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Women's Cooperative Motivation towards Ovulating Women Under Male Threat Context

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Women's Cooperative Motivation towards Ovulating Women Under Male Threat Context

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Abstract

The present study investigated women's intrasexual cooperation as a function women's partner competitiveness and other woman's fertility. It was expected that when the interacting target is depicted as being threatened by a male, women with highly competitive partner would show more cooperative motivation toward fertile target than non-fertile target. Contrary to the hypothesis, it was found that women with less competitive partner showed lower level interaction intention to fertile woman than non-fertile woman. Additional supplementary study was implemented to observe women's psychological perception towards the fertility cue of male-threaten target and found that women perceive more risk in fertile target than non-fertile target. The current research provides primitive but novel evidence that women's cooperative motivation towards other same-sex target operate in functionally flexible ways on social factors.

Keywords: Fertility, Intrasexual Relationship, Female Sociality, Evolutionary Psychology

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CONTENTS

CONTENTS OF TABLE

CONTENTS OF FIGURE

Introduction

1. Women's Intrasexual Relationship

Intrasexual relationship is a double-edged sword that poses a threat on one side, while providing some benefits on the other. For women, same-sex friendship has played a crucial role in either their success or failure in survival and reproduction (Campbell, 2002).

The importance of the intrasexual relationship to women can be explained by the long-established practice of female exogamy. Throughout the evolutionary history, during which human societies have largely been patrilocal (e.g., Ember, 1974; Hawkes, O'Connell, Blurton-Jones, Alvarez, & Charnov, 1998) women have left their natal kin group to live with a new group of unrelated strangers during their reproductive years (e.g., Lizarralde & Lizarralde, 1991). Having received less support and benefits from their kin than male, it would have been adaptive for women to form a long-term trusting relationship with the individuals of their new community to recreate the benefits of remaining in their natal kin group. In line with the notion, women tend to treat their same-sex friends as their kin more than men do theirs, crediting and reporting similarity towards their friends as much as they do towards their family members (Ackerman, Kenrick and Schaller, 2007).

Women's access to the benefits of successful intrasexual relationships comes from various contexts (e.g., Campbell, 2002). Among the benefits are allomothering, sharing resources, and exchanging help in stressful situations (e.g., Campbell, 2002;

Hrdy, 2009; Taylor, 2006). Such mutual alliance also pertains to male aggression and undesirable courtships (e.g., Ackerman & Kenrick, 2009; Campbell, 2002; Smuts, 1992). However, under the mating context, same-sex friendships may constitute a threat to one's romantic relationship, because her local allies and friends are more likely than complete strangers to engage in mate poaching, by taking advantage of the information they have on the woman's mate (e.g., Bleske & Shackelford, 2001). Especially, retaining their partner from potential mate poachers is crucial for women as they are dependent on resources such as food and protection provided by the partner (Hurtado, Hill, Hurtado, & Kaplan, 1992; Kaplan, Hill, Lancaster, & Hurtado, 2000).

Thus, the formation of intrasexual relationship should be functionally flexible for women to navigate such socially recurrent problem, in a way that maximizes the benefit and minimizes the cost. Then how do women manage this problem? What is the psychological system that enables women to sensitively make judgment of when to cooperate or compete, and how does it work? A growing line of research suggests that women's strategy is moderated by women being sensitive to other women's fertility cue (e.g., Krems et al., 2016; Hurst, Alquist, & Puts, 2017).

2. Ovulation and Fertility Cue Detection

Evolutionary theorists posit that certain cognitions, perceptions, and behaviors are sensitive to the fertile phase of women's cycle, as the reproductive success is dependent on the timing of women's fertile window (e.g., Fessler, 2003; Gangestad, Garver-Apgar, Simpson, Cousins, 2007; Haselton & Gangestad, 2006). Many studies

have found that a) men can detect and respond to cyclic changes and b) ovulating women show increased sexual attraction to men and c) women respond to other ovulating women with increased competition for mates.

Firstly, men find fertile women more sexually attractive than non-fertile women. Previous research has found men's increased attraction in regards to women's faces (Bobst & Lobmaier, 2012; Puts et al., 2013), voices (Bryant & Haselton, 2009; Puts et al., 2013), and their odors (Thornhill, Gangestad, Miller, Scheyd, McCollough, & Franklin, 2003) during ovulation. One of the studies even showed how nightly tip earnings of dancers increased during their ovulation (Miller, Tybur, & Jordan, 2007). In response to the increased interest from men, ovulating women show increased sexual interest to men as well, especially for short-term purposes (Bullivant et al., 2004; Cantú et al., 2014; Pillsworth, Haselton, & Buss, 2004; Roney & Simmons, 2013). The preference of fertile women towards short-term mate ranges from physical symmetry and masculinity (Penton-Voak & Perrett, 2000; Thornhill et al., 2003), social dominance (Gangestad et al., 2004), to creative intelligence (Haselton & Miller, 2006). Further, ovulating women's increased intersexual interest instigates increased intrasexual competition. Fertile women engage in various behaviors that are aimed to attract men, as well as to successfully compete against other women. For instance, fertile women tend to use products to enhance their physical attractiveness (e.g., Durante, Griskevicius, Hill, Perilloux, & Li, 2010; Durante, Li, & Haselton, 2008; Haselton et al., 2007; Saad & Stenstrom, 2012) and show mate guarding behaviors (e.g., Krems et al., 2016; Hurst et al., 2017). Moreover, women in their fertile window show decreased cooperative motivation, by demonstrating, for example, growing reluctance to distribute resource(Anderl, Hahn, Notebaert, Klotz,

Rutter, & Windmann, 2015; Eisenbruch & Roney, 2016; Necka, Puts, Dimitroff, & Norman, 2016).

