An Agent-Based Model of Gender Differences in Short-Term Mating Behaviors as a Result of Mating Preferences

Yurun Ying[1,†], Jan Antfolk[2], Pekka Santtila[1,3]

[1] Faculty of Arts and Sciences, NYU Shanghai

[2] Faculty of Arts, Psychology and Theology, Åbo Akademi University

[3] NYU-ECNU Institute for Social Development at NYU Shanghai

[†] To whom correspondence should be addressed: yurun.ying@nyu.edu

Abstract

Gender differences in short-term mating behaviors are well-documented in human sexuality research. Existing studies usually conflate gender differences in mating preferences with differences in sexual behaviors, which is theoretically problematic. Using an agent-based model, we investigated the circumstances under which heterosexual and homosexual men and women's differential preferences for short-term mating would result in gender differences in short-term mating behaviors. The model showed that when all individuals in a closed heterosexual population were considered, men and women had the same average number of short-term mating experiences and short-term mates even when men had stronger preferences for short-term mating. Men (vs. women) had a higher average number of both experiences and mates only when heterosexual men and women who successfully participated in the mating pool (i.e., those with a non-zero number of short-term mating experiences) were considered. Moreover, when men (vs. women) had stronger preferences for short-term mating, gay men had a higher average number of both experiences and mates compared to both lesbian women and heterosexual men. These results suggest that theoretically speaking, even when gender differences in mating preferences exist, those in short-term mating behaviors only occur among particular populations, or when men's preferences for short-term mating are not constrained by those of women. Suggestions for future research in human mating psychology and behaviors were provided.

Keywords: agent-based modeling, short-term mating, casual sex, sexual strategy theory, female choice hypothesis

1 Introduction

Gender differences in sexual behaviors, especially short-term mating behaviors, are well-documented in human sexuality research. For example, research has found that heterosexual men, as compared to heterosexual women, report to have a higher average number of past short-term sexual partners (Oliver & Hyde, 1993; Petersen & Hyde, 2010; Rissel et al., 2014), and engage in both short-term mating and extramarital sex more often (Petersen & Hyde, 2010). These gender differences have also been observed between gay men and lesbian women (Bailey et al., 1994; Bryant & Demian, 1994; Peplau et al., 1997, 2004).

In the existing literature, gender differences in actual sexual behaviors are not usually distinguished from those in attitudes towards or preferences for short-term mating. Some researchers study gender differences at the two levels simultaneously without a conceptual distinction (e.g., Petersen & Hyde, 2010), whereas some implicitly equate the two, assuming that behavioral differences are a direct expression of psychological ones (e.g., Schmitt et al., 2001).

Intuitive as this line of reasoning is, there are good reasons to doubt its soundness. This is because any heterosexual sexual encounter involves both a man and a woman (the frequency of encounters involving more than two persons is negligible, e.g., Herbenick et al., 2017). A new short-term mating experience for a man is, therefore, also a new experience for a woman. Likewise, when a man has a new short-term mate, so does his partner. As a result, the psychological differences in short-term mating preferences may not result in behavioral ones in the heterosexual case (Archer, 2019).

As a starting point, we took gender differences in mating preferences as conceptualized by the sexual strategy theory (Buss & Schmitt, 1993; Buss & Schmitt, 2019), which is repeatedly supported by empirical investigations (e.g., Schmitt, 2003; Walter et al., 2020). Using an agent-based model, we investigated whether men and women's differential preferences for short-term mating would result in gender differences in short-term mating behaviors, and if so, then under what conditions they would result in differences in the number of short-term mating experiences and short-term mates.

1.1 Gender differences in short-term mating preferences

Gender differences in mating preferences have been studied in the light of sexual strategy theory (Buss & Schmitt, 1993; Buss & Schmitt, 2019). It posits that since the minimum obligatory investment that men must devote to their offspring (contribution of sperm through one sexual act) is lower than that of women (gestation, labor, and lactation), men tend to be relatively more interested in short-term mating compared to women. This is because the number of offspring women can produce is limited and cannot be increased by mating with a large number of men, whereas the reverse is the case for men. As a result, men are predicted to not only have a greater interest in short-term mating, but also desire a larger number of short-term mates in a given period and be less selective with respect to accepting a potential mate (Buss & Schmitt, 1993).

The hypotheses derived from sexual strategy theory have received extensive support in empirical studies. For example, men have reported to be currently seeking short-term mates to a larger extent than women (Buss & Schmitt, 1993; Schmitt et al., 2001; Schmitt, 2003), and a larger proportion of men were in any way seeking short-term mates (vs. not seeking) (Schmitt, 2003). Similar results have been found among both U.S. college students (Buss & Schmitt, 1993; Schmitt et al., 2001) as well as in ten world regions in a cross-cultural study (Schmitt, 2003). Similarly, men across the world have also reported to desire more short-term sexual partners compared to women over different future time periods (e.g., a month, a year) (Buss & Schmitt, 1993; McBurney et al., 2005; Schmitt, 2003). The gender differences have been found regardless of whether they were estimated using mean (Buss & Schmitt, 1993; Schmitt et al., 2001; Schmitt, 2003), median (Schmitt et al., 2001; Schmitt, 2003), or percentage (Schmitt, 2003) statistics.

