IMPLICIT ATTITUDES TOWARDS SEXUALLY AND REPRODUCTIVELY RELEVANT STIMULI: DO FEMALE ATTITUDES VARY BASED ON SEXUAL ORIENTATION, CONCEPTION-RISK, AND HORMONAL CONTRACEPTIVE USE?

A THESIS

SUBMITTED TO THE DEPARTMENT OF PSYCHOLOGY

OF THE STATE UNIVERSITY OF NEW YORK AT NEW PALTZ

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF ARTS IN PSYCHOLOGY

By

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May 2013

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ACKNOWLEDGEMENTS

I would like to first, and foremost, thank Dr. Glenn Geher for his continuous support and contagious excitement for evolutionary research. I would also like to thank Dr. Tabitha Holmes and Alice Andrews for not only agreeing to serve on my thesis committee, but also for being such inspirational examples of women in science. Further, I would like to thank all of the faculty and students at SUNY New Paltz who have made my time in the M.A. program so educational and entertaining. In particular, I would like to thank Dr. Giordana Grossi, Dr. Greta Winograd, and Dr. Allison Nash for being such supportive and useful resources during my time as a TA. Additionally, I would like to thank Rachael Carmen for not only inspiring me to go into ovulatory research, but also for being the best collaborator and friend anyone could ask for. Finally, thank you to my wonderful family who has always supported my dream of becoming a researcher: my soon-to-be husband Sean Darragh, my wonderful sister and brother-in-law Jenna and Mike DerrGuitar, and of course my amazing parents—whose love, encouragement, and passion for knowledge inspires me every day.

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ABSTRACT

Previous research has suggested that females at high fertility may be more sensitive to cues of *sexual-relevance* as opposed to *reproductive-relevance.* The current study examined this issue by having females of varying sexual orientation complete two implicit association tasks (IAT) while they were in either a high-conception risk phase (i.e., fertile phase) or low-conception risk phase (i.e., non-fertile phase), as well as comparing this data to women who were currently taking hormonal contraceptives. The IAT is an implicit measure designed to detect the strength of a person's automatic association between mental representations of concepts in memory. The first IAT assessed attitudes towards cues of *reproductively relevant* stimuli (images of women who are or are not visibly pregnant) and the second IAT examined cues of *sexually relevant* stimuli (images of provocatively or conservatively dressed women). Results suggest that women did differ on implicit attitudes towards both stimuli; however, these differences were not statistically significant.

INTRODUCTION

In most mammalian species, peak times of fertility in females are marked by obvious indicators of reproductive availability to potential mates (Domb & Pagel, 2001). Conversely, the dominant view in science over the past century has been that humans evolved to eventually lose these indicators (i.e., concealed ovulation; Alexander, 1990; Fink, Hugill, & Lange, 2012; Haselton & Gildersleeve, 2011; Symons, 1979). However, a number of recent studies have concluded that women undergo a number of detectable changes over the ovulatory cycle including physiological changes to their voice (Pipitone & Gallup, 2012) and body movements (Fink et al., 2012), as well as behavioral changes such as the clothing they select to wear (Durante, Li, & Haselton, 2008; Grammer, Renninger, & Fischer, 2004) and the faces they are attracted to (Jones et al. 2008; Penton-Voak et al., 1999). Further, several studies have found that these changes are detectable to men who rate women to be more attractive in their *fertile window* as compared to out of their *fertile window* (Fink et al., 2012; Havlicek et al., 2005; Poran, 1994; Singh & Bronstad, 2001). The *fertile window* refers to the (typically) six day span in a woman's menstrual cycle leading up to (and generally ending at or shortly after) the day of ovulation (Wilcox, Dunson, & Baird, 2000). It is important to note that ovulation does not occur during every cycle, with rates varying anywhere from 45% (Vizthum et al., 2002) to 85% (Harris & Vitzthum, 2013) depending on the sample; thus, any non-biological method for calculating ovulatory phase is considered an estimate.

There is not yet a consensus in the scientific literature as to whether it is beneficial for women to signal their ovulatory state. Some have suggested an *evolved signal theory* where women who signaled fertility throughout our ancestral past were at a

reproductive advantage because they attracted more mates (Haselton & Gildersleeve, 2011). This view is supported by non-human primate research which has demonstrated the reproductive success of species such as baboons (Domb & Pagel, 2001) and chimpanzees (Wallis, 1992) where females with the greatest genital swelling garner more mating attempts from males, resulting in more and higher quality offspring. Alternatively, researchers have suggested that it would be more adaptive for women to conceal ovulation as a means of increasing investment from men who will invest throughout the ovulatory cycle since they do not know when the woman is fertile (Alexander, 1990; Thornhill & Gangstad, 2008). A third option is that signals of fertility may be a by-product of the increase in estrogen that occurs during this time, something Haselton and Gildersleeve (2011) refer to as "leaky signals" because they are both a by-product as well as an adaptive signal.

While many studies have asked the question, "Can men detect ovulation?" (for a review see Haselton & Gildersleeve, 2011), fewer have tackled the question of whether non-concealed ovulation may have an adaptive benefit for women signaling other women. Referred to as the *female quality hypothesis* (Haselton & Gildersleeve, 2011); this suggests that since high levels of estrogen are associated with reproductive benefits, women who signal their overall quality through these leaky signals may be engaging in a form of intrasexual competition, or competition with other women. But what about non-heterosexual women?

Sexual Orientation

Sexual orientation is a commonly used term to describe the sex that an individual tends to be sexually attracted to (Rahman, 2005). From an evolutionary perspective, non-

heterosexual orientation is of significant interest, as only heterosexual sexual activities directly bear on reproductive success (see Geher & Kaufman, 2013). In fact, behavioral scientists who have studied sexual orientation have found many important factors that seem to underlie non-heterosexual orientations. The current work is particularly interested in the evolutionary psychology of lesbians, as these women may be less likely to show standard female-specific mating-relevant responses that have been documented by evolutionary psychologists (such as the tendency to be attracted to relatively masculine features during peak ovulation; Brinsmead-Stockham et al., 2008).

Some prior research on lesbian orientation from an evolutionary perspective has shown that, for women, sexual orientation seems to moderate the nature of fertility effects on mating-relevant judgments. For instance, previous research has found that heterosexual women at high fertility were more sensitive to markers of maleness (Johnston, Arden, Macrae, & Grace, 2003) while lesbian women at high fertility were more sensitive to markers of femaleness (Brinsmead-Stockham, Johnston, Miles, & Macrae, 2008). These findings suggest that, regardless of sexual orientation, women at high fertility may be more sensitive to cues of *sexually relevant* information as opposed to *reproductively relevant* information (Brinsmead-Stockham et al., 2008).

In an attempt to replicate Brinsmead-Stockham et al.'s (2008) findings, the current study was partly interested in comparing the attitudes of women of varying sexual orientation towards other women during times of high-conception risk (i.e., in the *fertile window*) or low-conception risk (i.e., not in the *fertile window*). Due to the limitations of the sample (as described in the Methods and Discussion sections), however, no participants identified as a lesbian and so the current study was only able to examine the

attitudes of heterosexual and bisexual women (see Original Hypotheses and the Limitations section for further discussion of this issue).

Hormonal Contraceptives

Although some studies on ovulatory state have excluded women who are currently taking hormonal contraceptives (Parma, Tirindelli, Bisazza, Massaccesi, & Castiello, 2012), others have used them as a control group to represent the reproductive status of non-ovulating (Kuukasjarvi et al., 2004). Additionally, research that has utilized a repeated-measures design has found interesting behavioral differences between the same women depending on her current use of hormonal contraceptives. For example, Cobey et al. (2012) found that women differed in self-reported jealously based on menstrual cycle stage and contraceptive pill use. Given the link between jealous behavior and intrasexual competition, the current study compared women who were currently taking hormonal contraceptives to the naturally cycling women.

Presenting Fertility Markers in Stimuli

In the past, researchers have relied upon various implicit measures of fertility such as images of ovulating women (Durante et al., 2008) as well as olfactory cues (Kuukasjarvi et al., 2004); however, this is the first study to utilize an explicit measure of fertility in the form of images of visibly pregnant women. Thus, a major goal of this research is demonstrate that using stimuli reflecting women during pregnant versus non-pregnant states can be a strong and reliable method for visually manipulating fertility status – in a way that is more conspicuous and less inferential than past studies that have relied upon getting photographs of non-pregnant women from different points in their ovulatory cycles.

