Original Research Article

Jealousy as Predicted by Allocation and Reception of Resources in an Economic Game

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Abstract

Evidence is abundant that evolution by selection has produced sex differences in the design of adaptations to solve the problems surrounding reproduction. A prime example is the design of human jealousy, which research suggests is triggered by distinct evoking acts that are specific challenges for women and men in their exclusive reproductive bond. It follows that jealousy would be directed toward driving away interlopers who could potentially threaten the bond with the romantic partner or increase mate retention efforts in response to sex-specific threats. To explore this possibility, we use as a methodological innovation an economic game for the evocation of jealousy. With a modified dictator game, we showed men and women in a committed relationship, conditions in which the partner or an intrasexual rival allocates money to (investing condition), or obtains money from (receiving condition), the partner or an opposite sex third party that they recently met. A sample of 56 heterosexual couples ($n = 112$) participated in a laboratory setting. Our results show the different scenarios of this dictator game exerted the expected evocation of jealousy (controlling individual differences), with women being more jealous by the partner's allocation of resources to a rival, and men reporting slightly more jealousy by their partner receiving money from a rival. We discuss the implications of this method to advance the comprehension of the adaptive function of sex differences in jealousy, the use of economic games, and possible modifications to improve the similarity of the game to a real assessment of actual male jealousy.

Introduction

In broad terms, jealousy is an emotion that appears in human infancy, aimed at safeguarding attachment and is initially triggered by the competition for maternal affection, caring, and proximity among social rivals, such as siblings (Hart, 2017). Throughout ontogeny, children tend to experience jealousy when they perceive threats to their relationships from other connections, such as friendships (Lennarz et al., 2017). Moreover, in adolescence and adulthood, this emotion has been observed when there is a perceived threat in various valued relationships, including friendships and romantic partnerships (Buss, 2018; Fernandez, Castro, et al., 2022). Consequently, jealousy emerges during development as a mechanism to safeguard close bonds (Fernandez, Acevedo, et al., 2022; Fernandez et al., 2023), but in the context of romantic relationships there are widely evidenced sex differences in jealousy (SDJ) that seem to develop early in life too (Larsen et al., 2021).

From an evolutionary perspective, sexual jealousy is understood as an emotion that motivates the protection of a valued relationship from rivals (Buunk, 1997; Symons, 1979; White, 1984). In the context of romantic relationships, jealousy appears as an emotion designed to protect the romantic pair-

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bond (Fernandez, 2017; Fletcher et al., 2015) preventing the diversion of reproductively relevant resources toward interlopers (Buss et al., 1992). Jealousy is a complex emotion (Buunk, 1997), which involves multiple affective reactions such as anger, sadness, and fear, and it is also very similar to the flight stress response (Buss, 2013; Fernandez & Palestini, 2010; Shackelford et al., 2000). Importantly, both sexes appear to have evolved a particular psychology of jealousy, sensible to the situations or cues that activate its behavioral expression (Buss, 2018; Buss et al., 1992; Sagarin et al., 2012).

The evolved function of jealousy in romantic couples is to discourage infidelity (Buss, 2018; Conroy-Beam et al., 2015). Reacting with jealousy when there is a suspicion of losing a partner is less costly than actually losing a valued reproductive partner or their resources (Buss & Haselton, 2005; Foster et al., 2014; Schmitt & Buss, 2001). Hence, Symons (1979) and Buss et al. (1992) hypothesized that sexual selection favored cognitive biases to dissuade a possible betrayal from a partner and increase the protection of the mating bond. With SDJ emerging as the result of sexual asymmetries in the allocation of resources for reproduction between the members of the romantic couple (Trivers, 1972). Specifically, women are the sex that incur the more significant obligatory investment during reproduction (i.e., in nutrient-rich eggs, internal female fertilization, internal gestation of 9 months, and postpartum lactation as described in Symons, 1979). These higher obligatory reproductive costs imply that women actively attempt to monopolize a mate's resources so that they can be channeled toward them and their offspring (Buss, 2013; Fernandez, 2017). A romantic partner who allocates resources to a rival female, therefore, should particularly evoke jealousy in women. In the case of men, investing resources toward one long-term partner allows them to increase their paternity certainty—an adaptive problem solely faced by men since maternity certainty is always 100%. Moreover, a man willing to devote the lion's share of his resources is generally able to attract and retain a woman higher in mate value (Buss, 2016). Thus, men are expected to experience increased jealousy when there is a risk of paternity uncertainty (Ein-Dor et al., 2015), which is highly associated with the monopolization of paternal resources (Conroy-Beam et al., 2015).

