



Prestige, conformity and gender consistency support a broad-context mechanism underpinning mate-choice copying

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ABSTRACT

Mate choice is a fitness-relevant decision, that can be informed by the mate choices of others. Such mate-choice copying has been documented across multiple species, including humans. However, so has copying in many other contexts. As such, the extent to which mate-choice copying is underpinned by the same psychological mechanisms as copying in other contexts remains unclear. To test these hypotheses, we conducted an online experiment (recruiting from M-Turk, $n = 165$) to examine whether human mate choice copying is prestige and/or conformist biased (both of which are documented in other domains), and whether it differs between men and women. If mate choice copying is underpinned by broad-context mechanisms, we predict it will be similar in men and women, with both groups also exhibiting prestige-biased and conformist transmission. Our results match these predictions, exhibiting no evidence of a difference in mate-choice copying between men and women, and evidence of prestige-biased and conformist transmission. These results suggest that mate choice copying is the product of adaptive, broad-context copying mechanisms.

1. Introduction

Mate choice is an important decision in sexually reproducing species, affecting the genes passed on to offspring, as well as the amount of investment partners and offspring receive. However, mate quality may not be readily observable, making effective mate-choice a potentially challenging endeavor. To improve their mate choices, individuals can learn from the choices of others, a process referred to as “mate choice copying” (Waynforth, 2007) which often generates a generalized preference for traits observed in chosen individuals (Bowers, Place, Todd, Penke, and Asendorpf, 2012; Jones and DuVal, 2019; Kavaliers, Matta, and Choleris, 2017).

Many empirical studies have documented mate choice copying in humans (Gouda-Vossos, Nakagawa, Dixon, and Brooks, 2018; Scammell and Anderson, 2020). For instance, Eva and Wood (2006) found that women perceive photos of men labeled as “married” more attractive than those labeled as “single”. Similarly, the presence of a female partner, or other women, near a potential mate causes observing women to perceive them as more desirable (Hill and Buss, 2008; Little, Caldwell, Jones, and DeBruine, 2015; Rodeheffer, Leyva, and Hill, 2016; Waynforth, 2007). Similar effects have been observed in speed dating

(Bowers et al., 2012) and in self-reports of third-party romantic interest (Vakirtzis and Roberts, 2012). While mate poaching (attracting someone who is already in a romantic relationship) does occur in humans (Schmitt and Buss, 2001), it is not the norm or a necessary consequence of mate choice copying (Thompson and O’Sullivan, 2016).

Mate-choice is not the only important decision that organisms make and so individuals can, and do, benefit from learning from others across a wide variety of contexts (Hoppitt and Laland, 2013). For instance, in addition to mate-choice copying, humans acquire adaptive dietary taboos through social learning (Henrich and Henrich, 2010). However, that copying occurs across contexts does not imply that the same psychological mechanisms are involved in different contexts. Thus, it remains unclear whether mate choice copying is guided by narrow-context copying mechanisms that evolved specifically for mate choice, or if it is instead affected by a broader capacity to learn socially. Evolutionary thinking alone cannot resolve this as many aspects of copying can be explained via narrow-context or broad-context adaptive reasoning. For instance, the increased use of social information when making long-term, as opposed to short-term, partnership decisions might be a feature of a mate-choice specific mechanism or a broad-context tendency to copy more when risks are higher (Hare, 2017; Street et al.,

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2018; Wachtmeister, 2001).

Such stances entail different views of the mind as well as how selection has shaped it. The narrow-context hypothesis suggests the mind is made of a large number of context specific systems, each of which solves problems in its specific context and so has been shaped by selection pressures unique to that context. The broad-context hypothesis, however, suggests the mind consists of a smaller (although potentially still large) number of systems which are flexibly recruited across a range of contexts to produce effective behavior. As these broad-context systems are shaped by selection pressures from multiple contexts, their design may reflect compromises to the competing needs of different decisions and exhibit general solutions. In the context of mate-choice this becomes a question of whether mate-choice copying is guided by mechanisms that are specific to a mate-choice context, or mechanisms that operate more broadly (Bolhuis, Brown, Richardson, and Laland, 2011; Miller and Todd, 1998; Street et al., 2018).

