Romantic Love and Attentional Biases Toward Attractive Alternatives and Rivals: Long-Term Relationship Maintenance Among Female Chinese College Students

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Abstract
Studies about heterosexual individuals’ long-term relationship maintenance have indicated that committed individuals possess evolved psychological mechanisms that help protect their ongoing romantic relationships against threats from attractive others during early stage attentional processing when mating-related motivation is activated. In this study, two experiments tested the relationship maintenance mechanism among committed female college students in the Chinese cultural context under different love priming conditions. Committed Chinese women displayed inattention to attractive alternatives in positive love-scenario priming (Study 1: 114 female undergraduates, age range = 18–26 years), subliminal semantic love priming (Study 2: 110 female undergraduates, age range = 18–25 years), and baseline conditions (Studies 1 and 2). Those with high levels of chronic jealousy showed significantly increased attention to and difficulty disengaging attention from attractive rivals when subliminally primed with love. This provides further evidence, from an Eastern cultural context, for the existence of attentional biases toward attractive alternatives and rivals in early stage attentional processes for relationship maintenance. This research also illustrates the important role of romantic love in maintaining long-term romantic relationships.

Keywords
emotion, attentional bias, relationship maintenance, motivation, evolutionary psychology

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Introduction
Individuals in romantic relationships face daily temptations from attractive alternatives (Neal & Lemay, 2017). Studies on heterosexual individuals’ long-term relationship maintenance found that being interested in desirable opposite-sex persons could lead to infidelity and even relationship dissolution (McNulty et al., 2018; Miller, 1997), which could cause negative psychological and health outcomes (e.g., Hall & Finc- ham, 2009; Wardlow, 2007).

However, a strong, stable long-term romantic relationship can promote mated individuals’ mental (Baumeister & Leary, 1995) and physical health (Robles et al., 2014). From an evolutionary perspective, long-term romantic relationships can produce higher reproductive fitness, such as survival across cultures, for both adults and offspring (Fletcher et al., 2015). Importantly, for women, long-term mating can intensify their social bonds. This can satisfy their affiliative needs, allow them to gain protection (Miller & Maner, 2008) and valuable resources from their partners, and enhance reproductive advantages for children through acquired social and economic benefits (Buss & Schmitt, 1993). Thus, previous studies have found that individuals in love who were committed to their relationship may have adapted psychological mechanisms that help them maintain a long-term romantic relationship by

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avoiding relationship threats from attractive others (e.g., Maner et al., 2008; Simpson et al., 1990).

To avoid temptation from attractive alternatives, committed individuals tend to devalue the attractiveness of alternatives (e.g., Cole et al., 2016; Ritter et al., 2010; Simpson et al., 1990), recall more about their negative behaviors (Visserman & Karremans, 2014), avoid engaging in positive interactions with them (Farley, 2014; Karremans & Verwijmeren, 2008), and are inattentive to them when relationship motivation is activated in the early stage of attentional processing (e.g., Linardatos & Lydon, 2011; Ma et al., 2015, 2019; Maner, Gailliot, & Miller, 2009; Q. Zhang et al., 2017).

Attractive alternatives also serve as one’s partner’s intrasexual rivals. To avoid threats from attractive rivals, committed individuals preferentially attend to, remember, and negatively evaluate attractive same-sex persons when primed with concerns about partner infidelity (Maner, Miller, et al., 2009). Especially, committed women are inclined to use indirect aggression to attractive rivals (e.g., derogation, which can influence men’s evaluations of other attractive women; M. Fisher & Cox, 2009, 2011; Vaillancourt, 2013). During the early stage of attentional processing, they are particularly vigilant and pay more attention to attractive same-sex members when their relationships are not going well (Maner et al., 2003) or when they feel insecure about their relationship, which can trigger mate-guarding motivation (Ma et al., 2015; Maner, Gailliot, & DeWall, 2007).

However, few studies from Eastern cultures have examined the early stage attention biases toward attractive others associated with relationship maintenance or what situations could activate relationship motivation to trigger such relationship maintenance mechanisms. Early stage attentional bias associated with relationship maintenance is of great importance for shaping individuals’ adaptive social cognition and actions (Maner, Gailliot, & DeWall, 2007). Thus, the current study addresses this issue by examining the role of romantic love in attentional biases associated with long-term relationship maintenance among committed Chinese women.

**Romantic Love and Inattention to Attractive Alternatives**

From an evolutionary perspective, romantic love may act as a “commitment device” that evolved to assist in the formation and maintenance of long-term bonds, motivating individuals to remain committed to an ongoing romantic relationship and helping them to avoid the temptation toward desirable opposite-sex members (Gonzaga & Haselton, 2008). Romantic love, as a universal emotion experienced by almost all people, has a common dimension—commitment (e.g., Aron & Westbay, 1996; Hatfield & Rapson, 1993; Sternberg, 1986), which is the feeling of emotional union and sharing a lifetime together. Neuroscientists have also found that the male–female attachment system in the brain evolved to motivate mated individuals to sustain an affiliative connection long enough to complete parental duties (H. E. Fisher, 1998; H. E. Fisher et al., 2002). Indeed, romantic love helps committed individuals to relinquish potential alternatives and resist temptation for relationship maintenance (e.g., Gonzaga et al., 2008; Lundström & Jones-Gotman, 2009).