Based on the theoretical rationale of parental investment theory (Trivers, 1972), recent studies that have investigated SDJ showing that women tend to experience higher levels of distress when they perceive a potential loss of partner support, especially in contexts where there is a greater impact of parental investment (Scelza et al., 2019). Furthermore, men's experience of jealousy is not solely limited to distress related to sexual encounters with other partners, but it also extends to the perceived loss of parenting opportunities (Edlund et al., 2019). This suggests that men are sensitive to the possibility of their partner engaging in sexual activities that could result in paternal uncertainty.

Along this tradition, SDJ have been studied with scenarios that presented an imaginary situation of infidelity (Bendixen et al., 2015; Buss et al., 1999; Sagarin et al., 2012), using the memory of romantic betrayal or movies about sexual infidelity

(Fernandez & Palestini, 2010), showing attractive rivals (Massar & Buunk, 2010), assessing the jealousy reaction to TV show cheaters (Kuhle, 2011) and reading histories about infidelity (Sabini & Green, 2004), among others. In some of these experimental designs, the hypothetical scenarios are linked to forced-choice questions in which two fictitious situations are presented, that is, sexual or romantic infidelity, and the target is forced to select the more jealousy (Buss et al., 1992). Other studies have focused on selecting participants who experienced actual infidelity or who had vividly imagined this transgression (Buunk & Fernandez, 2020; Fernandez & Palestini, 2010; Fussell & Stollery, 2012; Schützwohl, 2008), resulting in greater SDJ than the forced choice of an imagined situation.

The functional design of SDJ can be conceived as solutions to specific adaptive problems that each sex confronted during evolutionary time, motivating emotional reactions and behavior aimed at mate retention and repelling intrasexual rivals (Buss et al., 1992; Sagarin et al., 2012). However, the standard method used to assess SDJ has been the imagination of hypothetical jealousy situations (Carpenter, 2012; Sagarin et al., 2012) positing sexual and emotional infidelity as the target of jealousy (Buss, 2018). Similarly, there have been novel approaches to address SDJ, by inquiring on sexual differences in the type of transgressions that women and men focus on, when actual infidelity occurs, and their consequences around romantic relationships (Ein-Dor et al., 2015; Fussell & Stollery, 2012; Schützwohl, 2008; Shackelford et al., 2000).

Hence, the evocation of jealousy in more controlled conditions has been addressed scarcely (but see Edlund et al., 2006; Scelza et al., 2019) and, new protocols allowing for the actual induction of romantic jealousy should be welcome in this area. In the present research, we focus on contributing to this end using the observation of the outcome of an economic game between romantic partners, which was aimed at recreating the allocation and reception of resources between potential rivals and the romantic partner, to further enlighten SDJ (Barbato et al., 2018).

For this research, we implemented a novel experimental design piloted by Barbato et al. (2018) that allowed for evoking and assessing jealousy responses in romantic couples, in an attempt to trigger this emotional response as close to the real experience as possible, and without risking or damaging the affective bond of the participants throughout the experiment. Consequently, the use of economic games facilitated this end (Buskens et al., 2023; Larney et al., 2019; Lv et al., 2024; Takagishi et al., 2014; Tan et al., 2024), and our previous exploration of this method (Barbato et al., 2018) facilitated the inclusion of additional variables to control in the current experimental setting.