Other work has placed considerable emphasis on broad-context adaptive biases that influence when, who and what to copy (Boyd and Richerson, 1985; Kendal et al., 2018; Kendal and Watson, 2023; Laland, 2004; Rendell et al., 2011). Such biases enable learners to obtain high quality information across many contexts. One of the most studied social learning biases is conformist transmission; the disproportionate adoption of majority beliefs (Boyd and Richerson, 1985; Morgan & Laland, 2012). Adoption is disproportionate in the sense that the probability of adopting the majority belief is greater than the proportional size of the majority. As such, conformist transmission can drive popular beliefs to fixation, which can result in stable between group variation (Henrich and Boyd, 1998), although the stability of these traditions has been questioned (Morgan and Thompson, 2020). Nonetheless, the potential for conformist transmission to stabilize cultural traditions has led to its study in many species, with evidence for this phenomena being found in human adults (Morgan, Rendell, Ehn, Hoppitt, and Laland, 2011; Muthukrishna, Morgan, and Henrich, 2016), children (Morgan, Laland, and Harris, 2014), monkeys (van de Waal, Borgeaud, and Whiten, 2013), birds (Aplin et al., 2015; Lachlan, Ratmann, and Nowicki, 2018) and flies (Danchin, Nöbel, Pocheville, et al., 2018). Though negative results have also been reported (Battesti, Moreno, Joly, and Mery, 2014; Eriksson, Enquist, and Ghirlanda, 2007; Watson et al., 2018).

Another transmission bias that has received recent attention is the selective copying of prestigious individuals, known as prestige-biased transmission. Selection favors copying successful individuals (Kendal, Giraldeau, and Laland, 2009; Schlag, 1998, 1999), however, direct measurements of an individual's skill may be difficult to obtain. In these situations, indirect cues, or general markers of success, can be used in their place (Atkisson, O'Brien, and Mesoudi, 2012; Henrich and Gil-White, 2001). The reliance on these indirect cues of success creates a pattern where generally successful individuals are sought for advice on a variety of matters and, in exchange, receive deference, access to resources, and positions of power and leadership, which collectively are signals of success, referred to as "prestige" (Henrich, Chudek, and Boyd, 2015; Henrich and Gil-White, 2001; Jiménez and Mesoudi, 2019; Lenfesty and Morgan, 2019). This hypothesis is supported by empirical documentation of prestige biased transmission in humans (Atkisson et al., 2012; Brand, Heap, Morgan, and Mesoudi, 2020; Brand, Mesoudi, and Morgan, 2021; Chudek, Heller, Birch, and Henrich, 2012; Henrich and Henrich, 2010).

Here we draw on transmission biases to test whether mate-choice copying is underpinned by narrow-context or broad-context mechanisms. Specifically, we ask two questions: 1) is mate choice copying influenced by the same biases (specifically, conformist and prestige biases) documented in other contexts? and 2) does mate choice copying (including any effect of conformity or prestige) differ between men and women? If mate choice copying is underpinned by broad-context mechanisms, we predict that conformist transmission and prestige biased transmission, which are both documented in other contexts, will also occur in the context of mate choice. If mate choice strategies are

narrow-context, we predict that women will be more sensitive to the mate decisions of others than are men because women tend to have more at stake in reproduction than men (Bateman, 1948; Geary, Vigil, and Byrd-Craven, 2004; Kokko and Johnstone, 2002; Trivers, 1972), and they therefore should be expected to expend additional effort to evaluate potential mates.

2. Methods

Data were collected via an online experiment, using the platform Dallinger (<http://docs.dallinger.io/en/latest/>). Participants were recruited in groups of 10, and the experiment consisted of five phases: (1) group formation, (2) general knowledge quiz, (3) partner preference task, (4) post-experiment questionnaire and (5) payment. These phases are described in detail below. Within groups, participants completed the experiment synchronously, allowing them to view the decisions of their group mates live. Participants' final scores in the general knowledge quiz were shared alongside their choices made in the partner preference task and served as a proxy for prestige, being a measure of skill from a different domain (Brand et al., 2020, 2021). Ethical approval was granted by the Arizona State University IRB (Study ID: 00004815). All data and analysis code is available online (<https://github.com/thomasmorgan/mate-choice-copying-prestige-conformity>).

2.1. Recruitment and group formation

Participants were recruited from Amazon Mechanical Turk (MTurk), a virtual crowdsourcing marketplace. MTurk has a population of over 100,000 workers, and experiments typically reach about 7300 individuals (Difallah, Filatova, and Ipeirotis, 2018; Stewart et al., 2015). The MTurk population is broadly comparable to the United States population (Levy, Freese, and Druckman, 2016; Ross, Zaldivar, Irani, and Tomlinson, 2010), but slightly female-biased, with a higher level of education and lower socioeconomic status.