Especially, in the early stage of attentional processing, Maner et al. (2008) asked participants to recall a positive love experience with their current partner to elicit positive feelings of romantic love (which is, for the purposes of our study, called “positive love-scenario priming”) and then to complete an adapted dot-probe task. They found that committed individuals greatly reduced their attention toward attractive alternatives in the love priming versus control priming condition; in the latter, participants were asked to write an essay about any happy time. Evidence from Eastern cultures showed that committed women and men did not significantly decrease their attention to attractive alternatives when primed with love (using rapid presentation of words associated with love); rather, they were inattentive to attractive alternatives in both the baseline (control priming condition; rapid presentation of positive affective words) and love priming conditions (Ma et al., 2015, 2019). Whether different love prime procedures lead to distinct early stage attentional bias toward attractive alternatives was explored in this study.

**Mate-Guarding and Attentiveness to Attractive Rivals**

Evolutionary theories suggest that both men and women prefer physically attractive partners: Women prefer attractive men for their good genes (e.g., Gangestad & Simpson, 2000), while men prefer attractive women because their attractiveness signals fertility (e.g., Buss & Schmitt, 1993; Pflüger et al., 2012). Thus, attractive rivals serve as threats to their same-sex individuals’ ongoing relationships (Dijkstra & Buunk, 2001; Maner, Miller, et al., 2009). Especially, physically attractive women pose a strong threat for mated women (Fink et al., 2014). This is partly because, on the one hand, men place a premium on women’s physical attractiveness; on the other hand, men are more likely to succumb to mate-poaching than are women (Schmitt & 121 members of the International Sexuality Description Project, 2004), and attractive (vs. unattractive) women are more successful at luring mated men (Schmitt & Buss, 2001; Sunderani et al., 2013). Thus, women may have evolved with an awareness of potential attractive rivals and strategies to repel such competitors through mate-guarding (Schmitt & Buss, 2001). Identification of potential rivals could facilitate the use of mate-guarding tactics (Maner, Gailliot, & DeWall, 2007). Indeed, previous studies found that women pay more attention to attractive rivals when mate-guarding was activated (W. Li et al., 2015; Y. Zhang et al., 2019).

Even at the early stages of attentional processing, women also show vigilance to attractive same-sex rivals. For example, committed women who felt insecure about their ongoing romantic relationships were attentive toward attractive rivals for mate-guarding (Maner, Gailliot, & DeWall, 2007). Specifically, when mental representations of romantic love were activated (using rapid presentation of words associated with love), committed Chinese women showed greatly increased attention...
and difficulty disengaging from attractive same-sex members (Ma et al., 2015). However, this love priming effect on attention to attractive rivals was not found in Maner et al.’s (2008) study, which employed positive love-scenario priming. This discrepancy may be due to different prime procedures or different conceptions of romantic love between Western and Eastern individuals. Western individuals are inclined to equate love with happiness, whereas Chinese women tend to consider the negative aspects of romantic relationships and associate love with jealousy and betrayal (Jackson et al., 2006; Zang, 2013), which could easily trigger one’s mate-guarding motivations when mental representations of love are activated. Thus, we explored whether committed Chinese women would show different early stage attentional bias toward attractive rivals under different love priming conditions in this study.

This Study

Based on the literature reviewed above, to explore the role of romantic love in long-term relationship maintenance in the Chinese cultural context, we conducted two studies to investigate committed women’s attentional biases toward attractive others during early stage attentional processing. This was done via “love priming” that employed love-related cues to experimentally elicit participants’ feelings of romantic love or activate participants’ mental representations of romantic love.

Study 1

As mentioned in the Introduction, Maner et al. (2008), using the positive love-scenario priming and adapted dot-probe task, found that committed individuals showed significantly decreased attention to attractive alternatives when love was primed. However, Ma et al. (2015) used a distinct method of love priming: presenting a word associated with love to committed women for 500 ms before a target appeared in each trial and a modified dot-probe task. They found that committed women did not significantly decrease their attention toward attractive opposite-sex targets after love priming; rather, they were already relatively inattentive to attractive alternatives at baseline. In addition, they found that committed Chinese women increased their attention to attractive same-sex targets in the love priming condition. Thus, in Study 1, we used the same experimental procedure as Maner et al. (2008) to explore whether different love priming methods lead to distinct attentional biases associated with relationship maintenance toward attractive others, between Eastern and Western individuals and to examine the role of positive feelings of romantic love in long-term relationship maintenance among Chinese women.

Combining the finding that attractive men do not pose a strong threat to committed women (Plant et al., 2010) and the finding from Ma et al. (2015)—that committed Chinese women are already relatively inattentive to attractive alternatives at baseline—we tested the following hypothesis:

**Hypothesis 1:** Committed Chinese women will not significantly decrease their attention toward attractive alternatives in the love priming (vs. control priming) condition.

On the other hand, jealousy, which is inextricably linked to mate-guarding, is associated with early stage attentional bias toward potential rivals. Previous studies found that individuals with high (vs. low) levels of chronic jealousy attended to attractive same-sex members when primed with concerns about partner infidelity (Maner, Miller, et al., 2009) or jealousy (Maner, Gailliot, Rouby, & Miller, 2007). Thus, the variable “jealousy” was taken into account. Because positive love-scenario priming is less likely to elicit negative emotions, we proposed the following hypothesis:

**Hypothesis 2:** Committed women will not increase their attention to attractive same-sex targets in the love priming condition, regardless of their levels of chronic jealousy.

Method

Participants

One-hundred fourteen heterosexual female undergraduates (age range = 18–26 years) who were currently in an exclusive romantic relationship (mean relationship length = 21.26 ± 15.92 months; range = 4–84 months) were recruited by an Internet advertisement and each paid RMB 20 (about US$2.88) after the study.