In short, ovulating women are more effective competitors to other women under a mating context, thereby posing a credible threat to each other. Their motivation and behaviors shift in a functionally flexible manner toward increased competition and decreased cooperation, when they interact with other ovulating women within a mating context. However, no research, to my knowledge, has attempted to observe *under what condition* women might show increased intrasexual cooperation toward other ovulating women. Below, I reason that ovulating women may be perceived as particularly vulnerable to sexual assault, and thus, certain cues of fertility of other women may evoke cooperative motivation in women with competitive partners.

3. Contextual and Interpersonal Factors: Male Threat and Competitive Partner

Women's high probability of conception within the fertile window may also mean a high *risk* thereof. If men and women can shift their behavior based on other women's chances of conception, there may exist a similar psychological system that detects other women's *risk* of conception as well. In that case, fertility cues, depending on the context they are embedded in, may rather evoke cooperative motivation. For instance, when the reproductive cost of an ovulating target is great and the cost of aiding that target is relatively low, women may show cooperative motivation to the ovulating women.

A line of research posits that women have developed a rape detection system and a threat assessment system (e.g., Fessler, Holbrook, & Fleischman, 2015). The conception risk may represent the fitness costs of sexual assault, since pregnancy due to assault compromises female choice and imperils existing and subsequent male investment. Thus, it would have been adaptive for women to systematically diversify their behaviors across the ovulatory cycle to reduce the likelihood of sexual assault during fertile periods.

Based on the above notion, women may be sensitive and responsive to other women's fertility cues that signal their risk of conception. Considering that the female exogamy have been an evolutionarily recurrent adaptive problem, giving weight to the role of same-sex relationship in women's survival and reproduction, it would have been adaptive for women to know when they see other women faced with a serious risk. In other words, people might pick up the fertility cues of an ovulating woman being threatened by a male, and gain higher motivation to cooperate.

Moreover, the effectiveness of the cooperative motivation would depend on how much the intrapersonal or interpersonal factors would cut down the estimated cost of aiding the woman. For instance, women partnered with a competitive mate, who might be of useful resource in the aiding process, would be more inclined to step in to help. For instance, it has been reported that abused women turn to male kin and friends for practical help and in some cases male helpers show masculine support by responding with threats and/or violence against the abusers (Wilcox, 2006; Wilson & Daly, 1993). Thus, the presence of masculine male partner can be a viable material resource that may

keep women safe from the potential perpetrator and thereby encouraging women to cooperative with the other women facing threats from male.

The current study attempts to examine under what condition women may be cooperative towards other ovulating women. It is expected that when ovulating women is facing a male threat, women with competitive partners would be more likely to empathize, show higher interaction intention and helping intention. In doing so, I take more nuanced approach and test the assumption within a dual context, where an ovulation target is depicted as a potential mate poacher but at the same time, facing threats from man. When the perceived threat to the target is great along with a low potential cost of helping the target, cooperative motivation may outweigh the potential benefit of distancing the target to keep her away from the partner.

Hypothesis:

Whereas the fertility difference of target woman is unlikely to differentiate women's cooperative motivations when they have a less competitive partner, having a much competitive partner should lead women to show higher level of cooperative motivation towards threatened ovulating target than threatened non-ovulating target.

Method

1. Main Study

The study attempted to examine the women's cooperative motivation towards fertile vs. non-fertile target. It was expected that women would show higher level of cooperative motivation towards fertile target than non-fertile target, only when the women is partnered with competitive male. Cooperative motivation was measured by observing empathy, interaction intention and helping intention towards the target. Participants were shown with two scenarios depicting a social situation relevant to mate poaching and male threat along with a photo of either fertile or non-fertile woman.

1) Participants

One hundred and fifty three engaged or married women, living in US were recruited from Amazon's Mechanical Turk (MTurk) online participant platform (M_{age}= 32.24, SD_{age}= 6.52) and were paid .8 dollar for participating. Here I focused on engaged or married women to examine a population wherein a) the threat of mate poaching and b) potential support from partners would be the greatest. Because long-term committed relationships imply reliable and stable exchange of resources (e.g., Buss, 2003), engagement and/or marriages would represent such committed relationships.

2) Procedure

Participants were told they would be completing a study regarding the accuracy of first impressions. Before the focal task, participants provided their demographic information (e.g., gender, age, relationship status) and completed scales assessing perceptions of their own and their partner's mate value. Next, in order to induce attention, participants were told that three factors responsible for the process of forming the first impression - appearance, social situation, and conversation - would be shown sequentially. In the focal task, first, participants were randomly assigned to view one of the two photos of woman labeled "Sara", taken either at fertile phase or non-fertile phase. Next a mate poaching scenario was introduced. In it, the participants were asked to imagine themselves at a housewarming party where she saw Sara, making seemingly flirtatious gestures toward her partner. Participants were then introduced with a male threat scenario. In it, the participants were led to imagine themselves alone in the same party situation and met Sara to hear from her that a strange man has been following Sara for some weeks at night. Finally, participants answered series of scales regarding empathy, interaction intention, and helping intention toward Sara. The same photo of Sara shown to the participants was consistently accompanied with the two scenarios and all the scales. Then participants were asked to report any experience of engaging in a similar survey, device used to respond and were thanked.