In total 260 participants were recruited, forming 26 groups. However, 44 participants left the experiment before their group filled, meaning 216 participants took part. In addition, participants could leave at any time and participants who were too slow to respond were removed (see below). As a result 165 participants were included in the analysis. For a detailed description of participant retention, see SI.

Upon recruitment, participants were briefed on the experiment, gave their consent to take part and reported their primary romantic preference as either "men", "women", or "both". This information was used to assign participants to groups; those who selected "men" or "women" were placed with individuals who shared their preference, while participants who selected "both" were assigned to the fullest available group. Thus, groups were composed of participants with a shared attraction to men or women. Within groups, participants were assigned numeric IDs according to the order they arrived.

The experiment did not start until a group contained 10 participants, which typically took around 3 min (range: 0.5 to 8.9 min). While participants were waiting, they were shown a screen displaying the current number of participants in their group, with an audio alert notifying them when the group was full. This allowed participants to engage in other activities while they waited and increased participant retention. Once a group was full, the general knowledge quiz began.

2.2. The general knowledge quiz

The general knowledge quiz consisted of 30 two-alternative forced-choice trivia questions (see Table 1.2 in SI). Questions were presented in the same order for all participants. Within each group, participants completed the questions in sync. If a participant did not respond for over 30 s, they were removed from the experiment and their group continued without them. Once all questions were answered, participants moved on to the partner preference task.

2.3. The partner preference task

On each of 30 trials, participants were shown a pair of photographs of individuals matching the romantic preference of their group and were asked which they would prefer as a romantic partner (we did not indicate whether this was as a short- or long-term partner). Once all participants in a group made their decisions, they saw the photos again along with live social information, and were asked to make a second decision. The social information showed the decisions of the participant’s group mates, along with their group mates’ quiz scores (the proxy for prestige) and was displayed as two lists, one below each photo (see Fig. 1). Participants’ own decisions were not included in the social information to avoid commitment effects (Brody, 1965). Once all 30 trials were completed, the group advanced to the post-experiment questionnaire.

The photographs used in the partner preference task are from the *Fundação Educacional Inaciana Face Database*. From this dataset, 60 photographs of both men and women were chosen at random without replacement for this study; excluding photographs that were blurry, showed individuals with their eyes closed, or individuals who appeared to be under 18 years old. The pairing and ordering of photographs were randomized across groups, but they were the same for all participants within a group.

2.4. The post-experiment questionnaire

The questionnaire asked participants their (1) age, (2) sex they were assigned at birth, (3) gender identity that best describes them, (4) sexual orientation that best describes them, (5) country of origin and (6) country of residence. This information was collected at the end of the study, rather than the beginning, to avoid priming participants’ behavior during the experiment.

2.5. Payment

Participants were paid \$3 for completing the experiment, with a performance related bonus of up to \$3 calculated as $\frac{score-15}{5}$, where *score* is the number of quiz questions answered correctly. Scores below 15/30 (i.e. chance), did not receive a bonus.

3. Analysis

Data analysis was performed via Bayesian MCMC methods using JAGS in R to generate samples from posterior distributions. A minimum of 3000 effective samples were generated from three Markov chains for each parameter, with convergence confirmed using the Gelman-Rubin statistic (upper bound ≤ 1.01).

We modeled the probability a participant chose a given photograph (p) as their final choice after seeing the social information on each trial ($n = 4561$) as a Bernoulli variable with a logit link function. The linear predictor included: (1) which face the participant chose as their initial preference (β_j), and (2) the social information they viewed (s). The effect of the social information was the sum of each demonstrator’s influence, modified by the level of consensus to account for conformist transmission. Each demonstrator’s influence was given by a baseline value, modified by the demonstrator’s performance on the general knowledge quiz to account for prestige-biased transmission. The baseline influence of each demonstrator, the effect of quiz score and the effect of consensus were all conditional on the observing participant’s gender and sexual orientation, allowing us to explore differences in social information use across genders and orientations. The total impact of the social information was additionally scaled by participant-level effects (ϵ_p). The model structure is as follows:

$$F \sim \mathcal{B}(p)$$

$$\text{logit}(p) = \beta_I + s\epsilon_p$$

$$s = (1 + C\chi_{G,O}) \sum_{i=1}^N D_i(\omega_{G,O} + \delta_{G,O}Q_i)$$

With the following priors:

$$\beta_{1:2} \sim \mathcal{N}(0, 10)$$

$$\omega_{1:3,1:2} \sim \mathcal{N}(\mu_\omega \sigma_\omega), \quad \mu_\omega \sim \mathcal{N}(0.5), \quad \sigma_\omega \sim \mathcal{E}(0.5)$$

