OVULATION, STIMULUS DISCRIMINATION, AND MATE PREFERENCES

by

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ABSTRACT

The current research investigated whether ovulating women were more attuned to subtle changes in mating related stimuli, such as facial masculinity and symmetry and masculinity of gait, than nonovulating women and women taking hormonal contraceptives. Past research has found that ovulating women are more attracted to mates with increased levels of masculinity and symmetry as they are indicators of good gene quality. Our research expanded upon these previous findings by looking to see if ovulating women were also better at discriminating between subtle differences in such mating cues. To do so, we tested women's discrimination abilities during both ovulation and low fertility phases of the ovulatory cycle. Currently, a sample of 240 college women is being collected: 120 who are natural cycling and 120 who are taking hormonal contraceptives. We predict that ovulating women will be better able to detect subtle differences in facial masculinity, facial symmetry, and gait masculinity in comparison to their nonovulating counterparts and women taking hormonal contraceptives.

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Ovulation, Stimulus Discrimination, and Mate Preferences

When it comes to our mate choices and mating behavior, it's difficult and almost strange to look through a lens of investment imbalance, benefit acquisition, strategic motivations, and unconscious psychological mechanisms. Is there more to our relationships than random attraction? Although it may seem like an odd perspective, research in the field of evolutionary psychology has led to substantial evidence supporting the possible underlying motivations of our mate choices and strategies; implying that there may be more to your crush than meets the eye. More specifically, for the purpose of this study, past research has aided in a better understanding on the mate preferences of women and the effect that the ovulatory cycle has on their psychology. In this paper, we build upon the findings that ovulating women experience shifts in their mating psychology as a means of optimizing their reproductive success (Gangstead, Garver-Apgar, Simpson, & Cousins, 2007).

The current study hypothesizes that ovulating women will be better at discriminating subtle differences in the masculinity and symmetry of faces and the masculinity of gaits than nonovulating and hormonal contraceptive women. This will be tested through the completion of a set of discrimination tasks in the form of a computer survey. The survey was to be completed at times of both high and low fertility for comparison. Although we expect to find that all women will be able to discriminate between the mating stimuli when the contrast is large, we believe ovulating women will be better at discriminating when the contrast is subtler.

Mating Strategies

A popular and well supported finding in research on mating strategies is that women are the choosier sex (Stone, Goetz, & Shackelford, 2005). What is meant by this is that, when it comes to selecting a potential mate, women, more so than men, are more particular and picky in their evaluation criteria of a mate. This focal point of the female mating strategy differs from the strategies used by men, and is due to discrepancies in adaptive challenges (Buss, 2000).

Obligatory Parental Investment One explanation for why women are choosier when selecting mates is that they have a higher minimum obligatory parental investment that they must put into the creation and survival of their offspring (Trivers, 1972). Compared to men, women's sex cells, eggs, are more biologically costly to produce, requiring women to extend more energy than men. Further, women are required to sacrifice additional chances to optimize their reproductive success for a period of nine months while carrying an offspring. To clarify, women must place greater levels of time and energy into the creation of one offspring at a time. Because of this, the cost of making a poor mate decision (choosing a lower quality mate) is greater for women (Buss, 2000). Further, because women are the greater investing sex and spend a longer time period dedicated to producing each offspring, women have a lower reproductive value than their male counterparts (the number of potential offspring they can have is lower) (Buss, 1989). Once again, this increases the reproductive costs experienced by women if they were to poorly choose a mate. Due to these implications, women have adapted to be the choosier sex as an effective mating strategy.

Bateman Principle Just as women benefit from being choosy, they experience costly consequences when they aren't. This however is not the case for men who, unlike women, are able to place energy into the creation of multiple offspring at a time. The Bateman Principle provides support for this concept, highlighting that the lower investing sex, in this case males, can optimize their reproductive success by increasing their mating opportunities. Because of this, men benefit reproductively not through being choosy like women, but through being more advantageous in mate acquisition (Brown, Laland, & Mudler, 2000). To better illustrate, a woman can copulate with ten mates in the span of a month and only potentially produce one offspring, however, a man doing the same could potentially produce ten offspring. Thus, being opportunistic rather than choosy is the best mating strategy for males.