As for mating standards, men are less selective in accepting someone as a potential short-term mate. For example, studies using U.S. college samples have found that the minimum percentile ranks of the desirability of a potential short-term sexual partner accepted by men were lower than those accepted by women, in terms of both the overall desirability and the desirability of individual traits (e.g., social status, attractiveness) (Kenrick et al., 1990; Regan, 1998). Another study also found that when presented with identical descriptions of potential mates, men on average rated them as more desirable than women did (Wiederman & Dubois, 1998).

Some evidence shows that gender differences in mating preferences also exist between gay men and lesbian women, suggesting that these differences are based on individuals' gender rather than their sexual orientation. A survey study using a community sample from the U.S. found that gay men were more interested in short-term mating than lesbian women were, and that this gender difference was comparable to that existing among heterosexual individuals (Bailey et al., 1994). An additional indirect piece of evidence on differential standards for short-term mates comes from a recent study finding that significantly more gay men than lesbian women reported to have accepted a casual sexual offer from a same-gender person (Matsick et al., 2021). Past studies suggest that the gender difference in the acceptance rate of casual sexual offers may originate from men and women's differential standards for short-term mates (Conley et al., 2011; Hald & Høgh-Olesen, 2010). Thus, as a postulation, gay men may also have lower standards than lesbian women for short-term mates.

1.2 Constraints on men's preferences for short-term mating

Since heterosexual sex in most cases involves one man and one woman, men's relatively high interest in short-term mating can be constrained by women's preference for long-term relationships (Archer, 2019; Symons, 1979). This is because men's short-term mating preferences – with the exception of sexual violence – can only translate into behaviors when there are women willing to have sex with them. When a new short-term mating encounter occurs, it counts towards both men's total number of short-term mating encounters as well as women's, and both men and women have new short-term mates. Therefore, the total number of short-term mating experiences and short-term mates must be equal between heterosexual men and women at the population level. In a closed population with equal sex ratio, it follows that the average number of experiences and mates should also be equal between men and women. Following this line of reasoning, we would expect to observe no gender difference in short-term mating behaviors among heterosexual individuals even when there were gender differences in mating preferences.

However, it is important to note that although heterosexual men's total number of short-term mating is equal to that of women, this does not necessarily mean that the total number of men and women who have ever had short-term mating must be equal. Since women have higher stan-

dards for short-term mates than men (Buss & Schmitt, 1993), it is possible that the proportion of individuals who meet a potential partner's standards is lower among men than among women, assuming both men and women's desirability values follow the same distribution. Consequently, there may be a smaller proportion of men (vs. the proportion of women) who participate in the mating pool and contribute to the total number of short-term mating. For example, suppose that there is a population of 20 individuals with an equal sex ratio. There are 8 men and 8 women with a desirability value greater than x_1 and 3 men and 3 women with a value greater than x_2 ($x_1 < x_2$). Suppose that x_1 and x_2 happen to be men and women's standards for short-term mates, then in a long enough period of time, the 8 women who meet men's standards and the 3 men who meet women's standards will have had short-term mating. Since the total number of short-term mating behaviors is the same between men and women, we would expect that in a population of individuals who had any short-term mating, the average number of short-term mating experiences and mates was higher among men than women (e.g., in the aforementioned example, the number is n/3 for men and n/8 for women, where n can be the total number of short-term mating experiences or the number of short-term mates).

As a comparison, in the cases of gay men and lesbian women, men's preferences are not constrained by women's, but only by those of other men, who, arguably, have a similar high interest in short-term mating. This would allow for a more direct behavioral expression of men's mating preferences. The notion that gay men have less restricted preferences is borne out in the proportion of individuals who have engaged in extradyadic sex (Peplau et al., 2004). A study showed that the proportions of heterosexual men and women who had engaged in extradyadic sex were 26% and 21%, respectively, while the statistics among gay men and lesbian women were 82% and 28%, respectively (Peplau et al., 2004). Therefore, we would expect to observe gender differences in short-term mating behaviors between gay men and lesbian women. Moreover, we would also expect to find that gay men, compared to heterosexual men, engaged in more short-term mating behaviors due to less constraints on their mating preferences.

1.3 A simple model of short-term mating behaviors

By using a spatial agent-based model, the present study investigated whether men and women's differential preferences for short-term mating would result in gender differences in short-term mating behaviors, and if they did, under what circumstances. Preferences for short-term mating were operationally defined as the likelihood of engaging in short-term mating upon encountering a mate and the standards for short-term mates (Buss & Schmitt, 1993). Short-term mating behaviors were operationally defined as the number of short-term mating experiences and the number of past short-term mates (Petersen & Hyde, 2010).

We also modeled forming long-term relationships as a background process. A pair of individuals had a possibility to commit to a long-term relationship upon meeting each other. We modeled forming long-term relationships as a behavioral outcome and ignored the psychological processes behind it, although we recognize gender differences may also exist in long-term mating strategy (Buss & Schmitt, 1993; Buss & Schmitt, 2019).

We modeled these processes among both heterosexual individuals and gay men and lesbian women to examine whether constraints set by the opposite sex's preferences would affect short-term mating behaviors. Individuals' sexual orientation was conceptualized in terms of behaviors only in our model. Heterosexual men had short-term mating or formed a long-term relationship only with women, while gay men only with other men, and mutatis mutandis for women.