$$\delta_{1:3,1:2} \sim \mathcal{N}(\mu_\delta \sigma_\delta), \quad \mu_\delta \sim \mathcal{N}(0.1), \quad \sigma_\delta \sim \mathcal{E}(5)$$

$$\chi_{1:3,1:2} \sim \mathcal{N}(\mu_\chi \sigma_\chi), \quad \mu_\chi \sim \mathcal{N}(0.2), \quad \sigma_\chi \sim \mathcal{E}(5)$$

$$\epsilon_{1:166} \sim \mathcal{N}(1\sigma_\epsilon), \quad \sigma_\epsilon \sim \mathcal{E}(1)$$

Please review the decisions of your group mates and make a final decision.

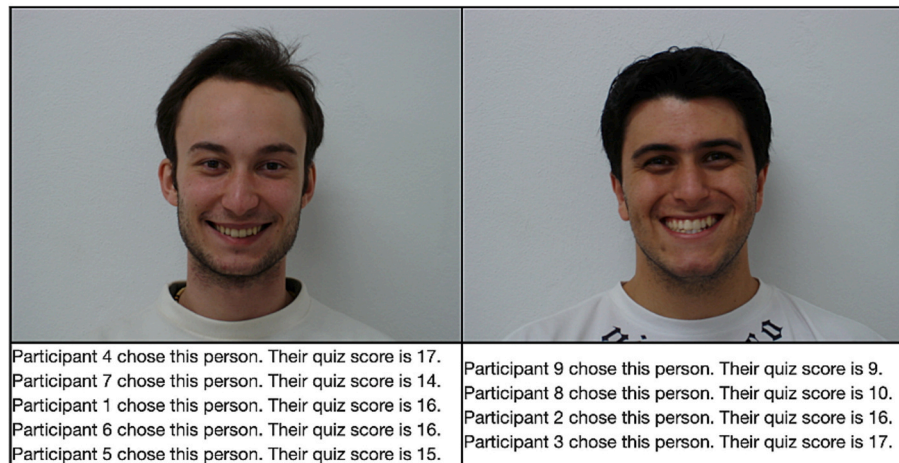


Fig. 1. An example of the participants’ view when making a final decision during the partner preference task. The social information is presented in a list underneath each photograph and showed the decisions of a participant’s group mates, along with their quiz scores (the proxy for prestige).

Where \mathcal{B} is a Bernoulli distribution, \mathcal{N} is a normal distribution, and \mathcal{E} is an exponential distribution. Definitions of measured and estimated variables are provided in Tables 1 and 2.

4. Results

4.1. Quiz performance and demographics

Participants' performance on the general knowledge quiz was above chance (mean score = 19.0/30) and exhibited considerable variation between participants (range: 11/30 to 28/30, SD: 4.06).

The majority of participants identified as male and heterosexual (97/165, 58.8%) or female and heterosexual (40/165, 24.2%). Only two participants identified as other genders (1.2%) and 27 participants identified as sexual orientations other than heterosexual (16.4%). Given these small samples, we could not reach firm conclusions about any groups other than heterosexual men and heterosexual women, and results for other groups are located in the supplementary material (see Tables 3.1 and 3.2 in SI).

4.2. Social information use

For quantitative parameter estimates see Table 2 (and Table 3.1 in SI for a complete list). Whether or not a heterosexual male or female participant chose a given photograph as their final choice on each trial was influenced by the decisions of their group mates (Fig. 2a). For both heterosexual men and women, the magnitude of a group mate's influence increased with their quiz score (Fig. 2b), consistent with prestige biased transmission. For both heterosexual men and women, the effect of consensus meant that observer's were disproportionately sensitive to small majorities, resulting in the sigmoidal curve characteristic of conformist transmission (Fig. 2c). There was little evidence of a difference between heterosexual men and women in any regard: difference in baseline demonstrator influence = 0.050, [-0.093, 0.224], difference in score effect = 0.013, [-0.013, 0.048], difference in consensus effect = 0.298, [-0.167, 1.068]. There was, however, strong evidence of participant level variation in social information use (see SI).

While participants were clearly sensitive to the social information, they were much more likely to choose a given photo as their final choice if they had already selected it as their initial choice, with their initial choice carrying roughly as much weight as five group mates.