3) Measures

Independent Variable: Target Fertility

Target fertility was manipulated by randomly assigning the participants to view one of two photographs of "Sara". The two target photographs were created by Bobst and Lobmaier (2012). Each photograph is a composite of the faces of the same 25 women, photographed during high fertility (late follicular) and low fertility (luteal) phases of their ovulatory cycles. In order to confirm the cycle phases of the women in the photos, urine and saliva samples were used to assess luteinizing hormone, progesterone, and estradiol.

Moderator: Partner Competitiveness

Partner competitiveness was measured to observe participants' perception of their partners as a competitive and reliable resource relevant to the situational context. Because the target interacting with the participants were facing male threat, traits that may be useful in protecting the target and the participants from the threating male were focused: masculinity and dominance (e.g., "How do you think another woman, upon just meeting your partner, would rate him on: *masculinity*, and *dominance*"). The ratings were completed on 7-point scales (1=*not at all* to 7=*extremely*) and were averaged to form a single composite partner competitiveness (α=.84).

Dependent Variable: Empathy, Interaction Intention, Helping Intention

Empathy

Empathy is a fundamental psychological process in social interaction, involving perspective taking to other's state of mind and empathic concern, an affective response to the emotion of others (Batson, 1987). Further, empathy is thought to have emerged as an

important factor in the formation of cooperative relations with non-kin (Axelrod, 1984; Frank, 1988) and considered as a motivational mechanism to evoke altruism towards others (Empathy-Altruism Hypothesis, Batson, 1987). Thus, empathy scale was used as a proxy measure of cooperative motivation.

Empathy was assessed by asking the participants to rate the extent of emotions felt after knowing about Sara. Specifically, four empathic adjectives were used: *sympathetic*, *compassionate*, *softhearted*, and *tender* (e.g., Batson et al., 1997; Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). The order of adjective items were randomly represented, completed on 7-point scales (1=*not at all* to 7=*extremely*) and were averaged to form a single composite empathy (α=.94).

Interaction Intention

Interaction intention was measured by using an established measure (e.g., Krems et al., 2016; Vaillancourt & Sharma, 2011; Vrangalova et al., 2014), asking participants to rate three itmes: 1) the amount of contact they would like to have with the target (1 = *I wouldn't want any kind of contact* to 7 = *I could see her as a best friend*); 2) willingness to consider the target a close friend (1 = *very unwilling* to 7 = *very willing*); and 3) overall impressions of the target (1 = *I strongly dislike her* to 7 =*I very much like her*; (α=.90).

Helping Intention

Helping intention was measured via a modified version of established measure frequently used in previous research (e.g., Batson et al., 1997; Cialdini et al., 1997; Maner et al., 2002; Maner et al., 2007). Participants were asked to indicate the level of help (if any) they would offer to Sara by choosing one of six increasingly costly helping options: 1) nothing, 2) tell her to find someone to walk home with, 3) help her find someone who might walk home with, 4) offer her a ride for a couple of days on her way home, 5) offer her a ride for a week on her way home, 6) offer her a ride until the police handle the issue clear.

Covariate: Self Mate Value, Partner Mate Value, Partner Sexiness

Partner sexiness, partner mate value and self mate value were measured to examine the independent effect of partner competitiveness. Firstly, as dominance and masculinity – two traits selected to measure partner competitiveness– are traits that fertile women find especially attractive (for review, Gildersleeve, Haselton, & Fales, 2014), other traits, such as physical attractiveness and sexiness that are desirable but not relevant as a resource in male threat context, were measured and controlled. Second, complimentary measure of partner mate value was assessed to control the overall perceived desirability of the partner. Lastly, as women with high mate value are likely to be partnered with highly desirable partner, participants' self mate value was measured to control the effect.

Partner sexiness was indexed with two traits: *physical attractiveness* and *sexiness* (e.g., "How do you think another woman, upon just meeting your partner, would

rate him on: *physical attractiveness, sexiness*). The ratings were completed on 7-point scales (1=*not at all* to 7=*extremely*) and were averaged to form a single composite partner sexiness (α=.89). Partner mate value was measured using a modified version of Landolt Mate-Value Scale (e.g., Krems et al., 2016). The modified version was used by asking the perception of their partners to the opposite sex (e.g., "Other women seem to notice my partner"). Items were completed on 7-point scales (1=*strongly disagree* to 7=*strongly agree*) and were averaged to form a single composite partner mate value (α=.86). Self mate value was measured by using the eight-item Landolt Mate-Value Scale (Landolt, Lalumiere, & Quinsey, 1995) and by asking self-perceived desirability to the opposite sex (e.g., "Members of the opposite sex are attracted to me"). Items were completed on 7-point scales (1=*strongly disagree* to 7=*strongly agree*) and were averaged to form a single composite of self mate value (α=.86).

4) Results

Table 1 presents descriptive statistics for this study. To test the hypothesis that when fertility cue is embedded in male threat context, women with competitive partner would show higher cooperative motivation toward ovulating target – the interaction effect of target fertility and partner competitiveness on the dependent variables were examined by using PROCESS SPSS macro (Hayes, 2012; Model 1). In the model, Fertility (dummy coded: 1 = fertile, 0 = non-fertile) was tested as an independent variable whereas Partner Competitiveness was tested as a moderator. Partner Sexiness, Partner Mate Value and Self Mate Value and Age were tested as covariates. Empathy,

Interaction Intention and Helping Intention were entered as dependent variables. 95% confidence interval (CI) was used and all of the independent and moderating variables were mean centered.