Behavioral Implications Because men and women's mating strategies differ, so do their mating behaviors. To illustrate, a study conducted by researchers Clark and Hatfield (1989) analyzed sex differences in sexual receptivity. When approached by a confederate of the opposite sex, participants were asked whether they were willing to go on a date, go back to their apartment, and have sex with the confederate. Being that women are the choosier sex, female participants were far less receptive to the invitations than the male participants. Although both men and women were willing to go out on a date, only males accepted the invitation to go to the apartment and have sex (Clark & Hartfield, 1989).

Mate Preferences

Just as men and women differ in their mating strategies, they also differ in their mate preferences. When it comes to selecting a mate, both men and women have adapted preferences to aid in their specific mating strategies. Although both women and men do share many preferences when it comes to a mate, such as someone who is kind and intellectual, there are also many differences (Li, Bailey, Kenrick, & Linsenmeier, 2002).

Men's Mate Preferences Compared to women, men cross-culturally greatly prioritize attraction as a mate preference. Preferred beauty cues such as a low waist-to-hip ratio, big eyes, large lips, small nose, etc. are favored by men as predictors of female fertility. This is important in men's mating strategy as choosing a lower fertility female would decrease their potential of producing an offspring (Buss, 1989).

Women's Mate Preferences There are two different types of mate benefits women prefer that we will touch on; both of these preferences are adaptive preferences aiding in women's choosiness. Firstly, and most commonly, women cross-culturally prefer mates with cues of resource acquisition. Given the title "direct benefits" as they directly benefit the female, resource acquisition is characterized by time, status, financial prospects, investment, and security (Eastwick &Finkel, 2008). Women are more likely to select mates with greater resource acquisition as it enhances the survival of both the female and their offspring (Buss, 1994). However, as we will see, contextual factors such as different phases of the ovulatory cycle can affect the types of preferences women emphasize, and subsequently lead us to our second benefit type. These benefits are referred to as "indirect benefits" and are characterized by a female's desire for mates with cues of good gene quality.

Ovulatory Cycle

Ovulation Over the course of a month, women experience variations in their fertility, shifting between stages of "high fertility" and "low fertility"; this is what is known as the Ovulatory Cycle. Ovulation is one point in time near the middle of the ovulatory cycle (usually around day 12-14) when conception is possible. This time period is thus considered to be a high fertility phase. Low fertility phases on the other hand are stages of the ovulatory cycle where conception is much less likely. For the purpose of this study, we will be using the luteal phase of the ovulatory cycle, the stage after ovulation, to define low fertility.

Luteinizing Hormone (LH) An increase in the levels of the luteinizing hormone in a female's system is a reliable indicator of ovulation and was analyzed for the purpose of this study. LH is a hormone produced by the pituitary gland and plays an important part in ovarian follicle growth. During the entire menstrual cycle, LH levels are consistently present at a low level. However, once the ovarian follicle reaches optimal size, LH levels surge and trigger the release of the mature egg from the ovaries within the next 24-48 hours (ovulation). This hormone thus plays a role in enhancing women's chances of fertilization during this phase of the ovulatory cycle (Filicori, 1999).

Ovulatory Shift Hypothesis

Although women are always choosy when selecting a mate, they become even choosier during ovulation. Because ovulation is the window of time in the ovulatory cycle when conception is possible, it becomes even riskier for females to make a poor mating choice due to the fact that the potential of successfully producing an offspring is greater. Further, during ovulation, women not only become choosier, but they also experience a shift in the mate qualities that they are choosy for. This phenomenon is known as the Ovulatory Shift Effect. Whereas women emphasize mate resource acquisition ability most of the time, during ovulation women shift their preferences and place a greater emphasis on mates with good gene qualities (Gangestad, Thornhill, & Garver-Apgar, 2005). This type of benefit is given the title, "indirect benefits", because they indirectly benefit women by enabling them to secure good genes for their offspring. The main explanation for this shift is the good-gene hypothesis, predicting that women will prefer cues of high gene quality the most when they are fertile and evaluating short-term mates (Gangestad, 2007). Essentially, when the likelihood of conception is highest, and women are evaluating short-term, non-committal mates (who are less likely to provide the woman with direct benefits), women shift their preferences and show a greater interest in good gene quality mates as a way to insure genetic fitness for their child, and thus indirectly gain inclusive fitness for themselves (Gangestad et al., 2000).