Current Study

The current study had participants complete two implicit association tests (IAT; Greenwald, McGhee, & Schwartz, 1998) online. The IAT is an implicit measure designed to detect the strength of a person's automatic association between mental representations of concepts in memory (Greenwald et al., 1998). In a series of categorization tasks involving words and images, the reaction time of the participant to respond to two concepts when they are associated with a particular attribute is compared. The task is completed on a computer, with the categories (concepts and attributes described below) displayed in the upper corners of the left and right side of the screen, and the stimuli presented in the center. Participants are asked to categorize the text and images using two letters on the keyboard ("e" or "i") with each letter representing a response for the left side of the screen ("e") or the right side of the screen ("i"). The results are interpreted as a longer reaction time reflecting a further distance in cognitive associations between the concept (e.g., pregnant or not pregnant images) and the attribute (positive or negative attitudes towards the concept), which suggests that the individual has a potential bias towards this concept in a particular direction of the attribute.

For the first IAT (referred to as the *reproductively relevant IAT*), the two concepts were women at high-conception risk (i.e., images of women who are not visibly pregnant) versus women at low-conception risk (i.e., images of women who are visibly pregnant) and the attribute measured was positive and negative attitudes. Thus, the current study assessed the attitudes that women of varying sexual preference have at different points of their ovulatory cycle towards photos of women who are at high-conception risk or low-conception risk.

In the second IAT (referred to as the *sexually relevant IAT*), the two concepts were women displaying sexually-relevant cues and women who were not. Previous

research has found correlations between provocative female clothing choice and self-reports of courtship motivations suggesting that women are aware of the signal value of their clothing (Grammer et al., 2004). Further, tight clothing and bare-skin displays are found by men to be more attractive as sexual partners (Abbey, 1987; Hill, 1984; Santin, 1995) and suggest that these cues can be seen as reproductive signals (Barber, 1999; Grammer et al., 2004). Therefore, the current study manipulated the clothing of the images for the *sexually relevant IAT* so that half of the images contained women wearing tight, sheer, and revealing clothing (i.e., women displaying sexually-relevant cues) while the other half of the images contained clothing that do not reflect these characteristics (i.e., neutral clothing).

Female participants' ovulatory stage was estimated based on self-reports of the last day of menstruation, as well as the average length of her cycle. This resulted in two groups: 1) low-conception risk phase (females who were not in their fertile window), and 2) high-conception risk phase (females who were in their fertile window).

Variables

The following are the two independent variables that were involved in the major hypotheses for the current study. This study was quasi-experimental in nature as none of the participants were assigned to their respective group. Further, since this was an online study, the conception-risk of the participant could only be estimated as no biological samples were collected (methods of calculations are discussed in the Method section).

IV_1: Conception-Risk of Participant. Conception-risk was examined in two ways: (a) only women who reported naturally-cycling were compared with two levels: 1) women who were estimated to be in a high-conception risk phase, and, 2) women who were estimated to be in a low-conception risk phase; and, (b) women currently taking hormonal-contraceptives were included as an additional level resulting in three groups

compared: 1) women who were estimated to be in a high-conception risk phase, 2) women who were estimated to be in a low-conception risk phase, and 3) women who reported currently taking hormonal contraceptives.

IV_2: Sexual Orientation of Participant. The current sample reported identifying as: 1) heterosexual, and 2) bisexual. No participants reported that they identified as a lesbian.

DVs: Implicit Attitudes Towards Stimuli. There were two dependent variables: 1) implicit attitudes towards the *pregnant* and *non-pregnant* stimuli, and 2) implicit attitudes towards the *sexy* and *not sexy* stimuli.

Original Hypotheses

The original prediction of the study was that women who identify as a lesbian and are currently at a high-conception risk would have the most positive attitudes for images of high-conception risk women (i.e., *not pregnant* stimuli) and women in provocative clothing (i.e., *sexy* stimuli) compared to the implicit attitudes that heterosexual women at a high-conception risk held. This prediction was based on the idea that the images of the women in both IATs may be interpreted as different markers depending on the sexual preference of the woman. For instance, the images of the *sexy* stimuli in the *sexually relevant IAT* could be seen by a heterosexual woman in a high-conception risk phase as a marker of potential intrasexual competition while a lesbian woman at a high-conception risk may have a more positive attitude towards these images because she views them as a *sexually relevant* cue—cues that previous research has demonstrated women are more sensitive to at times of peak fertility (Brinsmead-Stockham et al., 2008). As the research played out, while comparing the attitudes of heterosexual women and lesbian women was

the original aim of the study, unfortunately, no participants identified as a lesbian and so the focus of the study had to be shifted to compare the attitudes of the heterosexual women to the bisexual women who participated in the study (12 women identified as bisexual). It is important to note that it was the limitations of the sample that led to the comparison of heterosexual and bisexual women, and thusly the hypotheses had to be shifted to account for the lack of lesbian participants. This was by far the greatest limitation of the study as the original hypotheses were not formed based on predictions of bisexual women (see Limitations section for further discussion). Related, importantly, a great deal of research has documented important psychological differences between lesbian versus bisexual women (e.g., Rust, 1993).

Working Hypotheses

As the original hypotheses could not be tested given the sampling limitations described above, new working hypotheses that bear more directly on the actual data collected were formulated – as follows.

1. Women who (a) identify as heterosexual and (b) are currently in a high-conception risk phase will have the most positive attitudes towards the images of the *pregnant* versus *non-pregnant* targets.
2. Women who (a) identify as bisexual and (b) are currently in a high-conception risk phase will have the most positive ratings for the images of the *sexy* versus *not sexy* targets.
3. Women who (a) are currently taking hormonal contraceptives and (b) women who are in a low-conception risk will have similar scores as compared to women in a high-conception risk phase

METHOD

Participants

70 females (M_{age} = 22.5 years, age range: 18-42 years) were recruited from the SUNY New Paltz subject pool and Facebook. In exchange for participation, students were given the option to receive partial credit required to complete the psychology major. No other incentive was offered in exchange for participation.

Hormonal contraceptive use. 28 participants reported currently using hormonal contraceptives (40.0%) and 42 reported naturally cycling (60.0%). The average length of time on hormonal contraceptives was 33.4 months and ranged from 3 to 180 months. A minimum duration of three months on hormonal contraceptives was established as an exclusion criteria based on previous literature (Cobey et al., 2012), resulting in one participant's data being excluded because she had only been taking hormonal contraceptives for one month.

Conception-risk phase. Of the 42 female participants who reported naturally cycling, 35 were estimated to be in a low-conception risk phase (83.3%) and 7 were estimated to be in a high-conception risk phase (16.7%). Self-reported average cycle length varied from 25 to 35 days with the most participants reporting a 28 day average (19%); however, it is worth noting that a similar proportion of females reported an average cycle length of 25 days (14.3%) and 32 days (14.3%) demonstrating the individual variability of cycle length (see Discussion section for more on this issue). One participant's data were excluded from analysis due to an estimated average cycle length of 50 days (cycle length greater than 42 days is often referred to in the literature as *irregular menstruation*; see Cobey et al., 2012). Participants were asked to self-report the

regularity of their cycle (unpredictable, usually irregular, regular most of the time, highly regular), however, participants were not excluded based on responses to this question in light of research supporting the idea that it is both normal and common for a women's cycle length (i.e., segment) to vary from month to month (Harris & Vitzthum, 2013).

Sexual orientation. Participants were asked the question: "Which of these commonly used terms would you use to describe yourself?" The following options were provided: Heterosexual/Straight, Bisexual, Homosexual/Lesbian/Gay, Uncertain, I prefer not to answer, and Other (with an option to write in a response). 58 participants identified as heterosexual (82.9%) and 12 as bisexual (17.1%). None of the females sampled identified as lesbian.

25 heterosexual women reported currently taking hormonal contraceptives (43.1%) and 33 reported naturally cycling (56.9%). 2 bisexual women reported currently taking hormonal contraceptives (25.0%) and 9 reported naturally cycling (75.0%).

In the low-conception risk phase, 28 participants identified as heterosexual (80.0%) and 7 identified as bisexual (20.0%). In the high-conceptions risk phase, 5 participants identified as heterosexual (71.4%) and 2 identified as bisexual (28.6%).

Calculating Conception-Risk. The conception-risk phase of the participants was calculated by using the self-reported last day of menstruation and average cycle length. An online ovulation calculator (Nazario, 2012) was used to estimate participant fertility by inputting the reported last day of menstruation and then counting back the amount of days specified by the participant to be her average length of cycle. A calendar was then produced which estimates when the female's fertile window is based on her average cycle length. These dates were then compared to the date that the female participated in

the study and women were placed into two groups: 1) women in their fertile window (high-conception risk), and, 2) women not in their fertile window (low-conception risk). This method was utilized over other standard methods (e.g., backwards counting; Garver-Apgar, Gangestad, & Thornhill, 2008) because it took into account the unique cycle length of each woman.