We formulated the following hypotheses in the present study: assuming gender differences in preferences for short-term mating, 1) there would be no gender differences in short-term mating behaviors among all heterosexual men and women, 2) a smaller proportion of heterosexual men had ever engaged into short-term mating compared to the proportion of heterosexual women, 3) in a population of heterosexual individuals who had any short-term mating, men had higher average number of short-term mating behaviors than women, 4) there would be gender differences in short-term mating behaviors among gay men and lesbian women, with gay men being engaged in more such behaviors, and 5) gay men would engage in more short-term mating behaviors compared to heterosexual men.

2 Material and methods

2.1 Model Design

We developed an agent-based model to represent a simplified environment where men and women can move around, search for mates, and form long-term and/or short-term relationships. Space and time were modeled as discrete variables. Space was represented as discrete locations on a two-dimensional 33*33 lattice. Agents' movement in the space was not meant to simulate physical movement but a state of encountering potential mates. Staying at one location represented being committed to a long-term relationship.

The model measured two outcomes: (1) the number of short-term mating experiences of men and women; (2) the number of short-term mates of men and women. Additionally, we also measured the number of men and women in the mating pool (i.e., those with a non-zero number of short-term mating experiences). The average numbers of short-term mating experiences and short-term mates were calculated by taking the average among the whole population of men and women (N_{men} = N_{women} = 150) and among those who had engaged in any short-term mating.

See the Supplemental Materials for the overview, design concepts, and details (ODD) protocol of the model, which includes detailed scheduling and parameterization. The model can be downloaded from the Open Science Framework [link masked for peer review]. The model was programmed in Netlogo 6.2.1 (Wilensky, 1999).

2.2 Experiment Design

Using the agent-based model, the present study conducted two 2 (gender difference vs. no difference in the interest in short-term mating likelihood) x 2 (gender difference vs. no difference in mating standards) experiments. Experiment 1 was run among heterosexual agents who only engaged in short-term or long-term relationships with agents of the opposite gender. Experiment 2 was run among gay men and lesbian women who only engaged in short-term or long-term relationships with agents of the same gender.

The interest in short-term mating was modeled as an agent's likelihood of deciding to have short-term mating at each time step. The standards for short-term mates were modeled as the minimum desirability of a potential mate with whom an agent was willing to have sex. The values of the two parameters were set based on empirical findings in human mating psychology. When there was a gender difference in short-term mating likelihood, men had a 40% likelihood of deciding to engage in short-term mating, while women had a likelihood of 25% (Buss & Schmitt, 1993; Schmitt et al., 2001; Schmitt, 2003). When there was no gender difference in short-term mating likelihood, both women and men had a likelihood of 25%. When there was a gender difference in mating standards, men had a mating standard of 3 (the highest possible value = 10), while women had a standard of 5 (Kenrick et al., 1990; Regan, 1998), that is, they would not mate with a person with a lower mate value. When there was no gender difference in mating standards, both men and women had a standard of 5.

2.3 Model Schedule

2.3.1 Initial setup

In total, 150 women and 150 men were created on the lattice at random locations. All agents were initialized with (1) a three-unit maximum distance by which agents can move away from their birthplace (movement range); (2) a 10% likelihood of two agents forming a long-term relationship upon meeting; (3) single status and no long-term partner; (4) a mate value, sampled from a Gaussian distribution (M = 5.0, SD = 1.5); (5) no short-term mate or short-term mating history.

The likelihood of engaging in short-term mating and the standard for short-term mates were initialized to the values discussed previously. Whether men and women had the same initial values depended on the experimental conditions.

2.3.2 Procedures

2.3.2.1 Procedures for heterosexual agents. At each time step, agents first checked whether they were in a long-term relationship. If they were not in a long-term relationship, they set their

heading randomly (if they were within the movement range from the birthplace) or faced the birthplace (if they were out of the movement range from the birthplace) and moved by a random distance. The random distance was less than half of the movement range. If they were in a long-term relationship, they did not move. Then, the agents decided on whether to engage in short-term mating using the predetermined likelihood (either 25% or 40%).

Women checked to see if any men were at the same location. If there were, they randomly chose one of them as a potential short-term mate. If both men and women met each other's mating standards and both of them decided to engage in short-term mating, they had sex. This would result in increasing both parties' number of short-term mating experiences by one. They also recorded each other on their respective lists of past short-term mates if they were not on the lists yet.

Then, women randomly selected one man at the same location as their potential long-term partner. There was a 10% of chance that a pair would form a long-term relationship. After forming a long-term relationship, both men and women changed to coupled status and registered each other as their long-term partner.

2.3.2.2 Procedures for gay men and lesbian women agents. At each time step, men and women moved and decided on short-term mating as the agents did in the heterosexual case. Half of the agents (75 men and 75 women) were also given an initiator status. The initiators checked to see whether there were other agents at the same location. The rest of the procedures were identical to the heterosexual procedures, except that the agents only chose those with the same gender as potential short-term mates or long-term partners.

2.4 Simulations

The model was run for 1,000 time steps in each simulation. We ran 10,000 simulations for each experiment, including 2,500 simulations for each condition. We controlled for initializing random seeds in the model runs. All simulations were run using Netlogo 6.2.1 (Wilensky, 1999).

2.5 Statistical analyses

Statistical analyses were conducted using R version 4.1.3 (R Core Team, 2022) and the figures were generated by the ggplot2 package (Wickham, 2016). Two-tailed independent samples *t*-tests were used for all statistical comparisons. The data were assumed to be normally distributed within each condition.

