



Resource Scarcity Predicts Women's Intrasexual Competition: The Role of Trait and State Envy

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Abstract

Researchers studying non-human females have highlighted the role of intrasexual resource competition. Here, we considered women's intrasexual competitive attitudes toward rival derogation and self-promotion as a function of resource availability. Further, we tested the overarching hypothesis that both trait and state envy are complicit in the motivation to compete with intrasexual rivals in the face of resource scarcity. Using a resource availability prime, in Study 1 ($N = 167$), Canadian heterosexual young adult women in the resource scarcity condition held greater derogatory attitudes toward rivals when they were average or high in dispositional envy. However, contrary to our prediction for self-promotion, the interaction demonstrated that the resource scarcity prime was only effective among women low in envy. In Study 2 ($N = 132$), there were indirect effects for heightened state envy on the link between resource scarcity with stronger attitudes toward rival derogation. These findings highlight that resource availability exerts an important influence on women's intrasexual rivalry, which appears to be driven, in part, by envy experienced in the face of perceived resource scarcity. At the trait level, high envy women might compete for scarcer resources by derogating rivals, whereas low envy women might do so via self-promotion.

Keywords Female competition · Intrasexual rivalry · Intrasexual competition · Resource scarcity · Resource availability · Resource priming

Introduction

Intrasexual competition involves rivalry with same-sex others over reproductively relevant resources and mating opportunities, which broadly takes the form of *rival derogation*—attempts to lower the mate value and reproductive success of rivals—and *self-promotion*, effort aimed at making oneself more desirable than competitors (Fisher & Cox, 2011; Schmitt & Buss, 1996; Sheyd, 2018). Across most sexually reproducing species, intrasexual competition is more direct, vigorous, and violent among males relative to females (Archer, 2009; Clutton-Brock & Parker, 1995; Daly & Wilson, 2001; Darwin, 1871; Georgiev et al., 2013; Wilson et al., 2014). Nonetheless, researchers have begun

to recognize the importance of female competition across a wide variety of species (Rosvall, 2011; Stockley & Bro-Jørgensen, 2011; Watson & Simmons, 2010), including humans (Arnocky et al., 2012; Arnocky & Vaillancourt, 2017; Benenson, 2013; Burbank, 1987; Campbell, 1995; Durante et al., 2011; Fisher, 2004, 2013; Vaillancourt, 2013). There are, however, important gaps in this literature, such as a focus on mating-related competition at the relative neglect of female competition over social and economic resources (Blake, 2022; Bradshaw & DelPriore, 2022).

There is currently little experimental research addressing how women's competition is influenced by conditions of resource scarcity (see Hill et al., 2012 for exception). Few have considered how psychological variables, such as emotions like *envy*—negative emotionality surrounding others who hold a superior quality or desired resource (Hill & Buss, 2006, 2008; Parrott & Smith, 1993; Smith & Kim, 2007)—might relate to women's resource-based intrasexual rivalry. We predicted that both trait and state envy would be complicit in women's motivation to compete with intrasexual rivals in the face of resource scarcity.

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In the current study, following others (e.g., Arnocky et al., 2016; Lange et al., 2020), envy was examined as both a stable trait and malleable state. Our objectives were to experimentally examine whether (1) *trait* envy might interact with experiencing resource scarcity to predict attitudes toward rival derogation and self-promotion and (2) whether *state* envy might function as an emotional mechanism to help explain (i.e., mediate) the relations between conditions of resource scarcity with rival derogation and self-promotion attitudes.