Game theory has long been used to test evolutionary hypotheses in order to know which cognitive adaptations underlie behavior, thus leading to decision making tailored to face ancestral problems (Cosmides, 1989). The dictator game is an allocation game useful for measuring direct altruism and emulating conditions of cooperation (Benenson et al., 2007; Bhogal et al., 2016; Camerer, 2003). For example, it has been used in

studies to analyze different manifest behaviors according to social distance. Specifically, when partners have greater anonymity dictators allocate less money compared to reduced anonymity (Charness & Gneezy, 2008). Moreover, thanks to this approach it has been evidenced that the closeness of a social partner is associated with the money allocation received (Freitag & Bauer, 2016; Hackman et al., 2017).

In the present study, the observation of the outcome of an allocation game, in which a dictator (one member of a couple) distributes a fixed amount of money between two potential recipients: the partner or an interloper. For the partner investing condition, individuals observe the outcome of a game in which the individual and the partner play the role of dictator, with a same-sex rival playing the role of the recipient. In this situation, they are told that their partners allocated an exaggerated amount of resources to the rival and less to themselves (the participant). The receiving condition conveyed that the romantic partner received an exaggerated amount of resources from a rival in detriment of the rival's partner. In Barbato et al. (2018), the structure of the games is shown around the sexual differences in three conditions without differentiating conditions of investment nor reception of resources. In the present study, we modify this structure of analysis of the games and assess the conditions considering multiple covariates (age, time in relationship, socioeconomic status, general trust, reactive jealousy, anxious jealousy, possessive jealousy). Similarly, we doubled the sample size, adding to the robustness of hypotheses regarding jealousy evocation.

Considering SDJ, the partner investing more in a sexual rival is a typical female evoking a jealousy condition, while the participant's romantic partner receiving more resources than the rival's partner, is a typical male evoking a jealousy condition. Therefore, our predictions were as follows:

1. In women, one of the primary behaviors that incite jealousy with greater intensity is the risk of losing the resources the partner invests in her. Consequently, women observing their partner in the investing condition of the dictator game, should report greater jealousy than males in the same condition. Additionally, women will also report more jealousy by observing the partner in the investing condition more so than when their romantic partner is in the receiving condition.
2. In men, one of the main behaviors that provoke jealousy with greater intensity is related to the risk of losing sexual exclusivity. Consequently, men in the receiving condition, conveying their female partner receiving resources from a rival should report greater jealousy than females in the same condition, on the (admittedly untested) assumption that receiving resources from another man might be a cue to *sexual* infidelity. In addition, men will also report more jealousy when observing their partner in the receiving condition, more so than when they observe the partner in the investing condition.

Methods

Participants

We recruited a total of 56 heterosexual romantic dyads (112 individuals) for the study (for preliminary analyses of a subsample, see Barbato et al., 2018). The mean age of participants was 23.48 ($SD = 3.92$) years. The mean time of relationship was 33 ($SD = 34.04$) months. The dyads were summoned via social media and email invitations. Participants received a monetary incentive for their time of $7.5 USD. We complied with the ethical standards of APA in our research and the study received approval from the ethics committee at the University of Santiago de Chile where it was conducted.

Procedure

All participants followed the same protocol in the Laboratory, that is, each member of the dyad enters the same room separated by a partition where they sit, sign the informed consent, and follow an ONLINE protocol. All procedures were programmed in the Qualtrics platform. Participants signed an informed consent, completed a sociodemographic questionnaire, measures of general trust, and jealousy. Later, they were presented with a pre-game, which consisted of a single-play allocation game in which the participant is the dictator and splits a specific amount of money between his or her partner and another person. The pre-game is made so that the participant intuitively understands what a dictator game looks like, and can follow the conditions presented to them later. Participants were then introduced to the games, followed by a subjective assessment of the amount of emotions evoked by the game. After receiving feedback on their partner's behavior with the rival, they indicated how jealous the situation made them feel. Couples played simultaneously and believed they were playing online with a third party and their partner, depending on the condition of the game (see below). After the study was completed, we asked participants of their thoughts and feelings (which revolved around the amount of money the partner allocated to the rival), and debriefed participants explaining that for the jealousy induction, we had greatly exaggerated this amount to evoke this emotional response. We gave the incentive to the participant, and finally, a clinical psychologist double checked that there were no appreciable consequences of the procedure, and offered referral contact in case of any future issues.