Materials and Apparatus

Participants were administered two online IATs (see Current Study section for an overview of the IAT) using Inquisit 4 Web software (Inquisit, Millisecond Software LLC, Seattle) which downloaded to the participant's engine and ran locally on the participant's machine. The program presented the participant with stimuli in the form of images and words, and measured response latencies. The IATs were run back-to-back, and due to the limitations of the software, these could not be presented in random order; therefore, the *reproductively relevant IAT* was always presented first and the *sexually relevant IAT* was always presented second (this issue is covered in detail in the Limitations section).

The first IAT gauged attitudes towards women displaying reproductively relevant cues and the second IAT measured attitudes towards images of women displaying sexually relevant cues. For the *reproductively relevant IAT*, two categories were used: words representing emotional valence (*good* versus *bad*; see Appendix A for words) and images representing reproductively relevant cues (*visibly pregnant* versus *not visibly pregnant*; see Appendix B for images). The *sexually relevant IAT* also had two categories used: words representing emotional valence (*good* versus *bad*; see Appendix A for words) and images representing sexually relevant cues (*sexy* versus *not sexy*; see Appendix C for images). Further, participants were given a set of demographic questions

including questions regarding: age, sexual orientation, hormonal contraceptive use (length of time on hormonal contraceptive use was asked for participants who reported current use), average length of menstrual cycle, and date of last menstruation (the last two questions were used to calculate estimated ovulatory phase of the participant; see appendix E for all questions asked).

Images Used for IATs. For both IATs, the images of the women were obtained from internet searches of celebrities and the same four women were used to control for individual variation amongst the stimuli. The heads of the women were cropped out of the photo to control for recognition, and all images were independently rated by an outside group to ensure that the participants could not infer who the celebrity is. Additionally, all images were rated as belonging to the intended categories, so that all images for the *reproductively relevant IAT* were rated as visibly pregnant or not pregnant, and all images from the *sexually relevant IAT* were rated as being either provocatively dressed or not.

Scoring of IAT. IAT scores were computed by the Inquisit 4 software using the improved algorithm (see Greenwald, Nosek, & Banaji, 2003 for a review of this method). Referred to as the *IAT effect* (or *D*), these scores reflect the degree of positivity the held towards the two target categories for each IAT (*pregnant* versus *not pregnant* for the *reproductively relevant IAT*; *sexy* versus *not sexy* for the *sexually relevant IAT*). Further, positive scores reflect an implicit positive attitude towards the target categories of *pregnant* (*reproductively relevant IAT*) and *sexy* (*sexually relevant IAT*) while negative scores reflect an automatic association between good and the target categories of *not pregnant* (*reproductively relevant IAT*) and *not sexy* (*sexually relevant IAT*). *D* scores

range from -2 to 2 with scores over .65 considered to be a strong effect (Project Implicit, 2007).

Procedure

The experiment was conducted in five phases (see Table 1). Prior to each phase, participants received instructions regarding the upcoming phase (see appendix D). In the first 5 phases, participants were asked to categorize the text stimuli and images (described in previous section) into one or two superordinate categories. Labels for the categories were displayed in the upper corners of the screen (see appendix D for example screens). Participants were instructed that if the word stimulus belongs to the left category, then they would respond with the "e" key. If it belongs to the right, they would respond with the "i" key. Table 1 outlines an example of how the phases proceeded for the *reproductively relevant IAT* (this same procedure was followed for the *sexually relevant IAT*). Additionally, participants were presented with a set of demographic questions to respond to (see appendix E).

RESULTS

First, the three major hypotheses will be discussed in light of the results, followed by a description of the main effects for sexual orientation, conception-risk phase, hormonal contraceptive use, as well as the interaction of these variables.

Data Analysis

A series of independent-samples t-tests were calculated for each of the variables described in the previous sentence as well as a 2 x 2 x 3 repeated-measures analysis of variance (ANOVA) to examine potential effects on scores on each IAT (*reproductively relevant IAT*, *sexually relevant IAT*) based on the sexual orientation (heterosexual,

bisexual) and conception-risk of the participant (low-conception risk phase, high-conception risk phase, hormonal contraceptive user)

Additionally, estimated effect size indices in the form of Cohen's *d* (Small (.2), Medium (.5), & Large (.8); Cohen, 1988) were computed for specific contrasts relating to implicit attitudes of targets across the different conditions. Cohen's *d* was selected over Pearson's correlation coefficient *r* due to the discrepancy in sample sizes for all of the analyses, which can lead to a biased *r* compared to *d* (McGrath & Meyer, 2006). While this research was interested in examining any potential differences between groups, it was also concerned with the effects of the IAT—regardless of whether they differed between groups; thus, data were also interpreted in terms of IAT effect size (Slight (.15), Moderate (.35), & Strong (.65); Project Implicit, 2007).

Hypothesis 1

The first hypothesis predicted that women who (a) identify as heterosexual and (b) are currently in a high-conception risk phase will have the most positive attitudes towards the images of the *pregnant* versus *non-pregnant* targets. As Figure 1 displays, this prediction was not supported; in fact, it was the high-conception risk bisexual females who had the most positive attitudes towards the *pregnant* targets (M = .35, SD = .01) and the bisexual hormonal-contraceptive users who had the most positive attitudes towards the *not pregnant* targets (M = -.36, SD = .24). Despite a small sample size, follow-up analysis found that these moderate IAT effects were significantly different from one another with a very large estimated effect size, $t(3) = 3.98$, $p < .05$, $d = 4.18$. This difference was not found for the heterosexual females at a high-conception risk (M =

.22, *SD* = .34) and those using hormonal contraceptives (*M* = .18, *SD* = .46) who both demonstrated a slight preference for the pregnant targets, *t*(28) = .19, *p* = .854, *d* = .10.

Hypothesis 2

The second hypothesis predicted that women who (a) identify as bisexual and (b) are currently in a high-conception risk phase will have the most positive ratings for the images of the *sexy* versus *not sexy* targets. This hypothesis was also not supported with the bisexual females in a high-conception risk showing a slight preference for the *not sexy* targets (*M* = -.10, *SD* = .57) and the heterosexual females in a high-conception risk phase demonstrating a moderate to strong effect for the *sexy* stimuli (*M* = .42, *SD* = .55). Although this difference was not statistically significant (*t*(5) = 1.128, *p* = .311), it did correspond to a large estimated effect size estimate (*d* = .93).

Hypothesis 3

The third hypothesis predicted that women who (a) are currently taking hormonal contraceptives and (b) women who are in a low-conception risk will have similar scores as compared to women in a high-conception risk phase. As Figure 3 demonstrates, this was not the case for all females; however, Figure 1 and 2 both show the trend for females at a low-conception risk and those currently taking hormonal contraceptives to score in a similar direction when participant sexual orientation is taken into account.

Sexual Orientation

Independent samples t-tests were conducted for the *reproductively relevant IAT* and *sexually relevant IAT* with participant sexual orientation serving as the between-subjects factor with two levels (bisexual, heterosexual) and scores on the IATs serving as the dependent variables.

Reproductively Relevant IAT. There was a strong estimated effect size for sexual orientation with heterosexual females showing a slight to moderate preference for the *pregnant* stimuli (M = .26, SD = .50) and bisexual females approaching a slight preference for the *not pregnant* stimuli (M = -.03, SD = .33), $t(68) = 1.93$, $p = .058$, d = .68.

Sexually Relevant IAT. There was a medium estimated effect size for sexual orientation where both heterosexual and bisexual females preferred the sexy stimuli, however, heterosexual females approached a moderate preference for the *sexy* stimuli (M = .31, SD = .43) and bisexual females approached a slight preference for the *sexy* stimuli (M = .12, SD = .52), $t(67) = 1.93$, $p = .182$, $d = .40$.

Conception-Risk Phase

Since many of the previous studies in ovulatory research have excluded hormonal contraceptive users from analysis because they are not naturally cycling the first ANOVA excluded these participants from the analysis. However, one of the major hypotheses of the current study was to compare hormonal contraceptive users to women estimated to be in a low-conception risk phase so a second ANOVA was conducted that included these participants as an additional level to the conception-risk variable.

Hormonal Contraceptive Users Excluded. Independent samples t-tests were conducted for the *reproductively relevant IAT* and *sexually relevant IAT* with participant hormonal contraceptive use serving as the between-subjects factor with two levels (currently taking hormonal contraceptives, naturally cycling) and scores on the IATs serving as the dependent variables.

There was not a significant difference between scores for females in a low or high-conception risk phase on the *reproductively relevant IAT* ($t(40) = .042$, $p = .967$, $d = .02$) or *sexually relevant IAT* ($t(40) = .322$, $p = .749$, $d = .12$).