Table 1. Means, SD, and Correlations (*N* = 153)

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Fertility	.49	.50	1							
2. Partner Competitiveness	5.23	1.32	.03	1						
3. Empathy	4.48	1.61	.01	.04	1					
4. Interaction Intention	3.71	1.40	-.07	.07	.68**	1				
5. Helping Intention	3.41	1.58	-.07	.09	.54**	.54**	1			
6. Partner Sexiness	5.25	1.19	.02	.43**	.12	.12	.14	1		
7. Partner Mate Value	4.51	1.13	.05	.34**	.15	.08	.11	.67**	1	
8. Self Mate Value	4.53	1.14	.02	.13	.07	.17*	.12	.28**	.32**	1

1. *p<.05, **p<.01 (2-tailed).
2. Fertility (1=fertile, 0=non-fertile)

Empathy

There were no main effect of Fertility, B = .01, SE = .26, t(146) = .03, p = .98, Partner Competitiveness, B = -.01, SE = .11, t(146) = -.05, p = .96, nor the interaction of Partner Competitiveness and Fertility, B = .31, SE = .20, t(146) = 1.51, p = .13.

Interaction Intention

There were no main effect of Fertility, B = -.19, SE = .22, t(146) = -.87, p = .39, Partner Competitiveness, B = .07, SE = .09, t(146) = .76, p = .45. However, the

interaction of Fertility X Partner Competitiveness was found, B = .45, SE = .17, t(146) = 2.62, p = .01 (Table2).

Following Aiken and West (1991), I probed the interaction at 1 *SD* above and below the mean of Partner Competitiveness. Contrary to the expectation, women with highly competitive partners show no difference in self-interaction intention between fertile and non-fertile target, SE = .32, t(146) = 1.27, p = .21, B = .40. For women with lower competitive partners wanted lesser interaction with the fertile target than with the non-fertile target, SE = .32, t(146) = -2.47, p = .01, B = -.79 (Fig.1).

Helping Intention

No main effect were found with Fertility, B = -.25, SE = .26, t(146) = -.97, p = .34, Partner Competitiveness, B = .06, SE = .11, t(146) =.55, p = .58, nor the significant interaction effect of Fertility and Partner Competitiveness, B = .20, SE = .20, t(146) = 1.00, p = .32.

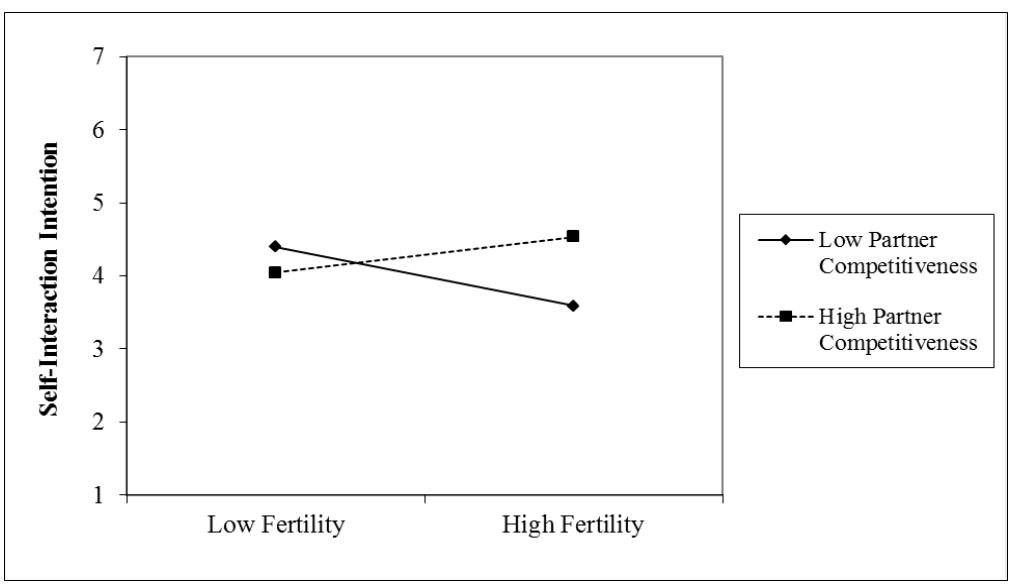
Table2. Result of Hierarchical Regression on Interaction Intention

	B	***SE(B)***	**β**	R^2	$adjusted R^2$	ΔR^2
Step1				.04	.02	.04
constant	2.41	.61				
Self Mate Value	.19	.11	.16			
Partner Mate Value	-.05	.14	-.04			
Partner Sexiness	.12	.13	.10			

Step2				.04	.01	.01
constant	2.41	.67				
Self Mate Value	.19	.11	.16			
Partner Mate Value	-.05	.14	-.04			
Partner Sexiness	.11	.14	.09			
Fertility	-.19	.23	-.07			
Partner Competitiveness	.03	.10	.03			
Step3				.09	.05	.04**
constant	2.26	.66				
Self Mate Value	.20	.10	.16			
Partner Mate Value	-.07	.14	-.06			
Partner Sexiness	.11	.13	.09			
Fertility	-.19	.22	-.07			
Partner Competitiveness	.07	.10	.07			
Fertility X Partner Competitiveness	.45	.17	.21**			

1. *p<.05, **p<.01 (2-tailed).