The Allocation Game

Each participant performed the role of the dictator and the role of one of the recipients in the allocation game. It is important to stress that in the allocation game, the dictator cannot keep any money for herself or himself. It is an allocation between two recipients and thus the allocation should reflect the relative valuation of the two recipients for the dictator (Figure 1).
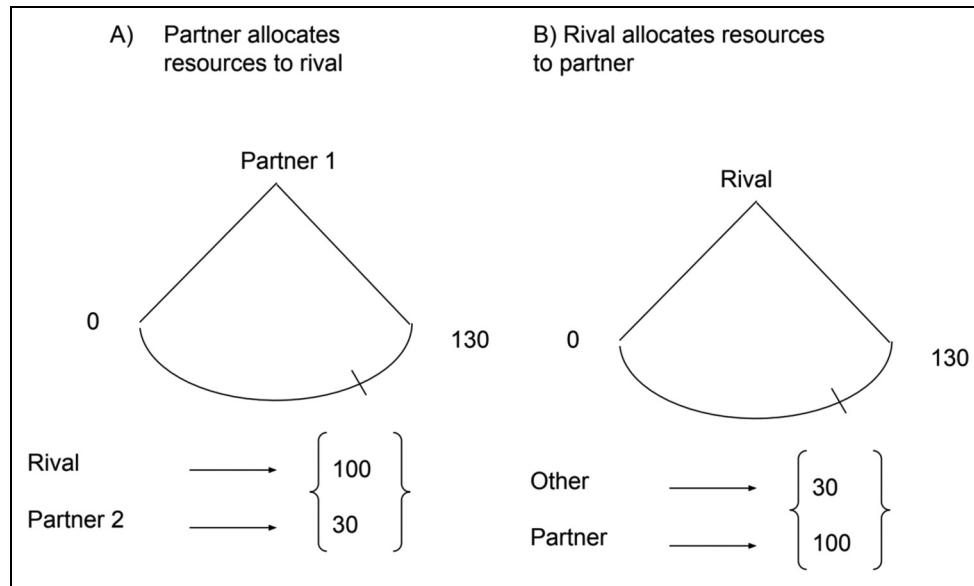
Figure 1. The allocation game. The investing condition corresponds to the game presented in Panel A when a participant (Partner 2) observes the decision of their partner (Partner 1) to invest in a same-sex rival. The receiving condition corresponds to panel B when the participant (Partner) observes the decision of a same-sex rival.

As a jealousy-evoking mechanism, the outcome of the games involving the partners is communicated to the participant. For the investing condition, participants were told that out of a total of $130 USD (100,000 Chilean pesos approx.), their partner allocated $100 USD (75,000 Chilean pesos approx.) to a same-sex rival they believed was playing with them, leaving only $ 30 USD for the participant, that is, less than 25% of the total amount. For the receiving condition, the participant was told that a same-sex rival (believed to be playing with them) allocated $100 USD (75,000 Chilean pesos approx.) out of a total of $130 USD (100,000 Chilean pesos approx.) to their romantic partner, and only $ 30 USD to another opposite sex person, which was the rival's partner. This amount represents an exaggerated payment in comparison to the standard mean presented in a common dictator's game that can be up to half the endowment received by the participant (Fehr & Schmidt, 1999; Heinz et al., 2012; Hoffman et al., 1999; Parker & Hammerstein, 1985).