Intrasexual Competitiveness

Some research on human intrasexual rivalry suggests that men and women do not differ in their overall levels of intrasexual competitiveness (Buunk & Fisher, 2009). However, differences emerge when considering the specific tactics and motives that underly this competition (Cashden, 1998; Schmitt & Buss, 1996). To date, most of the research on women's intrasexual competitiveness has focused on competition for mates (see Arnocky, 2016 for review). These studies have explored sex differences in the perceived effectiveness of mate competition tactics (Schmitt & Buss, 1996), whether women competitively target physically attractive or sexually available same-sex rivals (Arnocky et al., 2012, 2019; Keys & Bhogal, 2018; Piccoli et al., 2013; Vaillancourt & Sharma, 2011), whether intrasexual competition increases alongside conception risk across the phases of the menstrual cycle (Zhuang & Wang, 2014), the role of contextual factors (e.g., mate scarcity) in promoting intrasexual competition (Arnocky & Piché, 2014; McKelvie et al., 2022), and whether these tactics are effective in increasing women's access to mates or reducing men's attraction to rivals (e.g., Arnocky et al., 2013; Fisher, 2004). This aligns with research on non-human species, which suggests that females compete for access to high-quality mates in terms of the direct (e.g., parenting assistance or resources) or indirect (e.g., genetic) benefits those mates can provide (Rosvall, 2011).

Beyond competition for mates, Rosvall (2011) also highlighted the prevalence of female intrasexual competition for resources across diverse species, including for food and offspring protection, and nesting sites (especially when scarce). Similarly, researchers focused on human competition have argued that women's intrasexual rivalry should also involve "the acquisition and defense of scarce resources" (Campbell, 1999, p. 203). Burbank (1987) argued that across observed cultures, women-women aggression consistently surrounds either mates or subsistence resources. Competition for mates and reproductively relevant resources are not mutually exclusive, given that women tend to compete for mates with high resource holding potential. As Cross and Campbell (2014) suggested, women often fight for men with resources, and this competition is intensified in resource-deprived contexts.

Moreover, Griskevicius et al. (2009) argued that aggression, which exists, in part, as a way of outcompeting rivals for reproductively relevant resources, is highly correlated across the sexes (albeit proportionally higher in men than women) and is more concentrated in areas with limited physical and monetary resources. In times of economic hardship, women also increase their appearance enhancement effort, ostensibly as a tactic aimed at outcompeting intrasexual rivals for attracting men with resources (Hill et al., 2012). These links have also been supported in studies examining shifts in intrasexually competitive attitudes (Buunk & Fisher, 2009). For instance, researchers have shown increases in self-reported intrasexual competitiveness after priming women (and men) with perceived mate scarcity (e.g., Arnocky & Piché, 2014; McKelvie et al., 2022). These findings demonstrate that intrasexually competitive attitudes are, in part, flexibly tuned to environmental inputs. However, comparatively less attention has been paid to examining shifts in these attitudes following resource availability priming.

Resource Scarcity and Intrasexual Competition

Previous research has shown that women compete over resources with same-sex others (Mago & Razzolini, 2019; Sutter et al., 2009). Furthermore, research on adolescents shows how resource scarcity intensifies same-sex competition among girls (Benenson et al., 2008). Therefore, it is sensible to expect that variability in access to economic resources should influence aspects of women's same-sex competition (Bradshaw et al., 2022), including rival derogation and self-promotion tactics.

This idea has been supported by both cross-sectional and experimental evidence. At the cross-sectional level, Campbell et al. (1998) found that women's experiences of same-sex assault were greater in contexts characterized by high unemployment. Similarly, Hurst (2018) found that women reporting lower household income were more willing to aggress against an imagined same-sex rival flirting with their partner. At the experimental level, Griskevicius et al. (2009) primed women with imagining getting a job after a period of economic struggle in a recession versus either a status motivation prime or neutral control. When imagining that they had to compete to retain their job, women who were also asked to imagine that they were childless were more likely to perpetrate direct aggression (e.g., physical aggression) against their same-sex competitors, whereas women imagining they had a young family did not. Neither group engaged in more indirect aggression than women in the control condition. Hess and Hagen (2021) primed men and women with a vignette depicting an imagined promotion, where they varied the number of positions available to influence perceived job scarcity. Results showed that those primed with imagined job scarcity were more likely to spread negative gossip

(a form of indirect aggression), with no sex differences observed. However, these researchers did not specifically explore intrasexual competition and whether the target of the gossip was a member of the same sex. In contrast, other studies have found null links between resource scarcity and female intrasexual aggression (Hurst, 2018). There are also recent findings that contradict the relation between resource scarcity and female intrasexual competition. In a recent series of four studies, Bradshaw et al. (2022) found consistent evidence that women in conditions of resource abundance (rather than scarcity) perceived same-sex others to be more competitive in comparison to male–male and cross-sex groups. These researchers reasoned that when resources are plentiful, women may see the benefits of employing more selfish and competitive tendencies.