Fig.1. Interaction of Fertility and Partner Competitiveness on Self-Interaction Intention



5) Discussion

In order to understand the complex intrasexual relationship among women, this study attempted to observe women's response to another woman either in her fertile or non-fertile phase, within a dual context, where the target woman being depicted as a potential mate poacher as well as a potential victim of a male threat.

In this study, the overall pattern of the results did not support the hypothesis that women with highly competitive partner would show higher level of cooperative motivation when the fertile target is in male threat context. Specifically, no main effect or the interaction effect of fertility and partner competitiveness on empathy and helping intention were found. However, an unexpected result was revealed with regards to women's interaction intention. That is, while women with highly competitive partners showed no difference in their interaction intention regardless of the fertility of the target, women with less competitive partners wanted lower level of interaction with the fertile target than with the non-fertile target. Further, for the non-fertile target, the level of partner competitiveness did not alter women's interaction intention. For the fertile target, contrary to the hypothesis, women with less competitive partners showed lower level of interaction intention than women with higher competitive partners.

Although unexpected, that only women with less competitive partners hesitated to befriend with an ovulating woman does not alter the assumption that women's cooperative motivations toward another woman are calibrated with two factors: a) the target's fertility status and b) the credibility of their partner as a competitive resource in affiliating and cooperating with the target. This sensitive calibration seems well-designed,

given that the judgments regarding same-sex relationships cannot be executed without the cost-benefit analysis. Even though women are aware that the potential benefit of female-female relationship is likely to be achieved by cooperating with a male-threatened target, they are also aware that they might be putting her own survival and/or reproductive fitness in risk by doing so. Thus, without an additional resource, such as a competent male partner, of which can be used to diminish the potential cost, women would be reluctant to show cooperative motivation. The current result suggests that women who are less likely be supported by their partner showed lower inclination to affiliate with the target to avoid any potential risks.

However, current interpretation is limited in that no attempts were made to measure the psychological process that fertility cue may signal conception risk. It is this limitation that I have focused through Supplementary Study. In particular, perceptions of risk, probability of sexual assault, and partner's resource value in helping the target was measured. It was expected that these perceptions would be higher towards fertile target than non-fertile target.

2. Supplementary Study

Additional study was implemented to examine whether fertility cue embedded in male-threating context can elicit perceptions of risk, probability of sexual assault and women's partner as a viable resource. In order to focus on this purpose, only the male threat scenario from the previous study was used. Further, to match the participant pool,

participants with the same demographic background (e.g., engaged or married women) were recruited.

1) Participants

Seventy two engaged or married women of U.S. were recruited from Amazon's Mechanical Turk (MTurk) online participant platform (M_{age}= 35.64, SD_{age}= 8.65) and were paid .8 dollar for participating.

2) Procedure

Participants were told they would be completing a study regarding the first impressions and social perceptions. In the focal task, participants were randomly assigned to view one of the same two photos (fertile vs. non-fertile) that were used in Main Study. Next the same male threat scenario previously used was introduced. In it, the participants were asked to imagine themselves at a housewarming party where she saw Sara. Participants were further led to imagine that after hanging with other party guests, they were alone in the same party situation and met Sara to hear that a strange male has been following Sara for some weeks at night. Next, most relevant to the current study, participants answered to series of scales regarding their perception of risk, probability of sexual assault, and partner resource value in helping Sara. The same photo of Sara shown to the participants was consistently accompanied with the scenario and all

scales to inform the participants of the fertile status of Sara. Then participants were asked to report any experience of engaging in a similar survey, device used to respond and were thanked.

3) Measures

Target Fertility

Method used to manipulate the target fertility in Main Study was replicated.

Dependent Variable: Perceived Risk, Probability of Sexual Assault, Partner Resource Value,

Perceived Risk

Perceived risk was assessed to measure the risk perception of Sara regarding her situation, by creating five adjectives for the purpose of this study (e.g., "What do you think about Sara regarding the described situation: She seems: *vulnerable, fragile, threatened, endangered,* and *risky*). The order of adjective items were randomly represented, completed on 7-point scales (1=*not at all* to 7=*extremely*) and were averaged to form a single composite (α=.70).

Probability of Sexual Assault

Probability of sexual assault was measured with an item created for the purpose of this study. Participants were asked to indicate the likelihood of the occurrence of sexual assault to Sara, based on the described situation: "*Sara could be sexually assaulted by the described stranger"*. The item was completed on 7-point scales (1 = *highly unlikely to occur* to 7 = *highly likely to occur*).

Partner Resource Value

Partner resource value was assessed with an item created for the purpose of this study. Participants were led to indicate their thought toward their partner as a useful additional resource to help Sara more effectively (*reliable man: e.g., your husband; boyfriend*). The item was completed on 7-point scales (1 = *not at all useful* to 7 = *highly useful*).