5. Discussion

This study tested the context-specificity of mate choice copying by addressing two questions: 1) does mate choice copying exhibit conformist transmission and/or prestige-biased transmission? and 2)

Table 1
Measured variables in the analysis.

| Parameter | Definition |
|-----------|--|
| F | Whether the participant chose the given photo as their final decision (1 = they did, 0 = they didn't) |
| I | Whether the participant chose the given photo as their initial decision (2 = they did, 1 = they didn't) |
| C | The consensus among demonstrators (centered around 0 such that 0.5 = unanimity, -0.5 = maximal disagreement) |
| N | The number of demonstrators |
| D_i | Whether or not the participant's i^{th} demonstrator chose the given photo (1 = they did, -1 = they didn't) |
| G | The participants' self-reported gender identification (1 = female, 2 = male, 3 = all other genders) |
| O | The participants' self-reported sexual orientation (1 = heterosexual, 2 = all other orientations) |
| Q_i | The quiz score of the i^{th} demonstrator relative to the mean score of all participants |
| P | The numeric ID of the participant |

Table 2

Values estimated by the analysis, including selected results (provided as the median sample and 95% highest density interval). For full model estimates see SI.

| Parameter | Definition | Median and 95% HDI |
|--------------------|--|--|
| $\beta_{1:2}$ | The baseline logit-probability that a participant chooses the given photo for their final decision | β_1 : -2.447 [-2.627, -2.274] β_2 : 2.433 [2.262, 2.610] |
| $\epsilon_{1:165}$ | The individual-level effect for each participant | See SI |
| $\omega_{1:3,1:2}$ | The baseline influence of each demonstrator | $\omega_{1, 1}$: 0.491 [0.354, 0.654] $\omega_{2, 1}$: 0.439 [0.347, 0.534] See SI for full estimates |
| $\delta_{1:3,1:2}$ | The effect of demonstrators' quiz score (Q) on their influence | $\delta_{1, 1}$: 0.026 [0.000, 0.058] $\delta_{2, 1}$: 0.012 [0.001, 0.023] See SI for full estimates |
| $\chi_{1:3,1:2}$ | The effect of consensus (C) on social influence (values <1 indicate conformist transmission) | $\chi_{1, 1}$: -0.249 [-0.739, 0.388] $\chi_{2, 1}$: -0.574 [-0.936, -0.192] See SI for full estimates |
| μ_ω | Mean of distribution of baseline demonstrator influence | 0.408 [0.137, 0.668] |
| σ_ω | Standard deviation of distribution of baseline demonstrator influence | 0.178 [0.000, 0.519] |
| μ_δ | Mean of distribution of effects of demonstrator quiz performance on demonstrator influence | 0.018 [-0.024, 0.065] |
| σ_δ | Standard deviation of distribution of effects of demonstrator quiz score on demonstrator influence | 0.0258 [0.000, 0.087] |
| μ_χ | Mean of distribution of effects of consensus on social influence | -0.291 [-0.787, 0.413] |
| σ_χ | Standard deviation of distribution of effects of consensus on social influence | 0.267 [0.000, 0.765] |
| σ_ϵ | Standard deviation of distribution of individual participant effects | 0.851 [0.663, 1.069] |

does mate choice copying (including any effects of consensus and prestige) differ between men and women? If broad-context mechanisms underpin mate choice copying, we predicted that we would observe conformist transmission, prestige biased transmission and similar levels of copying in both men and women. In all cases the collected data supports the broad-context hypothesis. We found that mate choice copying exhibits both conformist transmission (small majorities had a disproportionate influence on the mate choices of observing participants) and prestige bias (demonstrators with higher quiz scores had greater influence over other participants' decisions). These biases have been documented in other experimental tasks, including mental rotation, quantity estimation (Morgan et al., 2014), simulated crop choice (Mcelreath et al., 2005), noisy payoff estimation (Efferson, Lalive, Richerson, Mcelreath, and Lubell, 2008), general knowledge (Brand et al., 2020), virtual arrowhead design (Atkisson et al., 2012), and taboos and norms (Henrich and Henrich, 2010). The present study adds mate choice to this list, providing further evidence that transmission biases operate across contexts. In addition, we found both heterosexual men and women engaged in mate choice copying to a similar extent. Our findings are particularly striking because mate-choice is more pronounced in females of other species (Kavaliers et al., 2017). This difference between humans and other species is consistent with the hypothesis that humans, uniquely, are social learning generalists (Laland, 2017), i.e. we learn socially in far more contexts than do other species.

Our conclusion that there is little evidence for a difference between mate choice copying in heterosexual men and women is based on the credible intervals for contrasts between these groups including 0.