3 Results

3.1 Gender differences in short-term mating behaviors in the full population

The results from Experiment 1 showed that when there were gender differences in preferences for short-term mating, there was no gender difference in the average number of short-term mating experiences among the full population of heterosexual individuals (M_{men} = 1.43, SD_{men} = 0.24; M_{women} = 1.43, SD_{women} = 0.24), Cohen's d = 0.00. Nor was there a difference in the average number of short-term mates (M_{men} = 0.80, SD_{men} = 0.11; M_{women} = 0.80, SD_{women} = 0.11), Cohen's d = 0.00 (Figure 1).

The results from Experiment 2 showed that when there were gender differences in preferences for short-term mating, there were gender differences in short-term mating behaviors between gay men and lesbian women (Figure 1). The average number of short-term mating experiences was higher among gay men (M = 2.63, SD = 0.37) than among lesbian women (M = 0.32, SD = 0.10), t(4,998) = -301.78, $p < .001$, Cohen's d = 8.54. Similarly, the average number of short-term mates was higher among gay men (M = 1.72, SD = 0.19) than among lesbian women (M = 0.25, SD = 0.07), t(4,998) = -357.69, $p < .001$, Cohen's d = 10.12.

3.2 Heterosexual individuals in the mating pool

In Experiment 1, there was a smaller proportion of heterosexual men in the mating pool (M = 0.38, SD = 0.04) compared to women (M = 0.51, SD = 0.05), t(4,998) = 104.85, $p < .001$, Cohen's d = 2.97. In this population, there were gender differences in short-term mating behaviors when men

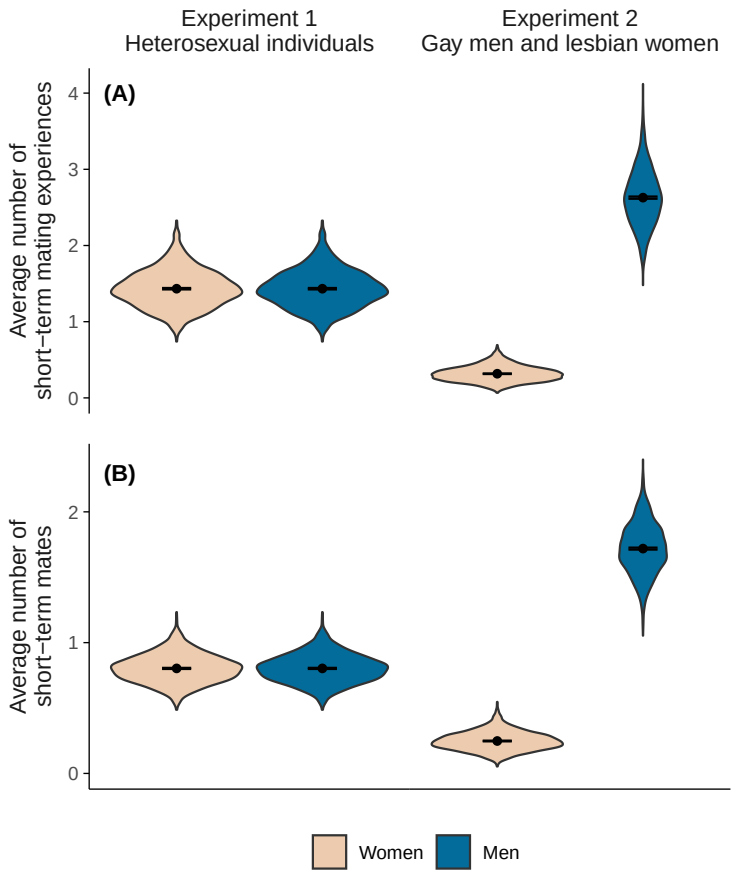

Figure 1: Short-term mating behaviors of men and women after 1,000 time steps in the model when gender differences existed in mating preferences. Violin plots summarizing the outcome variables separately for heterosexual individuals and gay men and lesbian women. Plot (A) shows the average number of short-term mating experiences, and plot (B) shows the average number of short-term mates. Central points show mean values and whiskers represent standard errors, but the standard errors are small and overlap to form a single bar. The averages were calculated using the full population of men and women in the model (N_{men} = N_{women} = 150).

and women had differential preferences for short-term mating (Figure 2). The average number of short-term mating experiences was higher among heterosexual men (M = 3.78, SD = 0.50) than among heterosexual women (M = 2.79, SD = 0.35), t(4,998) = -81.53, p < .001, Cohen's d = 2.31. Likewise, the average number of short-term mates was higher among heterosexual men (M = 2.12, SD = 0.17) than among heterosexual women (M = 1.56, SD = 0.11), t(4,998) = -135.85, p < .001, Cohen's d = 3.84.