4) Results

Table2 presents descriptive statistics for this study. One-way ANOVA was used to test the effect of Fertility on the dependent variables. In regards to For Perceived Risk, a Levene's test indicated significant heterogeneity of variance among the two groups, $F(1, 70) = 5.28$, $p < .05$, and therefore Welch's method was applied (Wilcox, 1996). It was found that the effect of Fertility on Perception of Risk was significant at the borderline, $F(1,70) = 3.701$, $p = .050$ (Table3). Participants who saw the photo of Sara in fertile phase perceived higher level of risk (M = 5.89, SD = .69) than participants who saw the

photo of Sara in non-fertile phase (M = 5.51, SD = .94). The result is shown on Fig.2. The effects of Fertility on Probability of Sexual Assault, $F(1,70) = .19$, $p = .66$, and Partner Resource Value, $F(1,70) = 1.63$, $p = .21$, were not found.

Table3. Means, SD, and Correlations (*N* = 72)

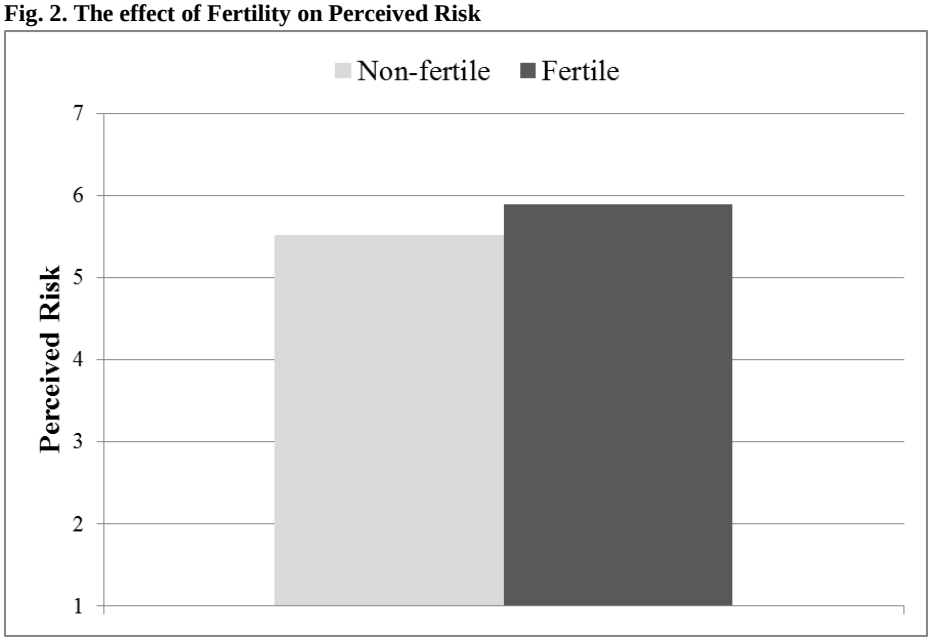
	Mean	*SD*	*1*	*2*	*3*	*4*
1. Fertility	0.44	0.50	1			
2. Perceived Risk	5.68	.87	.22	1		
3. Probability of Sexual Assault	5.71	1.26	.05	.66**	1	
4. Partner Resource Value	5.42	1.62	.15	.39**	.32*	-.22

1. *p<.05, **p<.01 (2-tailed).
2. Fertility (1=fertile, 0=non-fertile)

Table4. Result of Welch ANOVA on Perceived Risk

	SS	*df*	*MS*	*F*	*p*	η^2
Fertility	2.62	1	2.62	3.965	.05	.05
Error	49.52	70	.71			
Total	52.14	71				

Fig. 2. The effect of Fertility on Perceived Risk



5) Discussion

Supplementary Study was implemented to observe women's psychological mechanism towards other fertile target when the information of potential reproductive risk to the target was contextually given. In particular, women's perception of target's risk, their partner's value as a resource, and probability of sexual assault within a described situation were measured. It was predicted that participants would show higher level of the three perceptions toward fertile target than non-fertile target.

Although the difference between the groups was significant at the borderline, women were able to detect higher level of risk from fertile target than non-fertile target. However, no significant effect of fertility on perceptions of probability of sexual assault and partner resource value were found. Such results may have been due to the method of measurement, as only single item made exclusively for the purpose of this study were used to assess the each concept. Further, the scenario used to manipulate the potential conception risk of the target may have not been precise enough to elicit perceptual sophistications. As a recent research posits that the dimensions of potential sexual offender's physical factors are used to represent risk to reproductive assets (Fessler, Holbrook, & Fleischman, 2015), more detailed demonstration of the threating male could have been necessary for the participants to be sensitive and discern the probability of sexual assault between fertile and non-fertile targets.

Notwithstanding the limitations, the current study made the first attempt to observe whether the fertility cue of an ovulating woman can evoke risk perception. It seems that when the cues implying the fertile window – the time within a month when

women are the most effective mating competitors but also when they are most vulnerable to become pregnant by an unwanted male – are embedded in a certain context, women can be sensitive regarding the potential risk the target.

General Discussion

Throughout the evolutionary history, women were forced to leave their kin and natal group at the reproductive age. Under such selective pressure, intrasexual affiliation would have played a crucial role in women's fitness. It was expected that women's cooperative motivation towards the same-sex other would have evolved in flexible ways as the function of the target woman's fertility status and their partner's competitiveness. The Main Study examined whether the effect of target's fertility on women's cooperative intentions can be moderated by the level of their partner's competitiveness when the target's fertility cue is presented within a male threat context. Supplementary Study observed the psychological representation of the fertility cue. In Main Study it was found that women with less competitive partner showed lower level of interaction intention towards fertile target than non-fertile target. The result of Supplementary Study revealed that women perceive higher level of risk towards fertile target than non-fertile target.