Other researchers have focused on the links between resource scarcity and another important aspect of intrasexual competition: self-promotion. Blake et al. (2018) showed how women's tendencies to post "sexy-selfies" on social media and their beautification purchasing behavior were greater in geographic contexts with higher income inequality. Conditions of income inequality also appear to increase the likelihood of women wearing sexualized clothing for a hypothetical date, which may be mediated by status-related concerns (Blake & Brooks, 2019). High-income inequality translates into fewer individuals having access to valued survival and reproductive resources and is therefore related to, but different from, resource scarcity.

Together, these studies suggest mixed evidence regarding whether scarcity of economic resources increases women's competitiveness and their intrasexual competition and there is limited experimental work that has been devoted to addressing the question (Benenson et al., 2008; Bradshaw et al., 2022; Campbell et al., 1998; Griskevicius et al., 2009; Hurst, 2018). Furthermore, it is currently uncertain how the expression of different emotions might relate to the experience of economic resource scarcity and women's intrasexual competitiveness. *Envy* is one emotion that is expected to enhance the desire to compete for social and reproductive resources, including mates and economic goods (DelPriore et al., 2012; Hill & Buss, 2006).

Envy

Hill and Buss (2008) argued that envy is one emotional adaptation that generates distress when one is outperformed by rivals, which then motivates compensatory action in domains relevant to survival and reproduction. These authors reasoned that envy should be associated with competition over mating opportunities as well as other fitness-enhancing resources by motivating intrasexual competition either via

self-enhancement or rival derogation. Buunk et al. (2017) argued that trait intrasexual competitiveness is comprised, in part, of experiences of "envy and frustration when others are successful and a feeling of malicious pleasure when the most successful lose confidence and hope" (p. 179).

In support of these arguments, among young adult women, stable individual differences in trait envy have been positively associated with the inclination to compare one's physical appearance to peers, spending on beauty enhancing products (e.g., makeup), a desire to lose weight, and intentions to go skin tanning (Arnocky et al., 2016). Experimental priming studies have further supported this general framework, showing that induced state envy in women increases self-promotion (appearance enhancement motivation; Arnocky et al., 2016) and rival derogation (willingness to gossip about an attractive same-sex rival; Morgan et al., 2022). Accordingly, it was expected that women who were higher in dispositional envy would be most prone to increasing their intrasexually competitive attitudes when asked to recall experiences of resource scarcity (Study 1) and that resource scarcity priming would activate state envy which would motivate intrasexual competition (Study 2).

The Current Studies

Previous researchers have highlighted the links between women's mating effort and intrasexually competitive attitudes and behavior. However, evidence linking resource availability to women's intrasexual competitiveness is limited and less consistent in its findings. Moreover, envy has not yet been considered a likely emotional motivator of intrasexual competition in relation with resource scarcity. Therefore, across two studies, we tested whether trait (Study 1) and state (Study 2) envy play a role in women's intrasexually competitive attitudes when primed with resource scarcity. In both studies, we employed a well-validated resource availability priming manipulation (Roux et al., 2015) to test whether women primed with resource scarcity would report more intrasexual rivalry by way of greater rival derogation and self-promotion attitudes.

Study 1

In Study 1, we tested whether trait envy would moderate the links between resource scarcity priming and the two facets of intrasexual competitiveness: rival derogation and self-promotion. We expected that the predicted increase in both subtypes of intrasexual competitiveness would be greatest for those women high in dispositional (trait) envy. Given our interest in intrasexual rivalry within the context

of reproductive fitness, we limited the analytic sample to heterosexual undergraduate women respondents.