Cues of Gene Quality Good gene quality of mates is more specifically indicated by a male's Testosterone (T) levels. Men with greater levels of testosterone are characterized by more masculine and symmetrical faces, more masculine voices, and more masculine walking patterns (gaits) (Fink & Penton-Voak, 2002). In parallel with the ovulatory shift hypothesis, ovulating women are thus more attracted to such cues of higher testosterone. Researchers were able to support this as they found that women's preferences for testosterone levels mapped almost identically to the hormonal changes experienced during their ovulatory cycle. More notably, the highest attraction to testosterone cues were reported during ovulation (Roney & Simmons, 2008). One explanation as to why testosterone is an indicator of good gene quality is that it signifies an immunocompetence handicap. More specifically, since high levels of testosterone can be costly to men's immune function, men with higher T levels signal to women that they are genetically strong enough to withstand unfavorable conditions (Iwasa & Pomiankowski, 1991; Penton-Voak &Perrett, 2000).

Past Research Findings

Prior research has supported the theory that ovulating women are more attracted to mates showing greater testosterone levels, or greater cues of masculinity and symmetry. In the case of facial masculinity and facial symmetry, researchers brought women into their lab at both a high and low fertility stage of their ovulatory cycle and played them a video of a morphing masculine to feminine face. Ovulating women were found to have a greater preference for more masculine faces compared to nonovulating women (Johnston, Hagel, Franklin, Fink, & Grammer, 2001). This effect was also shown in research investigating ovulation and the facial symmetry of mates. In this case, ovulating women showed a greater preference for mates with greater levels of symmetrical facial cues (Little, Jones, Burt, & Perrett, 2007b).

Similar to preferences for facial masculinity, body masculinity is another mate related cue that ovulating women show a greater attraction to. Research conducted by Little, Jones, and Burriss (2007a) morphed masculine and feminine bodies and asked female participants (at both low and high fertility) to choose the body they thought was the most attractive. Results of this study suggested that ovulating women are also more attracted to higher levels of body masculinity. Lastly, another study conducted by researchers, Provost, Troje, and Quinsey (2008) used point walker videos resembling human walking patterns varying from masculine to feminine. Participants were asked to select the motion figures they found to be the most attractive when compared to each other. Results of this study found that fertile women showed a greater preference for the more masculine point figures than nonfertile women (Provost et al., 2008).

Current Research

Past literature supports that ovulating women are more attracted and attuned to mate cues signaling masculinity and symmetry. The current research study intends to take this a step further by testing to see if ovulation also increases women's abilities to discriminate subtle differences in such mating cues. The specific cues used in this study to assess women's mate discrimination abilities are facial masculinity, facial symmetry, and gait masculinity. The study recruited both natural cycling women (experimental group) and hormonal contraceptive women (control group) and analyzed participant's task performance at both high and low fertility phases of the ovulatory cycle. Results are expected to find that ovulating women are better able to discriminate between slight changes in the mating related stimuli than nonovulating women and women taking hormonal contraceptives.

METHOD

Participants

Two hundred forty female university students were recruited as participants for this study. 120 of these participants were natural cycling and reported having regular ovulatory cycles (experience a monthly ovulatory phase) and the other 120 participants were currently taking hormonal contraceptives. This group of women thus served as the control group, as their use of hormonal contraceptives inhibits an ovulatory phase from occurring. All participants fell between 18-21 years of age. Each participant was compensated for their time either through course credit or $20-30 gift cards. Natural cycling women received either 2.5 hours of course credit or $30 gift cards and hormonal contraceptive women received either 2 hours of course credit or $20 gift cards. Women in the natural cycling condition were awarded additional compensation compared to the women in the control condition due to their required completion of multiple urine tests.