Taken together, the current research provides primitive information of under what condition women are *not* likely to be cooperative towards the other women. Two factors – other women's fertility and partner's competitiveness are sensitively calibrated in cost-benefit analysis. Although cooperation towards other women and thereby the

formation of intrasexual relationship may bring benefits (e.g., Campbell, 2002), the behavior should be functionally flexible around the contextual and interpersonal factors to minimize the potential cost. It seems that under male threat context, because ovulating women are perceived to be in greater risk, women show hesitation to interact with the target in order to avoid potential vicarious risks.

Limitations and Further Directions

Several improvements can be made with regards to the research methods and designs. First, target fertility was manipulated by using photos of either fertile or non-fertile women. Although the photos were made of composite faces of 25 women, replication should be made by using photos of women with various ethnic background and physical characteristics. Recently, Puts and his colleagues (2013) created photos from more than four hundred women taken both during their fertile phase and non-fertile phase. Using these materials may enable further elaboration of the current findings. Secondly, it is crucial to replicate the overall result by integrating the measures of the two studies so that the psychological process and motivational outcome can be observed in a single study. In doing so, reliable scales previously established to measure perception risk in social contexts can be implemented for more robust findings.

Further attempts can be made to extend and develop current findings. Firstly, other factors that may influent and moderate the current results can be observed. In the present research, all targets were portrayed as novel acquaintance and the present data cannot address how women with competitive partners would respond towards their

same-sex friends. In one hand, women may be more reluctant to show higher level of cooperation to their already-existing social acquaintances as they are more effective mate-poachers than novel acquaintances (e.g., Bleske & Shackelford, 2001). In contrast, one may speculate that the cooperative motivation can be expected towards friends as future payback can be expected from the help-receiver, when the relationship is stable. In this sense, the potential benefit of cooperating with the needy friend may outweigh the potential risk and cost during the process.

Further, the perception of women's partner can be measured while considering other factors. Factors such as relationship insecurities and partner idealization (e.g., Simpson, Ickes, & Blackstone, 1995) may influence the perception or women's partner and the perception of how their partners may be used as an additional resource in cooperating with other women. Thus, the role of relationship factors should be explored in the further studies.

Lastly but most importantly, fertility status of the both interacting agents should be manipulated or measured in order to provide more comprehensive and conclusive understanding of the impact of women's fertility on their perception, motivation and behaviors. Within the literature of evolutionary psychology, only few attempted to observe the interaction effect of fertility between two women. Necka and colleagues (2016) explored how women differentially compete with other women in a behavioral economic game as a function of both women's fertility. Now that the findings have accumulated on how women's social inclinations are shifted across ovulatory cycle and how women react towards other ovulating women, attempts to observe the fertile status

of the two interacting women should be made to fully understand the complex dynamic of women's intrasexual relationship.

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Korean Abstract

남성 위협 상황의 배란기 여성에 대한 여성의 협력 동기

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본 연구는 상대방 여성의 배란기 및 배우자의 경쟁력이 여성 간의 협력 동기에 미치는 영향을 알아보았다. 구체적으로, 상대 여성이 남성으로부터 위협을 받는 상황에 처해있을 경우, 경쟁력이 높은 배우자를 가진 여성일수록 비배란기 여성보다 배란기의 여성에 대해 높은 협력 동기를 보일 것이라 예상하였다. 연구 결과 가설과는 달리 경쟁력 낮은 배우자를 가진 여성일수록 비배란기 여성보다 배란기 여성에게 더 낮은 상호작용 의도를 보였다. 이에 추가 연구를 통해 남성 위협에 처한 상대 여성의 배란신호에 대한 여성들의 심리적 지각을 관찰하였으며, 그 결과 여성들이 비배란기의 여성보다 배란기 여성에 대하여 더 높은 위협을 지각하는 것을 확인하였다. 본 연구는 여성 간의 협력 동기가 사회적 요인들에 따라 기능적으로 유연한 방식으로 작동한다는 기초적이지만 새로운 연구방향을 제안하였다.

주요어 : 배란기, 성 내 관계, 여성 사회성, 진화 심리학

학번 : 2016-20096

Appendices

[Appendice1] Main Study: Introduction

Welcome to our survey!

You will be participating in a research regarding the accuracy of first impressions.

The survey consists of two parts:
Part 1: Individual Information
Part 2: Accuracy of First Impression

The entire survey should take approximately 15 minutes.

Please answer openly and truthfully.
Thank you.

[Appendice2] Main Study: Individual Information

Part1. Individual Information

What is your gender?

Male

Female

What is your age?

What is your relationship status?

Single

In Casual Relationship

In Committed Relationship

Engaged

Married

[Appendice3] Main Study: Moderator and Covariates

	1	2	3	4	5	6	7
Members of the opposite sex that I like, tend to like me back.	○	○	○	○	○	○	○
Members of the opposite sex notice me.	○	○	○	○	○	○	○
I receive many compliments from members of the opposite sex.	○	○	○	○	○	○	○
Members of the opposite sex are not very attracted to me.	○	○	○	○	○	○	○
I receive sexual invitations from members of the opposite sex.	○	○	○	○	○	○	○
Members of the opposite sex are attracted to me.	○	○	○	○	○	○	○
I can have as many sexual partners as I choose.	○	○	○	○	○	○	○
I do not receive many compliments from members of the opposite sex.	○	○	○	○	○	○	○

Please indicate how strongly you agree or disagree with the following statements about your **partner**.