Method

Participants and Procedure

In the fall of 2019, 167 heterosexual undergraduate women were recruited from Nipissing University located in Ontario, Canada. Participants were aged 17–37 ($M_{age} = 20$, $SD = 2.62$). Ninety-one percent of these participants were Caucasian. Participants completed a measure of dispositional envy online in a private testing room, as part of a larger survey package on mating psychology and behavior, where self-report scales were presented in a randomized order via Qualtrics. Following the survey package, all participants were randomly assigned to either a control condition or resource scarcity priming condition, after which they completed a measure of intrasexual rivalry as described below, before being debriefed and excused from the laboratory. The Nipissing University Research Ethics Board approved all procedures.

Procedure and Measures

Dispositional Envy

Participants completed the Dispositional Envy Scale (DES; Smith et al., 1999) consisting of 8 items scored along a 7-point Likert scale ranging from 1 = *strongly disagree* to 7 = *strongly agree* (Lin & Utz, 2015; Mola et al., 2014). Example items were as follows: “I feel envy every day,” “It is so frustrating to see some people succeed so easily,” and “I am troubled by feelings of inadequacy.” The measure showed good internal consistency ($\alpha = .87$), and items were averaged to create a mean score.

Resource Scarcity Versus Control Priming Task

Following Roux et al. (2015), participants in the *control condition* read the following instructions: “Briefly describe three or four things that you did in the past week. They can be activities, interactions you had with other people, or anything else that first comes to mind.” Participants typed their response into an open text field. Once complete, they read the following instructions: “Now, please write 3–5 sentences elaborating on two of the things that you mentioned above. Please think about the feelings that you experienced. How did engaging in the activity make you feel? Why do you

think that activity was particularly memorable?” Conversely, in the *resource scarcity condition*, participants read the following instructions: “Briefly describe three or four times when you felt like you didn’t have enough of something in the past or times when you usually feel resources are scarce. They can be specific situations, prior instances, or anything else that comes to mind.” Participants typed their response into an open text field. Once complete, they read the following instructions: “Now, please write 3–5 sentences elaborating on two of the things that you mentioned above. Please think about what you experienced. Why did you feel like you didn’t have enough? What resources were you lacking?”

Intrasexual Rivalry

Participants completed the Intrasexual Rivalry Scale (Karimi-Malekabadi et al., 2019), which was used to measure the extent to which women held attitudes in favor of derogating rivals and competitive self-promotion. The Rival Derogation subscale consists of eight items, with responses recorded on a 4-point Likert-type scale (1 = *not at all applicable* and 4 = *completely applicable*). Example items included “I cannot stand very successful and wealthy women,” “I look for negative points in successful women,” and “I cannot stand very attractive women.” The Self-Promotion subscale uses the same anchors, with example items including “I’d like to be kinder and more dependable than other women” and “I look for negative points in successful women.” The measure showed good internal consistency (rival derogation $\alpha = .91$, self-promotion $\alpha = .81$). Items were averaged to create mean scores.

Data Analysis Plan

To test the moderation model, resource priming condition (control versus scarcity) was entered as the predictor variable (coded: resource scarcity = 0.50, control = −0.50), dispositional envy as the moderator variable, and post-prime derogation and self-promotion attitudes as the dependent variables (Model 1 in PROCESS; Hayes, 2013). Continuous variables that define products were mean centered in the analyses. The Johnson-Neyman technique (Aiken et al., 1991) was used to assess the ranges within which the moderation was significant. A power analysis was performed to determine the sample size needed for detecting significant effects. It was determined that a sample size of $n > 114$ participants would provide sufficient power (80% power, $\alpha = .05$, two-tailed) for detecting a small-medium size effect ($f^2 = .10$). No variables were missing more than 5% of cases; accordingly, cases with missing data were excluded listwise.

