**Response to reviewers**

Authors’ summary of changes:

**Editor**

**Based on the comments of the reviewers and my own reading of your paper, I am not able to accept the manuscript in its current form. You will see from the reviews that there was some considerable range in recommendations about its prospects, although overall in my view and from my reading of the reviewers' comments, I believe that there is sufficient room for addressing the issues raised if done carefully, and that there is likely a valuable contribution to the field. I will ask you to address the substantive issues raised by the reviewers, and I would be glad to have the paper re-reviewed. I plan to ask our statistical consultant at that time to review it as well to ensure that all seems solid in that regard.**

**Reviewer: 1**

**In the current manuscript, the authors use agent-based modelling for investigating gender differences and differences in sexual orientation and their associations with short-term mating behaviors. Their results suggest that men do not necessarily engage in more short-term mating behaviors than women, although their preference for short-term mating is higher. Further, simulated agents of gay men had more sexual contacts as lesbian women or heterosexual individuals.**

**Overall, I found this manuscript to be very interesting and extremely well written. I only have a couple of comments and questions that should be easy to address in a revision. However, I would like to notice that I am not an expert in agent-based modelling (I took a workshop a couple of years ago, but never used it myself), so I cannot really comment on the procedure.**

Response: We thank the reviewer for the positive feedback.

**1) What exactly do you mean with “less constraints on gay men’s mating preferences” (page 6, first sentence)? That gay men usually have a higher preference for short-term mating as compared to heterosexual men/ have a more unrestricted sociosexual orientation? Please provide a reference for this claim.**

Response: Our main point here is that men have greater interest in short-term mating in virtue of their gender regardless of sexual orientations (we already fully explicated the reasoning and evidence for this claim earlier in the Introduction). Heterosexual and gay men should arguably have comparable degrees of interest in short-term mating. Their short-term mating behaviors, however, can be different because their target sexual partners have difference genders and therefore different degrees of interest in short-term mating behaviors. When a man’s sexual partner is a woman, his interest is constrained greatly because women are less interested in short-term mating; in comparison, when a man’s partner is a man, his interest is less constrained than heterosexual men because their partners are also highly interested in short-term mating.

We added a sentence in the beginning of the subsection to make these points clearer:

“Since evolutionary theories predict that men have greater interest in short-term mating than women regardless of sexual orientations, this interest can lead to different behavioral consequences depending on whether they are heterosexual (partners being women) or gay men (partners being men).”

**2) Why is the OSF link masked? This does not allow me to check whether the data is accessible and reusable. There is the possibility to create an anonymous view only link, so that reviewers can evaluate the content on the OSF while the authors identity remains anonymous. Please use this tool in a revision/ future studies.**

Response: We apologize for the inconvenience. We masked the link because our OSF repository is directly linked to a Github repository, where some of the files cannot be completely anonymized. For the data files to be reviewed at this stage, we have independently uploaded the files and analysis code to OSF, which can be accessed at: <https://osf.io/4kf26/?view_only=7456a90f4fbb43f8912de876d74597d9>. The Github repository has been temporarily unlinked but will be linked back when this paper gets accepted.

**3) Page 8: Why did you decide for the 10% likelihood to engage in long-term relationship? Is this empirically based? Please justify.**

Response: We thank the reviewer for pointing this out. To our best knowledge, there was no empirical statistics for the likelihood of forming long-term relationship as how we formalized it. Our choice for the 10% likelihood was entirely arbitrary. To show the robustness of our results, we ran additional sensitivity analyses while setting the long-term likelihood to 0, 2, 4, 6, and 8. The simulations for sensitivity analyses used the same experimental designs but was run only 100 times for each set of parameter setting. The same set of statistical analyses were adopted. We reported the addition of sensitivity analyses in the last paragraph on page 8:

“…(2) a 10% likelihood of two agents forming a long-term relationship upon meeting (To our best knowledge, there is no available empirical statistics for the probability of this event. We ran sensitivity analyses on different values of this parameter to check the robustness of our results. See Section C of the Supplemental Materials)…”

The results from the sensitivity analyses were similar to the main results presented in the manuscript and were reported in the Supplemental Materials. In the revised manuscript, we added a subsection titled “Sensitivity Analyses” to the “Results” section to highlight this.