	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
Other women that my partner likes, tend to like him back.	○	○	○	○	○	○	○
Other women notice my partner.	○	○	○	○	○	○	○
My partner receives many compliments from other women.	○	○	○	○	○	○	○
Other women are not very attracted to my partner.	○	○	○	○	○	○	○
My partner receives sexual invitations from other women.	○	○	○	○	○	○	○
Other women are attracted to my partner.	○	○	○	○	○	○	○
My partner can have as many sexual partners as he chooses.	○	○	○	○	○	○	○
My partner does not receive many compliments from other women.	○	○	○	○	○	○	○

How do you think another woman, upon just meeting your partner, would rate him on:

	not at all						extremely
	1	2	3	4	5	6	7
Physical Attractiveness	○	○	○	○	○	○	○
Sexiness	○	○	○	○	○	○	○
Masculinity	○	○	○	○	○	○	○
Dominance	○	○	○	○	○	○	○

[Appendice4] Main Study: Manipulation and Scenarios

On the next page, two pages of a short story will be presented.
Imagine yourself as part of the story where you and your partner saw Sara.

Sara

Sara

Imagine you are at a small housewarming party of friends and acquaintances of a new friend of yours. While you're getting a drink and chatting with your new friend, you look across the room and your partner chatting with Sara and another woman. You can tell he's in the middle of a story, gesticulating wildly. You see them laugh at his story; Sara puts her hand on his arm and the other woman covers her face, laughing. He seems to be getting along with these new people well, but before you can walk over and introduce yourself, your new friend pulls you over to meet her cousin and get a glass of wine.

Sara

Later on, while you are sitting alone on a couch, Sara comes by and sits across the table. Without thinking, you say 'hi, enjoying the party?', and she starts talking.

"Oh, this party is great but it's really bad in my life at the moment. You see, I have been working late at work. I would walk home alone and… a stranger seems to be following me. After few minutes I leave the building, I hear those footsteps behind me… I cross the street, he crosses the street, I turn left, he turns left… he follows me wherever I go. I am too afraid to turn around so I just keep walking. What is he up to? Did I do something wrong? It's been several weeks so I called the police but they did not track him down yet. I'm so afraid to head home these days", she says.

You can tell that while speaking, Sara seems irritated and stressed at the thought.

[Appendice5] Main Study: Dependent Measures

Indicate the extent to which you feel each emotion about Sara.

	not at all						very much
	1	2	3	4	5	6	7
pleased	○	○	○	○	○	○	○
worried	○	○	○	○	○	○	○
heavy-hearted	○	○	○	○	○	○	○
low-spirited	○	○	○	○	○	○	○
sympathetic	○	○	○	○	○	○	○

What are your overall impressions of Sara?

	1	2	3	4	5	6	7	
I strongly dislike her	○	○	○	○	○	○	○	**I very much like her**

How strong is your willingness to consider Sara a close friend?

	1	2	3	4	5	6	7	
very unwilling	○	○	○	○	○	○	○	**very willing**

How much contact would you like to have with Sara?

	1	2	3	4	5	6	7	
I wouldn't want any kind of contact	○	○	○	○	○	○	○	**I could see her as a best friend**

Indicate the level of help (if any) you would offer Sara to aid the situation she is facing.
Choose one of the below options.

- Nothing
- Tell her to find someone to walk home with
- Help her find someone who might walk home with
- Offer her a ride for a couple of days on her way home
- Offer her a ride for a week on her way home
- Offer her a ride until the police handle the issue clear

[Appendice6]Supplementary Study: Manipulation and Scenario

On the next page, you will be shown with a short story.
Imagine yourself as part of the story where you saw Sara, a friend of your friend.

Sara

Sara

Imagine you are at a small housewarming party of friends and acquaintances of a new friend of yours. You are getting a drink and chatting with the party host and new friends.

Later on, while you are sitting alone on a couch, Sara comes by and sits across the table. Without thinking, you say 'hi, enjoying the party?', and she starts talking.

"Oh, this party is great but it's really bad in my life at the moment. You see, I have been working late at work. I would walk home alone and… a stranger seems to be following me. After few minutes I leave the building, I hear those footsteps behind me… I cross the street, he crosses the street, I turn left, he turns left… he follows me wherever I go. I am too afraid to turn around so I just keep walking. What is he up to? Did I do something wrong? It's been several weeks so I called the police but they did not track him down yet. I'm so afraid to head home these days", she says.

You can tell that while speaking, Sara seems irritated and stressed at the thought.

[Appendice7] Supplementary Study: Dependent Measures

What do you think about **Sara regarding the described situation**?

She seems...

	not at all						extremely
	1	2	3	4	5	6	7
Vulnerable	○	○	○	○	○	○	○
Fragile	○	○	○	○	○	○	○
Threatened	○	○	○	○	○	○	○
Endangered	○	○	○	○	○	○	○
Risky	○	○	○	○	○	○	○

How likely do you think each case would occur to Sara, based on the described situation?

Sara could be O O O *by the described stranger.*

	highly unlikely to occur						highly likely to occur
	1	2	3	4	5	6	7
sexually assaulted	○	○	○	○	○	○	○

Below are the additional resources that may be available while offering help to Sara.
Please indicate how each resource can be useful for you to help Sara more effectively.

	not at all useful						highly useful
	1	2	3	4	5	6	7
reliable man (e.g., your husband; boyfriend)	○	○	○	○	○	○	○