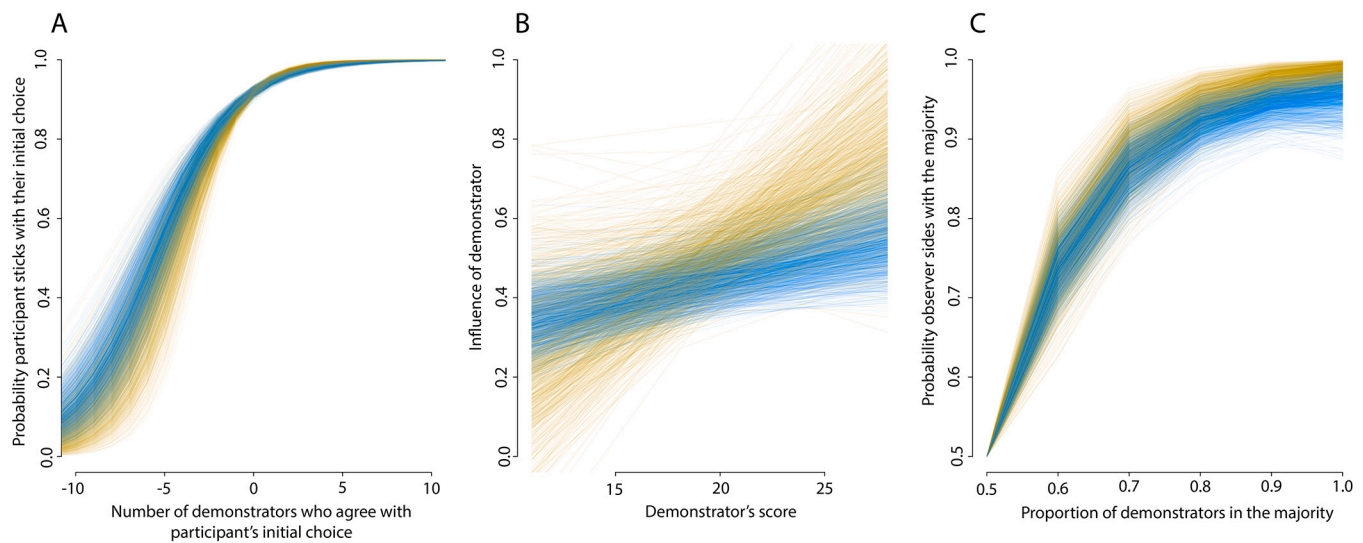


Fig. 2. In all panels the lines are plotted according to independent samples drawn from the posterior distributions for average participant behavior, as such dense areas correspond to highly plausible values. *a)* Heterosexual men (blue) and women (yellow) are more likely to chose photos favored by demonstrators. On the x-axis, negative numbers indicate the majority of demonstrators disagreed with the observer's initial selection. *b)* The magnitude of a demonstrator's influence increases with their score. Note the y-axis is on the logit-scale. While the two sets of lines are not perfectly concordant, there is little evidence of a difference between heterosexual men and women. *c)* The effect of consensus on the probability an observer adopts the majority position, assuming a group of 10 demonstrators and an otherwise naïve observer. Note the x-axis starts at 0.5. For both heterosexual men and women the response is consistent with conformist transmission. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Nonetheless, these intervals also include values which, at their most extreme, could be argued to be biologically meaningful. We can quantify the probability that these differences are biologically meaningful by setting a threshold. For example, consider a case where observers are equally likely to choose either of the two photos and are then shown the decision of a single demonstrator with an average score. We can use the model to estimate the probabilities that men and women, respectively, adopt the decision of the demonstrator, and set a 5% difference in this probability as the threshold for biological significance. In this case, the model suggests there is strong evidence against biological significance, with the probability of a 5% or greater difference being 0.036. The value chosen as the threshold for biological significance affects this probability; lowering it to 3% raises the probability of biological significance to 0.192, whereas raising it to 10% lowers the probability to 0.00003. These findings imply there is good evidence against a biologically significant difference between how men and women respond to the presence of demonstrators, although additional data could refine this conclusion.

Similar calculations can shed light on the magnitude of the difference between men and women in their sensitivity to consensus and prestige. In the cases of prestige, the evidence against a biologically meaningful effect (defined as a 5% difference in the relative probability of copying a high-scoring as opposed to a low-scoring demonstrator, see SI) is weaker, with a probability of roughly 0.5 that the true difference can be considered biologically meaningful. In the case of conformity, the evidence against a biologically meaningful effect is fairly strong, with a probability of only 0.035 that the true difference is biologically meaningful (defined as a 5% difference in the probability of copying an intermediate majority, see SI). Thus, overall, the data are consistent with there being no gender differences in mate-choice copying, and there is strong evidence against such differences in baseline social influence and the strength of conformist transmission. However, while the results favor no gender difference in the strength of prestige-biased transmission, the posterior interval is broad enough that *small-yet-biologically-significant* differences remain plausible. Additional visualization of these differences can be seen in SI Fig. 2.