**4) Were agents allowed to break up with their long-term partner to engage in short-term mating again? If yes, what was the defined break-up rate? If no, why not?**

Response: Agents were not allowed to break up with their long-term partners, but they were allowed to engage in short-term mating even when they stayed in a long-term relationship. The likelihood of short-term mating for paired agents was reduced (See the “Process overview and scheduling” for a detailed description of the procedures). We made these assumptions because we think it is more realistic to assume engaging in short-term mating is possible while staying in a long-term relationship than to assume the two procedures are completely independent.

**5) The point I feel most strongly about is that I really wondered about the effect sizes. The reported Cohens ds are extremely large, sometimes larger than any effect sizes I’ve ever seen in any research. Just to give some reference on effect sizes, gender differences in mental rotation are usually about d = 0.60, gender differences in body height are about d = 1.40. Gender differences here are much larger, in a range that I don’t interpret as being realistic. Maybe the authors can give some explanation and justification for this. Is it because of the simplified environment (but I’ve also never seen such great effect sizes in other studies using agent-based modeling)?**

Response: We agree with the reviewer on this point. The direct reason for the unrealistically large effect sizes is that there was less variance in our data compared to the data collected from the real world. This might be because there were no measurement errors and because we omitted many factors that might affect short-term mating behaviors. For example, we modeled desirability and mating standards using monotonic scales, but there are many dimensions of these two variables (e.g., appearance, socioeconomic status, age…) in the real life. This may contribute to greater variance in short-term mating behaviors in a more realistic setting.

**Please also double check if this can be right. Further, the confidence intervals do not fit to the reported effect sizes (the CIs do not include the point estimates), please also double check whether this is right and explain what the Confidence Intervals show if not the possible range of the effect size. I might be misunderstanding something here, so my apologies if I do.**

Response: We apologize for the confusion. The reported confidence intervals were not intervals of the Cohen’s *d*s, but of the differences of the group means. To avoid further confusion, we reported all the CIs right after *p* values in the revised manuscript.

**Reviewer: 2**

**Page 4. When we say "Some evidence shows…" we need references for that sentence.**

**The authors should add information about the differences between the preferences of people with a homosexual orientation and those with a heterosexual orientation, not only between men and women. It is also necessary to add explanations and solid arguments regarding the differences in short/long-term mating preferences. What could be the reasons for these differences?**

Response: The topic sentence of the referred paragraph goes as follows:

“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.”

This paragraph does not intend to argue that there are differences in mating preferences between heterosexual individuals and gays and lesbians. Rather, we would like to stress that gender differences exist between gays and lesbians as they do between heterosexual men and women, which suggest that gender can be the sole explanatory factor for this difference. Moreover, the evolutionary explanations for the gender differences have been discussed at the beginning of the section “Gender Differences in Short-term Mating Preferences”. The reviewer seems to have misunderstood these points.

**Page 4. At the moment, in the first paragraph, the argument in the section Constraints on Men's Preferences for Short-term Mating is not convincing. The authors concluded that "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 very abrupt way in the text, without relying on evidence, only following a personal logic.**

Response: We would like to highlight that the intention of this section was to derive hypotheses through theoretical reasoning. The conclusion that “the total number of short-term mating experiences and short-term mates must be equal between heterosexual men and women at the population level” was logically derived from the fact that one short-term mating experience counts equally towards heterosexual men’s and women’s total number of experiences. We did not intend to use empirical evidence to support this logical argument in the first place. To make this point clearer, we modified the sentence into “Therefore, theoretically speaking,…” in the revised manuscript.

**Page 6. The proportion of people with no sexual experience is slightly higher among men than among women in most age groups over 18 is not an argument to conclude that short-term mating behaviors are the same between men and women. The mentioned studies address, instead, that in the population of young adults, several different ways can lead to either the lack of sexual experience of adults, voluntary or involuntary. Why does this lead us to conclude that men do not prefer short-term mating?**

Response: The evidence “the proportion of individuals who are sexually inexperienced is slightly higher among men than women in most age groups above 18 years old” intended to support the argument that “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”. We argued neither “short-term mating behaviors are the same between men and women”, nor “men do not prefer short-term mating”. The reviewer seems to have misunderstood this paragraph.