Jealousy Assessment

During the game, one member of the couple observes the invested or received money from the partner with an opposite sex person, and in turn, on each condition, there is an outcome of the game and a self-report about the emotions felt. After receiving the information about his/her partner's behavior on the allocation game, participants indicated how jealous the situation made them feel on a scale from 1 (*none*) to 5 (*extremely*) following each scenario. In addition, participants also reported other emotions such as happiness, fear, trust, and indifference, to control the consistency of the affective response which were randomly presented.

Sociodemographic Questionnaire

Participants answered sociodemographic questions including sex, age, relationship status, socioeconomic level, and sexual orientation (categorical), time they had been with the partner, number of relationships they have had in their lives, and number of children.

Psychological Measures

In addition, psychological variables that allowed for controlling individual differences in jealousy were measured, and an assessment of estimated trust in the partner was included as a way to establish whether this is a factor that explains the evocation of jealousy in the economic game.

Jealousy Scale. Participants completed the jealousy scale developed by Buunk (1997), containing 15 items, five for each of the three jealousy dimensions. Reactive jealousy refers to how upset one would feel if their partner would engage in various extra-dyadic emotional and sexual behaviors. These five items were assessed on 5-point scale, ranging from 1 = *not at all upset* to 5 = *extremely upset*. For Anxious jealousy participants indicate how concerned they would feel if their partner engaged in various emotional and sexual behaviors. Items are scored on 5-point scale, ranging from 1 = *never* to 5 = *very often*. Possessive jealousy was assessed by situations involving the threat of the partner engaging in various emotional and sexual behaviors, scored on a 5-point Likert scale ranging from *strongly disagree* to *strongly agree*. Cronbach's alphas for the three subscales in the present study were .85, .80, and .68, respectively.

Trust Scale. Participants completed the Dyadic Trust Scale (Larzelere & Huston, 1980). An eight-item measure with a Likert-type response format, asking participants to rate their agreement with statements like "My partner is truly sincere in their promises" ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The General Trust Scale showed a Cronbach's alpha of .78.

Statistical Analyses

In order to test the predictions, a two-level hierarchical linear model (HLM) was assessed. Level-1 variables were within individual measures and Level-2 variables were between individual measures. The dependent variable was the level of jealousy evoked during the game (Level 1), while the predictor variables were sex of the individual (Level 2) and the condition in which jealousy was provoked—observing the partner investing resources in a rival versus receiving resources from a rival —(Level 1). The interaction between the predictor variables was included, while controlling for trust, age, socioeconomic status, and time in the relationship. Jealousy dimensions were also controlled (reactive, anxious, and preventive) since these were not directly provoked by our experimental setting. All the control variables were Level-2 variables and were standardized. Individual ID was included as the random effect.

We employed an HLM in order to account for the repeated measure of the data while comparing sexual differences across conditions (cross-level interaction). We specified full maximum likelihood (ML) estimation and Type III variance. Post-hoc tests (using Sidak correction) followed whenever a significant effect was detected. Since HLM entails residuals at different levels, we calculated for each significant result the effect size following the following expression:

$$f^2 = \frac{R_2^2 - R_1^2}{1 - R_2^2}$$

Table 1. Descriptive analysis. We observed two allocating game conditions assessing jealousy in a 5-point scale in real couples and estimated the effect of the seven covariables in the marginal means in jealousy for each sex.

Variable	Men		Women	
	M	SD	M	SD
Age	23.75	3.65	23.21	4.20
Time in relationship	32.61	32.09	34.42	36.15
Socioeconomic status	2.91	0.90	2.91	0.84
General trust	4.34	0.57	4.42	0.51
Reactive jealousy	3.36	0.92	3.61	0.91
Anxious jealousy	1.99	0.81	2.30	1.00
Possessive jealousy	1.38	0.41	1.90	0.97
Jealousy when partner invest	0.91	1.27	1.93	1.46
Jealousy when partner receive	1.02	1.31	1.21	1.36

Note. The table shows descriptive statistics for the variables employed in our analysis.

where R_2^2 represents the variance explained for a full model and R_1^2 the variance explained for a model in which a given effect was removed (Lorah, 2018). In order to calculate R^2 of the models, we employed the following expression:

$$R^2 = 1 - \frac{\sigma_F^2 + \tau_F^2}{\sigma_E^2 + \tau_E^2}$$

where σ_F^2 is Level-1 error variance of the full model, τ_F^2 is Level-2 error variance of the full model, σ_E^2 is Level-1 error variance of the empty or null model and τ_E^2 is Level-2 error variance of the empty or null model (Lorah, 2018).