The question of the context-specificity of mate choice has some

overlap with discussion regarding the domain-specificity (or -generality) of the human mind (Street et al., 2018). Some renditions of the domain-specific hypothesis have invoked a number of narrow-context mechanisms (e.g. face recognition, Duchaine, Yovel, Butterworth, and Nakayama, 2006; folk physics, Leslie, 1994; or cheater detection, Cosmides, 1989). Such narrow-context mechanisms, and a corresponding inclination towards “massive modularity”, have been contrasted with broad, domain-general cognitive systems, (Bolhuis et al., 2011; Boyer and Barrett, 2015; Ellis and Solms, 2018; Laland and Brown, 2011). To the extent that our results apply to this debate, they argue against such theories of domain-specificity, at least in the context of copying. However, other specifications of the domain-specific hypothesis have incorporated broad-context mechanisms to a much greater degree (Barrett and Kurzban, 2006; Sperber and Hirschfeld, 2004) and such theories are consistent with our findings. In particular, Barrett and Kurzban (2006) argue that broad-context mechanisms do not necessarily challenge the modularity of the mind provided these mechanisms still have an evolved domain. Nonetheless, they recognized that broad-context modules may reasonably be considered as modular-yet-domain-general (Barrett and Kurzban, 2006). These varying definitions of what constitutes domain-specificity have added complexity to the debate. In particular, broad-context mechanisms can simultaneously be described as domain-general and domain-specific depending on which definition is adopted. Such complexity may have contributed to different approaches talking past each other. Nonetheless, we can still distinguish narrow-context mechanisms (such as those specific to mate-choice) from broad-context mechanisms, and this is the focus of this work: we conclude that mate choice copying involves a broad-context social learning mechanism, and not one that specifically copies mate choices.

Indeed, the well documented sensitivity of social learning to contextual factors offers a means to tailor broad-context copying to mate-choice, without requiring a narrow-context mechanism. For instance, the tendency to copy when risks are high (Boyd and Richerson, 1985, 1988; Feldman, Aoki, and Kumm, 1996; Galef, 2009; Laland, 2004; Valone, 1989) may lead to more copying when rating the attractiveness of potential partners as opposed to other people (Little,

Caldwell, Jones, and Debruine, 2011). Similarly, a tendency to copy when uncertain (Morgan et al., 2011) may prompt younger people to copy mate choices more than older people, as they feel less confident when selecting partners (Little et al., 2015). In such a framework, mate choice can be considered as a cue that moderates otherwise broad-context psychological mechanisms through abstract properties such as risk, difficulty and cost. This allows mate choice copying to be differentiable at a behavioral level, even if the underlying psychology operates across multiple contexts. If true, this would imply mate choice copying can be integrated into the broader realm of copying as a whole. As such, any copying biases documented in other contexts (e.g. payoff-biased, or uncertainty-biased copying; Morgan et al., 2011; Rendell et al., 2011) should also be detectable in mate choice copying. These predictions can be tested in future work, and if additional evidence continues suggesting that human social learning is similar across contexts, then such verification may no longer be necessary.

Several other studies have looked at gender differences in mate-choice copying and also provide evidence concerning the context-specificity of the underlying cognitive mechanism. Some agree with our work, for instance, an experiment comparing mate-choice copying across five different gender identities (cisgender female, cisgender male, transgender female, transgender male, non-binary) found that all groups responded similarly to different romantic histories; increasing their ratings of single targets with two or no relationships in the past four years, but decreasing ratings for single targets with four relationships, or married targets (Jarrett and Anderson, 2022). However, other work finds evidence of a difference between men and women, with the presence of third-party women increasing women's ratings of male desirability, but third-party men decreasing men's ratings of female desirability (Hill and Buss, 2008). Similarly, a gender difference was observed in the extent to which mate-choice copying generalized or remained limited to a specific target (Bowers et al., 2012). Such differences, in turn, argue in favor of a narrow-context mate-choice copying adaptation, although the literature as a whole is conflicted. A meta-analysis (Gouda-Vossos et al., 2018) highlights these discrepancies. This work examined two specific designs commonly used in mate-choice copying studies; one in which hypothetical mates either are, or are not, paired with third-parties and another in which all hypothetical mates are paired with third parties, but where the favorability of these third-parties is varied. They concluded that a gender difference was present in studies using the former design, but not the latter, although they also found evidence of publication bias which may distort results. The discrepancy between the two designs may be due to that fact that few studies collected data from men (and even fewer from both men and women) making estimates of male behavior challenging. Nonetheless, it also highlights that mate-choice copying may be highly context sensitive.