Hormonal Contraceptive Users Included. One-way ANOVAs were conducted on data from the *reproductively relevant IAT* and *sexually relevant IAT* with conception-risk of participant serving as between-subjects factor with three levels (low-conception risk phase, high-conception risk phase, hormonal contraceptive users) and scores on the IATs serving as the dependent variables.

There was not a significant difference found between scores for females in a low-conception risk phase, high-conception risk phase, or those currently taking hormonal contraceptives on the *reproductively relevant IAT* ($F(2, 67) = .718$, $p = .491$) or *sexually relevant IAT* ($F(2, 67) = 1.18$, $p = .315$).

Hormonal Contraceptive Use

Independent samples t-tests were conducted for the *reproductively relevant IAT* and *sexually relevant IAT* with participant hormonal contraceptive use serving as the between-subjects factor with two levels (currently taking hormonal contraceptives, naturally cycling) and scores on the IATs serving as the dependent variables.

Reproductively Relevant IAT. There was a small to medium estimated effect size for hormonal contraceptive use where all females preferred the *pregnant* stimuli, however, females currently taking hormonal contraceptives approached a slight preference for the *pregnant* stimuli ($M = .12$, $SD = .47$) and naturally cycling females showed a slight to moderate preference for the *pregnant* stimuli ($M = .27$, $SD = .50$), $t(68) = 1.21$, $p = .232$, $d = .30$.

Sexually Relevant IAT. There was a moderate estimated effect size for sexual orientation where both heterosexual and bisexual females preferred the *sexy* stimuli, however, heterosexual females approached a moderate preference for the *sexy* stimuli (M = .38, SD = .40) and bisexual females approached a slight preference for the *sexy* stimuli (M = .22, SD = .47), $t(67) = 1.93$, $p = .182$, $d = .39$.

Interaction

Sexual Orientation and Conception-Risk Phase. A 2 x 2 x 3 mixed-measures ANOVA was conducted with scores on the IAT serving as the within-subjects factor with two levels (*reproductively relevant IAT, sexually relevant IAT*) and two between-subjects factors of sexual orientation of the participant with two levels (bisexual, heterosexual) and participant conception-risk with three levels (low-conception risk phase, high-conception risk phase, hormonal contraceptive users).

No main effect was found for scores on the *reproductively relevant IAT* for participant conception-risk ($F(2, 63) = 1.04$, $p = .359$), sexual orientation ($F(1, 63) = 1.58$, $p = .214$), or the interaction of those two variables, $F(2, 63) = .770$, $p = .467$. Additionally, no main effect was found for scores on the *sexually relevant IAT* for participant conception-risk ($F(2, 63) = .675$, $p = .513$), sexual orientation ($F(1, 63) = 1.51$, $p = .224$), or the interaction of those two variables, $F(2, 63) = .597$, $p = .553$. However, effect size estimates calculated for the different levels of conception-risk and sexual orientation for both IATs produced several notable results (see Table 2 and 3). Figure 1 and 2 also demonstrate an interesting pattern for both IATs. As predicted, females in a low-conception risk phase and females currently taking hormonal

contraceptives performed similarly as compared to the females in a high-conception risk phase (Hypothesis 3).

DISCUSSION

The current study evaluated the implicit attitudes that are held towards females displaying reproductively and sexually relevant cues as measured by two IATs. The participant attributes of sexual preference, conception-risk phase and use of hormonal contraceptives were examined in regards to scores on the IATs. It was found that bisexual females who were currently in a high-conception risk phase had the most positive attitudes towards the *pregnant* stimuli, while bisexual women currently taking hormonal contraceptives had the most positive attitudes towards the *not pregnant* stimuli (contrary to hypothesis 1). Additionally, heterosexual females in a high-conception risk phase had the most positive attitudes towards the *sexy* stimuli while bisexual females in a high-conception risk phase had the most positive attitudes towards the *not sexy* stimuli (contrary to hypothesis 2). Finally, females in a low-conception risk phase and females currently taking hormonal contraceptives performed similarly as compared to the females in a high-conception risk phase when sexual orientation was taken into account (in support of hypothesis 3).

The tendency for self-identified heterosexual females in a high-conception risk phase to have an automatic preference for the *sexy* images of women as compared to the *not sexy* images may be an indicator of the sexual fluidity that has often been suggested for women (Rahman, 2005). This view is supported by research on female sexual arousal which found that, regardless of sexual orientation, females demonstrated strong genital arousal for sexual stimuli of both males and females (Chivers, Rieger, Latty & Bailey,

2004). Alternatively, it could have been that the heterosexual females at a high-conception risk were actually identifying with the *sexy* images as opposed to viewing them as markers of competition. Since there was no explicit measure included in this study, there is no way to conclude what the women were actually interpreting the images as; however, given that an effect was found (such that heterosexual women were biased in a positive manner toward the *sexy* stimuli), this opens the door for future research to explore this issue further.

Novel Stimuli to Manipulate Target Fertility Status – Focus on Pregnancy

Previous studies have used various implicit measures of fertility such as images of ovulating women (Durante et al., 2008) as well as olfactory cues (Kuukasjarvi et al., 2004). The current research presents the first study to utilize an explicit measure of fertility in the form of images of visibly pregnant women. Past research that asks participants to make ratings of women at different parts of their ovulatory cycles seems to have overlooked the enormous natural manipulation of fertility that is pregnancy. Pregnancy changes women's hormones and morphologies in predictable ways – and detecting pregnancy seems a core part of visual social perception. Instead of using pictures of non-pregnant women from different stages of their ovulatory cycles, this research used well-controlled pictures of women in states of pregnancy versus non-pregnancy – and several main effects using the unconscious-based IAT were obtained, showing that this is a powerful way to manipulate fertility status of a target in this kind of research.

Given that participants did respond differently as a function of conditions, this suggests that images of visibly pregnant women may be a valid methodological tool in

the future. As more research begins to look into the variety of signals women use to determine the fertile state of other women, explicit measures such as the one used in the current study should be considered as well as the more well-studied implicit measures.

Limitations

Due to the instability of the software used for this study (Inquisit 4 Web) a large number of participants reported that they were unable to run the software. Despite attempts to contact the software company about this problem, no solution was ever found and so this limited the number of participants that were able to complete the study. Additionally, several participants who were able to complete the demographics survey identified as being a lesbian, however, as things played out, the IATs did not load for these particular participants resulting in an exclusively heterosexual and bisexual sample which limited the research questions that could be asked regarding possible effects of sexual orientation on implicit attitudes towards females. One change that may have helped with this issue would have been to examine sexual orientation on a spectrum as opposed to having participants identify categorically. This change would have resulted in the possibility of examining how the degree of sexual preference may influence implicit attitudes as opposed to examining separate groups. The main reason for not utilizing the spectrum in this study is that the original hypotheses were directly related to previous research that looked at self-identified lesbian and heterosexual women (i.e., Brinsmead-Stockham et al., 2008), so the current study was looking to replicate that finding with a similar sample. However, as things played out, it would have been beneficial to have used a continuous measure of orientation.

Participants were also always presented with the *reproductively relevant IAT* first and the *sexually relevant IAT* second. While it would have been ideal to counterbalance the order that the IATs were presented, previous research has found that potential order effects do not reduce the sensitivity of the IAT to measure individual differences in implicit attitudes (Greenwald et al., 1998) and so this was not considered a detriment to the current research.

Another issue that is true for most studies in ovulatory research is that conception-risk phase was calculated based on self-report measures as opposed to biological samples and therefore it is not possible to know for sure if the women were accurately grouped based on their fertile state. Additionally, the current method used for calculating conception-risk grouped all women who were not in their fertile window into the same category which may have prevented identifying effects for women who were at different points in their ovulatory cycle (i.e., menstruating, pre-ovulation, post-ovulation). Given the small sample size of the current study, it was not practical to reduce the power further by dividing these up into smaller groups, however, future research would benefit from looking into possible effects of being in these different ovulatory stages. Ideally, direct hormonal measures of ovulatory status would be optimal in future research on this topic.

Future directions

Two variables that data were collected on but were not included in the current analysis were participant sex (female, male) and relationship status (Single/Never married, Cohabitating (Living together), Married, Separated/Divorced, Widowed). Given that previous research has reported differences in self-reported jealousy between females

on hormonal contraceptives based on relationship status and fertile phase (Cobey et al., 2012); this data may produce interesting results relating to these variables.

Future research in this area may benefit from including additional implicit measures. For example, including an implicit measure of sexual preference along with the explicit measure would have provided a more complete assessment of the participant's preference (see Brinsmead-Stockham et al., 2007 for an example of an implicit measure). Along these same lines, better methods of calculating cycle phase would result in a better assessment of the participant's fertile phase. An example of excellent methodology in this regard is Cobey et al. (2012) where a within-subjects design was utilized so that women were tested both on and off of hormonal contraceptives, as well as utilizing rigorous methods for calculating estimated ovulatory phase including transvaginal ultrasonography and months of tracking the participants. While this methodology is optimal, it would not have been practical given the limited resources available for the current study.