All participants completed the Passionate Love Scale (Hatfield & Sprecher, 1986; α = .87 in this study) and the Commitment subscale of the Companionate Love Scale (Hatfield & Rapson, 1996; α = .74 in this study). Per the scores of the Commitment subscale (1 = not at all true to 9 = definitively true), which was used to measure individuals’ relationship commitment (e.g., “I am committed to maintaining my relationship with my boyfriend”), participants were deemed either moderately or highly committed to their current partner (M = 6.94, SD = 1.19). Participants were also asked to complete the 8-item Emotional Jealousy subscale of the Multidimensional Jealousy Scale (Pfeiffer & Wong, 1989; α = .77 in this study), which was used to assess the extent to which they would be upset, ranging from 1 (very pleased) to 7 (very upset; e.g., “your boyfriend comments to you on how great looking a particular member of the opposite sex is”). Per Linardatos and Lydon (2011), Emotional Jealousy subscale scores were split at the median to create high and low jealousy groups. The jealousy scores, passionate love scores, and commitment scores of the high jealousy group were significantly higher than those of the low jealousy group, t(89) = 13.86, p < .001; t(112) = 3.34, p = .001; and t(112) = 3.126, p = .002, respectively. There were no significant differences in age or relationship length between the two groups. Ethical approval for Studies 1 and 2 was obtained from the local research ethics committee, and written informed consent was obtained from all participants.
Materials
All the facial photographs used in this study were validated by Ma et al. (2015). Facial photos of 67 men and 58 women of unfamiliar college-age Chinese people (i.e., no famous faces or faces of students from the same campus), who posed with a neutral expression, were obtained online by searching using the keyword “images” (证件照 in Chinese) or photographed by the experimenters. Faces were edited to grayscale photographs and equated for size, brightness, and contrast using Adobe Photoshop CS5. All images were rated on their levels of attractiveness (1 = very unattractive to 7 = very attractive) by 30 undergraduate judges (12 men and 18 women; mean age = 20.73 years, SD = 1.55; Ma et al., 2015). The average ratings of four facial types were as follows: 16 attractive women (M = 5.54, SD = 0.85), 16 attractive men (M = 5.49, SD = 0.87), 16 average-looking women (M = 3.24, SD = 0.61), and 16 average-looking men (M = 3.21, SD = 0.59). The ratings of attractive faces were significantly higher than those of average-looking faces, t\text{women}(30) = 25.44, p < .001, t\text{men}(20) = 24.88, p < .001.

Procedure
Participants completed the Emotional Jealousy subscale, which was used to assess individuals’ chronic jealousy online 1 day prior to visiting the laboratory. Participants with high and low levels of jealousy were randomly assigned to either the love priming condition or the control priming condition. To control the influence of participants’ expectations on the experimental results, all participants were informed that the experiment investigated cognitive performance ability via the online recruitment advertisement. When arriving at the laboratory, participants performed the same positive love-scenario priming manipulation as in Maner et al. (2008). Those who were assigned to the love priming condition wrote a brief essay about a happy time in which they experienced strong feelings of love for their current partner, and those who were in the control condition wrote about an extremely happy time with their best same-sex friends. The control condition was designed to match the priming condition on level of positive affect and arousal (Maner et al., 2008).

Then, working individually in private laboratory rooms, participants performed the attention task, which was programmed with E-Prime 2.0 on a desktop computer (19 in.) with a refresh rate of 60 Hz and a resolution ratio of 1024 × 768. The attention task included three experimental blocks, and participants were given 5 min to write an essay before each block began. The attention task was adopted from Maner et al. (2008) to assess the extent that individuals attended to each target stimuli. Each trial started with a black fixation point “+” (0.4° × 0.4° visual angle) that appeared in the center of the computer screen for 1 s, followed by a facial photo (4.2° × 3.6°) displayed in one quadrant of the screen for 500 ms. Immediately after the photo disappeared, a probe target (circle or square, 0.4° × 0.4°) was presented in either the same location as the picture (filler trials) or in a different quadrant (attentional shift trials, which were the trials of interest, reflecting how efficiently individuals shifted their attention away from the facial target). Participants had to indicate the type of probe by pressing the “A” or “K” key on the keyboard as quickly as possible. The probe was displayed until a response was made, up to a maximum of 4 s.

Participants were required to complete at least one block of 16 practice trials until the correct rate reached 90% or more to ensure familiarity with the experimental process. Then, they completed three blocks of 64 experimental trials. All the practice trial stimuli were neutral pictures (e.g., household furniture). Each experimental block consisted of all facial photos presented in random order; four photos of each target type were randomly used in filler trials, and twelve photos of each target type were in attentional shift trials. The types and locations of probes were counterbalanced across each block.

All participants were randomly assigned to complete a Mood Questionnaire (Fürstner et al., 2010; α = .78 in this study), following one of three priming manipulations to assess their current mood by asking how “loving,” “aroused,” “happy,” “worried,” “disappointed,” “nervous,” and “threatened” they felt on a scale anchored by 1 (not at all) and 7 (extremely). After completing the whole attention task, participants completed another questionnaire that included demographic information (e.g., age, relationship length), and the Passionate Love Scale and Commitment subscale. All participants were carefully probed for suspicion; however, none recognized the true purpose of the experiment.

Data Preparation and Analyses
Trials with reaction times (RTs) of less than 200 ms (unreasonably fast response i.e., usually due to response before the prompt), more than three standard deviations above the sample mean (extremely long response), and those with errors (i.e., 1.56% of trials) were excluded from analyses (Q. Zhang et al., 2017).

