THE 2D4D RATIO AND CYCLIC SHIFTS AS PREDICTORS OF SELF-PERCEIVED QUALITY AND PERMISSIVENESS

by

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Presented to the Faculty of the Graduate School of

The University of Texas at Arlington in Partial Fulfillment

of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

THE UNIVERSITY OF TEXAS AT ARLINGTON

August 2005

ACKNOWLEDGEMENTS

I would like to thank my graduate advisor Dr. Roger Mellgren, the faculty at the University of Texas at Arlington, those on my committee and those not, and the Animal Behavior and Evolutionary Psychology Laboratory for their continued support.

I would further like to thank the following undergraduate psychology students for assisting in this research; Jeannie Tucker, Jenny DeLong, Kevin Ware, Leila Musa, Maily Nguyen, and Allyson Dalley.

July 14, 2005

ABSTRACT

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Publication No. _____

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The University of Texas at Arlington, 2005

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The following paper discusses the findings from background research leading up to a discussion of findings from the present study. The relationships between female sexual permissiveness and female's self-perceived quality (SPQ) as a potential mate, male quality, and female age were evaluated. A woman's SPQ was predicted to correlate negatively with acceptance of sexual propositions but the data failed to support the prediction. It was further predicted that when male quality was relatively greater than female SPQ, the probability of accepting a casual sex proposition would be greater. Partial support for this prediction was found. Older females were more likely to accept sexual propositions than younger females, although this age difference decreased with increased male quality. The results of this study are discussed as well as some possible

problems in methodology. The present study examines the previous relationships as predicted by variations in activational and developmental hormone levels as estimated by the 2D4D ratio by the participant's position in the menstrual cycle reported by the participants following revisions to the SPQ scale. Following this revision we expected to observe a negative correlation between the female participant's SPQ and the participant's scores of sexual permissiveness. This finding was supported. The scores of SPQ were predicted to be higher and scores of sexual permissiveness were predicted to be lower in women with high 2D4D ratios than in women with lower 2D4D ratios. After the removal of participants reporting sexual abstinence due to religious beliefs, current involvement in a relationship, and alcohol use, this relationship was observed. The relationship between SPQ and sexual permissiveness across the menstrual cycle was also examined. Relationships between sexual permissiveness and the menstrual cycle were not observed, but SPQ and the progression through the menstrual cycle showed a negative correlations. The possibility of SPQ serving as a mechanism for risk avoidance and other implications of these findings are discussed.

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INTRODUCTION

Research on gender differences in receptivity to sexual offers has received considerable attention of late. One recurring theme of the gender difference studies in their area has been the examination of cultural stereotypes that presume that men are eager for sexual intercourse whereas women seek to set limits. Findings from several studies seem to conform to this stereotype. However, disagreements still exist about why the gender differences exist, with both the cultural stereotype explanation and an evolutionary explanation based on the costs and benefits of an individual's fitness receiving some support. More recently, increasing attention has been given to the differences in behaviors within each gender such as differences in sexual permissiveness and the predictable fluctuations in these behaviors. Two factors which are commonly used to attempt prediction of these behaviors are the menstrual cycle, and the 2D4D ratio.

Before examining the intrasexual differences, it would be beneficial to briefly review some of the literature of intersexual differences. Men can produce a virtually unlimited number of sexual gametes, whereas women are limited to a finite number of eggs. Trivers' theory of parental investment (1972) suggests that because females make

the largest investment in their offspring, they should delay sexual interaction. By delaying sexual interaction women have time to evaluate their potential mates for preferred qualities such as good financial prospects a characteristic found to be more important for women surveyed than men across 37 cultures (Buss, 1989). When evaluating potential male sexual partners, women indicated that high social status was found to be only slightly less important than wealth (Betzig, 1986; Buss and Barnes, 1986). The desire for financial security and social status, which may take time to achieve, leads women to prefer men an average of 3.5 years older then themselves (Buss, 1994). Other preferred qualities include physical superiority as exemplified by status-based wrestling matches conducted by the Mehinaku, a Brazilian tribe (Gregor, 1985); a willingness to provide resources (Buss, 1999); and facial symmetry (Cunningham, Roberts, Wu, Barbee, & Druen, 1995; Halberstadt & Rhodes, 2000; Langlois & Roggman, 1990). Facial symmetry, a measure of attractiveness which continues to draw attention, was demonstrated to correlate positively with measures of physical, psychological, and emotional health (Shackelford & Larson, 1997). More symmetric faces are judged to be more sexually attractive, and people with more symmetric faces reported having sexual intercourse earlier in life and having more sexual partners (Shackelford & Larson, 1997). Because of the female tendency to delay sexual interaction in order to gauge the presence of these preferred features, many theories based on the physiological differences in reproduction between males and females suggest that males are typically the initiators in sexual encounters whereas females act as "gatekeepers" (Symons, 1995).

The potential benefits achieved by women pursuing long-term relationships seem fairly clear. But it would seem that the gatekeeper role increases the woman's reproductive potential to the detriment of the man's. However, men still agree to long-term relationships. Among the possible benefits achieved by men pursuing a long-term relationship is the increased likelihood of obtaining a high quality woman, an increase in paternal certainty, and an increase in the probability of mating during a fertile period in the woman's ovulation cycle. From the man's perspective, a desirable mate would have characteristics such as youth, which signals reproductive viability before the onset of menopause (Buss, 1989a; Kenrick & Keefe, 1992); facial attractiveness, or averageness, signaling health or the absence of genetic defects (Cunningham, Roberts, Wu, Barbee, & Druen, 1995; Langlois & Roggman, 1990); and a waist to hip ratio of 0.7, an index of body shape that is strongly correlated with attractiveness, lower occurrences of disease, and high fertility (Singh, 1993).

1.1 Short-term relationships

Smith (1984) pointed out that if women never engaged in short-term mating, men would not have evolved a preference for it. Not only do women engage in short-term relationships, but they achieve some benefits from short-term relationships as well. Some hypothesized benefits include obscuring paternal certainty among multiple males and thus increasing resources received by the female (Hrdy, 1999), elevated status and protection (Smith, 1984; Smuts, 1985), and mate manipulation (Greiling & Buss, 2000). Although such behaviors offer reasons for women to engage in sexually permissive behaviors such as short-term relationships, they do not explain why the majority of

women still prefer long-term relationships over short-term relationships even though they may benefit from short-term relationships as well. It is possible that this difference could be explained through an examination of female quality.

Buss and Schmitt (1993) observed that men are willing to show a relaxation in a wide variety of standards such as athleticism, charm, education, generosity, loyalty, kindness, emotional stability, wealth, violent behaviors, and bisexuality for the opportunity to engage in a short-term relationship. Similarly, it is possible that women will accept a short-term relationship from a high quality man that is operating under relaxed standards when a long-term relationship with that high quality man is not likely due to her own quality.

A study performed by Clark and Hatfield (1989) examined the gender differences in receptivity to short-term sexual offers. The procedure used involved a male and a female confederate approaching a random person of the opposite sex found alone on a college campus. After approaching the subject, the confederate asked one of three prepared questions. 1) Would you go out with me tonight? 2) Would you come over to my apartment tonight? 3) Would you go to bed with me tonight? The percentages of females agreeing to the three requests in the 1982 data set, respectively, were 50%, 0%, and 0%, but the male responses were 50%, 69%, and 69%. The results conformed to the traditional expectations that men are more likely to engage in casual sex than to enter a possible relationship (by accepting a date), while the women in this study were more willing to enter into a potential relationship (by accepting a date) than they were to engage in casual sex.

Script theory, suggests that sex has been stereotyped as a man's goal, and that avoiding sex has become a woman's goal through social learning. Males and females learn the appropriate responses to sexual advances as part of their social scripts (Griffitt & Hatfield, 1984) and thus the differences in attitudes imparted to us by the culturally-driven double standard regarding sex within this script provide a model for sexual behavior (McCormick, 1987). Males are more sexually permissive than females because cultures and male-dominated societies encourage them to be, whereas females are typically punished for the same behaviors.

Herold and Mewhinney (1993) focused on the differences in sexual behavior derived from social scripts through the administration of a survey across nine "singles' bars" in Southern Ontario, Canada. The constructs addressed by the questionnaire of interest in this study were sexual history, casual sex behavior, the participants' acceptance of casual sex, and the participants' condom usage. The results revealed no sex differences in willingness to engage in casual sex, defined by sex with someone the individual had just met that day. Herold and Mewhinney (1993) found no difference in the number of lifetime or casual sex partners reported, and noted that these findings happen to conflict with the findings reported in the Clark and Hatfield study.

One finding from Herold and Mewhinney (1993) in particular, suggests the need for further study. Women reported a lack of anticipation of casual sex before entering a singles bar or party environment, whereas men reported the anticipation of casual sex. If a relaxed social script allowing women more sexual freedom existed within this party atmosphere, then we should see some increase in the *anticipation* of sexual encounters

as reported by women, assuming that this is not the first time they entered into this type of social setting. We should see also see some reduction in negative feelings reported, such as guilt, following casual sex.

The studies conducted by Clark et al. and Herold et al. were both assessing gender differences in receptivity to sexual offers. However, both studies reported different findings. These differences in finding may be better understood by evaluating the individual differences within gender, rather than cross-gender. In a previous unpublished study, Lyons investigated whether the differences in the above studies could have resulted from differences in individuals which lead people to prefer one social atmosphere over another. In this study the total number of casual sex partners and levels of sexual permissiveness (defined as a general openness towards sexual behavior) were calculated for males and females whom indicated a preference for two different social locations (church groups vs. nightclubs). This study was conducted to assess if differences in behavior could be found across the different social locations. It was predicted that females with a preference for nightclubs over church groups would report a greater number of total casual sex partners and would be more sexually permissive than women preferring church groups over nightclubs, due to more relaxed and permissive social scripts. This difference was not found. Though the men in this sample demonstrated significantly greater scores of sexual permissiveness than the females consistent with traditional findings, there was no significant difference in sexual permissiveness scores across preferred locations. Although the men did report

significantly more casual sex partners than did the women, there was no significant difference in total number of casual sex partners across locations within sex.

1.2 Self-perceived quality

Another possible factor leading to individual differences within gender is self-perceive quality as a potential mate (defined as how desirable individuals believe themselves to be based on the availability of the characteristics desired by the opposite sex). Regan (1998) found that women with high levels of self-perceived mate value set higher minimum mate standards for a potential mate than those which perceived themselves to be of a lower quality. If a woman, whether unconsciously or consciously, did not feel she had the qualities most desired by men (e.g., waist-to-hip ratio of 0.7) then seeking out a man with a quality level sufficient to acquire a woman of higher quality for the purpose of a long-term relationship would have a low probability of success. Women that perceive themselves to be of a lower quality may pursue short-term relationships with a man of relatively higher quality that would relax his standards for short-term mating. If a woman is of low self-perceived quality, it is less likely that she would be capable of attracting a man of higher quality while simultaneously withholding sexual favors, thus leading her to be more willing to having casual sex (having sexual intercourse with someone met that day or night) with a high-quality male partner. This possibility would offer an explanation for the discrepancy between attitudes about casual sex and the action of engaging in casual sex (as demonstrated by Herold and Mewhinney's study), without turning to social scripts.

1.3 Background research

Lyons and Mellgren (under review) first evaluated this relationship and made the following predictions. First, a woman's self-perceived quality (SPQ), as a potential mate was predicted to be negatively correlated with her sexual permissiveness, and also with the probability that she would accept a sexual proposition. Second, the probability that a woman will accept a sexual proposition was predicted to increase as the man's mate quality became increasingly greater than her own self-perceived quality.