Implications

The current study has important implications regarding the effect of a woman's phase (i.e., point in ovulatory cycle) on how she perceives other women. By looking at an implicit measure of female perceptions, this research may lead to a better understanding of the fluctuations that occur in female-female personal relationships over the ovulatory cycle. As Haselton and Gildersleeve (2011) say about this line of research "this work is powerful evidence of the footprints of evolution in modern social behavior" (p. 91). Additionally, the current study included two populations that are rarely studied in research on ovulatory states: non-heterosexual women and women taking hormonal

contraceptives. It is important for research to take into consideration that possible differences exist in sexual attraction experienced by women and therefore this population should not be excluded from research. Further, women taking hormonal contraceptives are often left out of these studies because they are not naturally cycling; however, given the large number of women on birth control in Western society, it is important to examine what effect these substances have on female behavior and perceptions of other females.

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TABLE 1: *Example Procedure for Implicit Association Test (IAT)*

Phase	**Task Description**	***LEFT response location***	***RIGHT response location***
1	*Initial target-concept discrimination*	PREGNANT	NOT PREGNANT
2	*Associated attribute discrimination*	GOOD	BAD
3	*Initial combined task*	PREGNANT or BAD	NOT PREGNANT or GOOD
4	*Reversed target-concept discrimination*	NOT PREGNANT	PREGNANT
5	*Reversed combined task*	NOT PREGNANT or BAD	PREGNANT or GOOD

Note. Task descriptions are taken from Greenwald, McGhee, and Schwartz (1998). This same procedure was followed for both the reproductive-relevance IAT and the sexual-relevance IAT (the words "sexy" were used in place of "pregnant").

TABLE 2: *Effect Sizes for Conception-Risk of Participant and Sexual Orientation for the Reproductively Relevant IAT*

	Heterosexual		**Bisexual**		**Effect Size Estimate (*d*)**
	N	***M*(*SD*)**	***N***	***M*(*SD*)**	
Low-Conception Risk Phase	28	.336(.56)	7	-.001(.28)	.76
High-Conception Risk Phase	5	.222(.34)	2	.353(.01)	.54
Hormonal Contraceptive User	25	.182(.46)	2	-.331(.33)	1.28

Note. The following conventions for strength of estimated effect size are as follows: Small (.2), Medium (.5), & Large (.8) (Cohen, 1988).

TABLE 3: *Effect Sizes for Conception-Risk of Participant and Sexual Orientation for the Sexually Relevant IAT*

	Heterosexual		**Bisexual**		**Effect Size Estimate (*d*)**
	N	***M*(*SD*)**	***N***	***M*(*SD*)**	
Low-Conception Risk Phase	28	.234(.43)	7	.105(.55)	.26
High-Conception Risk Phase	5	.421(.55)	2	-.102(.57)	.93
Hormonal Contraceptive User	25	.383(.40)	2	.381(.54)	.00

Note. The following conventions for strength of estimated effect size are as follows: Small (.2), Medium (.5), & Large (.8) (Cohen, 1988).

FIGURE 1

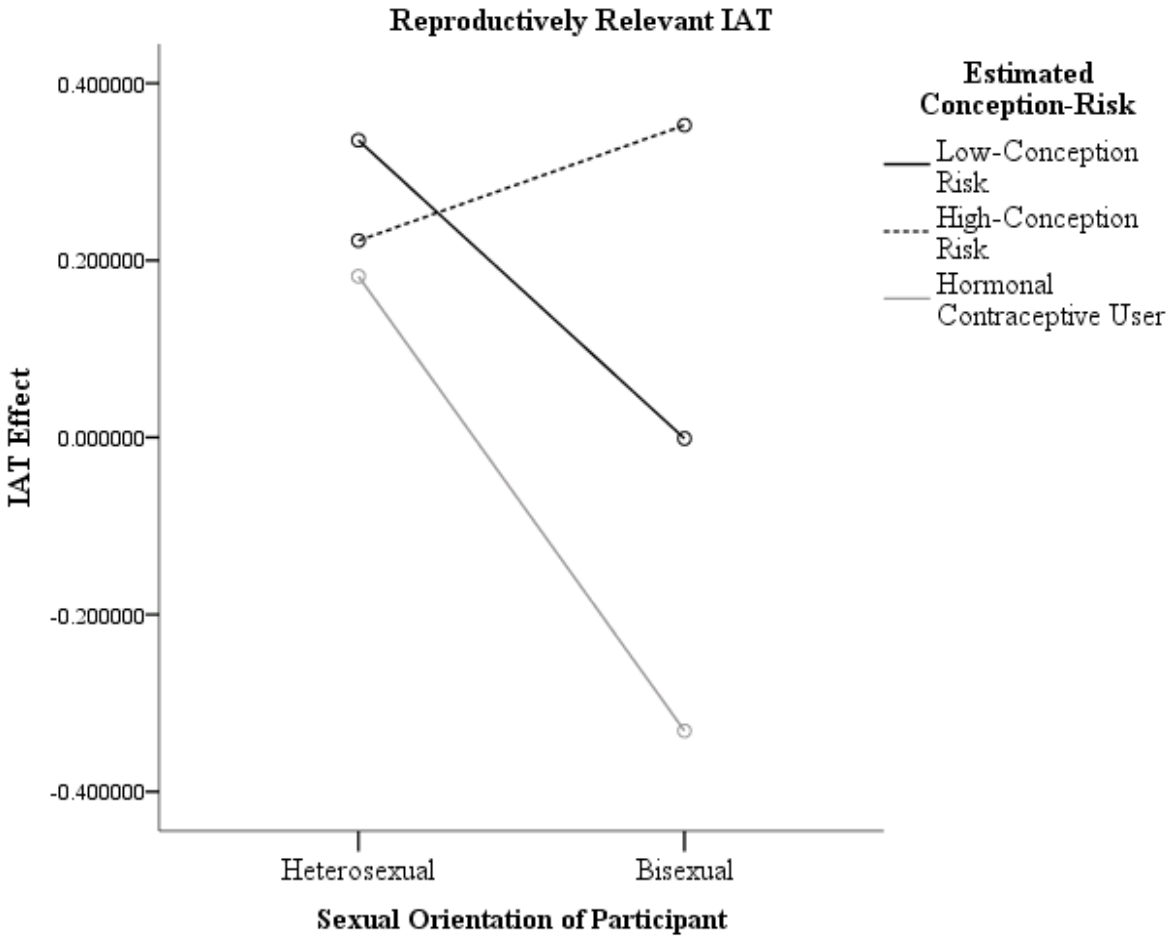

Reproductively Relevant IAT
IAT Effect
0.400000
0.200000
0.000000
-0.200000
-0.400000
Heterosexual
Bisexual
Sexual Orientation of Participant
Estimated Conception-Risk
Low-Conception Risk
High-Conception Risk
Hormonal Contraceptive User