We checked for normality of the residuals and for homogeneity of variance in Level 1. The global significance level was set at $a = 0.05$. Analyses were performed with IBM SPSS 25 software.

On the other hand, according to an ANOVA repeated measures design and considering an $\alpha = .05$, a sample size of 112, two groups (sex as a between-subject factor), and two measurements (within-subject factor of two repeated measures), we have a statistical power of .80 of detecting an effect size of $f = 0.13$ (η^2p = .017). This design is equivalent to that employed in our analysis but excluding covariates. If we consider covariates as an addition between-subject factors, we have a statistical power of .80 of detecting an effect size of $f = 0.19$ (η^2p = .036). Both values of η^2p are below .06 that indicates a medium effect size and close to .01 that indicates a small effect size. We employed G*Power 3.1.9.7 to perform these calculations.

Results

Descriptive statistics for all the variables by sex are presented in Table 1. None of the controlled variables were significant in the model (trust, age, socioeconomic status, or time in the relationship).

We found a significant interaction between sex and condition ($\beta = -.59$, $t = -3.833$, $p < .001$, $f^2 = .032$; Figure 1). Post-hoc analysis (see Figure 2) indicated that as expected women reported more jealousy than men when observing their partners investing resources in a rival (mean differences = 0.556, $SE = 0.163$, $p = .001$). In addition, women reported more jealousy when they observed their partners investing resources in contrast to receiving resources from a rival (mean differences = 0.510, $SE = 0.108$; $p < .001$). Men reported similar levels of jealousy as women when observing their partners receiving resources from a rival (mean differences = 0.030, $SE = 0.163$, $p = .855$). Finally, men reported similar levels of jealousy when observing their partners receiving resources from a rival compared to investing resources in a rival, this difference was not significant (mean differences = 0.076, $SE = 0.108$, $p = .481$).

As Table 2 shows, there was a main effect of condition ($\beta = .51$, $t = 4.714$, $p < .001$, $f^2 = 0.050$). Individuals who observed their partners investing resources in a rival reported more jealousy than the same individuals observing their
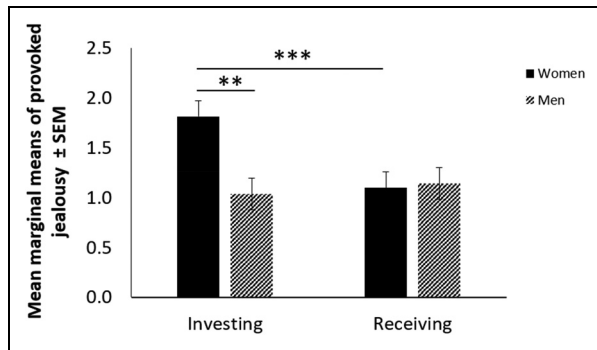
Figure 2. Jealousy evoking protocol. For women and men, we observed two conditions. Investing: "partner divests resources to rival" and Receiving: "rival invest resources in partner" where the means are significantly different from each other as determined by post-hoc tests (Bonferroni correction).

Table 2. Standardized parameters of the fitted hierarchical linear model (HLM). The HLM for measuring the effect of the two conditions in the estimated marginal means of jealousy for each sex and for measuring the effect of eight covariables in the estimated marginal means in jealousy.