Data for this study were collected from 291 female volunteers. Of the 291 subjects, 164 were recruited from the university's introduction to psychology subject pool and the remaining 127 were recruited from the general public by means of flyers and message board postings. Each participant completed an internet-based survey composed of two sections. Section one consisted of a three-measure survey: Self-Perceived Quality as a Potential Mate, Sexual Permissiveness (SP), and Sexual and Condom Use History for a total of 27 items. The participant's SPQ score was derived from the SPQ scale, with a Cronbach's coefficient alpha of 0.75. The SPQ scale was made up of the following 4 questions. From 1 to 10 (1 being the least attractive and 10 being most attractive), how do *you rate yourself* in attractiveness? From 1 to 10 (1 being the least attractive and 10 being most attractive), how do *other people rate you* in attractiveness? From 1 to 5 (1 meaning never and 5 meaning very often), Compared to other women, how often do men flirt with you? From 1 to 5 (1 meaning much less and 5 meaning much more), Compared to other women, to what extent do you have the qualities that men look for in a desired mate? The scale measuring Sexual

Permissiveness was taken from the Permissiveness factor of the Sexual Attitudes Scale (Hendrick and Hendrick, 1987) (Appendix A). The questions used in the Sexual and Condom Use History were designed to obtain information about each participant's reported frequency of engaging in casual sex (defined throughout the survey as sex with someone you had just met that day or evening) and casual sex without wearing a condom. To prevent incomplete surveys, the questionnaire was designed so that each measure had to be completed before access to the next section was granted.

Section two consisted of the "Stranger Assessment Task" composed of six male photographs (between 18 and 33 years of age) each paired with a fictitious description of that individual systematically varied in terms of the man's social status, career success, and type of relationship desired. Each factor of the description was assigned a point value and was combined with the attractiveness rating of the photograph (as rated independently by 15 individuals who did not participate in the survey), to create low, medium, and high quality scores for each picture-description combination. After approximately 30 participants had completed the survey, the photographs were rotated such that each photograph was paired at least once with each description. For each of the six photographs, the participant was asked, "What is the probability that you would accept a sexual proposition from this individual?" The participants were instructed to select the button which represents the probability (in discrete increments of 10 from 0% chance to 100% chance) that you would accept his proposition.

Recall Fisher's "sexy son hypothesis" (1958) which states that by mating with an attractive man, a woman would increase her own reproductive success in subsequent

generations by producing more attractive offspring. Therefore, a short-term relationship with a high quality man, enabling her to acquire high quality genes, would be more preferable to the woman than a long-term relationship with a lower quality male. An evaluation mechanism such as a self-perceived quality would help women, consciously or unconsciously, to determine when to engage in a short-term relationship to maximize genetic quality of potential offspring and when to hold out for a long-term relationship.

Lyons and Mellgren's first two predictions focused on this issue. The first prediction stated that a woman's self-perceived quality should be negatively correlated with sexual permissiveness and a corresponding high rate of accepting casual sex propositions. Second, the probability that a woman would accept a sexual proposition should increase as the man's quality becomes increasingly greater than her own self-perceived quality. The first prediction was not supported. There was no relationship between the woman's self-perceived quality and her sexual permissiveness. Likewise, although the relationship between the mean self-reported probabilities of accepting a sexual proposition increased as the individual's SPQ decreased, consistent with the first prediction, the trend was not significant. However, self-perceived quality did show a significant positive correlation with the total number of causal sex partners. Given the findings reported in the literature this result was unexpected (see Appendix E for detailed results).

It is possible that the lack of evidence supporting the first prediction was due to a self-report bias. The female participants may have rated themselves as being higher in mate quality than men would have rated them. A previous study demonstrated a low

correlation between self-rated attractiveness and other people's ratings of attractiveness ($r = 0.227$, $p < .047$) (Penton-Voak, Little, Jones, Burt, Tiddeman, & Perret, 2003). Given the positive correlation between the number of casual sex partners and self-perceived quality, the participants may have rated themselves as being high quality as a result of having received more attention and more sexual offers from men. So, consistent with the first prediction, men may have lowered their mate standards and approached these women with the intention of setting up a short-term casual sex relationship. The women misinterpreted these advances as assurances of high mate quality. This process could result in the woman developing inflated self-perceived quality as well as accounting for the positive correlation between self-perceived quality and total number of casual sex partners. In the following study, photographs will be taken of the subjects so that other people's ratings of attractiveness could be obtained.

The second prediction was partially supported. An interaction was found between the woman's self-perceived quality and the man's quality in predicting the woman's self-reported probability of accepting a casual sex proposition (Figure 1.1). Low self-perceived quality women were more likely than medium or high quality women to accept casual sex propositions from low and medium quality men, but they were less likely than medium or high quality women to accept casual sex propositions from the high quality men. One explanation for this is that low self-perceived quality women did not vary in their probability of accepting a casual sex proposition from men of varying quality, whereas medium and high self-perceived quality women were more selective in the choice of their mates.

Prior to beginning the survey, each participant was asked to indicate whether they were currently in an exclusive relationship (with only one person), with a member of the opposite sex, that began 6 months ago or longer. The women whom reported being in a relationship for the previous six months were older than those whom reported not being

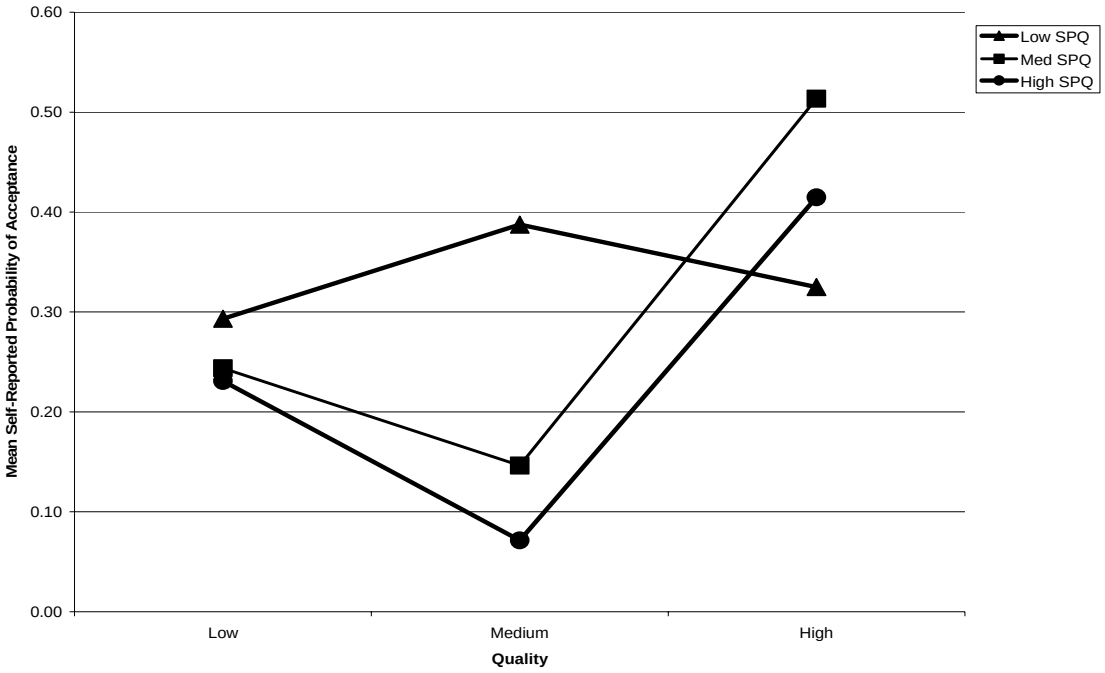

Figure 1.1 Interaction between female self-perceived quality and male quality on self-reported probability of accepting a casual sex proposition (Lyons and Mellgren, under review)

in an exclusive relationship. However, there was no difference in the self-reported probability of accepting casual sex propositions between those participants reporting being in an exclusive relationship, and those participants reporting not being in an exclusive relationship.

Significant relationships between the participant's age and SPQ and the participant's age and sexual permissiveness were found. In fact, although age was not specifically included in this study's predictions, including these relationships seemed to make sense conceptually. A negative correlation between age and self-perceived quality, as well as a positive relationship between age and sexual permissiveness was observed. Participants between the ages of 26-40 showed a greater mean self-reported probability of accepting casual sex propositions than 19 year old participants

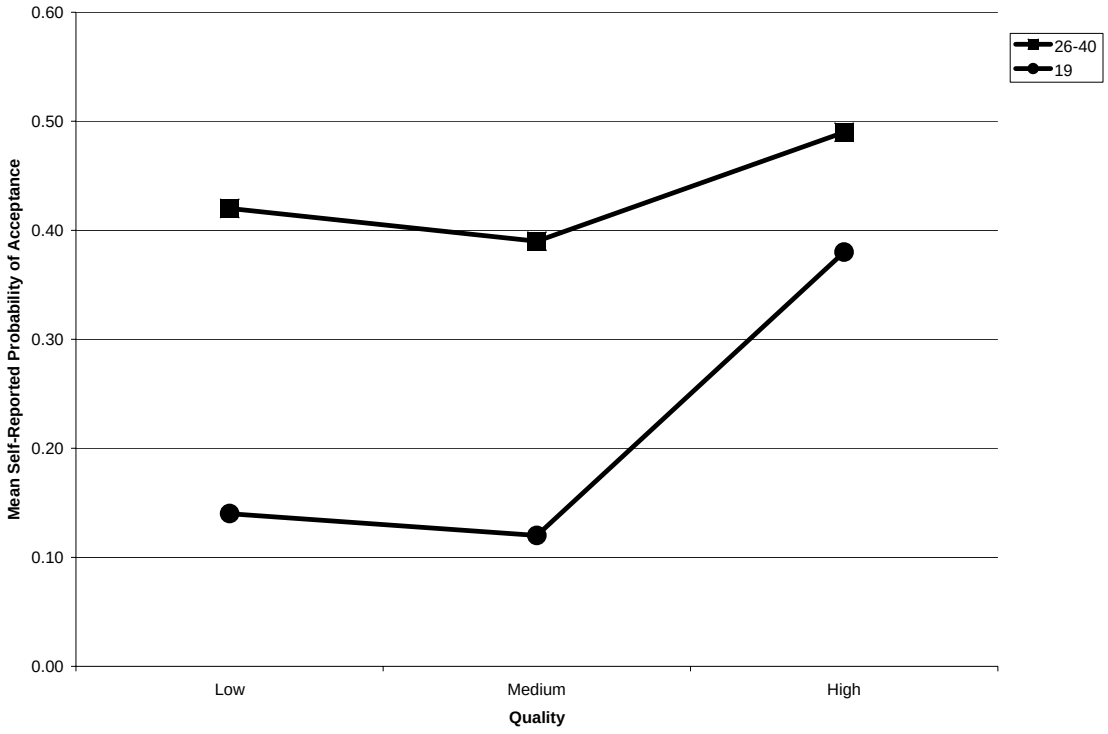

Figure 1.2 Interaction between participant's age and male quality on self-reported probability of accepting a casual sex proposition (Lyons and Mellgren, under review)

(figure 1.2). It is likely that this difference was the result of compensating for a reduction in self-perceived quality as these women aged. The positive correlation between age and sexual permissiveness offers further support for this interpretation.

The previous study was concerned with the hypothesized relationships between a woman's self-perceived quality as a potential mate and her level of sexual permissiveness along with her willingness to engage in such risky, costly behaviors as casual sex. The previous analysis assumed that an individual woman's self-perceived quality and the associated sexual behaviors are relatively stable over time. However, research has shown that not only do sexual behaviors vary among individuals, but they will also fluctuate within the same individual.

