstrual cycle. If menstrual phase effects both male and female face ratings, women could have a mechanism for discriminating faces in general. It is also possible that women are examining the attractiveness of other women as these individuals are potential competition for mates.

If you have further questions, please contact the experimenter, Maryanne Fisher, at (905) 525-9140 X22038, or email fisheml@mcmail.mcmaster.ca. If you are interested in having a copy of the results mailed to you, please address the provided envelope.

Appendix G


Average Attractiveness Rating
Given to Male and Female Faces
Number of Images
15
10
5
0
1 - 2
2 - 3
3 - 4
4 - 5
Attractiveness Rating
male
female