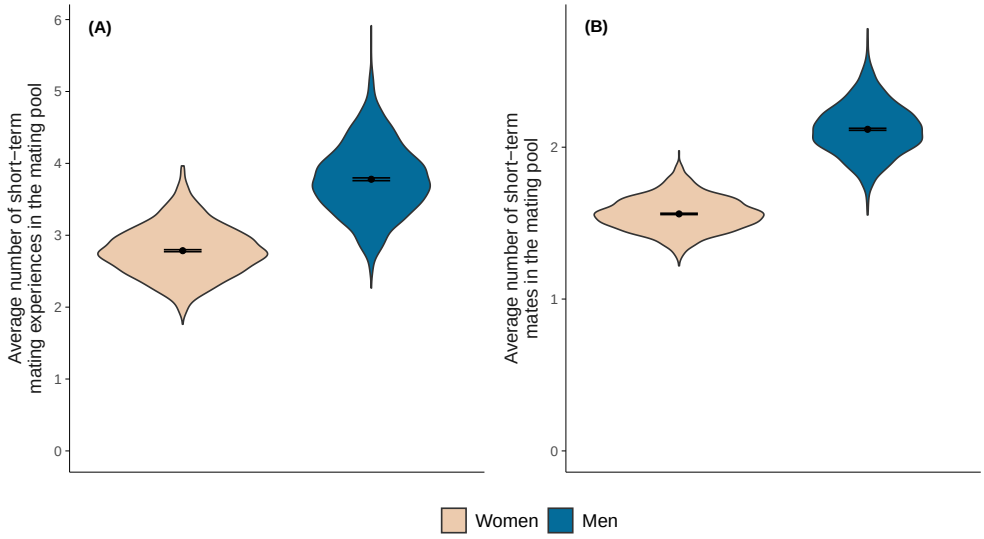

Figure 2: Short-term mating behaviors of heterosexual men and women in the mating pool after 1,000 time steps in the model when gender differences existed in mating preferences. Violin plots summarizing the outcome variables. Plot (A) shows the average number of short-term mating experiences in the mating pool, and plot (B) shows the average number of short-term mates in the mating pool. Central points show mean values and whiskers represent standard errors, but the standard errors are small and overlap to form a single bar. The averages were calculated using the population of heterosexual men and women in the mating pool (M_{men} = 56.85, M_{men} = 77.04).

3.3 Comparing heterosexual and gay men

Gay men engaged in short-term mating behaviors more than heterosexual men did (Figure 3). The average number of short-term mating experiences (as calculated using the full population of men) was higher among gay men (M = 2.63, SD = 0.37) than among heterosexual men (M = 1.43, SD = 0.24), t(4,998) = -134.87, p < .001, Cohen's d = 3.81. Similarly, the average number of short-term mates (as calculated using the full population of men) was higher among gay men (M = 1.72, SD = 0.19) than among heterosexual men (M = 0.80, SD = 0.11), t(4,998) = -206.91, p < .001, Cohen's d = 5.85.

3.4 Comparing across conditions

We also ran analyses across conditions to see which of the two dimensions of mating preferences contributed to gender differences in short-term mating behaviors.

Among heterosexual individuals, gender differences in short-term mating behaviors, when calcu-

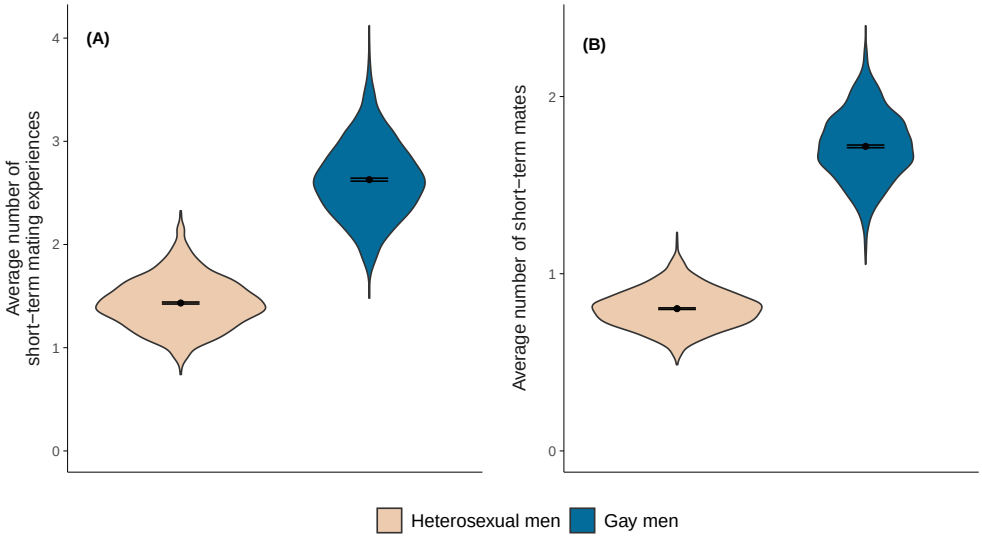

Figure 3: Short-term mating behaviors of heterosexual and gay men after 1,000 time steps in the model when gender differences existed in mating preferences. Violin plots summarizing the outcome variables. Plot (A) shows the average number of short-term mating experiences, and plot (B) shows the average number of short-term mates. Central points show mean values and whiskers represent standard errors, but the standard errors are small and overlap to form a single bar. The averages were calculated using the full population of heterosexual and gay men in the model (N_{hetero} = N_{gay} = 150).

lated among individuals in the mating pool, emerged when men and women had different standards for short-term mates. Heterosexual men (vs. heterosexual women) in the mating pool had a higher average number of short-term mating experiences and short-term mates as long as they had lower mating standards, even when no gender difference existed in short-term mating likelihood (experiences: M_{men} = 2.82, SD_{men} = 0.36, M_{women} = 2.21, SD_{women} = 0.28, Cohen's d = 1.89; partners: M_{men} = 1.76, SD_{men} = 0.15; M_{women} = 1.38, SD_{women} = 0.09, Cohen's d = 3.13). In comparison, virtually no gender differences in short-term mating behaviors existed when men and women had the same mating standards (Table 1).