1.4 Cyclic shifts

There is strong evidence that the behavioral fluctuation in willingness to engage in casual sex is largely driven by hormonal fluctuations. Theses hormonal fluctuations revolve around a 28 day cycle on average. Following the end of the menstruation stage, the anterior pituitary releases follicle stimulating hormone (FSH), which in turn promotes the growth of the follicle in the ovary. The follicle then produces an increasing amount of estradiol, in turn causing the release of luteinizing hormone (LH). The continuous increase in estradiol will cause a spike in LH and FSH which will, in turn, cause the release of the ovum. This occurs around days 13 to 17 and is referred to as the ovulatory stage (characterized by the greatest concentration of estrogen). During this phase, women that were not taking birth control pills were

Table 1.1 Days corresponding to the stages of the menstrual cycle

Stage	Days
Menstrual	**1 to 5**
Postmenstrual (Follicular)	**6 to 12**
Ovulatory	**13 to 17**
Premenstrual (Luteal)	**18 to 28**

observed to initiate more sexual activity, either with a partner or through masturbation than at any other point during the monthly cycle (Adams, Gold, & Burt, 1978). Following the ovulatory phase, the cycle enters the luteal phase and there is a gradual reduction in estrogen until the next cycle occurs. The changes in behavior to be discussed become most extreme during the end of the follicular phase and beginning of the ovulatory phase, and to a lesser degree at the mid-luteal phase, both of which are characterized by the strongest concentration of estradiol (table 1.1).

These fluctuations in sexual behavior could be byproducts of the biological cycle but the question of their adaptiveness remains. Almost all other primate females enter into periodic estrus and attract mates to their fertile states through visual signs of swelling and smells (Baker & Bellis, 1995). It would seem possible that these

behavioral changes occur because otherwise there would not be an advertisement of ovulation by the human females. Previous findings suggest that human females developed concealed ovulation to protect their peak fertility stage. If this is true then these behavioral fluctuations may be seen as maladaptive byproducts of a necessary biological system. Rogel (1976) evaluated 785 cases of sexual assault to determine the phase of the menstrual cycle the victim was in at the time of the attack. It was observed that significantly fewer women were raped during the middle of their menstrual cycles. These findings are consistent with the hypothesis that women have developed concealed ovulation to protect themselves during their peak fertility stage.

If man's knowledge of a woman's ovulation is limited, then we should expect selection upon males to improve their detection and selection upon females to conceal it (Thornhill, & Gangestad, 2005). Kuukasjarvi, Eriksson, Koskela, Mappes, Nissinen, & Rantala (2004) examined the possibility that men would find the body odor of women as more attractive during the ovulatory phase. Males rated the sexual attractiveness and intensity of the female body odors on T-shirts which had been worn by the women on the previous two evenings. Males rated the T-shirts of women that were in the ovulation phase of the menstrual cycle and were not using hormonal contraceptives as more attractive.

Chavane and Gallup (1998) hypothesized that women reduce the amount of risky behaviors during the ovulatory phase of the menstrual cycle to reduce the probability of being sexually assaulted. Participants were asked to indicate their location in the menstrual cycle, and were given a list of risky activities (such as walking

through the park at night alone). They were then asked to indicate if they had engaged in any of these activities in the last 24 hours. The results supported the prediction by showing that women who were not using oral contraceptives showed a significant decrease in risky behaviors during their ovulation stage, whereas those women who were taking oral contraceptives maintained the same approximate levels across the menstrual cycle. These findings were replicated by Broder & Hohmann, (2003) following improvements to the methodology.

Other research has suggested that ovulation may not be concealed at all (Symons, 1995; Thornhill & Gangestad, 2005; van den Berghe and Frost, 1986). The fluctuations in sexual behaviors, though possibly maladaptive, could be a subtle ovulation display. Investigating these displays, Symons (1995) observed a vascularization of the skin and a lightening of color, which van den Berghe and Frost (1986) also reported as being a universal sexual attractant. Grammer (1996) assessed differences in female display behavior in bars, including differences in the length and tightness of the female's skirt as well as differences in number of times she was touched by males. Upon leaving the bar, each observed female was interviewed to determine her phase of the menstrual cycle and whether she was taking hormonal contraceptives and the data for those who were and were not were analyzed separately. Then each female was photographed. These photographs were then digitized so that the amount of skin showing on each female could be calculated. The results revealed that women who were not taking oral contraceptives engaged in more sexual signaling, showed more skin, and were touched more frequently while in the ovulation stage of the cycle than

the women who were currently taking oral contraceptives (and therefore not experiencing natural menstrual cycles). Two possible explanations for this behavior were offered by Grammer (1996) and Symons (1995). Either the men were detecting the women's ovulation, or the women were altering their behavior to increase their sexual desirability during the ovulation stage. In either case, these findings suggest that not all risky behaviors are being avoided during the ovulation stage.

Freund, Scher, & Hucher (1983) observed stages of courtship behaviors to progress through four phases. The first phase consisted of the initial appraisal and location of a potential partner, followed by "pre-tactile" interaction (eye contact, body signals), followed by tactile interaction, and finally ending in intercourse. Women are engage in the first three phases more than is usually assumed. In fact, Moore (1985) found that in a singles' bar setting it is often the female who initiates contact. Buss (1994) found that more women than men reported engaging in pre-tactile interaction but usually reported having no interest in sexual contact with the men to whom these interactions were directed. Though a woman may appear to be more flirtatious during the ovulatory phase, she could still be maintaining their risk avoidance by preventing actual sexual contact.

In the current research we will evaluate change in the woman's self-perceived quality during these fluctuations. One possible outcome is that the woman's supposed increase in sexual activity during the peak fertility stage will be reflected in increases in sexual permissiveness and will cause a corresponding increase in the woman's feelings of desirability reflected in increases in self-perceived quality.

1.5 2D4D ratio

A relatively new external measure of hormonal differences has recently been applied to numerous intersexual and intrasexual differences. This measure, the second to fourth digit ratio (2D4D ratio), is based on the assumption that finger length is a morphological marker of prenatal exposure to testosterone (Manning, Scutt, Wilson, & Lewis, 1998; Csatho, Osvath, Bicsak, Karadi, Manning, & Kallai, 2003; Wade, Shanley, & Imm, 2003; Neave, Laing, Fink, & Manning, 2003; Manning, & Taylor, 2001). The differentiation of the urogenital system and the appendicular skeletal system are both controlled by *Hox* genes. The *Hox* genes are organized into 4 clusters (*Hoxa* through *Hoxd*), with the most posterior *Hoxa* and *Hoxd* genes required for the growth of digits and the differentiation of genital buds (Kondo, Zackany, Innis, & Duboule, 1997). De-regulation of *Hoxd* in mice alters relative digit length (even to the point of digit loss) and results in genital bud derivatives. Because the differentiation of genitals is dependent on *Hox* genes, so are the sources of prenatal sex hormones (i.e. the gonads). Therefore, the so-called "Manning hypothesis" states that dividing the length of the second digit by the length of the fourth digit will yield a ratio that estimates the level of prenatal exposure to testosterone, with lower ratios reflecting more testosterone.

Sexually dimorphic pattern are digit ratios that appear to be fixed by the 14^{th} week of development, *inutero* (Garn, Burdi, Babler, 1975). In women, the two digits are typically close in length or the second digit is slightly longer than the fourth resulting in a higher ratio, around one on average, indicating exposure to low levels of prenatal testosterone (Wade, Shanley, & Imm, 2003). Men, on the other hand, typically

possess a lower 2D4D ratio, fourth digit longer than second digit, indicating exposure to high levels of prenatal testosterone.

Use of the 2D4D ratio as an estimate of prenatal testosterone is supported by the following findings. The 2D4D ratio of children has been observed to negatively correlate with their mother's waist-to-hip ratio, which in turn is positively correlated to testosterone (Manning, Trivers, Singh, & Thornhill, 1999). In other words, the greater the woman's WHR (higher prenatal exposure to testosterone) the lower her offspring's 2D4D will be. Moreover, children with congenital adrenal hyperplasia (CAH), a condition associated with a higher-than-average exposure to prenatal androgens have lower 2D4D ratios than controls (Brown, Hines, Fane, & Breedlove, 2002). Similarly, children with autism, a developmental disorder related higher that average levels of testosterone, have been observed to have lower-than-normal 2D4D ratios (Manning, Baron-cohen, Wheelwright, & Sanders, 2001).

Recent findings have shown that gonadal steroids play a critical role in the development of sex-role identities (Collaer & Hines, 1995). Baucom, Besch, & Callahan (1985) found a strong relationship between sex-role identity and adult levels of testosterone. Specifically, females with higher than average levels of testosterone demonstrated high levels of instrumental orientations ("take charge" orientation) typically observed in men versus the expressive orientations (warm and sympathetic) typically seen in women. This finding is consistent with the data that shows that women with CAH show a masculine bias towards indirect aggression and responses on personality inventories. In light of such findings, the relationship between sex-role

identities and the 2D4D ratio have been examined. Csatho, Osvath, Bicsak, Karadi, Manning, & Kallai (2003) examined hormonal influence on sex-role identity using the 2D4D ratio as an external measure. Their findings showed that women with low 2D4D ratios adopted more masculine traits on the masculinity scale and less feminine traits on the femininity scale.

As previously mentioned, Buss (1994) found that more females than males reported using pre-tactile interaction, but usually reported no interest in sexual contact with those males to whom the interaction was directed. On the other hand, males typically reported a willingness to engage in sexual intercourse with females following pre-tactile interactions. It is possible that women with lower 2D4D ratios than the female norm may take on a more "masculine" sex-role identities and may thus behave in ways which deviate from traditional feminized roles, which Elias (1981) defined as being less assertive, engaging in fewer competitive behaviors, and possessing greater caring attitudes and sociability. Specifically, women with lower 2D4D ratios may be more willing to engage in risky sexual behaviors. Wade, Shanley, and Imm (2003) observed that women with high 2D4D ratios were more likely to be married, had greater reproductive success, and were rated as more attractive than women with lower 2D4D ratios. If women with low 2D4D ratios are perceived as being less desirable mates by men, it is possible that they would have a correspondingly low self-perceived quality and that this would lead to higher sexual permissiveness and more willingness to engage in casual sex. If these assumptions are correct, then the 2D4D ratio could be viewed as a predictor of women's self-perceived quality and the corresponding

participation in risky casual sex. However, because high 2D4D ratios signal high prenatal exposure to estrogen, and estrogen is a strong predictor of female attractiveness (Wade et al. 2003), then the relationship between the 2D4D ratio and self-perceived quality may fluctuate if the female's self-perceived quality increases as the ovulation stage approaches.

1.6 Present study

The purpose of this research is to extend the predictions of those from the previous research to include prenatal and cyclic hormonal influences at both the activational and organizational levels. Fluctuations in sexual behaviors within individuals during various stages of the menstrual cycle will be used to *estimate* activational hormone levels and who vary in and the 2D4D digit ratio will be used to *estimate* differences in developmental hormone levels between individuals. This will be accomplished through the administration of a laboratory based survey, hand measurements, and an improved version of the stranger assessment task.

Following revisions to the self-perceived quality scale, the relationship between the self- perceived quality and scores of sexual permissiveness will be re-evaluated. As in the previous study, a negative correlation between the female participant's self-perceived quality and the participant's scores of sexual permissiveness is expected to be observed. We also predict that self-perceived quality will be higher but scores of sexual permissiveness will be lower in women with high 2D4D ratios compared to women with lower 2D4D ratios. We suggested that obtaining other's ratings of attractiveness may allow us to account for a possible self-rating bias. To this end, we predict that the

photograph ratings attained from male raters will show only a weak positive correlation with the female participant's SPQ. Finally, we predict that women will be more likely to accept a sexual proposition from a high quality male that from a low quality male.

Findings that suggest women may initiate more sexual activity during ovulation when not on birth control (Adams, Gold, & Burt, 1978), but that women may also increase risk avoidance during the ovulatory stage (Chavanne & Gallup, 1998 ; Broder & Hohmann, 2003) have been reviewed. Given the apparent contradiction in these findings, we will evaluate changes in sexual permissiveness during ovulation to determine if the scores of sexual permissiveness increase as suggested by Adams et al. or if they decrease due to risk avoidance as suggested by Chavanne & Gallup (1998). Likewise, we will evaluate changes in self-perceived quality during ovulation to determine if it increases along with increases in sexual behavior or if it decreases as a possible internal mechanism for increased risk avoidance. Finally, we will test for the existence of interactions between the participant's 2D4D ratios and her current position in the menstrual cycle in predicting scores of sexual permissiveness, or self-perceived quality.