**Page 6. The authors mentioned, "As a comparison, in the cases of gay men and lesbian women, men's preferences are not constrained by those of women, but only by those of other men, who, arguably, have a similar high interest in short-term mating." This kind of statement should be based on arguments and scientific sources.**

Response: This statement is a logical consequence if we accept that 1) gay men have sex with men rather than women, and 2) men are more interested in short-term mating than women. We have added the source where this reasoning has appeared in the revised manuscript to avoid further confusion.

**The authors should pay more attention to providing explanations for the fact that homosexual men could engage more in extradyadic sex.**

Response: We thank the reviewer for raising this point. We have added one line of explanation in the revised manuscript: “This might be because when gay men had the intention to engage in extradyadic sex, their male partners were more likely to agree due to an equally strong interest in short-term mating as compared to heterosexual men’s or lesbian women’s female partners.”

**Also, it is important to clarify to readers why we would expect to see gender differences in short-term mating behaviors between gay men and lesbian women.**

Response: We have highlighted in the section “Gender Differences in Short-term Mating Preferences” that evolutionary theories predict gender differences in short-term mating preferences solely based on gender. In other words, regardless of sexual orientations, we would expect to observe gender differences. This clarification has also been raised in response to the reviewer’s first comment.

**Short-term mating should be conceptualized much earlier than page 6 because until then, the authors frequently link to this concept. Being conceptualized in the middle of the introduction, it is inappropriately placed.**

Response: We thank the reviewer for pointing this out. To make this concept clearer, we added on page 2 “…i.e., in mating behaviors of short duration without commitment (Buss & Schmitt, 1993)”.

**The authors must again consult the APA 7 guide to rewrite the "METHOD" section. The order of the information is not the one according to the APA; there is no demographic data about the participants or the method of selecting the participants. Please revise that.**

Response: Our manuscript reports a study based on agent-based modeling, which is a theoretical contribution rather than an empirical one. The study did not involve any participants.

**As a general trend, societies are starting to become more prosperous and safer. Therefore, the authors should include in the discussions and evolutionary explanations regarding the migration of species from the fast life strategy (which facilitates short-term mating for men) to the slow life strategy (which no longer forces people to entrench these differences of gender).**

Response: We thank the reviewer for this advice. We have already added this point as a possible future research direction to the discussions.

**Reviewer: 3**

**The manuscript attempts to further our understanding of sex and sexual orientation differences in short-term mating behaviour by using computational models to determine the circumstances in which they arise. While the aims of the study are valuable, I struggle to see how this study enhances the literature on this subject. Please see my specific comments below.**

**1. I am not sure what this study provides that previous research has not already established. The main outcome of the computational model was that when a group of individuals attempt to engage in sexual interactions with another group who has higher mating standards, the former groups sexual interaction will be constrained.** **One thing that I found to be somewhat novel in the study was that the number of mating experiences was more readily influenced by “mating standards” as opposed to “short-term mating likelihood.” However, given that the authors themselves are setting the group parameters for “mating standards,” it is not particularly surprising to see that group differences in sexual behavior emerge when the parameters are set to differ by group. I think the study would have more value if the authors attempted to confirm the results from the computational model by recruiting male and female participants, quantified and assessed their short-term mating preferences and standards, and analyzed which of the two better predicts potential differences in short-term mating behaviours (if any).**

Response: We are grateful to the reviewer for bringing up this great idea for a further study. However, we would like to highlight that the present study is meant to be a theoretical contribution to the field. Its value partially lies in directing our attention to issues that are worth investigating empirically. For example, the distinction between mating standards and likelihood that was brought up by the reviewer may not be noticed by empirical researchers if not shown to have different predictive power towards short-term mating behaviors.

**As is, however, I do not see how this study enhances our understanding of sex differences in mating behavior/preferences. Perhaps I am missing something. If so, the authors should attempt to enhance the rationale of the study and its contribution to the greater literature.**

Response: Our ultimate rationale for this study is to find simple explanations for the pattern we empirically observe in the world, as well as to raise questions about the validity of existing observations that are incompatible with theoretical predictions. To make this rationale more explicit, we pointed out the novelty of our study at the beginning of the third paragraph in the Introduction:

“The present study aimed to address two theoretical issues that have been underexamined in the literature: a) the conceptual link between gender differences in mating preferences and those in behaviors, and b) the existence of a shared explanation for gender differences in mating behaviors among heterosexual individuals on the one hand, and those among gays and lesbians on the other.”