Recruitment & Scheduling

All participants were recruited based on their answers to a prescreening questionnaire on the university's research hosting site. Women whose answers indicated that they met the current study's baseline requirements were added to a contact list and received both an email and phone call to ensure their eligibility. During these calls, women were asked for information including (1.) the start date of their last period, (2.) how many days long their ovulatory cycle typically lasts (for most, this range is between 24-35 days), (3.) were they currently using hormonal contraceptives, (4.) had they taken hormonal contraceptives within the last three months, and (5.) the generic name of their hormonal contraceptive if applicable; those taking fourth generation oral contraceptives were excluded from the study as they may not suppress the effects of ovulation as other generations of oral contraceptives do. In order to be recruited as a natural cycling participant, women had to have not taken any form of hormonal contraception for the last three months (the amount of time it takes for the effects of the medication to diminish). Women who reported they were currently using oral hormonal contraception were recruited to be a part of the study's control group. The information collected from questions (1.) & (2.) was used to accurately schedule the participants for their first session.

All participants, both natural cycling and control, were scheduled through a forward counting measure. The forward counting measure used in this study estimated where participants currently were in their ovulatory cycle based on the start date of their last period and their cycle length. This allowed us to schedule women for the appropriate session, and to determine whether they would complete a high or low fertility session first.

High fertility sessions were to be completed closely before the ovulation phase of the ovulatory cycle (usually around day 10-12 of the woman's cycle) and low fertility sessions were to be completed after the ovulation phase of the cycle (usually around 8-10 days after). If the forward counting measure indicated that the participant was approaching their high fertility phase, they were scheduled to complete their high fertility session first. If the forward counting measure indicated that the participant had already passed the high fertility portion of their cycle and were thus approaching low fertility, they were scheduled to complete their low fertility session first. Because all participants were required to complete both a high fertility and low fertility session, which ever session they were scheduled for first (high or low) determined which session they would complete second.

Materials

Urine tests employed in this study were LH Ovulation Midstream Urine Tests purchased from MEDIMPEX United Inc., a medical testing supply company (www.meditests.com). The tests are described as a one-step over-the-counter applicator that only requires a brief, ten second urine presence on the fiber tip of the test stick to induce a result. These tests detect whether LH, the luteinizing hormone, is present in the user's urine. If the test delivers a positive result, a surge in LH was detected and the user is likely to begin ovulation within the next 24-48 hours. If the test delivers a negative result, a surge in LH was not detected and the user is not likely to be within the realm of ovulation. The results of the urine tests are to be read 5-7 minutes after use.

Procedure

All scheduled participants completed two one-hour sessions (a high condition and a low condition). Upon entering each session, participants filled out a consent form, provided a saliva sample (the saliva sample served as an extended look at women's hormonal profiles across the ovulatory cycle, and was immediately stored in a -80-degree freezer for later hormonal analysis, however this is not the focus of this paper), and completed a computer survey. This was the exact process for women in the control group. Natural cycling women however had to complete an additional step at the beginning of each session- the completion of a urine test. The urine test served as a crucial step in natural cycling sessions because it ensured that the women were where they were predicted to be in their menstrual cycle when scheduled for either a high or low session. Urine tests were completed at the beginning of each natural cycling session and if the result indicated that the participant was in the correct phase of their menstrual cycle, they were asked to continue on with the rest of the session. If the participant was not in the correct phase of their cycle, they were either asked to come in the next day for additional urine analysis or asked to contact the lab on the start date of their next period for rescheduling purposes.