FIGURE 2

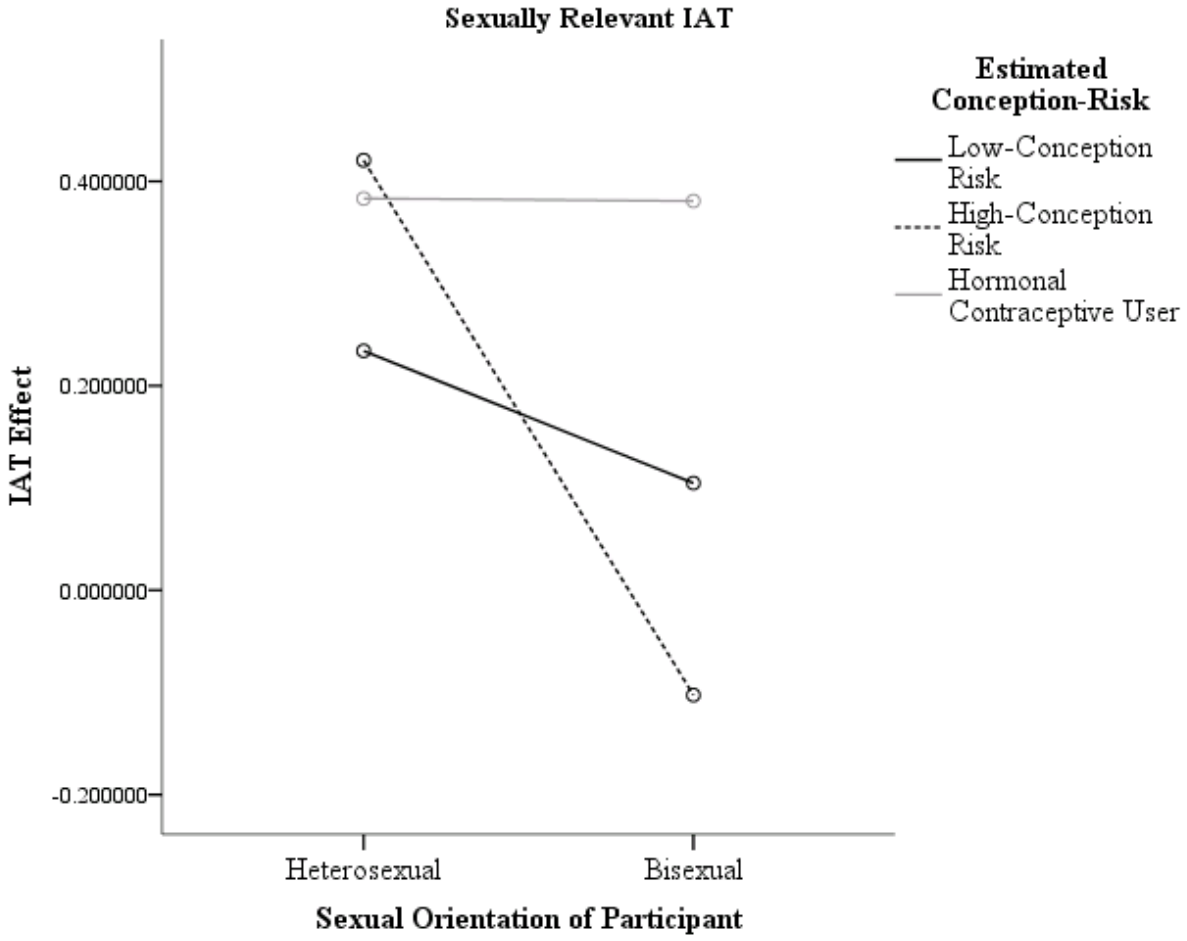
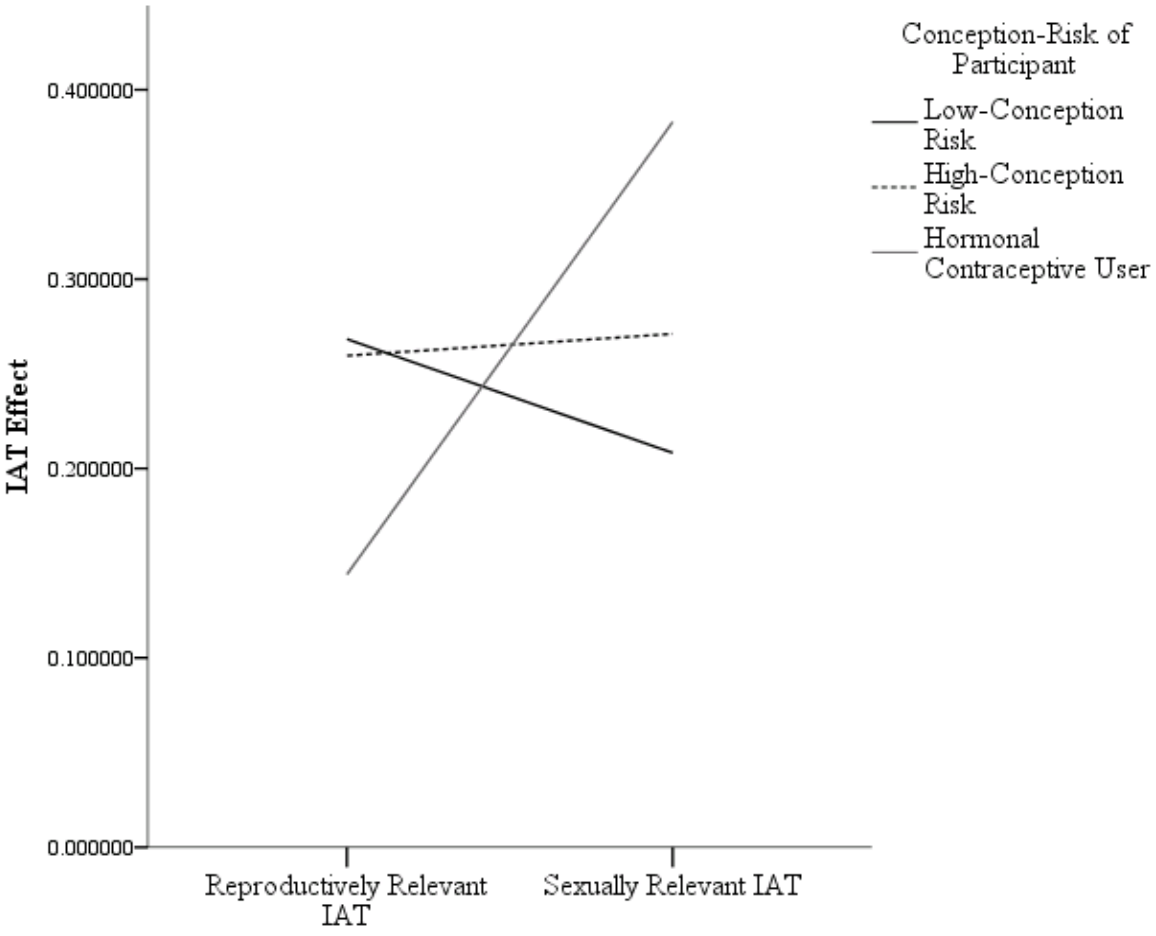

Sexually Relevant IAT
Estimated Conception-Risk
Low-Conception Risk
High-Conception Risk
Hormonal Contraceptive User
IAT Effect
0.400000
0.200000
0.000000
-0.200000
Heterosexual
Bisexual
Sexual Orientation of Participant

FIGURE 3


Conception-Risk of Participant
Low-Conception Risk
High-Conception Risk
Hormonal Contraceptive User
IAT Effect
0.400000
0.300000
0.200000
0.100000
0.000000
Reproductively Relevant IAT
Sexually Relevant IAT

APPENDIX A: "*Good" versus "Bad" Words for IAT Stimuli*

- **"Good" Words**

    1. Marvelous
    2. Superb
    3. Pleasure
    4. Beautiful
    5. Joyful
    6. Glorious
    7. Lovely
    8. Wonderful

- **"Bad Words"**

    1. Tragic
    2. Horrible
    3. Agony
    4. Painful
    5. Terrible
    6. Awful
    7. Humiliate
    8. Nasty

APPENDIX B: *Reproductively Relevant Stimuli for IAT 1*

- **Pregnant:**

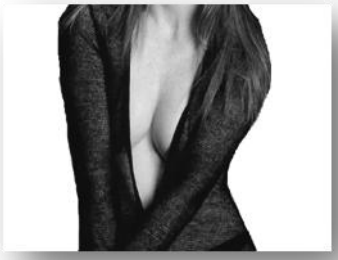
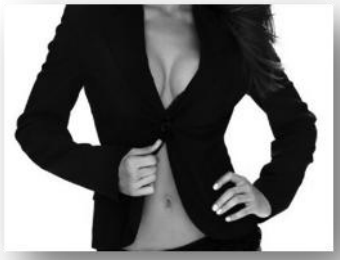