**2. Given that the differences in (short-term) sexual behaviors between birth-assigned males and females have been found among heterosexuals, homosexuals (e.g., Lippa, 2020), transgender indivduals (de Menezes Gomes et al., 2021), and, as discussed by the authors, across cultural contexts (see also Lippa, 2009), I think it's fair to say that these are "sex" differences and not just "gender" differences.**

Ok. Pay attention to this.

de Menezes Gomes, R., de Araújo Lopes, F., & Castro, F. N. (2020). Influence of Sexual Genotype and Gender Self-Perception on Sociosexuality and Self-Esteem among Transgender People. Human Nature, 31(4), 483-496.

Lippa, R. A. (2009). Sex differences in sex drive, sociosexuality, and height across 53 nations: testing evolutionary and social-structural theories. Archives of Sexual Behavior. 38, 631–651.

Lippa, R. A. (2020). Interest, personality, and sexual traits that distinguish heterosexual, bisexual, and homosexual individuals: Are there two dimensions that underlie variations in sexual orientation? Archives of Sexual Behavior, 49(2), 607-622.

**3. Introduction, Page 2. When providing the rationale for the study, the authors state that “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.” and that “Some researchers study gender differences at the two levels simultaneously without a conceptual distinction (e.g., Petersen & Hyde, 2010).” The cited meta-analysis looked at men’s and women’s self-reported sexual behaviours (e.g., number of sexual partners) and attitudes (e.g., attitudes towards casual sex) individually and found significant differences in both. This distinction is also examined or reviewed in other works by David Schmitt. As such, it is not clear what the authors mean when they state that previous literature does not provide a “conceptual distinction” between sexual behaviours and attitudes/preferences.**

Response: We thank the reviewer for pointing this out and apologize for the confusion here. We agree that past studies have conceptualized and investigated sexual behaviors and attitudes separately. What we wanted to emphasize was that the existing literature implicitly assumes that sexual behaviors directly reflect people’s sexual preferences (e.g., Schmitt et al., 2001), a logic that we think requires more reflections on. To make this point clearer, we have revised the manuscript to directly stress this point: “In the existing literature, gender differences in actual sexual behaviors are usually explained through the differences in attitudes towards or preferences for short-term mating. For example, many assume that behavioral differences are a direct expression of the psychological ones (e.g., Schmitt et al., 2001).”

**4. Results. The 95% CI for every single effect size reported in the study appears to be incorrect (except for the first two). For example, the Cohen’s d comparing gay men’s and lesbian women’s average number of short-term mating experiences is 8.54 but the interval is -2.33 to -2.30 (see page 10).**

Response: We apologize for the confusion. The reported confidence intervals were not intervals of the Cohen’s *d*s, but of the differences of the group means. To avoid further confusion, we reported all the CIs right after *p* values in the revised manuscript.

**5. Discussion, Page 14. The authors state that in light of their 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).” As mentioned earlier, Petersen & Hyde (2010) found sex differences in both short-term mating behaviors and attitudes, and these sex differences emerge among heterosexual, homosexuals, and transgender individuals, and across cultural contexts. The consistency of these findings reduces the possibility of being a result of “sampling bias” or “social desirability bias.” Thus, I am not sure why the findings from Petersen & Hyde (2010) are “perplexing.”**

Response: Thanks for raising the question. The point here is to highlight that the existing empirical evidence is at odds with the theoretical conclusions drawn from our model, and we tried to offer some possible explanations for it. They were not particularly directed at Petersen & Hyde (2010), nor were they exhaustive of all possible explanations. We recognize that Petersen & Hyde (2010) may not suffer from problems like sampling bias. However, since their conclusions regarding behaviors were inconsistent with the theoretical implications, there should be some explanations for it, which may or may not have been considered by us. To make this point clearer, we modified the second sentence of the paragraph in the revised manuscript: “Possible explanations for these empirical results that seem illogical considering the simulation findings may include but not limited to the following features of the observation process.”