To test Hypothesis 1, data analyses were conducted consistently with Maner et al. (2008)—based on the separate mean RTs of attentional shift trials in which participants responded to different target types—to exclude the influence of analytical methods on the results. A planned contrast was conducted to compare attractive opposite-sex targets to all other targets. A 2 (priming condition: love priming vs. control priming; between-subjects) × 2 (target type: attractive man vs. other target types; within-subjects) repeated-measures analysis of variance (ANOVA) was performed. Then, to control for overall RT differences, we created a difference score by subtracting RTs for average-looking targets (mean RTs of average-looking men = 1.56% of trials) were excluded from analyses (Q. Zhang et al., 2017).

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To test Hypothesis 2, an independent-samples \( t \) test was first conducted to compare difference scores concerning attention to attractive women in the love priming condition to those in the control priming condition. Furthermore, we submitted the difference scores concerning attractive women to a 2 (priming condition: love priming vs. control priming; between-subjects) × 2 (jealousy group: high jealousy vs. low jealousy; between-subjects) ANOVA.

Finally, we added several control variables including age, logged relationship length (log transformed the relationship length for normalization), passionate love score, and commitment score, to examine whether those variables affected the results.

**Results**

**Primming Manipulation Checks**

We conducted an independent-samples \( t \) test to test the effectiveness of the priming manipulation for each single emotion. We only found effects for “loving” and “aroused.” Specifically, participants felt more loving after love priming \( (M = 5.79, SD = 1.00) \) than after control priming, \( M = 4.65, SD = 1.11; t(112) = 5.78, p < .001 \). The aroused scores reported by participants in the love priming condition \( (M = 4.37, SD = 1.06) \) were marginally significantly higher than those in the control priming condition, \( M = 3.98, SD = 1.16; t(112) = 1.86, p = .066 \).

**Attentional Bias**

See Table 1 for descriptive statistics. A 2 (priming condition) × 2 (target type) repeated-measures ANOVA based on raw mean RTs showed that there were no significant main nor interaction effects (all \( ps > .273 \); Figure 1). To explore whether several covariates would affect the results, we conducted a 2 (priming condition) × 2 (target type) repeated-measures ANOVA including age, logged relationship length, passionate love score, and committed score as covariates, and there were still no significant main nor interaction effects (all \( ps > .166 \)). The results indicated that committed women did not significantly decrease their attention toward attractive alternatives under the love priming (vs. control priming) condition.

To test Hypothesis 1 further, an independent-samples \( t \) test based on the difference score of attention to attractive men in the control and love priming conditions revealed that committed women did not decrease their attention toward attractive alternatives when primed with romantic love, \( t(112) = 0.173, p = .863 \). In addition, we compared the difference scores of attention to attractive men in the love and control priming condition to zero using an independent-samples \( t \) test. The results showed that there were no differences between the attention biases of committed women toward attractive opposite-sex targets and those toward average-looking targets in the love, \( t(56) = 0.345, p = .731 \) or control priming conditions, \( t(56) = 0.059, p = .953 \).

Furthermore, a 2 (priming condition) × 2 (jealousy group) ANOVA showed that there were no significant main or interaction effects (all \( ps > .277 \)). We also did not find significant main or interaction effects from a 2 (priming condition) × 2 (jealousy group) ANOVA that included age, logged relationship length, passionate love score, and committed score as covariates (all \( ps > .393 \)). These results support Hypothesis 2 that committed women did not increase their attention to attractive same-sex targets in the love priming condition that elicited

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**Table 1. Raw Mean RTs (ms), Difference Scores by Priming Condition.**

| Variable                        | Control Priming (n = 57) | Love Priming (n = 57) |
|---------------------------------|--------------------------|-----------------------|
| Attractive opposite-sex targets | 536 (60)                 | 531 (54)              |
| Attractive same-sex targets     | 537 (60)                 | 533 (56)              |
| Average-looking opposite-sex targets | 536 (58)             | 532 (57)              |
| Average-looking same-sex targets | 537 (64)              | 531 (52)              |
| Average-looking targets        | 537 (60)                 | 532 (53)              |
| Difference scores of opposite-sex targets | 0 (18)              | –1 (14)               |
| Difference scores of same-sex targets | 0 (17)              | 3 (18)                |

*Note. Standard deviations are shown in parentheses. RTs = reaction times.*
Evolutionary Psychology

Discussion

We used the same experimental procedure as Maner et al. (2008) to explore whether elicited positive feelings of romantic love would affect attentional biases of committed Chinese women to attractive others. We did not observe that committed Chinese women significantly decreased their attention toward attractive opposite-sex targets under the love priming condition. However, Maner et al. (2008) found that committed Western individuals significantly decreased their attention to attractive opposite-sex targets under positive love-scenario priming condition to resist the temptation from attractive opposite-sex members.

We further tested the priming effect for relationship maintenance based on the difference score, which used the mean RTs of average-looking targets as a baseline to minimize the influence of individual differences in overall RTs. The same result that committed Chinese women did not decrease attention toward attractive alternatives under love priming was found. The results also showed that attractive opposite-sex targets did not attract committed women’s attention during early stage attentional processing like average-looking targets.

In sum, under the positive love-scenario priming condition, committed Chinese women did not greatly decrease their attention toward attractive alternatives. This may be because the attractive opposite-sex members did not attract committed women, they did not need to drastically reduce attention to attractive alternatives to resist temptation when relationship motives were activated.

On the other hand, we found that committed women did not increase their attention toward attractive same-sex targets in the love priming condition, which could arouse positive feelings of romantic love. The results of Study 1 and Ma et al. (2015) indicated that different methods of love priming might have distinct effects on committed women’s attentional bias toward attractive same-sex targets. The rapidly presented words associated with love may activate negative love representation of some committed women, which could trigger mate-guarding motives and lead them to attend to attractive same-sex rivals (Ma et al., 2015). However, recalling positive love experiences and feelings of romantic love might not activate committed women’s motivations for intrasexual competition; therefore, they did not attend vigilantly to attractive women in the early stage of attentional processing.