Fixed effect	Estimate	t-ratio	p	f^2
Intercept	−0.120	−1.072	.285	—
Sex = men	0.030	0.184	.855	—
Condition	0.510	4.714	<.001	0.050
Age	0.047	0.639	.524	—
Time in the relationship	−0.001	−0.007	.995	—
Socioeconomic status	0.047	0.700	.486	—
General trust	−0.061	−0.850	.397	—
Reactive jealousy	0.380	5.066	<.001	0.180
Anxious jealousy	0.247	3.009	.003	0.053
Possessive jealousy	−0.015	−0.174	.862	—
Sex × Condition	−0.586	−3.833	<.001	0.032

partners receiving resources from a rival, regardless of the sex. And there were no significant SDJ on this condition ($\beta = .03$, $t = 0.184$, $p = .855$). But all the other variables we assessed did not.

Discussion

In the present study, adaptive SDJ were evaluated by applying a new method (Barbato et al., 2018) with two experimental conditions (Buss et al., 1992), depicting jealousy would fend off or repel individuals perceived as rivals that potentially threaten a reproductive bond (Buss, 2018; Buunk, 1997). We tested two predictions, only one of which was supported. Specifically, we found that women in the conditions of "the partner investing in a rival" reported greater jealousy than men in the same condition as well as greater jealousy than in the condition of "rival investing in the partner." In the case of males, no differences between the conditions were found. These results support the use of an economic game logic, as a new method to elicit and measure jealousy in women (where the distribution of resources

in a similar scenario as the dictator game allocating limited resources to a partner or/and the rival can simulate a scenario of emotional infidelity).

In general, our results point to SDJ, where men and women respond to situations that in the evolved past were recurring problems that this emotional reaction solved. For women, a diversion of resources is similar to an emotional infidelity and/or loss of commitment, fitting the evolutionary hypothesis, since the game presents the partner explicitly investing resources favoring another woman over her. Accordingly, the investing condition could be equivalent to the loss of parental investment, associated with a greater jealousy response when resources are diverted to another woman (Edlund & Sagarin, 2017; Scelza et al., 2019). The evidence from experimental economic games has shown that the closer the participants are, the more they invest in each other (Hackman et al., 2017).

Consistent with the first two predictions, females observing a dictator game in which the partner invests resources in a rival reported greater jealousy than males in this condition. Similarly, as the second prediction stated, women reported more jealousy by the partner investing in a sexual rival compared to a condition where a sexual rival invests in the partner. In this sense, the partner investing resources to a rival represents for women a similar context (but less artificial) than the use of hypothetical emotional infidelity scenarios with a same-sex rival. In this case, jealousy is triggered as a response that could result in behaviors such as driving away the rival who potentially threatens this bond or increasing effort allocated to mate guarding—predictions that could be tested in future studies (Fernandez, 2017).

Regarding our third prediction, males observing a dictator game in which a sexual rival invests in the romantic partner should report greater jealousy than females observing the same condition. Men did report a trend to have more jealousy in response to the condition in which a sexual rival invests in their romantic partner, more so than where the partner invested in a sexual rival. But this difference was not significant, despite being exposed to a situation where another man offers resources to his partner to evoke jealousy, the response was not as strong as we expected, possibly because the evolutionary function of male jealousy is to avoid "active" sexual infidelity from long-term reproductive partners. Therefore, the receiving condition of the game in which the partner gets resources from another man may be too distant psychologically from the sexual infidelity situation we intended to depict. It is possible that the experimental manipulation only targeted resource allocation, with the women not having an explicit intention to further interact or engage with the third-party allocator. Therefore, it would be necessary to improve and create a better economic scenario to similarly induce jealousy in men, as it was achieved in women, with a sex-specific emulated economic game situation that may more adequately target men's psychology. This is hypothesized to be attuned to a partner's sexual infidelity.