In order to complete a high fertility session, women coming into the lab needed to deliver a positive urine test result, indicating a surge in their luteinizing hormone, the precursor to ovulation. If women did not supply a positive test result on their high fertility session date, they would not complete the session that day and were asked to come back into the lab during the following days for additional urine analysis until their urine test indicated a surge in LH. Once a positive test was provided, participants were able to continue on and complete their high fertility session. If a woman was unable to achieve a positive urine test result after four attempts (usually due to missing the ovulatory window), they were either moved to the low fertility session (if they hadn't already completed it) or asked to contact the lab on the start date of their next period for rescheduling. Women coming into the lab for their low fertility session on the other hand needed to deliver a negative urine test result, indicating an absence of a luteinizing hormone surge, signifying that they are not in the ovulatory phase of their menstrual cycle (usually around 3 days prior to their next expected menstrual period). Most participants who came into the lab for their low fertility session were able to successfully provide a negative urine test result on the first try and consequentially completed the session that day.

At the end of the first session, both control and natural cycling participants were scheduled for their second session through the same forward counting measure as before. The steps listed above for the first session were repeated for the second session. At the end of the second session, all participants were properly debriefed and awarded compensation for their time and completion of the study.

Tasks

Once the participant completed filling out the online consent form and finished providing a saliva sample, the computer survey potion of the study was started in a quiet, small office setting (taking about 45 minutes on average to complete). Within the survey, participants were asked questions about demographics, reproductive history, relationship status, and their ovulatory cycle. Participants were also asked to discriminate between subtle differences in mating related stimuli such as facial symmetry, facial masculinity, and gait. The survey was built and completed using Qualtrics software.

Gait Discrimination Task This portion of the survey consisted of seven separate gait comparison videos. Each gait task displayed two separate motion figure videos and asked the participant to select which of the two they preferred. This was then followed up with the questions (1.) How strongly do you feel about your choice? and (2.) How different were the two videos from each other? These were measured on a 7-point scale with end points 1 (*not strongly at all*) to 7 (*very strongly*), and 1 (*not at all different*) to 7 (*very different*). The motion figures used in this study were taken from a tool created by the Bio Motion Lab (https://www.biomotionlab.ca/bml-walker/). This tool was designed by researchers at York's University and was created and based on the walking pattern dimensions of one hundred people. The figures consisted of animated point-like dots that were arranged to resemble the human form. With this tool, the gait patterns of the motion figures could be manipulated to display either a more masculine gait or a more feminine gait. For the task creation, eleven gait walking figure videos were recorded with incremental differences from the most masculine to the most feminine (on a spectrum, the most masculine was set at -5, and the most feminine at 5). In the finalized computer survey, only six of the recorded videos were used. The gaits used in the seven comparison tasks compared the most masculine gait (-5) to other gaits in a pseudorandom order that was the same for each participant. For this task, ovulating women were expected to prefer the more masculine gait (-5) when compared to less masculine, neutral, and feminine gaits.

Masculinity & Symmetry Discrimination Tasks The facial task portion of the survey specifically tested women's ability to discriminate between masculine and symmetrical cues in the faces of various men. These tasks were created using photo morphs of male to male and male to female faces using the Fantamorph facial morphing software. For the masculinity portion of the study, two attractive male faces and two attractive female faces were morphed together (creating two separate morphs) to alter the masculinity features of the male. For the symmetry portion, two pre-rated average asymmetrical males and two attractive symmetrical males were morphed together to create two separate morphs varying in levels of symmetry. The morphs for both masculinity and symmetry were displayed using a Forced Choice Task and a Changing Face Task. In the Forced Choice Task, participants were shown two images, the original face of the male and a morphed version of the male differing in either symmetry or masculinity on a scale from 0-30% with 5% increments. Participants were asked which of the two faces they found to be more attractive, followed by the questions (1.) How strongly do you feel about your choice? and (2.) How different were the two men from each other? (measured on the same 7-point scale described in Gait). For the Changing Face Task, participants were shown a video of each morph and were asked to click on the screen whenever they noticed a change in the face being shown. This was followed by the question, "How sure are you that there was a change in the face you just viewed" (another 7-point scale).