Thus, we continued to explore committed women’s attentional bias toward intrasexual rivals when mental representations of love were activated in Study 2. In addition, using average-looking targets as a baseline was flawed because average-looking faces can attract an individual’s attention (e.g., those who perceive their own attractiveness as having a low mating “market value”; Morgan & Kisley, 2014). Thus, in Study 2, we added neutral pictures that were widely used as the baseline in previous studies of attention bias to control for the overall group differences in RTs (e.g., Koster et al., 2006).

Study 2

In Study 2, we further explored the attentional biases associated with relationship maintenance among committed Chinese women under subliminal semantic love priming. A functional magnetic resonance imaging (fMRI) study showed that the subliminal presentation of a beloved’s name can activate unconscious mental representation of love and activate some distinct brain areas compared with the explicit presentation of love-related stimuli (Ortigue et al., 2007). We therefore used “subliminal semantic love priming” that subliminally presented words associated with romantic love (in this study, the participants’ boyfriends’ names) to activate their mental representation of romantic love (see Procedure section). In addition, according to Ortigue et al. (2007), individuals’ passionate hobbies (vs. a friend’s name) activated more similar brain regions within the motivation and emotion systems to the names of lovers. Thus, we chose each participant’s hobby as the control priming word to control for level of arousal and positive affect (see the Method section for screening methods). In Study 2, we used a modified cueing task adding neutral stimuli (Koster et al., 2006) and the subliminal semantic love (or control) priming procedure (Ortigue et al., 2007) to explore committed women’s attentional bias toward attractive targets.

According to the results of Study 1 and Ma et al. (2015)—that committed Chinese women did not decrease their attention toward attractive alternatives when love was primed because they were not attracted to attractive opposite-sex members at baseline—we tested the following hypothesis:

Hypothesis 3: Committed women will be inattentive to attractive alternatives regardless of the love or control priming condition.

On the other hand, based on the findings of Ma et al. (2015)—that committed Chinese women increased their attention to and showed difficulty disengaging from attractive same-sex targets when primed with love, which could activate mental representations of romantic love—and the findings from Maner, Miller, et al. (2009)—that participants high in chronic jealousy increased their attention to attractive same-sex targets when concerns about partner infidelity were primed—we proposed the following hypotheses:

Hypothesis 4: Committed women with high levels of chronic jealousy will only significantly increase their attention toward attractive women in the love priming (vs. control priming) condition.

Hypothesis 5: Compared to committed women low in jealousy, committed women with high levels of jealousy will pay more attention to attractive women and show difficulty disengaging from them.
Method

Participants

One-hundred ten heterosexual female undergraduates (age range = 18–25 years; did not participate in Study 1) who were currently in an exclusive romantic relationship (mean relationship length = 23.50 ± 16.51 months; range = 3–75 months) were recruited by an Internet advertisement and each paid RMB 20 after the experiment.

All participants completed the same Passionate Love Scale (α = .91), Commitment subscale (α = .80), and Emotional Jealousy subscale (α = .82) as in Study 1. On average, participants were moderately or highly committed to their current partner (M = 7.01, SD = 1.28). The jealousy, passionate love, and commitment scores of the high jealousy group were significantly higher than those of the low jealousy group, t(94) = 13.21, p < .001; t(108) = 3.97, p < .001; and t(106) = 2.17, p = .032, respectively. There were no significant differences in age or relationship length between the two groups.

Materials

Stimulus materials. All the facial photographs were the same as those used in Study 1. In addition, 32 neutral pictures of household furniture (e.g., table, chair) were selected from those used by Ma et al. (2015), which were edited to match the facial photographs in size, brightness, contrast, and color. Sixteen were used in the experimental trials and the rest were used in the practice trials.

Priming words. The love priming word was the name of each participant’s boyfriend. The control priming word was the name of each participant’s passionate hobby. According to the selection criterion of Ortigue et al. (2007), only participants who reported thinking about their passion at least 60% of the day were included, and the word count of the hobby was two or three to match the word count of the name. The priming word was rendered with a gray background (RGB = all 128) and black font. The mask was #b9b9b9, which was rendered with a gray background (RGB = all 128) and black font.

Procedure

Participants completed a questionnaire including their boyfriends’ names, the names of their passionate hobbies, and the Emotional Jealousy subscale online 1 day prior to visiting the laboratory. Participants with high and low levels of jealousy were randomly assigned to either the love priming condition or the control priming condition. All participants were informed that the experiment investigated cognitive performance ability. When they arrived at the laboratory, the experimenter verified participants’ completed information by writing down their boyfriends’ names (or hobbies) and created the priming material (e.g., boyfriend or hobby names).

Then, working individually in private laboratory rooms, participants sat 80 cm from a desktop computer (19 in.) with a refresh rate of 60 Hz and a resolution ratio of 1024 × 768. Per the subliminal semantic love priming procedure of Ortigue et al. (2007) and a modified cueing task (Koster et al., 2006), the procedure for each trial was as follows: First, a gray screen was displayed for 500 ms (RGB = all 128). Next, a love (or control) priming word (2.1° × 1.1° visual angle) was displayed on the center of the computer screen for 26 ms, followed by a mask (3.7° × 2.1°) for 160 ms. Immediately after the mask disappeared, a black fixation point “+” (0.4° × 0.4°) appeared in the middle of the screen for 1 s, flanked by two black rectangles (4.3° × 3.7°). Then, a target stimulus (facial or neutral picture, 4.2° × 3.6°) was presented for 500 ms, filling one of the two rectangles, followed by the fixation with two blank rectangles displayed on the computer screen for 14 ms. Immediately, a probe target (circle or square, 0.4° × 0.4°) was presented at the same location (valid cue) or other side (invalid cue) as the picture. Participants had to indicate the type of probe by pressing the 1 or 2 key on the keyboard as quickly as possible. The probe was displayed until a response was made, up to a maximum of 4 s.