CHAPTER 2

METHOD

2.1 Participants

249 female participants were recruited for participation from the university's introductory to psychology subject pool. Five male participants were recruited as photograph raters from outside the university to ensure the female participant's confidentiality. Out of the five male raters, three completed the photograph ratings. Participants that had discontinued use of hormonal contraceptive within the last 60 days, or had discontinued use of a hormonal contraceptives causing quarterly cycles (four menstruations per year) were not included resulting in 243 subjects. Participants currently using hormonal contraceptives were analyzed separately from those participants not using hormonal contraceptives in all analyses using the menstrual cycle as a predictor. Participants reporting to be left hand dominant were removed from the study, leaving a total of 224 participants.

2.2 Survey design

Portions of the survey used in the background research were revised for use in the present study. The revised self-perceived quality (SPQ) scale (Appendix B) was a composite of eight questions, such as "Men consider my body shape to be very

attractive", on a five point Likert scale. The measure of sexual permissiveness is the same construct used in previous research taken from the permissiveness factor of the Sexual Attitudes Scale (Hendrick & Hendrick, 1987) (Appendix A). The sexual history inventory was expanded to include self assessments of the role of alcohol in the decision to engage in casual sex (Appendix C) as well as the number of times participating in casual sex (defined throughout the survey as sex with someone you had just met that day or evening), the number of times the they were approached by a man with a casual sex offer in the last three weeks, total number of casual sex partners, and sexual orientation. As a final part of the survey, the participant's were asked to complete an additional section of the survey designed to assess the involvement of religious beliefs in the decisions to engage in casual sex (Appendix D). Stage in the ovulation cycle was determined using the forward method, in which participants indicated the first day of their last menstruation with the use of a calendar labeled with significant current events as they occurred to aid in recollection of the correct day. Each participant was asked to indicate whether they were currently using oral contraceptives, if they had discontinued use within the previous 120 days, or if they were pregnant at the time of the experimental session. Finally, the stranger assessment task was administered in a fashion similar to the Frog and Prince™ card game (explained in the following section).

2.3 Procedure

The experimental sessions were administered by five female and two male experimenters each assigned to multiple time slots. Blind to the experimenter's

schedule, the participants signed up for a time slot that fit their schedule. Each participant was in the laboratory with the participant long enough to brief the participants on the procedures and then left the room to reduce possible discomfort due to the male's presence while completing this survey.

This study was divided into two separate phases separated by a two week delay. During phase one, participants were brought into the lab and were assigned a participant number. The participants were asked to sit at a computer logged on to the survey's internet site for the administration of the survey following a detailed briefing. Use of the website in a laboratory controlled situation allowed the data to be collected on a secure website in a format ready for direct export into statistical software packages for analysis without fear of data entry errors.

Following completion of the internet survey, the stranger assessment task was administered to the participants. Before the commencement of each session (phase one and phase two), for each participant, the experimenter drew one card from each of four shuffled card decks: the stranger deck, containing photos of men rated high in attractiveness; the social status deck, containing information on the stranger's social status; the financial status deck, containing information on the stranger's career; and from the relationship deck, containing information on the type of relationship the stranger desired. This was done six times to simulate six randomly generated strangers. The participant was told to imagine that they were in a social situation in which she was approached by the male stranger depicted in the photo and was asked to read the accompanying cards. After an imaginary conversation in which she learned the

accompanying information (offered in the descriptive cards) about that individual, she was asked to imagine that the stranger depicted in the cards propositioned them for sex. The participant was asked to indicate the probability of accepting the offer of casual sex issued from that stranger. The participant repeated this procedure for the six randomly generated strangers.

Following completion of the stranger assessment task, the participants were photographed. The photographs were paired with the survey information and the stranger assessment task by the participant's number. Next, the participant's left and right hands were scanned on a standard PC scanner to obtain measurements of the second finger (index finger) and their fourth finger (ring finger) of both hands. The hands were printed out and the digits were measured. Following completion of session one of the study, the participants were given a date to return in two weeks to complete session two consisting of a repeat of the procedures used in phase one.

Following completion of session two, each participant received a thorough debriefing, explaining the research's purpose, and a brief summary of relevant background research.

After all participant's had completed phase one and phase two of the study, the participant's photographs were copied to CD-ROM and where delivered to five male raters from outside the university to obtain attractiveness ratings of the participant's photographs. The raters gave each participant's photograph a rating of 1 (least attractive) to 10 (most attractive). The ratings were recorded on a form supplied by the experimenter and sent back to the experimenter via email. Out of the 5 males initially

volunteering to participate as raters in this study, only 3 completed ratings of all 498 photographs.

CHAPTER 3

RESULTS

3.1 Scales

Analysis of the Sexual Permissiveness scale resulted in a Cronbach's coefficient alpha of 0.82. A principle component factor analysis demonstrated a single factor yielding an eigenvalue greater than one suggesting a unitary measure.

Analysis of the SPQ scale resulted in a Cronbach's coefficient alpha of 0.81. A principle component factor analysis demonstrated two factors yielding eigenvalues greater than one suggesting that this revised SPQ scale is a binary measure. SPQ item numbers 2, 5, 6, 7, and 8 loaded heavily onto factor one. These items assess the extent that the participant's have the physical characteristics that a male is looking for in a mate and was therefore labeled the attractiveness factor. Evaluated separately, the attractiveness factor has a Cronbach's coefficient alpha of 0.82. SPQ item numbers 1, 3, and 4 loaded heavily onto factor two. These items assess the extent that the participant's have the loyalty and generosity characteristics that a male is looking for in a mate and was therefore labeled the LoyGen factor. Evaluated separately, the LoyGen factor has a Cronbach's coefficient alpha of 0.74

3.2 Predictions

A negative correlation between SPQ and scores of sexual permissiveness was predicted. This was found to be significant (r (223) = - 0.135 $p < 0.0429$). In addition, SPQ was found to be negatively correlated to the probability of accepting a casual sex

3.1 Summary of correlations

	SPQ	Attractiveness	LoyGen	Male Ratings	Sexual Perm.	Probability of Accepting Sexual Offer	Total Sex Partners
Attractiveness Component	0.905*						
LoyGen Component	0.581*	0.181*					
Male Ratings	0.075	0.147*	-0.108				
Sexual Permissiveness	-0.135*	0.001	-0.390*	-0.003			
Probability of accepting Sexual Offer	-0.164*	-0.083	-0.109	0.029	0.236*		
Total Sex Partners	0.064	0.157*	-0.153*	0.019	0.405*	0.177*	
Number of Sex Offers	0.121*	0.143*	0.013	-0.045	0.146*	0.031	0.107

* significant at $p < 0.05$

proposition from the strangers depicted in the stranger assessment task (r (223) = - 0.164 $p < 0.0081$) and that sexual permissiveness was positively correlated with the total number of casual sex partners reported by the participants (r (223) = 0.405 $p <$ 0.0001), the probability of accepting a sexual proposition from a male depicted in the

Stranger Assessment Task (r (223) = 0.236 p < 0.0004) and the number of times the participants were approached by a man with a casual sex offer in the last three weeks (r (223) = 0.146 p < 0.0284) Unlike the findings reported in the background research, SPQ was not observed to be related to the total number of casual sex partners reported but a positive correlation was observed between SPQ and the number of times the participants were approached by a man with a casual sex offer in the last three weeks (r (223) = 0.121 p < 0.0376). Correlations observed in this study are summarized in table 3.1.

However when evaluating the attractiveness component of SPQ, there was a positive correlation between attractiveness and the total number of casual sex partners (r (223) = 0.157 p < 0.0190) as well as the number of times the participants were approached by a man with a casual sex offer in the last three weeks (r (223) = 0.143 p < 0.0319). A negative correlation was shown between the LoyGen component of the SPQ scale and the total number of casual sex partners (r (223) = - 0.153 p < 0.0224). The LoyGen component of the SPQ scale was negatively correlated with scores of sexual permissiveness (r (223) = - 0.390 p < 0.0001). The attractiveness component and the LoyGen component themselves showed a positive correlation (r (223) = 0.181 p < 0.0068).

It was predicted that the attractiveness ratings of the participant's photographs attained from male raters would show a weak positive correlation with the female participant's SPQ. The results showed that there was a positive correlation between the attractiveness component of self-perceived quality and the male attractiveness ratings of

the female participant's photographs (r (223) = 0.148 p < 0.026), but there was not a significant relationship to the LoyGen component, or the SPQ scale as a whole. A significant relationship was not found between the attractiveness ratings of the female participant's photographs and either the total number of casual partners reported or the number of times the participants were approached by a man with a casual sex offer in the last three weeks.

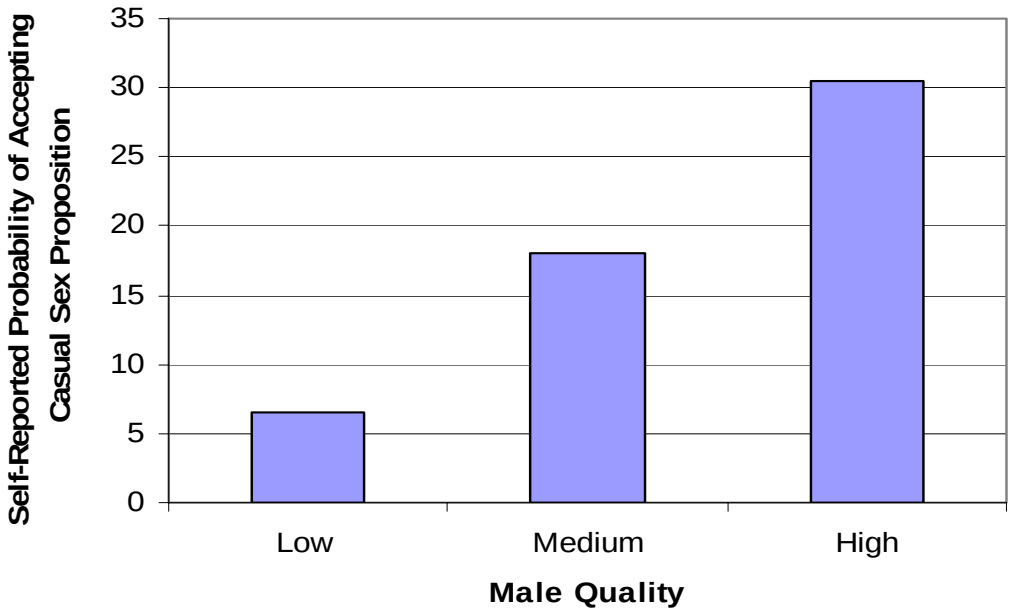

Figure 3.1 Self-reported probability of accepting a casual sex proposition from low, medium, or high quality males depicted in the Stranger Assessment Task

A MANOVA was performed showing the probability of accepting a sexual proposition from the strangers depicted in the stranger assessment task to be significantly different across low (n = 147, *M = 6.6, SD = 15.7*), medium (n =239, *M = 18.1, SD = 18.6*), and high (n =201, *M = 30.5, SD = 28.4*) male quality (F (2,107) =

6.82, $p < 0.0016$) (Figure 3.1). A MANOVA also showed a significant interaction between male quality and female SPQ (F (2,107) = 3.52, $p < 0.0330$). However, only the interaction between high male quality and SPQ was significant (at $\alpha = 0.10$ level) (t (1,108) = -1.66, $p < 0.10$).