Among gay men and lesbian women, gender differences in short-term mating behaviors emerged both when they had different short-term mating likelihood and when their mating standards were different. Gay men (vs. lesbian women) had a higher average number of short-term mating experiences and short-term mates when they had a higher short-term mating likelihood (experiences: M_{men} = 0.80, SD_{men} = 0.23, M_{women} = 0.32, SD_{women} = 0.10, Cohen's d = 2.67; partners: M_{men} = 0.52, SD_{men} = 0.13, M_{women} = 0.25, SD_{women} = 0.07, Cohen's d = 2.60), or when they had lower mating standards (experiences: M_{men} = 1.05, SD_{men} = 0.18, M_{women} = 0.32, SD_{women} = 0.10, Co-

Table 1: Short-term mating behaviors of heterosexual men and women in the mating pool after 1,000 time steps in the model

	Average short-term mating experiences (in-pool)					Average short-term mates (in-pool)				
	Men		Women			Men		Women		
	M	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
Same likelihood*Same standard	2.21	0.38	2.20	0.37	0.03	1.39	0.12	1.39	0.12	0.04
Same likelihood*Different standard	2.82	0.36	2.21	0.28	1.89	1.76	0.15	1.38	0.09	3.13
Different likelihood*Same standard	2.80	0.48	2.78	0.47	0.03	1.57	0.14	1.56	0.14	0.05
Different likelihood*Different standard	3.78	0.50	2.79	0.35	2.31	2.12	0.17	1.56	0.11	3.84

Note. The averages were calculated with subsamples of men and women who had had engaged in short-term mating behaviors. See Supplementary Materials for the mean and standard deviation of sample sizes.

hen's $d = 5.10$; partners: $M_{men} = 0.82$, $SD_{men} = 0.12$, $M_{women} = 0.25$, $SD_{women} = 0.07$, Cohen's $d = 5.78$). In comparison, virtually no gender differences in short-term mating behaviors existed when gay men and lesbian women had the same short-term mating likelihood and mating standards (Table 2).

4 Discussion

The present study used agent-based modeling to investigate whether men and women's differential preferences for short-term mating would result in gender differences in short-term mating behaviors, and if so, then under what conditions they would result in differences in the number of short-term mating experiences and short-term mates. We formulated two hypotheses: 1) gay men would engage in more short-term mating behaviors as compared to lesbian women, and 2) gay men would engage in more short-term mating behaviors as compared to heterosexual men. The results from 1,000 time steps in a model simulating men and women's mating behaviors provided strong evidence in favor of our hypotheses. First of all, as compared to lesbian women, gay men had higher average numbers of short-term mating experiences and short-term mates. Secondly, gay men also had higher average numbers of short-term mating experiences and short-term mates as compared to heterosexual men. In contrast, we found no gender differences in

Table 2: Short-term mating behaviors of gay men and lesbian women after 1,000 time steps in the model

	Average short-term mating experiences					Average short-term mates				
	Men		Women			Men		Women		
	M	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
Same likelihood*Same standard	0.32	0.10	0.32	0.10	0.04	0.25	0.07	0.25	0.07	0.03
Same likelihood*Different standard	1.05	0.18	0.32	0.10	5.10	0.82	0.12	0.25	0.07	5.78
Different likelihood*Same standard	0.80	0.23	0.32	0.10	2.67	0.52	0.13	0.25	0.07	2.60
Different likelihood*Different standard	2.63	0.37	0.32	0.10	8.54	1.72	0.19	0.25	0.07	10.12

Note. $N_{men} = N_{women} = 150$ in all conditions.

short-term mating behaviors between heterosexual men and women, although heterosexual men in the mating pool had higher average numbers of short-term mating experiences and short-term mates.

As expected, heterosexual men and women did not differ in short-term mating behaviors despite their differential preferences for short-term mating. This was because heterosexual men and women had an equal total number of both short-term mating experiences and short-term mates. This is not surprising since the sex ratio was 1:1 in our model. It therefore follows that the average number of short-term mating experiences and short-term mates must be equal between men and women as well. However, we did find that when we only looked at individuals in the mating pool (from which more men than women were excluded), men engaged in more short-term mating behaviors as compared to women. This was because there were more women than men in the mating pool, resulting in lower averages among heterosexual women despite the equal numbers of experiences and mates in total.

Moreover, gender differences in short-term mating behaviors emerged when heterosexual men and women had different mating standards, but not when they had different short-term mating likelihood. When women had a higher standard than men did, less men than women in the population were above a potential partner's standard and thus had a chance to have sex with them. This contributed to the unequal number of men and women in the mating pool, which led to gender

differences in short-term mating behaviors among this population. In comparison, even when men and women had different short-term mating likelihood, the probability of any pair of them ending up having sex is the product of their individual likelihood (since men and women made decisions independently). As this probability is the same for both parties, the gender difference in short-term mating likelihood did not translate into different behaviors.