Participants completed 16 practice trials and four blocks of 80 experimental trials. Each block comprised eight valid cues and eight invalid cues of each stimulus type (attractive man, attractive woman, average-looking man, average-looking woman, and neutral picture). Each picture was presented only once in each block and presented in random order. The location of the pictures for each stimulus type, and the probe type and locations were counterbalanced across each block.

After completing the task, participants completed a questionnaire that included demographic information (e.g., age, relationship length, whether they were in a long-distance relationship, and whether they lived with their current boyfriend), the Passionate Love Scale, and the Commitment subscale. All participants were carefully probed for suspicion, and none recognized the true purpose of the experiment nor saw the priming words.

Data Preparation and Analyses

Trials with RTs of less than 200 ms and more than three standard deviations above the sample mean, and those with errors (i.e., 0.98% of trials) were excluded from the analyses.

First, we conducted a 2 (validity: valid cue vs. invalid cue) × 5 (target type: attractive man vs. attractive woman vs. average-looking man vs. average-looking woman vs. neutral target) within-subjects repeated-measures ANOVA on raw mean RTs to test inhibition of return effects. Then, all data analyses were based on the disengaging indices of RTs (Ma et al., 2015), which can be used to control for overall group differences in RTs (Ellenbogen & Schwartzman, 2009). The disengagement indices (RTinvalid/facial cue − RTinvalid/neutral cue) were calculated. A positive score on the disengagement index that is significantly different from zero is indicative of difficulty with disengagement from facial pictures compared with neutral pictures. A negative score significantly different from zero suggests faster attending away from facial pictures as compared to
neutral pictures. A score of zero implies no differences in attentional disengagement for facial versus neutral pictures. Raw mean RTs and disengagement indices by target type, priming condition, and jealousy group are presented in Table 2.

Based on the disengagement index, a 2 (priming condition: love priming vs. control priming; between-subjects) × 4 (target type: attractive man vs. attractive woman vs. average-looking man vs. average-looking woman; within subjects) repeated-measures ANOVA was performed to test Hypothesis 3, and a 2 (priming condition: love priming vs. control priming; between-subjects) × 2 (jealousy group: high level of jealousy vs. low level of jealousy; between-subjects) × 4 (target type: attractive man vs. attractive woman vs. average-looking man vs. average-looking woman; within subjects) repeated-measures ANOVA was conducted to test Hypotheses 4 and 5.

In a second set of analyses, we added several control variables including age, long-distance, cohabitation, logged relationship length, passionate love score, and commitment score to examine whether the effects of interest were robust.

### Results

#### Inhibition of Return Effects

A 2 (validity) × 5 (target type) within-subjects repeated-measures ANOVA revealed that the main effect of Validity and Validity × Target Type interaction were not significant, $F(1, 109) = 1.840, p = .178$; $F(4, 436) = 1.821, p = .124$, respectively. No inhibition of return effects was observed.

#### Disengagement Index

To examine Hypothesis 3, we conducted a 2 (priming condition) × 4 (target type) mixed-model repeated-measures ANOVA based on the disengagement index. There was a main effect of target type, $F(3, 324) = 2.889, p = .036$, with longer RTs on attractive same-sex targets than on other target types. No other main effect nor interaction effects were observed (all $p s > .289$). The results suggested that committed women did not alter their attention toward attractive alternatives in the love priming condition compared with those in the control priming condition. Furthermore, an independent-samples $t$ test was performed to compare disengagement index on attractive men in the love and control priming condition with zero, and no significant differences were found. $t_{\text{love priming}} (55) = 1.165, p = .249$; $t_{\text{control priming}} (53) = 0.808, p = .423$. These results indicated that, consistent with Hypothesis 3, committed women displayed inattention to attractive alternatives regardless of condition (Figure 2).

To examine Hypotheses 4 and 5, a 2 (priming condition) × 2 (jealousy group) × 4 (target type) mixed-model repeated-measures ANOVA revealed that there were significant interaction effects for the Priming Condition × Target Type × Jealousy Group, $F(3, 318) = 5.237, p = .002$, partial $\eta^2 = .047$, along with the main effect of target type, $F(3, 318) = 3.013, p = .030$, partial $\eta^2 = .028$. No other significant effects were observed (all $p s > .269$). Further simple effects analyses showed that committed women in the high jealousy group significantly increased their attention toward attractive women in the love priming condition, $F(1, 106) = 10.453, p = .002$, partial $\eta^2 = .08$.
.090; however, no significant priming effect was observed among committed women in the low jealousy group, $F(1, 106) = 1.085, p = .300$, partial $\eta^2 = .010$. Moreover, committed women in the high jealousy group paid more attention toward attractive women than did those in the low jealousy group in the love priming condition, $F(1, 106) = 10.995, p = .001$, partial $\eta^2 = .094$, but not in the control priming condition, $F(1, 106) = 0.961, p = .329$, partial $\eta^2 = .009$ (Figure 3). In addition, committed women with high levels of jealousy in the love priming condition were more attentive to attractive women than any other target type, $F(3, 104) = 9.044, p < .001$, partial $\eta^2 = .207$, while no significant such effect of priming was observed among committed women low in jealousy, $F(3, 104) = 0.153, p = .928$, partial $\eta^2 = .004$ (Figure 4). There were no other significant results (all $p$s > .132).