It is possible that sexual experience may have influenced the probability of accepting a casual sex proposition from a stranger in the Stranger Assessment Task. To account for

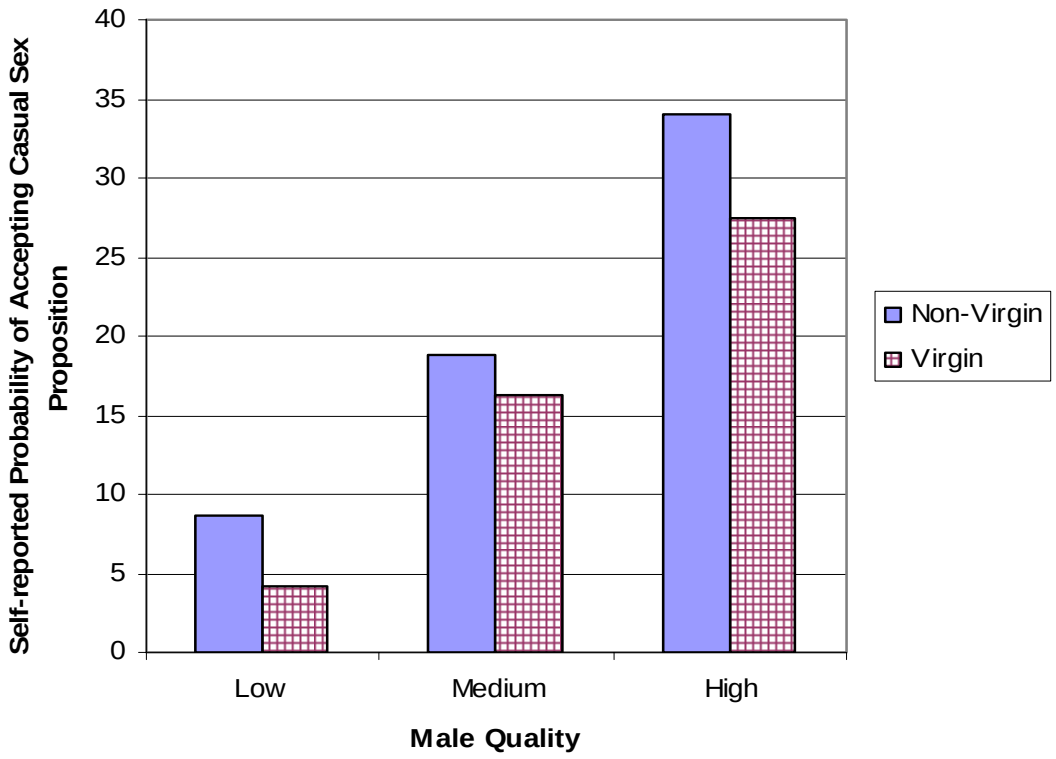

Figure 3.2 Probability of accepting casual sex propositions for virgin versus non-virgin across male quality

this, participants were coded as virgin versus non-virgin. While the pattern of accepting the casual sex propositions for virgin versus non-virgin across male quality (low, medium, high) fit the expected pattern (figure 3.2), a MANOVA showed that it was not significant (F (2,107) = 0.21, $p < 0.8082$). When male quality was ignored, a t-test shows that the probability of accepting a casual sex offer, averaged across the 6 stimuli in the Stranger Assessment Task , was greater for non-virgins (M = 21.65, SD = 16.25) than for virgins (M = 12.36, SD = 14.17) (t (222) = 3.74 $p < 0.0002$). Consistent with these results, non-virgins were observed to have greater scores of sexual permissiveness (M = 45.02, SD = 11.12) than did virgins (M = 39.08, SD = 9.14) (t (222) = 3.54 $p <$ 0.0005). SPQ was not observed to be significantly different for non-virgins versus virgins.

It was predicted that the participant's scores of SPQ would be higher but scores of sexual permissiveness would be lower in women with high 2D4D ratios compared to women with lower 2D4D ratios. To address these predictions, 2D4D ratio was dichotomized into high (0.984 – 1.098) and low (0.848 – 0.983) 2D4D ratios, to remain consistent with previous literature, and standardized t-tests were performed. Neither the participant's SPQ nor the participant's scores of sexual permissiveness were observed to be significant for either the right or left hand. Likewise, the total number of casual sex partners was not observed to be significantly related to the 2D4D ratio.

The distribution of participants in each stage of the menstrual cycle is depicted in figure 3.3. No significant difference was observed in sexual permissiveness scores in

any of the four stages of the menstrual cycle. The relationship between SPQ scores across the menstrual cycle was also evaluated. These differences were not found to be

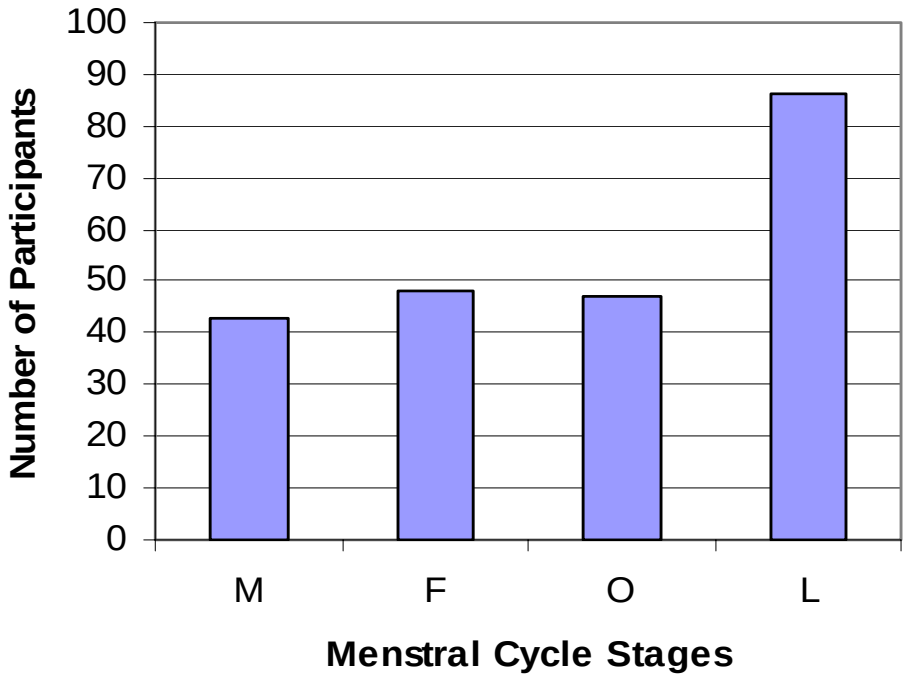

Figure 3.3 Distribution of participants in each stage of the menstrual cycle

significant though SPQ was observed to be lowest in the ovulatory stage (Figure 3.4). This same pattern was demonstrated with the attractiveness and LoyGen components of the SPQ scale. Consistent with this finding, a negative correlation *was* observed between SPQ and the progression through the menstrual cycle from the menstruation stage to the end of the ovulation period (Day 1 to 17) (r (182) = - 0.230 $p < 0.0344$).

Of 224 participants included in this study, 95 participants were currently using a form of hormonal contraceptive and 129 were not using a form of hormonal contraceptive. An ANOVA was performed, showing that hormonal contraceptive use

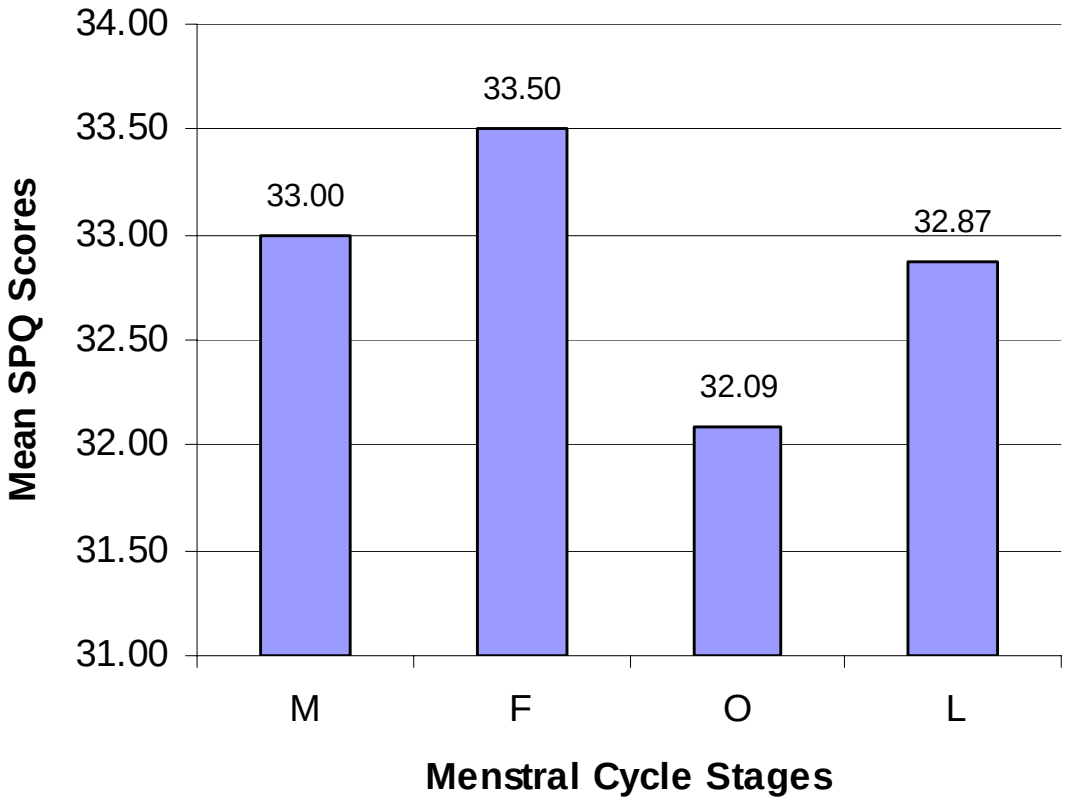

Figure 3.4 Self-perceived quality scores across the menstrual cycle

and the current stage in the menstrual cycle did not significantly predict sexual permissiveness (F (7, 216) = 1.55 $p < 0.1518$) or SPQ (F (7, 216) = 1.04 $p < 0.4065$). Differences in SPQ and sexual permissiveness scores were not observed to be

significant in either the low or high 2D4D ratio groups across the four stages of the menstrual cycle at the alpha = 0.05 level.

3.3 Religious factors

The participants in this study were asked whether they abstained from casual sex due to religious beliefs and how frequently they attended religious services. Of the 224 participants included in the study, 188 participants reported that they did not abstained from casual sex due to religious beliefs. T-tests showed that the participants who reported abstaining from casual sex due to religious beliefs had significantly lower scores of sexual permissiveness (M = 37.46, SD = 7.30) than those participants who reported that they don't abstain from casual sex because of religious belief (M = 45.21, SD = 11.20) (t (222) = 4.45 $p < 0.0001$). The frequency of attending religious services was negatively correlated to the participant's scores of sexual permissiveness (r (223) = - 0.307 $p < .0001$).

Alpha levels were corrected for the multiple comparisons to follow using the Bonferroni method, setting the alpha level for these analysis at $\alpha = 0.02533$. The participants who reported abstaining from casual sex due to religious beliefs had a significantly lower total number of casual sex partners (M = 1.65, SD = 4.06) than those participants whom reported that they don't abstain from casual sex because of religious belief (M = 3.88, SD = 4.37) (t (222) = 3.12 $p < 0.0021$). The probability that participants whom reported abstinence due to religious beliefs would accept a sexual proposition from the strangers depicted in the stranger assessment task was significantly lower (M = 13.96, SD = 15.19) than the probability that participants whom did not

report abstaining from casual sex due to religious beliefs would accept a sexual proposition (M = 20.58, SD = 16.22) (t (190) = 2.26 p <0.0252.

. SPQ was not found to be related to whether the participants reported abstaining from casual sex due to religious beliefs or the frequency of attending religious services.