SDJ can be seen as a result of perceived threats in reproductive cooperation, where emotional infidelity threatens paternal

investment and sexual infidelity threatens paternal certainty (Edlund et al., 2019). In a context of cooperation there are expectations about resources that differ for each sex Our allocation game emulates this situation, since each condition is presented to the person, the expected allocation is assessed, and then the exaggerated result is exposed to induce jealousy.

With our method, similar to a dictator game, the allocation and investment expectations are modified to evoke jealousy. In other words, if the theoretical function of jealousy is to protect the loss of a valuable relationship to a rival, the allocation game should elicit jealousy (Buunk, 1997; Buss, 2018). So, the depiction of resource diversion with sex-specific hypothetical scenarios is an appropriate choice for testing our hypothesis. Nonetheless, in the case of the evocation of jealousy for men, depicting the women in a passive situation in which she only receives resources from a third party, but does not actively take part in the acceptance and use of those resources, is not made explicit and may not be inferred by the men. Consequently, this may be preventing a more robust jealousy response in the "rival invest resources in partner" scenario for men, as it does not achieve a similar real threat as sexual infidelity does.

Previous research suggests that paternal uncertainty is not the only factor that motivates cooperation in men, since even when there is certainty of paternity, men respond with jealousy in scenarios where sex is not at stake (Edlund et al., 2019; Grøntvedt et al., 2020). In this context, the theory of lost opportunities proposes that men will also show jealousy in response to scenarios in which there is simply a perceived loss of paternity opportunities (Buller, 2005). Thus, there may be situations that threaten paternal certainty, but also scenarios that threaten paternal opportunities and, in these situations, women should have an active role in deciding whether to accept/use third party's resources or not, leading to male jealousy. In this way, this factor can be a key to evoking jealousy in men and it is a major limitation of our method. In addition, physical attractiveness could be an important variable in assessing the actual quality of a rival for evoking jealousy (Massar & Buunk, 2010), which was not recorded in the study, highlighting the need for further research to understand more fully the impact of various rival characteristics on the experience of jealousy.

Therefore, the incorporation of economic games to study adaptive SDJ allowed for observing the real behavior, in a context of opposite-sex rivalry, without making up a story, achieving an emotional response that may be closer to the actual emotion than imagining hypothetical scenarios. This is a step forward for a functional hypothesis of SDJ, and it is also innovating with a method that solves problems common to the study of complex emotional behaviors.

However, the research has several limitations. First, the sample size was relatively small, consisting of only 112 individuals (within 56 heterosexual couples). Second, our conditions within the dictator game may only manipulate resource allocation from the part of a rival, and not the active betrayal from the female toward the rival. This may be too far detached from sexual infidelity cues that activate male sexual jealousy.

Third, our study did not examine participant's responses, such as acceptance or declination to the proffered resource distributions received.

Furthermore, this study does not explore the type of rival (attractive or not) that we believe plays a significant role in evoking sexual jealousy, as most research on jealousy has focused on the function of sexual jealousy to prevent attractive rivals from usurping a mating partner (Buss, 2018; Buss et al., 1992). Nevertheless, we find it interesting that we were able to explore only the movement of resources while keeping these factors constant, which could be investigated in future studies using the same paradigm.

Another limitation of this study is that it did not analyze all the emotions that could be involved in situations of injustice or shared resources, such as envy and anger, where literature has shown a relationship with this type of behavior (Parrott & Smith, 1993; Ramachandran & Jalal, 2017). However, we acknowledge that jealousy may have other derivative or involved emotions in its complex phenomenon.

Our study leads us to conclude that evocation of jealousy in women with a sex-specific structure of dictator game (by the partner investing resources to a female rival) may be similar to emotional infidelity. The manipulation of sexual jealousy for the men, in contrast, requires more attention to effectively manipulate cues of sexual infidelity in the future. In this sense, the current research breaks new ground in the study of jealousy with a novel method, but it represents only the first important step. Overall, these findings highlight the complex nature of SDJ, with men and women exhibiting distinct patterns of jealousy rooted in their respective adaptive psychology, underlying concerns about paternity certainty, and partner support.

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