In the light of these results, previous empirical observations of gender differences in short-term mating behaviors among heterosexual individuals (e.g., Petersen & Hyde, 2010) appear perplexing (e.g., Gurman, 1989). Possible explanations for these empirical results that seem illogical considering the simulation findings may have to do with features of the observation process. One possibility is sampling bias in the observations (e.g., Wiederman & Dubois, 1998) since surveys regarding short-term mating behaviors may tend to attract individuals who already engage in such behaviors. Our results suggest that when this group of individuals is considered, there can be gender differences in short-term mating behaviors that do not exist in the full population. A second explanation is that heterosexual men and women's self-reported sexual behaviors are affected by social desirability bias due to gender norms. Men may overreport since having more sexual partners can show their masculinity and yield them reputation benefits, while women may underreport because this violates the chastity norm (Fisher, 2013). A third explanation is that men and women have different estimation strategies of their sexual experiences. Men may tend to approximate and round up, while women's tendency to count instances may lead to lower estimations (Brown & Sinclair, 1999; Mitchell et al., 2019).

Among gay men and lesbian women, large gender differences in short-term mating behaviors existed when men and women had differential preferences for short-term mating, which was in line with empirical observations (e.g., Peplau et al., 1997, 2004). This was likely because the number of short-term mating experiences and short-term mates no longer counted towards men and women simultaneously. Any gender differences in mating preferences would result in differences in behaviors. A closer look at the results did support this postulation. Both a difference in the likelihood of short-term mating and in mating standards alone resulted in gender differences in mating behaviors. This was likely because the former increased the probability of both parties of a given gay couple deciding to have short-term mating, and the latter increased the probability of

both meeting each other's standards, as compared to the case of a given lesbian couple.

Also, as gay men's preferences for short-term mating were not constrained by those of women, we found that gay men engaged in more short-term mating behaviors compared to heterosexual men. This was consistent with the empirical literature (e.g., Peplau et al., 1997). Interestingly, gay men and heterosexual men had the same short-term mating likelihood and the same standards for short-term mates in our model. The only difference was a change in the preferences of potential partners. When men's partners had a stronger preferences for short-term mating (i.e., having men vs. having women as potential partners), men also appeared to engage in more short-term mating behaviors.

5 Conclusion

Using agent-based modeling to simulate short-term mating behaviors, we found when men (vs. women) had a stronger preferences for short-term mating, heterosexual men and women engaged in short-term mating behaviors to the same extent, while gay men engaged in more short-term mating behaviors as compared to lesbian women. Gay men engaged in more short-term mating behaviors than heterosexual men did.

These results highlight the distinction between preferences and behaviors in human mating. Individuals' mating behaviors do not only depend on one's own preferences, but are also constrained by partners' preferences. Future research in human mating should not only focus on the psychological aspect but also pay attention to the interaction between individuals' psychology and its context. These results also cast doubt to the prevalent belief in the gender differences in short-term mating behaviors, especially among heterosexual individuals. Our findings suggest that there may be factors in the observation process, such as sampling bias, that contribute to the observed differences. Future research in human sexuality should note such possibilities and interpret any observed gender differences in short-term mating behaviors cautiously.

6 Acknowledgements

7 Data availability

All models, data, and analysis code can be downloaded at: [link masked for peer review]

References

Archer, J. (2019). The reality and evolutionary significance of human psychological sex differences. *Biological Reviews*, *94*(4), 1381–1415. https://doi.org/10.1111/brv.12507

Bailey, J. M., Gaulin, S., Agyei, Y., & Gladue, B. A. (1994). Effects of gender and sexual orientation on evolutionarily relevant aspects of human mating psychology. *Journal of Personality and Social Psychology*, *66*(6), 1081–1093. https://doi.org/10.1037/0022-3514.66.6.1081

Brown, N. R., & Sinclair, R. C. (1999). Estimating number of lifetime sexual partners: Men and women do it differently. *The Journal of Sex Research*, *36*(3), 292–297. https://doi.org/10.1080/00224499909551999

Bryant, A. S., & Demian. (1994). Relationship characteristics of american gay and lesbian couples. *Journal of Gay & Lesbian Social Services*, *1*(2), 101–117. https://doi.org/10.1300/J041v01n02_06

Buss, D. M., & Schmitt, D. P. (1993). Sexual strategies theory: An evolutionary perspective on human mating. *Psychological Review*, *100*(2), 204–232. https://doi.org/doi:10.1037/0033-295X.100.2.204d

Buss, D. M., & Schmitt, D. P. (2019). Mate preferences and their behavioral manifestations. *Annual Review of Psychology*, *70*, 77–110.

Conley, T. D., Moors, A. C., Matsick, J. L., Ziegler, A., & Valentine, B. A. (2011). Women, men, and the bedroom: Methodological and conceptual insights that narrow, reframe, and eliminate gender differences in sexuality. *Current Directions in Psychological Science*, *20*(5), 296–300. https://doi.org/10.1177/0963721411418467

Fisher, T. D. (2013). Gender roles and pressure to be truthful: The bogus pipeline modifies gender differences in sexual but not non-sexual behavior. *Sex Roles*, *68*(7), 401–414.