3.4 Relationship status

The participants were asked whether they were in "an exclusive relationship (only one person), with a member of the opposite sex, that began 6 months ago or longer". Of the 224 participants included in the study, 131 participants reported that they where no in a relationship as defined above. This relationships status was not found to be correlated with the scores of SPQ, or sexual permissiveness. The number of times the participants were approached by a man with a casual sex offer in the last three weeks *was* significantly lower for women whom reported being in a relationship as defined above (M = 0.54, SD = 1.43) than for women whom were not in a relationship (M = 1.10, SD = 1.67) t (222) 2.71 p < 0.0073.

When only looking at participants who were in exclusive relationships, the correlation between self-perceived quality and male attractiveness ratings of the participant's photographs was (r (107) = 0.219 p < 0.023). Though the correlation showed an increase after controlling for women involved in exclusive relationships, this increase was not significant.

3.5 Alcohol use

Participants were asked whether alcohol use influenced their engaging in casual sex. Of the 224 participants included in the study, 163 participants indicated that alcohol use did not influence their engaging in casual sex. Attributing casual sex to the influence of alcohol was not found to be related to the scores of sexual permissiveness, SPQ, or the total number of casual sex partners. A positive correlation was observed between participants currently involved in relationships and the use of alcohol as an excuse for casual sex (r (223) = 0.1468 $p < 0.0280$).

3.6 Controlling for abstinence due to religion, relationship status, and alcohol use

Participant's who indicated that they abstained from sexual intercourse due to religious beliefs, or indicated that they were involved in a committed relationships (by our definition), or stated that alcohol was the reason they had engaged in casual sex were removed, and the analyses were repeated. The negative correlation between SPQ and sexual permissiveness scores remained significant (r (52) = -0.398 $p < 0.0035$). The relationship between SPQ and total number of casual sex partners was still not observed**.**

The relationship between SPQ and the probability of accepting a sexual proposition from the strangers depicted in the stranger assessment task was no longer significant (r (52) = -0.137 $p < 0.3326$). After re-including the participants who reported using alcohol as the reason they engaged in casual sex the relationship between SPQ and the probability of accepting a sexual proposition was greater but still not significant (r (103) = -0.18 $p < 0.0905$). Fisher Z transformation showed that the

difference in the correlations between SPQ and the probability of accepting a sexual proposition before the removal of the above participants and the same correlation following their re-instatement was not significant ($Z = 0.25$ $p < .05$)

Alpha levels were corrected for the multiple comparisons to follow using the Bonferroni method, setting the alpha level for these analysis at $\alpha = 0.02533$. After the participants who indicated that they abstained from sexual intercourse due to religious beliefs, or indicated that they were involved in a committed relationship, or stated that alcohol was the reason they had engaged in casual sex were removed the scores of sexual permissiveness were observed to be significantly higher for women with low

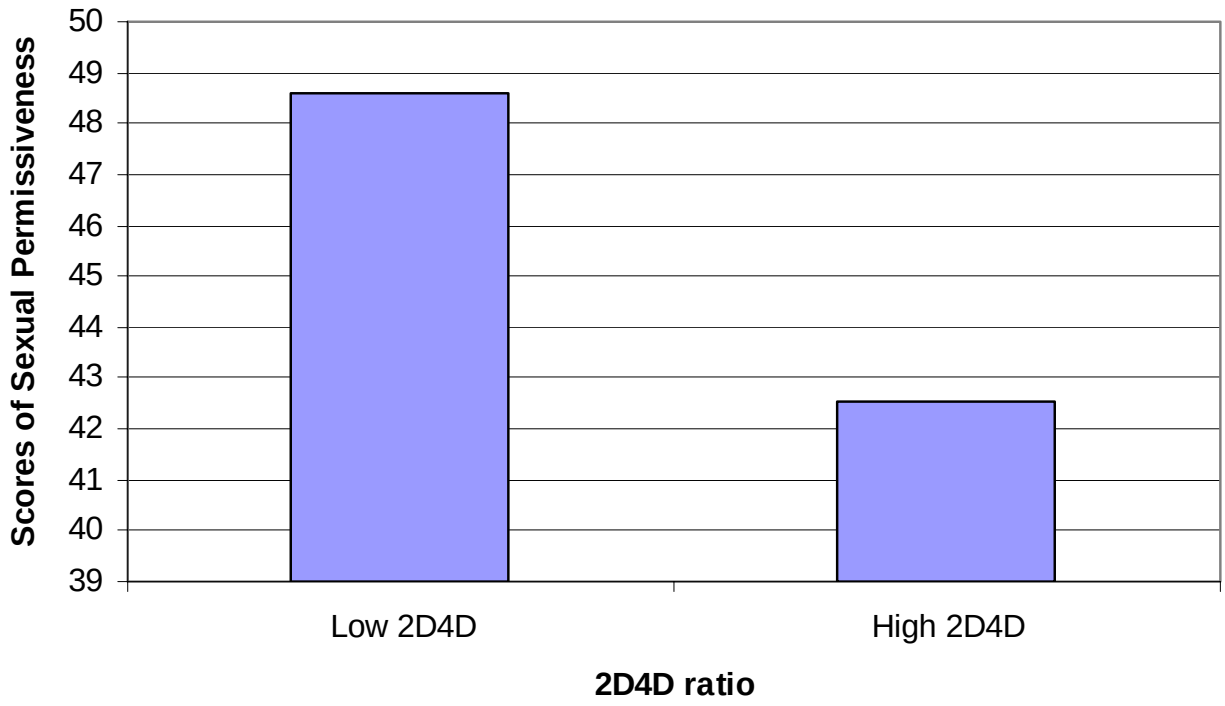

Figure 3.5 Sexual permissiveness scores for low versus high 2D4D ratio (left hand)

2D4D ratios (M = 48.60 SD = 12.7) than for women with high 2D4D ratios (M = 42.56 SD = 8.57) ($t(50) = 3.21$ $p < 0.0017$) as predicted, but only in the left hand 2D4D ratio (Figure 3.5).

SPQ was observed to be greater for women with high 2D4D ratios (M = 34.05, SD = 3.19) than women with low 2D4D ratios (M = 32.72, SD = 4.15) ($t(50) = 2.03$ $p <$ 0.049) as predicted (Figure 3.6). This relationship was also only observed in the left

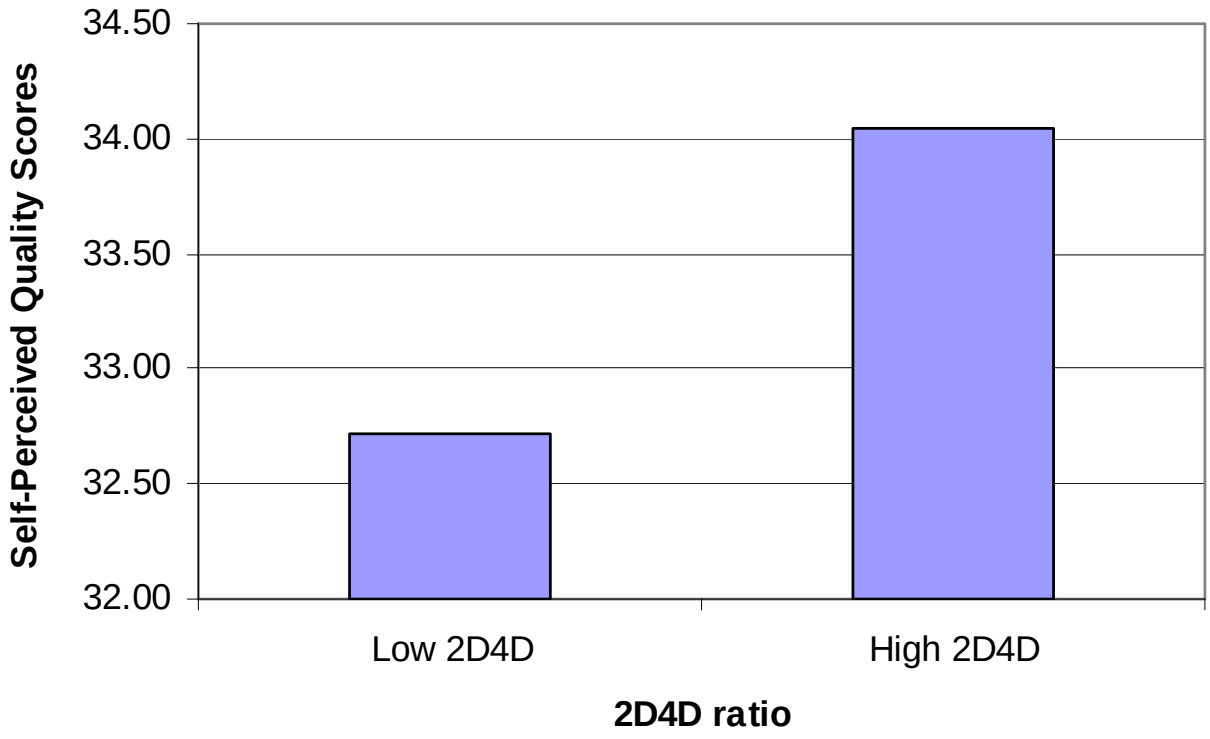

Figure 3.6 Self-perceived quality scores for low versus high 2D4D ratio (left hand

hand 2D4D ratio. Neither the total casual sex partners reported, nor the probability of accepting a casual sex proposition from the strangers depicted in the stranger

assessment task were significantly related to the 2D4D ratio after removal of the religious abstinence, relationship status, and alcohol use participants.

Significant differences were not observed in either the SPQ scores nor the sexual permissiveness scores in any of the four stages of the menstrual cycle from the menstruation stage, to the follicular stage, to the ovulation stage, to the luteal stage However, as before removal of the selected participants, SPQ and the progression through the menstrual cycle from the menstruation stage to the end of the ovulation period (Day 0 to 17) showed a negative correlation (r (55) = - 0.308 $p < 0.0208$). The magnitude of the negative correlation increased by 0.234, however, this was not a significant increase ($Z = .532$ $p < 0.05$).

CHAPTER 4

DISCUSSION

Self-perceived quality was observed to be negatively correlated to sexual permissiveness in the present study in line with the predictions, but not in the background research. On the other hand, the self- perceived quality was not observed to be related to the total number of casual sex partners in the present study but a positive relationship was observed in the background research. If self-perceived quality is negatively correlated to sexual permissiveness as suggested by the present study and sexual permissiveness *was* positively correlated to the total number of casual sex partners as suggested by the present study, then a *negative* relationship between self-perceived quality and the total number of casual sex partners should be expected. Therefore, it was unexpected that neither a negative nor a positive relationship between self-perceived quality and the total number of casual sex partners was observed in this study. A principle component factor analysis suggested that the revised self-perceived quality scale used in the present study was made up of two factors; attractiveness and loyalty/generosity.

When the attractiveness factor of the self-perceived quality scale is evaluated as a separate component, it *is* observed to positively correlate with the total number of

casual sex partners reported but it showed no relationship to sexual permissiveness. The loyalty and generosity factor of the SPQ scale is observed to *negatively* correlate with the total number of casual sex partners reported and to *negatively* correlate to sexual permissiveness. It is possible that the positive correlation between self-perceived quality and the total number of casual sex partners observed in the background research was the result of the previous version of the SPQ scale only the assessing attractiveness factor of self-perceived quality.

The attractiveness factor may be susceptible to misinterpretation of male advances as reassurances of high quality. This possibility is further supported by the findings which show that self-perceived quality positively correlated with the number of times the participants were approached by a man with a casual sex offer in the last three weeks but it did not correlate to the attractiveness ratings received from men. The attractiveness component of the SPQ scale, however, showed a weak positive correlation to the attractiveness ratings received from men. This finding was consistent with the results obtained by Penton-Voak, Little, Jones, Burt, Tiddeman, and Perret (2003) which showed that self-attractiveness ratings showed only a weak positive correlation to other's ratings of attractiveness. Loyalty and generosity are two additional characteristics that are highly favored by men. Because the LoyGen factor is negatively correlated with the total number of casual sex partners and sexual permissiveness, it may *not* be susceptible to misinterpretation of male advances as a reassurance of high quality. Instead, it may relate to a personality characteristic

reflecting stereotypical sex roles resulting in the *negative* correlation between self-perceived quality and sexual permissiveness.