Table 1 Descriptive statistics and bivariate correlations for all study variables

	Study 1							
	<i>M</i>	<i>SD</i>	Min	Max	1.	2.	3.	4.
1. Age	20.00	2.62	17.00	37.00	-----			
2. Condition	-----	-----	-----	-----	.03	-----		
3. Dispositional envy	3.29	1.15	1.00	7.00	-.08	-.03	-----	
4. Rival derogation	1.28	0.42	1.00	3.75	-.08	.13	.52**	-----
5. Self-promotion	2.88	0.55	1.00	4.00	-.06	.04	.23*	.25*
	Study 2							
	<i>M</i>	<i>SD</i>	Min	Max	1.	2.	3.	4.
1. Age	27.52	3.16	21.00	33.00	-----			
2. Condition	-----	-----	-----	-----	-.03	-----		
3. State envy	3.91	1.28	1.00	7.00	-.17	.20*	-----	
4. Rival derogation	2.12	0.85	1.00	4.00	-.37**	.18*	.66**	-----
5. Self-promotion	2.90	0.49	1.38	4.00	.06	-.02	.28*	.26*
Manipulation check	4.95	1.13	1.00	7.00	.13	.47**	.28**	.32**

Correlations significant at * = $p < .01$, ** = $p < .001$ (two-tailed). In S1, Condition was coded -0.5 = Control, 0.5 = Scarcity, and In S2, coding was 0 = Control, 1 = Scarcity

Results

Descriptive statistics and bivariate correlations among study variables are presented in Table 1. Bivariate correlations showed that dispositional envy correlated positively with rival derogation and self-promotion; however, the experimental condition did not correlate with either attitudes toward rival derogation or self-promotion. A null difference between conditions in dispositional envy suggested that the randomized groups did not differ on trait envy ($t(165) = 0.47$, $p = .63$, $M_{scarcity} = 3.25$, $SD = 1.16$, $M_{control} = 3.34$, $SD = 1.13$).

First, a simple moderation model was estimated with post-prime rival derogation attitudes as the dependent variable.

There was a main effect of priming condition ($B = 0.13$, $SE = 0.06$, $t = 2.34$, $p = .021$), as well as a main effect of envy ($B = 0.19$, $SE = 0.03$, $t = 7.61$, $p < .001$) upon rival derogation. There was a statistically significant condition \times envy interaction ($B = 0.11$, $SE = 0.05$, $t = 2.18$, $p = .031$). Specifically, the resource scarcity prime positively predicted rival derogation for women scoring either average ($B = 0.13$, $SE = 0.06$, $t = 2.34$, $p = .021$) or high (+1 SD) in envy ($B = 0.25$, $SE = 0.08$, $t = 3.21$, $p = .002$), but not for women scoring low (-1 SD) on envy ($B = 0.01$, $SE = 0.08$, $t = 0.10$, $p = .921$; Fig. 1, left panel). Deconstruction of the interaction showed that the moderation effect was significant for raw dispositional envy scores greater than 3.12 ($p = .050$), but not for