Other studies have used different tests of the context-specificity of mate-choice copying. For example, women were found to rate men as more attractive when other women were associated with them, but they did not rate women as more attractive when they were associated with other men (Little et al., 2011). However, as noted by Street et al. (2018), this could be explained by participants being more influenced by individuals of the same sex, considering them to offer more relevant information. However, a similar result was found where women's mate-choice copying increased when the female bystanders were described as the target man's current partner (Rodeheffer et al., 2016) which cannot be explained as sex-biased copying. Despite these results, other work supports a broad-context mechanism, finding that women copy attractiveness ratings of male faces, male hands and abstract art to the same degree (Street et al., 2018).

The inconsistencies in the literature highlight the difficulties of using behavioral experiments to establish the context-specificity of mate-choice copying. This applies to the current study as well. For instance, while we conclude in favor of the broad-context hypothesis, our findings cannot rule out a variety of more narrow-context scenarios. For instance,

perhaps male and female mate-choice copying have separate mechanisms that have converged due to the high degree of parental investment exhibited by both men and women in contemporary populations. Similarly, the broad value of conformist and prestige-biased transmission may have led to these biases evolving in multiple narrow-context social learning mechanisms (or evolving in an ancestral broad-context module that later split into multiple, homologous, narrow-context modules). Further work could address these hypotheses directly. In particular, formal theory could be used to generate predictions about specific details of a copying mechanism that would only be adaptive in a mate-choice context. Empirical validation of the presence of such features would then support a narrow-context hypothesis. Nonetheless, the disagreement among existing behavioral studies suggests that they may never provide a clear answer regarding the context-specificity of human mate-choice copying. Indeed, it may be that a flexible, broad-context system produces similar behaviors to a series of narrow-context systems. As such, alternative methods may provide clearer insights. For instance, Ellis and Solms (2018), reviewing developmental-genetic data, have argued against the possibility of evolved modules within the cortex, but in favor of such modules in subcortical brain regions. From this perspective the brain is a mix of hard-wired, subcortical modules which can operate in a narrow context (for instance, sensory modules like face detection, or affective modules such as fear, c.f. Panksepp and Biven, 2012) and a soft-wired cortex that developmentally adapts to environmental challenges across contexts, potentially including the construction modular systems that nonetheless have no specific evolutionary basis.

Limitations of this study impact the extent to which these results can be generalized across groups of people. As noted, almost all participants identified as male or female and heterosexual. Because so few participants identified as other genders or sexual orientations, we are unable to say much about how their mate choices are influenced by social information. However, as noted above, a recent study finds little evidence of a difference in mate-choice copying across gender identities, or across five sexual orientations (heterosexual, bisexual, gay, pansexual, asexual) (Jarrett and Anderson, 2022). Nonetheless, other work finds that the gender difference in mate choice copying between heterosexual men and women observed by Hill and Buss (2008) is reversed among homosexual men and women (Scofield, Kostic, and Buchanan, 2020). Further work will be needed to achieve clarity. In addition, because groups of participants were defined by shared attraction to either men or women, they were not consistently single-sex. Although participants were not directly informed of this, where participants inferred that groups may not be single-sex this could have changed their behavior, potentially reducing the activity of a narrow-context mechanism. Another limitation of this research is that all participants were residents of the United States and only a small number were born elsewhere. Therefore, we are unable to evaluate how mate choice copying differs across countries and cultures. Future studies should focus on including participants living outside the United States.

The study of human evolution is multifaceted. One area of research emphasizes the role of mate choice in sexual selection. Another focuses on social learning as the basis of cultural evolution. Mate choice copying brings these two areas together. Here, we provide evidence that mate choice copying is underpinned by a flexible, broad-context psychological mechanism that is sensitive to a wide range of factors, including consensus and prestige. If correct, the same mechanism is likely at work in other contexts. Additionally, the broad-context psychology of cultural inheritance may have played a key role in sexual selection by biasing mate choice decisions. Indeed, influential individuals' ability to dictate attractiveness norms may have intensified sexual selection. Further investigation into the psychology of mate choice copying will provide a more complete picture of the role social learning played in our evolutionary history.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.evolhumbehav.2023.09.002>.

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