A significant difference was observed in the probability that the participants would accept a casual sex proposition across male quality (low, medium, and high). However, as shown in figure 3.1, these results may be subject to a floor effect. The probabilities of accepting the casual sex proposition for the low and medium quality groups was very low while the probability of accepting the proposition from a high quality male increases to just over 30%. In addition, a significant interaction was observed between SPQ and the probability to accept a casual sex proposition, but only for males of high quality

The "sexy son hypothesis" suggested by Fisher (1958) states that by mating with an attractive man, a woman would increase her own reproductive success in subsequent generations by producing more attractive offspring. Therefore, a short-term relationship with a high quality man, enabling her to acquire high quality genes, would be more preferable to the woman than a long-term relationship with a lower quality male. In such a situation the presence of an evaluation mechanism like self-perceived quality which influences levels of sexual permissiveness would help women to determine when they should engage in a short-term relationship to improve the genetic quality of potential offspring, or whether they are of sufficient quality to attract a high quality man *and* demand a long-term relationship. Therefore, in this study, the females may have rated themselves as higher in relative quality than the hypothetical males they were

exposed to and were then unwilling to accept a risky short-term relationship with these males.

It is also possible that the low and medium quality males were therefore too low and as such, the majority of the women rated themselves as relatively higher in quality. Another explanation may be found in the unequal sample size. Because the males in the Stranger Assessment Task were randomly generated, the overall exposure to male quality groups was not equal. Overall, the participants were not exposed to more of one condition than others. Therefore, the male quality groups were not equally represented.

One concern with this study was the possible influence of sexual experience on the probability of accepting a casual sex proposition from the hypothetical Stranger Assessment Task. In fact, it may have been more difficult for women lacking in sexual experience to distinguish between the male quality groups. For this reason, differences in probability of accepting a casual sex proposition for virginity versus non-virgins across male quality were evaluated. As shown in figure 3.2, the probability of accepting casual sex propositions was greater for non-virgins than virgins for low, medium, and high quality groups, with the probabilities of both non-virgins and virgins increasing from low to high male quality. Although these differences were not significant, the pattern yields interesting results. Clearly, those participants lacking in sexual experience were less willing to engage in casual sex with a stranger than were the sexually experienced participants. However, since the probability that the non-sexually experienced participants would accept a casual sex proposition increased as male quality increased along with the sexually experienced participants, the hypothesis

that sexual experience better enables the individual to gauge male quality can not be supported with this data.

The relationship between self-perceived quality and sexual permissiveness scores across the menstrual cycle was also evaluated. No significant difference was observed in self-perceived quality or sexual permissiveness scores in any of the four stages of the menstrual cycle (menstruation, follicular, ovulation, and luteal). So according to the findings from this study, women's scores of sexual permissiveness did not fluctuate in response to the supposed increase in sexual activity typically seen around the ovulation stage (Adams, Gold, & Burt, 1978). In fact, a negative correlation was observed between self-perceived quality and the progression through the menstrual cycle from day 0 to day 17 and self-perceived quality was observed to be lowest in the ovulation stage (though this difference was not significant).

Self- perceived quality was expected to increase during the ovulation stage of the menstrual cycle, possible due to the same factors that promoted an increase in sexual activity during the peak fertility stage. The results, however, showed a decrease in self-perceived quality during the peak fertility stage. Since the self-perceived did not increase along with a presumed increase in sexual activity, then it may decrease to promote risk avoidance. An increase in risk avoidance in this case is a decrease in behaviors that may make a woman more vulnerable to unwanted sexual activity as observed during the stage of highest fertility by Chavanne and Gallup (1998) and Broder and Hohmann (2003).

A significant relationship between the 2D4D ratio and the self-perceived quality scales or the sexual permissiveness scales for either the left or the right hand was not observed.

4.1 Alternate possibilities

It is possible that sexual permissiveness and self-perceived quality were influenced by religious beliefs, relationship status, or alcohol use rather than by stages in the menstrual cycle, or the 2D4D ratio. These relationships were evaluated to account for this possibility,. Sexual permissiveness was found to be significantly lower in women indicating that they abstain from casual sex due to religious beliefs and was negatively correlated with the reported frequency of attending religious services. In addition, the total number of casual sex partners and the probability of accepting a sexual proposition from the strangers depicted in the stranger assessment task were found to be significantly lower in women indicating that they abstain from casual sex due to religious beliefs. Scores of self-perceived quality obtained from subjects in this sample were not found to be related to religious factors.

The participants were asked whether they were in "an exclusive relationship (only one person), with a member of the opposite sex, that began 6 months ago or longer". By this definition, relationship status was not found to be correlated with self-perceived quality or sexual permissiveness. However, the number of times they were approached by a man with a casual sex offer in the last three weeks *was* significantly lower for women whom reported being in a relationship (as defined by this study) than for women whom were not in a relationship.

Thornhill and Gangestad (2005) recently presented a study suggesting that human female estrus has not been "evolutionarily lost" and that contrary to previous findings, both men and women are aware of peaks in fertility. In fact, according to findings reported by Thornhill et al. (2005) men react to female estrus by an increase in mate guarding behavior. Given the relationship between relationship status and the number of times they were approached by a man with a casual sex offer reported in the present study, it is possible that the involvement in a relationship just prevented the woman's exposure to casual sex due to a man's increased mate guarding behaviors and that the extent of the mate guarding may increase as the woman approaches ovulation. Therefore, the decrease in self-perceived quality of the women in relationships may be caused from an increasing reduction in the attention from rival males as the women's ovulation stage approaches.

If the suggestion that self-perceived quality is serving as a mechanism to increase risk avoidance during stages of peak fertility is to be properly evaluated, then other factors that may lead to a reduction in self-perceived quality during the ovulation stage, such as relationship status which may increase the males knowledge of that particular female's cycle, must be controlled.

4.2 Abstinence due to religion, relationship status, and alcohol use

The participants indicating abstinence due to religion, reported being in a relationship by our definition, and/or attributed casual sex to alcohol use were removed and the analyses were performed again. The negative correlation that was observed between self-perceived quality and the progression through the menstrual cycle from

day 0 to day 17 was again observed following the removal of the participants involved in a relationship as defined by this study. We therefore conclude that there is enough evidence to suggest further study of the possibility that self-perceived quality moderates risk avoidance. Scores of sexual permissiveness were not related to the stages of the ovulation cycle.

After the removal of these participants, the relationship between SPQ and the probability of accepting a proposition from a stranger depicted in the stranger assessment task was no longer significant. However, after replacing the participants who reported using alcohol as the reason they engaged in casual sex, the relationship neared significance. These results suggest that alcohol has some affect on the individual's self-perceived quality and the corresponding probability that same individual will accept a proposition to engage in casual sex. Of course anecdotally speaking, this is not a novel finding. Nevertheless a study specifically targeting this interaction may be warranted.

Finally, relationships to 2D4D were found as predicted. SPQ scores were higher in women with high 2D4D ratios as compared to women with low 2D4D ratios, in support of the findings by Wade et al (2003) stating that women with high 2D4D ratios are rated as more attractive by men.

Csatho et al. (2003) observed that the 2D4D ratio proved to be a predictor of sex-role identity. They found that women with low 2D4D ratios adopted more masculine traits on the masculinity scale and less feminine traits on the femininity scale. We showed that sexual permissiveness scores were lower for women with high 2D4D

ratios as compared to women with low 2D4D ratios. Therefore, we would expect to observe that women with lower 2D4D ratios would report a higher total number of casual sex partners. However, our results failed to show a significant relationship between the total number of casual sex partners reported and the 2D4D ratio.

It should be pointed out, however, that the findings in the present research were only observed in the left hand, after eliminating all participant's reporting to be left hand dominant. Geschwind and Galaburda (1985) suggested that the growth rate of the left side of the brain is slowed by testosterone, while the growth rate of the right side of the brain is enhanced by testosterone. It is possible that testosterone effects demonstrate laterality (Manning, et al., 1998). Putz, Gaulin, Sporter, and Mcburney recently evaluated the correlations between 57 variables and the 2D4D ratio. They found that the 2D4D ratio predicted direction for sexual orientation among females, but only in the left hand. Putz et al. attributed the lack of findings to the limited usefulness of the 2D4D ratio due to developmental timing between the factors measured and the development of the 2D4D ratio.

Our results demonstrated significant directionality for self-perceived quality and sexual permissiveness, also only in the left hand. Therefore, it is possible that the 2D4D ratio may serve as a reliable predictor for sexual behavior in females, but only in the left hand due to lateralization rather than due to developmental timing.

4.3 Limitations

Both male and females were utilized as experimenters in this research. It is possible that the presence of male experimenters may have led to bias in the reporting

personal information with regards to sexual history. To reduce this possibility, all experimenters restricted the amount of time in the laboratory with the participants to the minimum time needed to brief each subject. Neither the male nor the female experimenter was in the room at the time the participant was completing the survey. Never the less, this may have led some participants to inaccurately report personal information with regards to sexual history.

All participants were asked whether they were currently using a method of hormonal contraceptive. If the participants were using hormonal contraceptives, they were asked to indicate the specific form of hormonal birth control. Next, the participants were asked if they had discontinued hormonal contraceptive use. If they had discontinued hormonal contraceptive use, they were asked how long ago they had stopped. However, we failed to inquire as to when the participants *began* hormonal contraceptive use. This methodological limitation may account for a lack of significant difference in participant's scores on the various scales across the menstruation cycle. The mean age of participants in this study was 21. However, the participant age occurring in this data set most frequently was 19. It is possible that the participants had recently begun using hormonal contraceptives and therefore were still experiencing the natural hormonal fluctuations.

It is also possible that the definitions of casual sex used in this study may have been too restricting and at the same time too vague. Our definition of casual sex being sex with someone just met that day or evening may have been less restricting if defined as sex with another individual with no thought of a long-term relationship afterwards.

This second definition eliminates the condition that you had just met that individual and allows for a one time casual encounter with someone you have been socially acquainted with for any length of time prior to sexual intercourse. The definition may have been taken as vague by participants not restricting their definitions of sex to vaginal penetration intended by the definition used in this study.

4.4 Final summary and future directions

In summary, the findings of this study showed a negative relationship between an individual's self-perceived quality and their scores of sexual permissiveness as predicted. Self-perceived quality did not directly relate to the total number of sexual partners reported by the participants. However when evaluating the attractiveness component of SPQ, there *was* a positive correlation between attractiveness and the total number of sexual partners reported by the participants, and a negative correlation was shown between the LoyGen component of the SPQ scale and the total number of sexual partners reported by the participants. The two component of the SPQ scale themselves showed a weak positive correlation, suggesting that they are not independent measures but are two related components building a composite measure of self-perceived quality, but have different effects on sexual permissiveness. However, given this *weak* positive correlation, this possibility should be re-assessed using an additional population.

Overall, the negative relationship between an individual's self-perceived quality and their scores of sexual permissiveness observed in this study suggests that the self-perceived quality scale designed here may be a good predictor of sexual behaviors. If this is true then this scale in may be useful in clinical settings as an additional measure

of the potential to engage in risky behavior, specifically risky sexual behaviors, that appears to be higher in some individuals than others. Likewise, the results obtained from the stranger assessment task may also be useful in the clinical setting. One drawback to these data, however, was it's failure to use equal representations of low, medium, and high male quality groups. In the future, this problem could be corrected by using several sets of pre-generated males, randomly assigned to each participants, that equally represent the three quality groups.