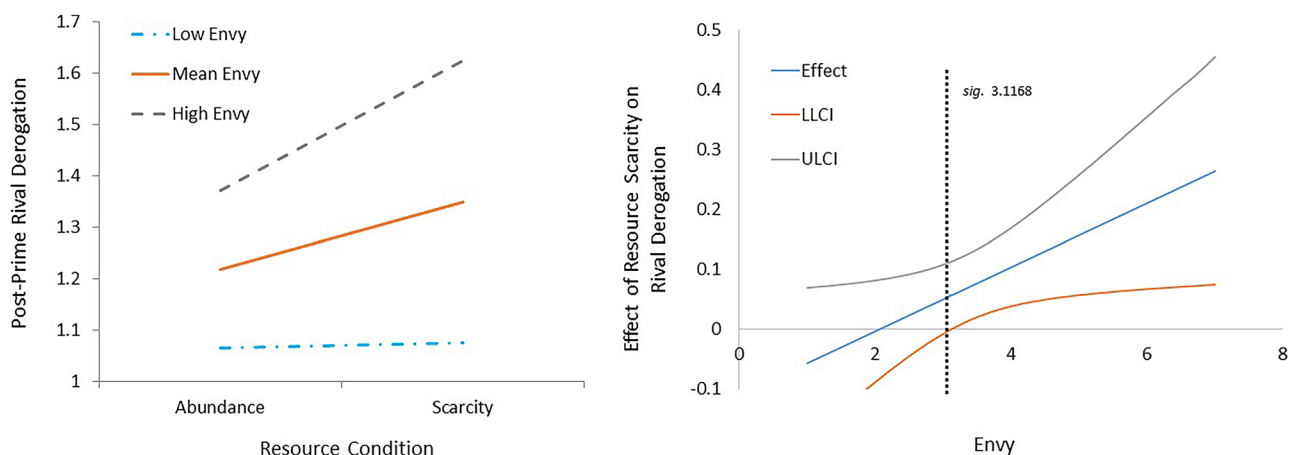


Fig. 1 Moderating effects of envy on resource scarcity and rival derogation. *Note.* Standardized conditional moderation effect of dispositional envy on the relationship between a resource scarcity prime and rival derogation (left) and Johnson-Neyman confidence limits (right)

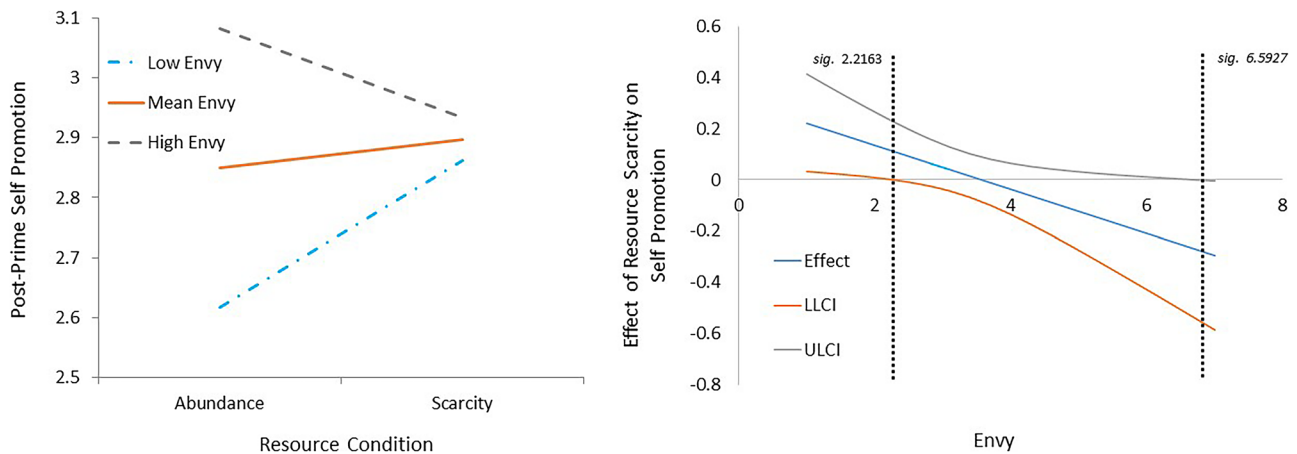


Fig. 2 Moderating effects of envy on resource scarcity and self-promotion. *Note.* Standardized conditional moderation effect of dispositional envy on the relationship between a resource scarcity prime and self-promotion (left) and Johnson-Neyman confidence limits (right)

raw envy scores below this value (Fig. 1, right panel). For example, there was no significant interaction for a raw envy score of 3.10 ($p = .054$). Considering the seven-point Likert scaling of the envy measure with a mean of 3.29 reported in the current study (see Table 1), this finding suggests a significant effect of resource scarcity upon intrasexual rivalry when envy is greater than just below average.

Second, we ran a model with post-prime self-promotion entered as the dependent variable. Results showed that there was no main effect of priming condition on self-promotion attitudes ($B = 0.05$, $SE = 0.09$, $t = 0.62$, $p = .536$). In contrast, there was a main effect of envy on self-promotion ($B = 0.12$, $SE = 0.04$, $t = 3.08$, $p = .002$). There was a condition \times envy interaction for self-promotion in the opposite direction than expected ($B = -0.18$, $SE = 0.08$, $t = -2.34$, $p = .021$). Deconstruction of the interaction indicated that the resource scarcity prime positively predicted self-promotion intrasexual rivalry for women scoring low (-1 SD) ($B = 0.25$, $SE = 0.12$, $t = 2.09$, $p = .039$), but not average ($B = 0.05$, $SE = 0.09$, $t = 0.62$, $p = .536$), or high ($+1$ SD) in envy ($B = -0.15$, $SE = 0.12$, $t = -1.22$, $p = .223$; see Fig. 2, left panel). Examination of the Johnson-Neyman confidence intervals demonstrated that the moderation effect was significant at levels of envy below 2.21 and above 6.59, such that individuals scoring low in envy (below 2.21) were higher in self-promotion when in the resource scarcity versus control condition, whereas envy scores above 6.59 were associated with lower self-promotion in the resource scarcity versus control condition.