Gurman, S. J. (1989). Six of one... *Nature*, *12*, 342. https://www.nature.com/articles/342012d0

Hald, G. M., & Høgh-Olesen, H. (2010). Receptivity to sexual invitations from strangers of the opposite gender. *Evolution and Human Behavior*, *31*(6), 453–458. https://doi.org/10.1016/j.evolhumbehav.2010.07.004

Herbenick, D., Bowling, J., Fu, T.-C. (Jane)., Dodge, B., Guerra-Reyes, L., & Sanders, S. (2017). Sexual diversity in the United States: Results from a nationally representative probability sam-

ple of adult women and men. *PLOS ONE*, *12*(7), e0181198. https://doi.org/10.1371/journal.pone.0181198

Kenrick, D. T., Sadalla, E. K., Groth, G., & Trost, M. R. (1990). Evolution, traits, and the stages of human courtship: Qualifying the parental investment model. *Journal of Personality*, *58*(1), 97–116. https://doi.org/10.1111/j.1467-6494.1990.tb00909.x

Matsick, J. L., Kruk, M., Conley, T. D., Moors, A. C., & Ziegler, A. (2021). Gender similarities and differences in casual sex acceptance among lesbian women and gay men. *Archives of Sexual Behavior*, *50*(3), 1151–1166. https://doi.org/10.1007/s10508-020-01864-y

McBurney, D. H., Zapp, D. J., & Streeter, S. A. (2005). Preferred number of sexual partners: Tails of distributions and tales of mating systems. *Evolution and Human Behavior*, *26*(3), 271–278. https://doi.org/10.1016/j.evolhumbehav.2004.09.005

Mitchell, K. R., Mercer, C. H., Prah, P., Clifton, S., Tanton, C., Wellings, K., & Copas, A. (2019). Why do men report more opposite-sex sexual partners than women? Analysis of the gender discrepancy in a british national probability survey. *The Journal of Sex Research*, *56*(1), 1–8. https://doi.org/10.1080/00224499.2018.1481193

Oliver, M. B., & Hyde, J. S. (1993). Gender differences in sexuality: A meta-analysis. *Psychological Bulletin*, *114*(1), 29–51. https://doi.org/http://dx.doi.org/10.1037/0033-2909.114.1.29

Peplau, L. A., Cochran, S. D., & Mays, V. (1997). A national survey of the intimate relationships of african american lesbians and gay men: A look at commitment, satisfaction, sexual behavior, and HIV disease. In *Ethnic and cultural diversity among lesbians and gay men* (pp. 11–38). Sage Publications.

Peplau, L. A., Fingerhut, A., & Beals, K. P. (2004). Sexuality in the relationships of lesbians and gay men. In *The handbook of sexuality in close relationships* (pp. 349–369). Lawrence Erlbaum Associates Publishers.

Petersen, J. L., & Hyde, J. S. (2010). A meta-analytic review of research on gender differences in sexuality, 1993–2007. *Psychological Bulletin*, *136*(1), 21–38. https://doi.org/10.1037/a0017504

R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. https://www.R-project.org/

Regan, P. C. (1998). Minimum mate selection standards as a function of perceived mate value,

relationship context, and gender. *Journal of Psychology & Human Sexuality*, *10*(1), 53–73. https://doi.org/10.1300/J056v10n01_04

Rissel, C., Badcock, P. B., Smith, A. M. A., Richters, J., Visser, R. O. de, Grulich, A. E., Simpson, J. M., Rissel, C., Badcock, P. B., Smith, A. M. A., Richters, J., Visser, R. O. de, Grulich, A. E., & Simpson, J. M. (2014). Heterosexual experience and recent heterosexual encounters among Australian adults: The second Australian study of health and relationships. *Sexual Health*, *11*(5), 416–426. https://doi.org/10.1071/SH14105

Schmitt, D. P. (2003). Universal sex differences in the desire for sexual variety: Tests from 52 nations, 6 continents, and 13 islands. *Journal of Personality and Social Psychology*, *85*(1), 85. https://doi.org/10.1037/0022-3514.85.1.85

Schmitt, D. P., Shackelford, T. K., & Buss, D. M. (2001). Are men really more 'oriented' toward short-term mating than women? A critical review of theory and research. *Psychology, Evolution & Gender*, *3*(3), 211–239. https://doi.org/10.1080/14616660110119331

Symons, D. (1979). *The evolution of human sexuality*. Oxford University Press.

Walter, K. V., Conroy-Beam, D., Buss, D. M., Asao, K., Sorokowska, A., Sorokowski, P., Aavik, T., Akello, G., Alhabahba, M. M., Alm, C., Amjad, N., Anjum, A., Atama, C. S., Atamtürk Duyar, D., Ayebare, R., Batres, C., Bendixen, M., Bensafia, A., Bizumic, B., . . . Zupančič, M. (2020). Sex differences in mate preferences across 45 countries: A large-scale replication. *Psychological Science*, *31*(4), 408–423. https://doi.org/10.1177/0956797620904154

Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. https://ggplot2.tidyverse.org

Wiederman, M. W., & Dubois, S. L. (1998). Evolution and sex differences in preferences for short-term mates: Results from a policy capturing study. *Evolution and Human Behavior*, *19*(3), 153–170. https://doi.org/10.1016/S1090-5138(98)00006-3

Wilensky, U. (1999). *NetLogo* [Http://ccl.northwestern.edu/netlogo/]. Center for Connected Learning; Computer-Based Modeling. http://ccl.northwestern.edu/netlogo/