Then, the six covariates—age, long-distance relationship, cohabitation, logged relationship length, passionate love score, and commitment score—were included in the analysis above. The three-way interaction remained significant, $F(3, 300) = 4.986, p = .002$, partial $\eta^2 = .047$. No other significant main effects and interaction effects were found (all $p$s > .186).

Furthermore, to test Hypothesis 5, we conducted an independent-samples $t$ test to compare disengagement indices with zero. The results confirmed that, in the love priming condition, the disengagement indices on attractive same-sex targets were significantly greater than zero among committed women in the high jealousy group, $t(27) = 3.272, p = .003$, indicating that committed women with high chronic jealousy had difficulty disengaging their attention from attractive women when love was subliminally primed. There were no significant differences between zero and other disengagement indices (all $p$s > .100), thus supporting Hypotheses 4 and 5.

**Discussion**

Consistent with the findings of Study 1 and Ma et al. (2015), committed Chinese women did not significantly decrease their attention toward attractive alternatives when subliminally primed with love in Study 2. In addition, we used neutral pictures as the baseline and found that committed women showed no attentional bias toward attractive opposite-sex targets, regardless of the condition. This indicates that committed Chinese women display inattention to attractive alternatives in both the control condition and in the love priming condition.

On the other hand, committed women with high levels of chronic jealousy significantly increased their attention to and experienced difficulties with disengagement from attractive same-sex targets when subliminally primed with love. Subliminal priming of love can activate participants’ mental representation associated with love and occurs at an associative level (Cacioppo et al., 2012). Thus, it could activate negative mental representations associated with the love of committed Chinese women, such as partner infidelity and betrayal, which could activate mate-guarding motivation, leading individuals with high levels of chronic jealousy to be attentive to attractive same-sex targets (Maner, Miller, et al., 2009).

**General Discussion**

The temptation of attractive alternatives is a key threat to the stability of individuals’ long-term romantic relationships. Some previous studies found that heterosexual individuals may have evolved adaptive psychological mechanisms to help them maintain long-term relationships when faced with desirable opposite-sex alternatives, such as inattention (decrease attention) to attractive alternatives when relationship motivation was activated (e.g., Maner et al., 2008; Maner, Gailliot, et al., 2009). Considering the context of Chinese culture, we noted
that when using romantic love to activate relationship motivation, committed Chinese women did not significantly decrease their attention toward attractive alternatives in the different love priming conditions such as recalling positive feelings of romantic love in Study 1, subliminal presentation of boyfriends’ names in Study 2, and presenting words associated with love to committed women for 500 ms before targets appeared in Ma et al. (2015).

According to our findings, one possibility is that committed Chinese women were already inattentive to attractive alternatives at baseline; therefore, they did not have to reduce their attention to resist temptation when love was primed. Influenced by traditional Confucian ethics, male-superior gender norms are still prominent in China (Higgins et al., 2002). Women’s chastity and loyalty to their husbands are still valued (Higgins & Sun, 2007), and women’s infidelity is hardly tolerated (Higgins et al., 2002; Zheng et al., 2011). Accordingly, although one of the dual-mating strategies suggest that women employ in long-term relationships is seeking highly attractive mates for extrapair relationships to obtain good genes (Buss & Shackelford, 2008; Pillsworth & Haselton, 2006b), committed Chinese women were still inattentive to attractive alternatives at baseline. This is consistent with the possibility that committed individuals regulate their attention in a way that helps them avoid the temptation of attractive alternatives to their ongoing romantic relationship and be faithful to their partners.

According to Plant et al. (2010), another possibility is that the attractive opposite-sex faces rapidly presented in this study were not perceived as strong threats to women’s ongoing romantic relationships; therefore, they did not show strong avoidance motivation and significantly decreased attention toward those alternatives when relationship motivation was activated. This might also explain why committed women in Western cultures slightly reduce their attention (reduction in attention of 40 ms vs. committed men’s reduction in attention of 134 ms) toward attractive alternatives when romantic love was primed. Future research should further explore the similarities and differences of attentional biases toward attractive alternatives among committed women based on different cultures.

The current findings also showed that committed Chinese women displayed inattention to attractive alternatives in the love priming condition, which could activate committed individuals’ relationship motivation. A prior study showed that single Chinese women increased their attention toward attractive alternatives when love was primed, which could activate their mate-seeking motivation (Ma et al., 2015). This might support the idea that romantic love promotes long-term commitment and helps committed women reduce their interest in attractive alternatives to solidify the bond with their current partner (Gonzaga et al., 2006, 2008).

For intrasexual rivals, committed Chinese women did not increase attention toward attractive women when positive romantic love situations were recalled, regardless of their levels of chronic jealousy. However, committed Chinese women high in chronic jealousy increased their attention to and showed difficulty disengaging from attractive women when the mental representations of romantic love were activated. A previous study showed a similar result that activated mental representations of love promoted committed Chinese women to attend to attractive same-sex members (albeit, jealousy was not examined; Ma et al., 2015).

Chinese individuals’ conceptual representation of romantic love is typically associated with sadness, pain, jealousy, and betrayal (vs. Western individuals who often equate love with happiness; Jackson et al., 2006; Z. X. Li et al., 2009), especially in Chinese women (Zang, 2013). An existing fMRI study found that romantic love can lead to changes in Chinese participants’ orbitofrontal system (a result not found in Western samples), which indicates that Chinese individuals in love may consider the negative aspects of love more readily (X. Xu et al., 2011). Thus, the love priming procedure, which was used to activate individuals’ mental representations of love, could easily trigger negative mental representations of love among some committed Chinese women, such as jealousy, concerns about partner infidelity, and relationship loss. Furthermore, concerns about partner infidelity and jealousy can activate the mate-guarding motivation most strongly among individuals high in chronic jealousy, who tend to worry about the threats posed by potential rivals and who are sensitive to their partners’ temptations for extradyadic relations (Maner, Gailliot, Rouby, & Miller, 2007; Maner, Miller, et al., 2009; Neal & Lemay, 2014).