Brief Discussion

Results showed that dispositional envy in Canadian heterosexual young adult women was positively associated with both rival derogation and self-promotion attitudes. When primed with recalling

times when they experienced resource hardships, women held more positive attitudes toward derogating rivals, particularly when they were average or high in dispositional envy, but not when they were low in envy, relative to the control condition. Surprisingly, when primed with resource scarcity, only women lower in dispositional envy expressed more favorable attitudes toward self-promotion. These findings suggest that when economic resources are in short supply, they may be perceived as more valuable. In these circumstances, women who are high in trait envy might be more likely to derogate rivals to compete for those valued social, economic, and reproductive resources, whereas women low in trait envy might opt for a less interpersonally harmful form of competing by way of self-promotion.

Study 2

The previous study provided evidence that being primed with resource scarcity increased heterosexual women's rival derogation, but only among those who were average-to-high in trait-level envy. The resource scarcity condition was also associated with heightened self-promotion, but, surprisingly only among women low in trait envy. However, Study 1 was limited in that it did not include a manipulation check to test the efficacy of the experimental priming procedure. When conducting an experiment, it is beneficial to assess whether the manipulation successfully produced the intended internal state in the participant (Ejelöv & Luke, 2020). Although the use and interpretation of manipulation checks has been critiqued, researchers still consider them to be advantageous (Hauser et al., 2018). It is recommended that investigators be clear that manipulation checks pertain to the focal independent variable of interest, that they be pilot tested or validated in previous work, and that significance level, effect size, and the distribution of responses be described (Ejelöv & Luke, 2020).

Study 1 was also limited in that trait-level envy was examined at the neglect of state-level envy. In previous studies, researchers have underscored the importance of considering both dispositional and state levels of emotions like envy when studying intrasexual competition dynamics (e.g., Arnocky et al., 2016). State envy would presumably serve as an affective proximate mechanism that might help to explain the relations between resource scarcity with self-promotion and/or rival derogation. Therefore, in a follow-up study, we tested the hypotheses that being in the resource scarcity condition would contribute to heightened levels of state envy (Prediction 1), that state envy would positively predict greater self-promotion and rival derogation (Prediction 2), and that state envy would exert indirect effects on the links between resource scarcity with both rival derogation and self-promotion (Prediction 3).

Participants and Procedure

From May to June 2022, a total of 320 women volunteered to participate in the “Self-Perceptions and Memory Study” on Amazon’s Mechanical Turk (MTurk), an online crowdsourcing platform. A total of 130 participants were flagged for one or more of the following reasons: failed to complete survey, completed study more than once, outside of requested age range (18–35), evidence of non-purposeful responding, and/or not currently living in North America. Following Study 1, we further restricted our analyses to heterosexual women ($n = 58$ identified with a non-heterosexual orientation). This resulted in a final sample size of $N = 132$ ($M_{\text{age}} = 27.52$, $SD = 3.16$, range = 21–33) heterosexual American women. Of the sample, 87.1% ($n = 115$) identified as White and 93.9% ($n = 124$) indicated that they were currently in a long-term romantic relationship.

North American young adult women were invited to participate in an online study on MTurk and, if interested, were redirected to Qualtrics to complete the online experiment and self-report scales of interest. Participants first completed a demographic questionnaire and then were randomly assigned to either a control condition or the resource scarcity priming condition, after which they completed the manipulation check, and then measures for state envy and intrasexual competitiveness. Participants were then debriefed and compensated \$1.00USD for their participation.