The findings in this study demonstrated that as the participant's ovulation stage approached, their self-perceived quality decreased. This relationship remained after the participants whom were in a relationship and therefore subject to mate guarding, which may increase during the ovulation stage, were removed. This suggested that self-perceived quality may moderate risk avoidance, rather than increasing sexual permissiveness in situations that may be threatening. In the future, this study could be expanded to include specific assessments of mate guarding for individuals in exclusive relationships, compared to individuals dating multiple partners to see how instances of mate guarding correlate with self-perceived quality, without the need to remove participants indicating involvement in a relationship. In addition, future studies could include evaluations of relationships between Broder and Hohmann's (2003) (an improved methodology to Chavanne and Gallup's 1998 study) risk assessments with assessments of self-perceived quality.

This study failed to show a significant difference in scores of sexual permissiveness across the menstrual cycle. This could be the result of either the

inadequate account of beginning hormonal contraceptive use, unequal representations of menstrual cycle stages, or no relationship between the menstrual cycle and sexual permissiveness. Since the latter in the least likely possibility, a study with better control over menstrual stage representation, and a better accounting of hormonal contraceptive use is warranted.

APPENDIX A

SEXUAL PERMISSIVENESS SCALE

1) I do not need to be committed to a person to have sex with him.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

2) Casual sex *(defined as sex with someone you had just met that day or night)* is not acceptable.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

3) I would like to have sex with many partners.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

4) One-night stands are sometimes very enjoyable.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

5) It is not okay to have ongoing sexual relationships with more than one person at a time.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

6) It is ok to manipulate someone into having sex as long as no future promises are made.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

7) Sex as a simple exchange of favors is not ok even if both people agree to it.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

8) The best sex is with strings attached.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

9) Life would have fewer problems if people could have sex more freely.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

10) It is possible to enjoy sex with someone and not like that person very much.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

11) Sex is more fun with someone you don't love.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

12) It is all not right to pressure someone into having sex.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

13) Extensive premarital sexual experience is fine.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

14) Extra marital affairs are not all right even if one's partner doesn't know about them.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

15) Sex for it's own sake is perfectly all right.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

16) Prostitution is not acceptable.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

17) I would not feel comfortable having intercourse with my partner in the presence of other people.

strongly disagree moderately disagree slightly disagree Can't Decide

slightly agree moderately agree strongly agree

APPENDIX B

SELF-PERCEIVED QUALITY SCALE

A. Please indicate your level of agreement with the following 8 statements about you.

Strongly Agree				**Strongly Disagree**
1	**2**	**3**	**4**	**5**

1) I am a very kind and generous woman.

1 2 3 4 5

2) I think that men consider my face to be very attractive.

1 2 3 4 5

3) I am a very nurturing woman.

1 2 3 4 5

4) I think that I am a very loyal woman.

1 2 3 4 5

5) I think that men find me to be very desirable as a potential mate.

1 2 3 4 5

6) I think that I am an intelligent woman.

1 2 3 4 5

7) Men consider my body shape to be very attractive.

1 2 3 4 5

8) I think that I am very desirable as a potential mate.

1 2 3 4 5

APPENDIX C

SEXUAL HISTORY

Keep the following definitions in mind while answering the following survey questions:

1) The terms "sex" or "sexual" refer to genital intercourse.

2) Casual sex is defined as sex with someone you met that day or that night with no regard to seeing that individual again.

1) How many total opposite sex partners (*including casual sex partners*) have you had?

_____

2) How many times have you engaged *in casual sex* with a member of the opposite sex in the past 2 weeks?

_____

3) How many times have you engaged *in casual sex* with a member of the opposite sex in the past 3 months?

_____

4) How many alcoholic drinks did you consume on average before engaging the above *casual sex* acts?

_____

5) If I had to choose one factor responsible for my acceptance of casual sex it would be alcohol.

Yes No

6) I have (or would have) negative feelings, such as guilt, after engaging *in casual sex* with a member of the opposite sex.

Yes No

7) I have engaged in casual sex with a member of the opposite sex without the use of a condom.

Yes No

8) How many opportunities have you had to accept a casual sex proposition, by someone of the opposite sex, within the last 2 weeks?

_____

9) How many opportunities have you had to accept a casual sex proposition, by someone of the opposite sex, within the last 3 months?

_____

10) Are you a heterosexual female?

Yes No

APPENDIX D

RELIGION ASSESSMENT

Please answer the remaining questions concerning your cultural background honestly.

1) Are you a member of an organized religion?

Yes No

2) How often do you attend services?

_____

3) Does your religion strictly forbid pre-marital sex?

Yes No

4) Do you avoid sexual activity because of your religious beliefs?

Yes No

APPENDIX E

BACKGROUND STUDY RESULTS

Predictions

The results of the analyses showed that the correlation between the participant's self-perceived quality (SPQ) and her corresponding level of sexual permissiveness (SP) was not significant ($\underline{r} = 0.04$, $p < 0.44$). The mean self-reported probability of accepting a sexual proposition increased as the participant's SPQ decreased, in line with the first prediction ($\underline{r} = -0.07$, $p < 0.24$), but because the correlation was not significant, therefore, the first prediction was not confirmed. However, a positive correlation was found between SPQ and the total number of casual sex partners reported ($\underline{r} = 0.13$, $p < 0.02$).

ANOVAs, as well as the linear regression analyses were conducted to test the second prediction that the probability that a woman would accept a sexual proposition would increase as the man's mate quality becomes increasingly greater than her own self- perceived quality. The results showed an interaction between the men's quality and the woman's SPQ in predicting the woman's self-reported probability of accepting a sexual proposition from a man she had just met, ($\underline{F}$ (4, 199) = 2.83, $p < 0.03$) (figure 1.1). Female self-perceived quality, female sexual permissiveness, and male quality scores were trichotomized into 3 groups (low, medium, and high) to examine more directly the differences between the groups. Females with low self-perceived quality were more likely to accept a casual sex proposition from a medium quality male than were the medium or the high self-perceived quality females, but there were no differences in the woman's acceptance for low and high quality males. This outcome partially supports the second prediction.

The mean self-reported probability of accepting a sexual proposition was found to be significantly different across male quality groups (F (2, 199) = 23.13, $p < 0.0001$) with no difference in the acceptance of propositions from low and medium quality males, but with a much more likely acceptance of propositions from high quality males (figure E.1). As sexual permissiveness increased, so did the likelihood of accepting a male's casual sex proposition (F (2, 26) = 13.08, $p < 0.0001$) (figure E.2).

Relationships

Before beginning the survey, each of the participants was asked to indicate whether they were involved in a relationship or whether they were single. The women whom reported being in an exclusive relationship for the previous six months were older (M = 25.2, SD = 8.88) than those who reported being not being in an exclusive relationship (M = 22.3, SD = 7.10), a significant difference, t (286) = 3.09, $p < 0.01$. However, there was no difference in the self-reported probability of accepting casual sex propositions between those participants who reported being in an exclusive relationship, and those participants who reported not being in an exclusive relationship, t (289) = 0.61, $p < 0.54$.

Age

All of the participants were grouped according to their ages. Age was found to be negatively correlated with SPQ (r = -0.13, $u < 0.03$). Age was found to positively correlate with sexual permissiveness (r = 0.27, $p < 0.0001$) and the self-reported probability of accepting a sexual proposition, but this relationship was not significant (r = 0.09, $p < 0.11$). An interaction was found between the participant's age, and male

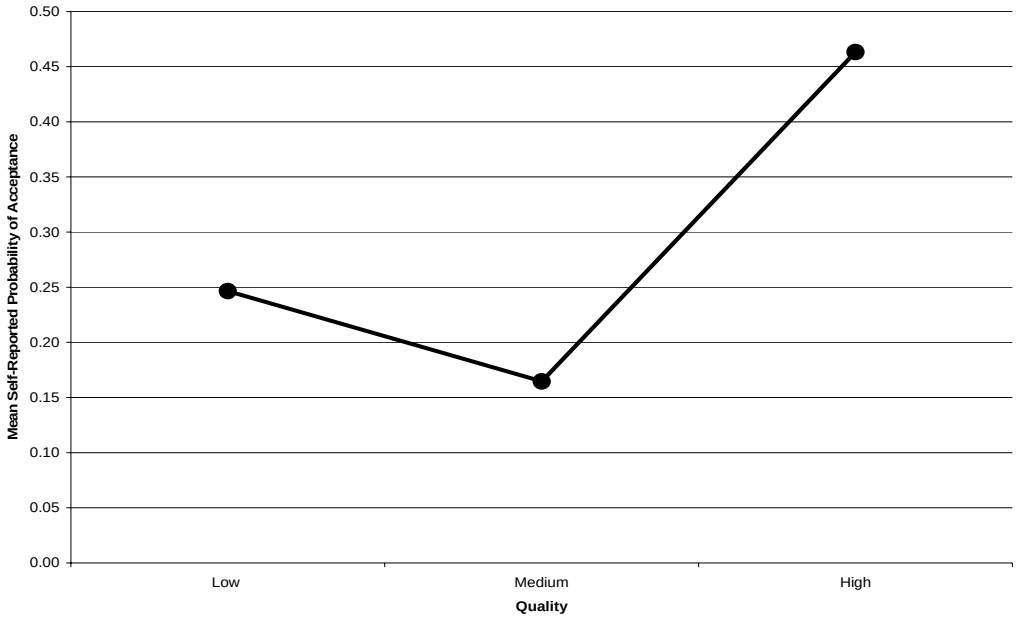

Figure E.1 Self-reported probability of accepting a casual sex proposition across male quality group

quality in predicting the self-reported probability of accepting a casual sex proposition, $\underline{t}$ (287) = 2.78, $\underline{p} < 0.0058$ (figure 1.2). Participants between the ages of 26 – 40 were more likely to accept a casual sex proposition than 19 year old participants for low, medium, and high quality males. For both age groups, the probability of accepting a casual sex proposition was greater for high quality males than for low quality males.

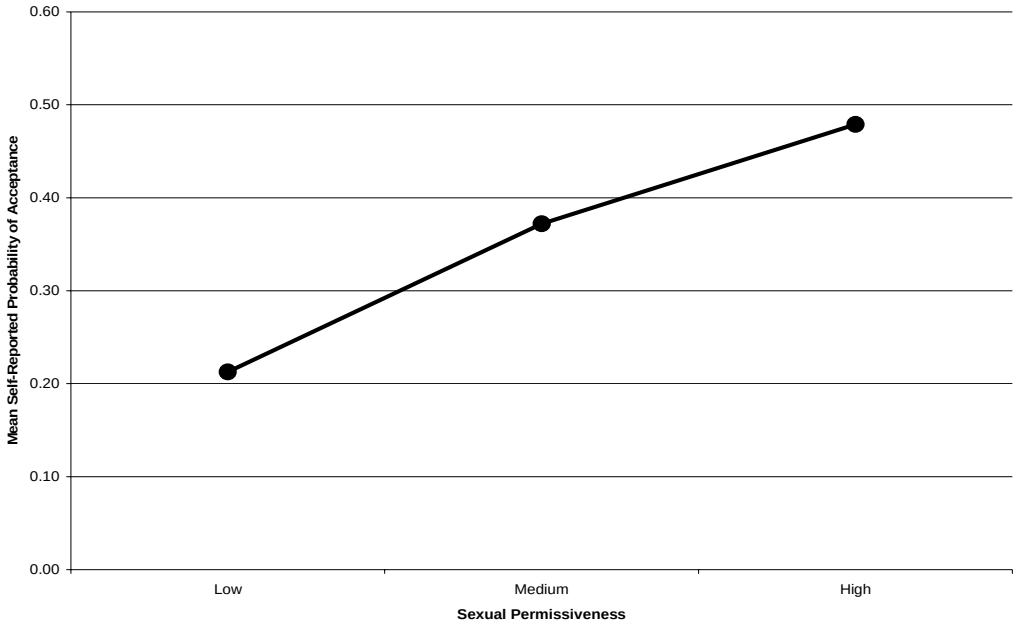

Figure E.2 Self-reported probability of accepting a casual sex proposition across female sexual permissiveness scores

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BIOGRAPHICAL INFORMATION

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