In addition, influenced by male-superior gender norms, many Chinese individuals still believe that the primary responsibilities of wives are housework and raising children. This is in line with the Chinese saying, “Working well cannot equal marrying a good husband” (H. Zhang et al., 2014). Furthermore, economic transition in modern China not only entails an increasing gap between the rich and poor but also limits women’s occupational choices because of the difficulty of balancing household duties and earning income (Cook & Dong, 2011). Thus, partners’ infidelity and relationship dissolution can pose serious threats to Chinese women because of loss of resource security (Hung et al., 2004). The evolutionary perspective holds that guarding one’s partner against potential rivals can ward off the loss of partners’ sexual, financial, or emotional resources and enhance reproductive success (e.g., Buss, 2007; Buss & Shackelford, 1997). Thus, the mate-guarding motivations of committed Chinese women with high jealousy were easily activated by love priming, which could activate participants’ negative mental representations of love.

Consistent with previous studies (Maner, Gailliot, Rouby, & Miller, 2007; Maner, Miller, et al., 2009), committed Chinese women high in jealousy only increased their attentional adherence to attractive same-sex members who serve as intrasexual rivals when mate-guarding motivation was activated. From an evolutionary perspective, attractive women pose strong threats to women’s mate-guarding (e.g., Fink et al., 2014) because men place a great premium on women’s physical attractiveness (Buss & Schmitt, 1993) and attractive women are more
successful at luring away men who are in an ongoing relationship (Sunderani et al., 2013), which can threaten committed women’s relationships and reproductive success. Attentiveness to attractive rivals could help committed Chinese women who worry about partner infidelity to identify and evaluate their potential rivals and engage in mate-guarding behaviors (Maner, Gailliot, & DeWall, 2007).

In turn, from an evolutionary perspective, jealousy—as an adaptive emotion—can be evoked by threats to one’s ongoing relationship in the form of attractive rivals; indeed, women’s jealousy can be triggered when faced with attractive rivals (Dijkstra & Buunk, 2002; Massar & Buunk, 2010). Consequently, the interaction between jealousy and attractive same-sex faces led committed Chinese women high in jealousy to greatly increase their attention to and find it hard to disengage their attention from attractive rivals when mental representations of romantic love were activated. This study further supported the view that emotions such as romantic love and jealousy play important roles in long-term romantic relationship maintenance (e.g., Maner et al., 2008; Maner, Miller, et al., 2009).

There are several limitations worth noting in our study. First, the samples of this study were unmarried female college students. Thus, the results of this study cannot be generalized to committed women who are older, married, or have children. Future studies should explore the relationship maintenance mechanism of women who are married or have children. Second, we overlooked the influence of physical appearance social comparison when exploring the attentional bias toward attractive same-sex members at the early stage of visual processing. Appearance-based comparisons can trigger intrasexual competition and may be associated with heterosexual women’s attention to intrasexual rivals (Arnocky et al., 2012; Y. Xu et al., 2017). Although the samples in our study were randomly assigned to treatment and control groups to balance this variable among the different conditions, to make results more rigorous, future studies should consider this variable and explore whether it affects the results when it is excluded. Third, we did not explore the effects of participants’ menstrual cycle, which can influence the extent that women are attracted to attractive alternatives ( Larson et al., 2012; S. Zhang et al., 2018) and competition with intrasexual rivals (Zhuang & Wang, 2014). Further research should investigate the attentional bias for relationship maintenance of committed women who are ovulating, that is, when they may have greater desires for extrapair mating and intrasexual competition when mating-related motivation is activated (Pillsworth, & Haselton, 2006a; Zhuang & Wang, 2014). Lastly, we overlooked the effects of menstrual cycle phase on face preferences. We used general facial attractiveness; however, women, including women in love, prefer more masculine male faces, which are indicative of good genes, when they are most fertile (Johnston et al., 2001; Jones et al., 2008; Little et al., 2002; Penton-Voak et al., 1999). Further studies should use target faces with masculine characteristics to investigate attentional bias associated with relationship maintenance toward opposite-sex targets when mating-related motivation is activated.

Conclusion

In conclusion, we found that committed female Chinese college students displayed inattention to attractive alternatives who could threaten their ongoing romantic relationships during the early stages of attentional processing, regardless of baseline or love priming condition. On the other hand, committed female Chinese college students high in jealousy increased their attention to and showed difficulty disengaging from attractive same-sex targets who could serve as potential intrasexual rivals for relationship maintenance when subliminally primed with romantic love, which could activate mental representations associated with love. The present findings provide further evidence within the Chinese cultural context for the existence of attentional biases toward attractive others at early stage attentional processes for relationship maintenance when romantic love is primed.

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Notes

1. Pictures were presented in grayscale to prevent the various colors of neutral pictures that were used in Study 2 from influencing the participants’ attentional bias and to maintain the consistency of the stimulus materials.
2. Normally, the reaction times of participants to complete this task were within 2 s (within three standard deviations). We set the reserved time as 4 s for participants to respond. On the one hand, this was enough for the participants to make a correct response; on the other hand, unkeyed responses that were recorded as “unresponsive” were discarded as invalid data during data analysis (data within three standard deviations were retained for data analysis in this study).
3. According to the central limit theorem, there were more than 30 trials under each experimental condition to bring the results closer to the actual reaction times of participants.

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