- **Not Pregnant:**




APPENDIX C: *Sexually Relevant Stimuli for IAT 2*

- **Sexy:**

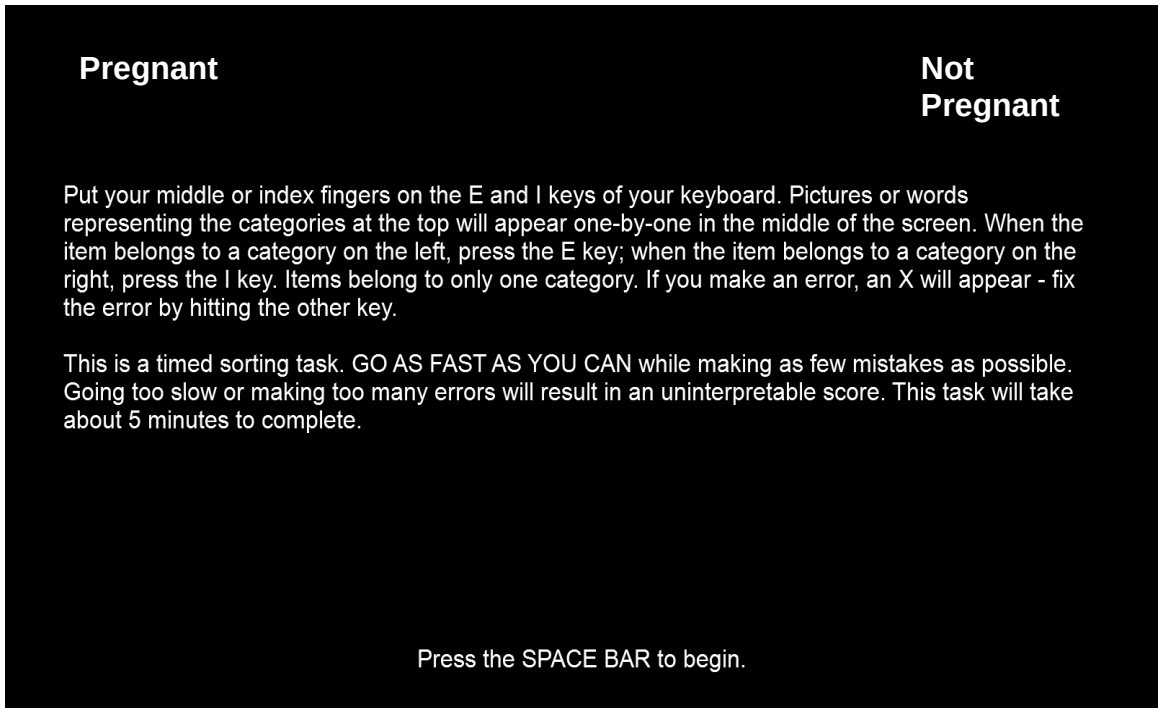





- **Not Sexy:**

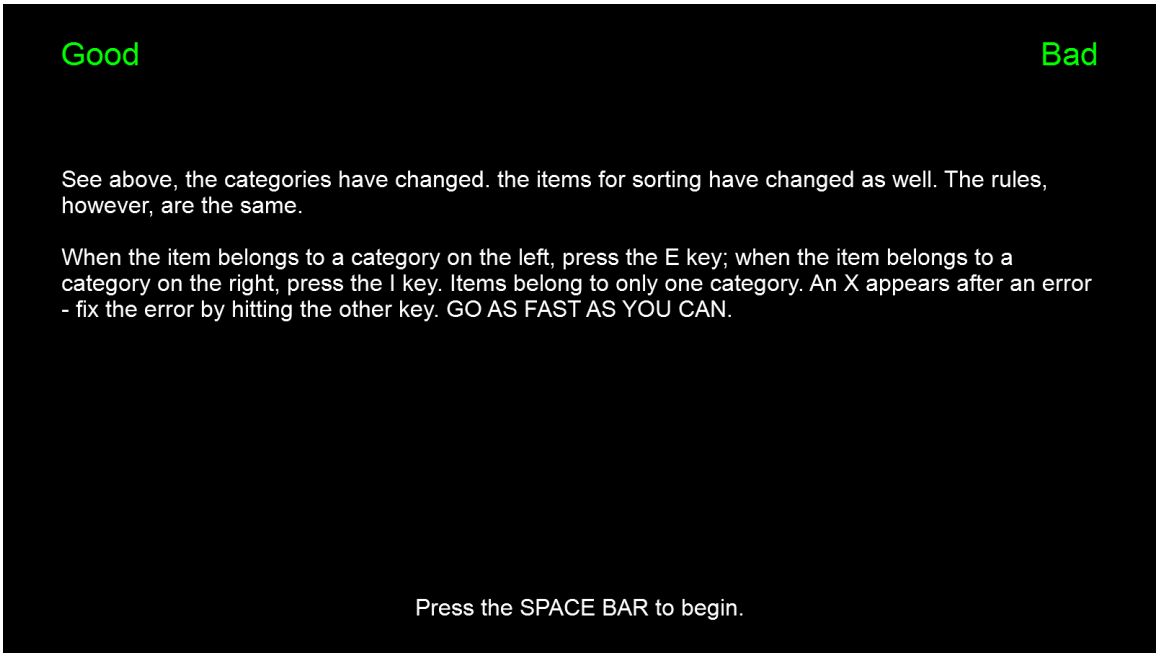



APPENDIX D: *Instructions*

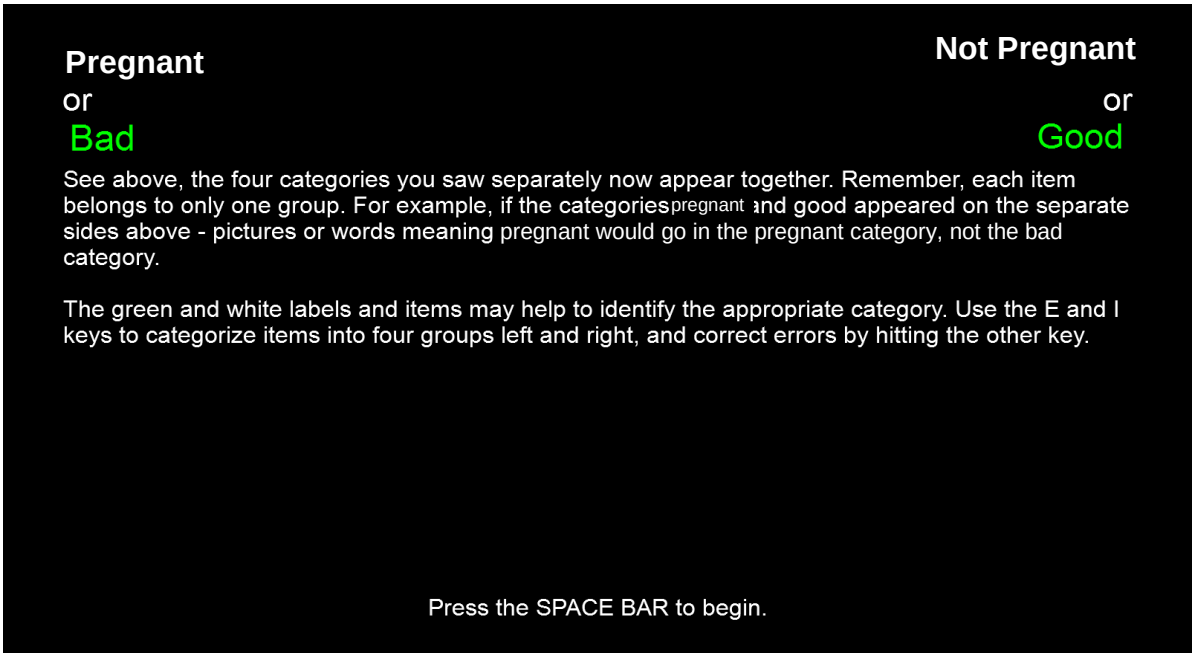
Phase 1:



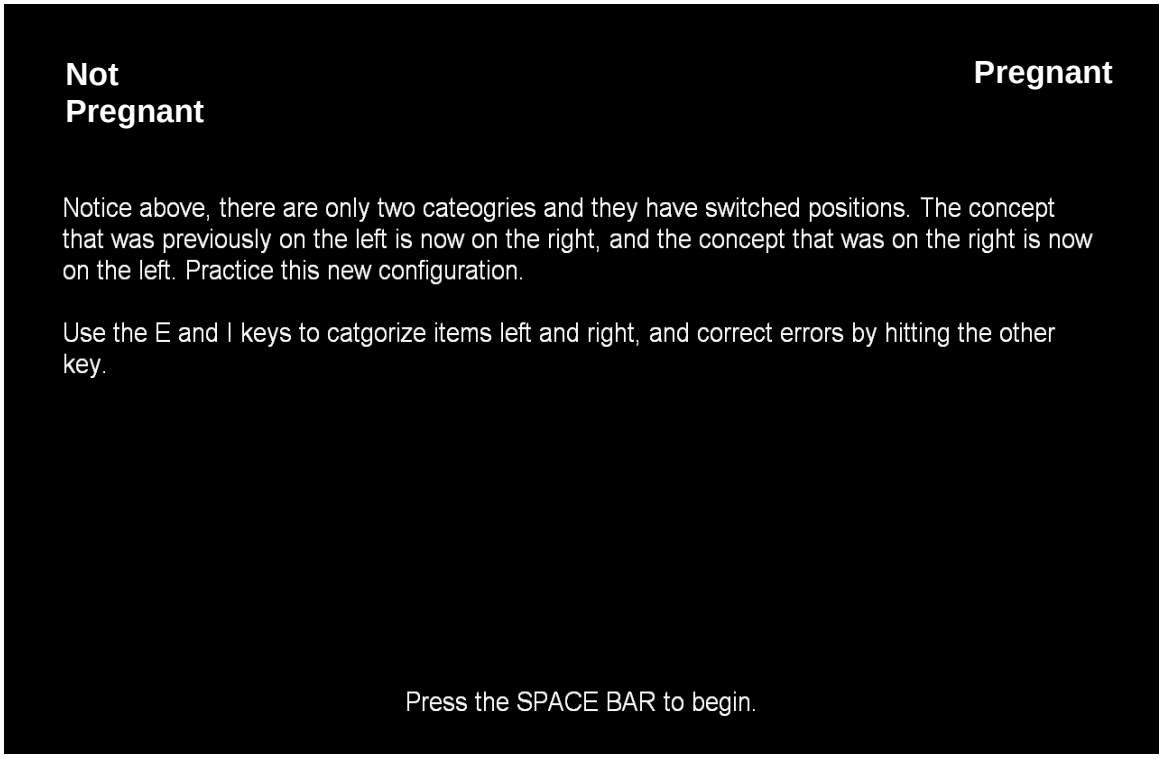
Phase 2:



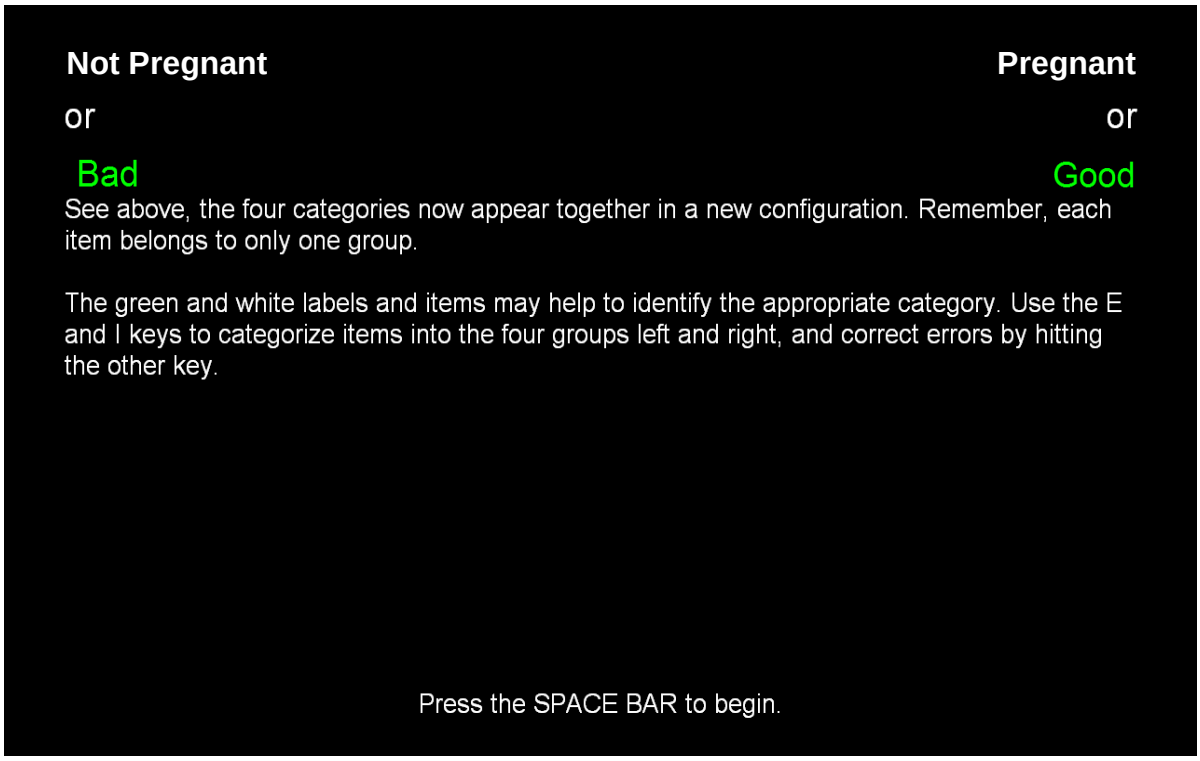
Phase 3:



Phase 4:



Phase 5:


Not Pregnant
or
Bad
Pregnant
or
Good
See above, the four categories now appear together in a new configuration. Remember, each item belongs to only one group.
The green and white labels and items may help to identify the appropriate category. Use the E and I keys to categorize items into the four groups left and right, and correct errors by hitting the other key.
Press the SPACE BAR to begin.

APPENDIX E: *Demographic Questionnaire*

1. Please select one of the following:

Female
Male
Intersex, Transsexual, or Other
I prefer not to answer

2. Please indicate your age in years: _____

3. Which of these commonly used terms would you use to describe yourself?
-Heterosexual/Straight
-Bisexual
-Homosexual/Lesbian/Gay
-Uncertain
-Other, please specify:
-I choose not to answer

4. What is your marital status?
-Single/Never married
-Cohabitating (Living together)
-Married
-Separated/Divorced
-Widowed
-I choose not to answer

5. If you are currently in a relationship, please indicate how long you have been together:
_____ years _____ months
I choose not to answer

*Participants who respond 'female' for question 1 will be directed to an additional page with questions regarding ovulatory phase (all other participants will then be directed to the debriefing screen; see Appendix F):

Please answer the following to your best knowledge:

1. Are you <u>currently</u> on any type of birth control that might influence your menstrual cycle – for example, the "pill" or the NuvaRing?

Yes No Prefer not to answer

2. How long have you been on this birth control?

3. Is your menstrual cycle typically regular? That is, does it follow a normal schedule, or is it instead unpredictable?

No, it is unpredictable	No, it is usually irregular	Yes, most of the time	Yes, it is highly regular

4. Please give your best estimate of the length of your menstrual cycle (in days). Select one of the following:

25 26 27 28 29 30 31 32 33 34 35

* If the option is not listed below, please write it in the space provided: _____.

4. Please try to identify the date of the <u>first day</u> (the start) of your last menstrual cycle:

5. Please try estimate the date when you expect your next menstrual cycle <u>to start</u>:

APPENDIX F: *Debriefing*

Thank you for your participation!

The purpose of the study in which you served as a participant today is to examine reactions to *reproductively-relevant* cues (i.e., images of visibly pregnant women) and *sexually-relevant* cues (i.e., images of women dressed sexy) provided by the images of women that you categorized. This research hopes to better understand how attitudes differ based on the reproductive or sexual relevance of the stimuli.

*****If you're in the psychology subject pool, to receive credit, please e-mail the following code to psychsubjectpool@hawkmail.newpaltz.edu:**

HKJ824

If you have any questions about this research, or if you would like a copy of the results, please contact Mandy Guitar at mguitar16@newpaltz.edu.

APPENDIX G: *Consent*

State University of New York at New Paltz – Informed Consent
Study Title: Perceptions of Females across the Ovulatory Cycle
Name of Principal Investigator: Amanda Guitar
Department: Psychology
Position: Graduate Student

***Please contact Amanda Guitar at mguitar16@hawkmail.newpaltz.edu or (575)-650-1410 with any questions or concerns regarding this study.**

This is a psychological research study. This research study includes only participants who choose to take part. Please take your time to make your decision. Discuss it with your friends and family. You are being asked to take part in this study because you are over the age of 18.

The purpose of this study is to examine perceptions of different images of females. This research is being done because currently, there is minimal information on this topic.

About 300 people will take part in this study.

If you take part in this study, you will have the following tests and procedures:
In this study we will ask you to complete 2 categorization tasks. The first task will ask you to categorize images of women based on whether the images are "pregnant" or "not pregnant." The second task will ask you to categorize a second set of images as "sexy" or "not sexy." We think it will take you about 30 minutes to complete the study. You can stop participating at any time and you will still receive full credit.

There are no known risks for participating in this study.

Efforts will be made to keep your personal information confidential. None of your answers given in this study will be able to be linked back to you, so please feel comfortable in answering as truthfully as possible.

We cannot guarantee absolute confidentiality. Your personal information may be disclosed if required by law, but your answers to all questions will remain anonymous.

You will receive 1 credit towards the New Paltz subject pool for taking part in this study.

Keep in mind that if you want to receive credit for this study, you must sign up for it at http://newpaltz.sona-systems.com which will link you to the survey.

Taking part in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may choose not to take part, may leave the study at any time, or not answer research questions, which you consider

inappropriate. Leaving the study will not result in any penalty or loss of benefits to which you are entitled.

For questions about the study or a research-related injury, contact Amanda Guitar at mguitar16@hawkmail.newpaltz.edu or by phone at
(575) 650-1410.

For questions about your rights as a research participant, contact the State University of New York at New Paltz Institutional Review Board (which is a group of people who review the research to protect your rights) at 845-257-3282.

OTHER INFORMATION:

The Institutional Review Board of the State University of New York at New Paltz has determined that this research meets the criteria for human subjects according to Federal guidelines.

CONSENT:
I have read or have had read to me the preceding information describing the study. All my questions have been answered to my satisfaction and this form is being signed voluntarily by me indicating my desire to participate in this study. By clicking below I agree to participate in this study.