Control Tasks Multiple control tasks were also included in the survey to ensure that women's discrimination abilities only differed with mate specific stimuli and not unrelated stimuli. One of the controls used was a color discrimination task that depicted multiple blue colored squares differing slightly in their hues. Participants were shown two squares at a time and asked which of the squares they found more appealing and how different they found the squares to be. This control task was very similar to the facial tasks seen earlier. The control tasks asked participants to discriminate subtle differences in stimuli, however, they were not mating related and thus all participants should have performed equally regardless of whether or not they were ovulating.

EXPECTED RESULTS

Since the study is still ongoing and data collection is not yet finished, the results of this study are not available at this time. Once we do have our results, we will be able to assess the validity of our hypothesis: that ovulating women are greater at mating related discrimination tasks and picking up on subtle differences in the stimuli than nonovulating women and hormonal contraceptive women. Although we expect that all women will be similar in their preferences for more masculine and symmetrical cues when the change effects are larger and more obvious, we expect that ovulating women will show a greater effect when the changes in the stimuli are subtle.

Once data collection is complete, we will be using a 2 (participant type: natural cycling vs. hormonal contraceptive using, between subjects) X 2 (session type: high fertility vs. low fertility, within subjects) mixed model ANOVA (analysis of variance) to analyze our results. The independent variables used in this study are (1.) whether the participant was a natural cycling or a hormonal contraceptive woman and (2.) whether they were in the high fertility or low fertility phase of their cycle. The dependent variable will be participant task performance. This will be measured based on participants' answers to the scale questions, their selected preferences on the different comparison tasks, and their mean reaction times. For the gait comparison task, we expect that ovulating women will prefer the most masculine gait and that they will be better able to notice a difference between the gaits. For symmetry and masculinity, we expect that ovulating women will be more attracted to the most masculine and symmetrical morphs on the Forced Choice Task (thus indicating higher discrimination abilities). For the Changing Face Task, ovulating women should have lower reaction times when asked to click when they saw a difference in the displayed morphs.

DISCUSSION

One possible limitation of the study is potential human error in the readings of the urine test results. Although these tests were used according to the instructions provided by the manufacturer, the tests often produced ambiguous results. In cases such as these, it was left up to human discretion whether or not the test indeed indicated a positive or negative result, and thus room for potential error is expected. One way we have tried to reduce these negative effects is by capturing a photo of each completed urine test for future reference when analyzing the results of the survey.

Another limitation of the study could be the phase of the ovulatory cycle that was chosen for the study's low fertility session. In the ovulatory cycle, there are low fertility phases both before and after ovulation. The low fertility phase chosen as the focus of this research was the period following ovulation. This phase is described as the "luteal phase" and is characterized as a time when estrogen levels are still high, which could potentially affect the results of our study. That said, the other low fertility phase, the "follicular phase", is a time when estrogen is very low. Although a complication in designing the study was choosing between these phases, the luteal phase was chosen as this is what previous research has used. One way we may be able to control for this limitation would be to redesign and create an additional study using the follicular phase of the ovulatory cycle for our low fertility session instead. However, we could also add an extra subgroup of women who would complete their low fertility session in the follicular stage to the current study. This would allow us to determine whether estrogen is a mediating factor in women's task performance or not.

This study will progress the current research literature as it will extend our understanding of the impact that ovulation, as well as hormonal contraception, has on our mating decisions. More particularly, the findings of our research could lead to future directions in the literature if it is discovered that ovulating women are not only more attracted to mating cues of masculinity and symmetry but are also better able to discriminate their subtle differences. Recent research has not found evidence supporting the original findings that ovulating women are more attracted to masculine and symmetrical men, however, if our results support our hypothesis, we will have added more literature to the support of the original theory.

A possible future direction to be taken with this research is seeing how the effect we are looking at could be impacted by various environmental and demographic variables. For instance, looking to see if participants of lower SES populations show mediated results. Further, we could also look to see how this effect could be expressed differently based on whether women are using long-term mating strategies or short-term mating strategies.

Despite the future results of our research, our findings will be adding to the literature on how our mating decisions and strategies are not completely random. We have adapted psychological mechanisms that affect our daily behavior and how we interact with others, and this study will further enhance our understandings of how that happens.

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