Materials

The same experimental procedure used in Study 1, where participants were asked to think and write about a time when they felt that resources were scarce (*experimental condition*) or activities and interactions they had with other people (*control condition*; see Roux et al., 2015 for detailed

description of experimental procedure) was also used in Study 2.¹ To assess the validity of the experimental manipulation for resource scarcity, we used the 4-item measure created by Roux et al. (2015). Using a Likert response scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), participants were asked to report their level of agreement with the following statements: (1) “My resources are scarce,” (2) “I don’t have enough resources,” (3) “I need to protect the resources that I have,” and (4) “I need to acquire more resources.” Items were averaged to calculate a mean scale score, with higher scores reflecting greater experienced scarcity, which had adequate internal consistency reliability ($\alpha = .74$).

After the experimental task and the manipulation check, to assess state envy, participants completed a self-report scale developed by Hill et al. (2011). Participants were instructed to “Please indicate how the previous writing exercise made you feel regarding the following emotions” regarding 10 emotions that described feelings of envy (e.g., “envious,” “inferior,” and “wishful”). Participants responded to items using a 7-point Likert-type scale ranging from 1 = *not at all* to 7 = *very much*. Items were averaged to create a mean scale score, with higher scores describing a higher level of state envy, which was internally consistent ($\alpha = .90$).

Like in Study 1, the Intrasexual Rivalry Scale (Karimi-Malekabadi et al., 2019) was used to measure individual differences in attitudes toward rival derogation and self-promotion. Both scales demonstrated evidence of internal consistency reliability (Rival Derogation subscale: $\alpha = .92$; Self-Promotion subscale: $\alpha = .73$).

Data Analysis Plan

To test the proposed mediation models, resource priming condition (control vs. scarcity) was entered as the dichotomous predictor variable (1 = resource scarcity condition, 0 = control condition), state envy as the mediator, and post-prime rival derogation and self-promotion attitudes as the dependent variables (Model 4 in PROCESS; Hayes, 2013). Bootstrapping ($N = 5000$ bootstrap samples) was used to test evidence of indirect (i.e., mediating) effects

¹ For descriptive purposes, we examined the sources of resource scarcity noted by the participants (note that participants were not limited in the number of factors recalled in the open-ended response). Roughly 60% identified monetary scarcity as having affected them, 25% noted food and toiletry scarcity, 9% noted employment scarcity, 8% identified healthcare scarcity, 15% noted housing scarcity, 13% noted transportation and gas scarcity, 8% identified clothing scarcity, 5% noted lack of time and energy due to experiencing poverty, 5% noted lack of social support, 5% had lacked electricity/water, 5% described effects of poverty on their physical or mental fitness, 7% noted concern for environmental resources, and 13% noted inability to afford leisure activities and travel.

by examining if the value of 0 was absent from the 95% bootstrap confidence intervals. To maintain an adequate level of statistical power (80%, $\alpha = .05$, two-tailed) and to detect evidence of mediation with medium effects for both the a -path and b -path, $n = > 71$ participants would be needed (Fritz & Mackinnon, 2007). No variables were missing more than 5% of cases. Therefore, missing data were excluded listwise.

Results

Descriptive statistics were calculated for all variables (see Table 1). Skewness and kurtosis values indicated that all variables assumed an approximately normal distribution. A one-way ANOVA showed that women primed with resource scarcity ($n = 62$, $M = 5.33$, $SD = 0.99$) had greater experienced scarcity than women in the control condition ($n = 70$, $M = 4.61$, $SD = 1.14$), $F(1, 130) = 15.12$, $p < .001$, $n^2 = .11$. Roux et al. (2015) reported a similar effect size estimate in their study with adult male MTurk participants ($n^2 = .15$). Dispersion statistics for the manipulation check are provided in Table 1. The manipulation check also correlated positively with being in the resource scarcity condition, state envy, rival derogation, and self-promotion (Table 1). These results supported the effectiveness of the experimental priming task.

Bivariate correlations showed that age correlated negatively with rival derogation (see Table 1). Being in the resource scarcity experimental condition correlated positively with state envy and rival derogation, but not self-promotion. State envy correlated positively with both rival derogation and self-promotion.

To test hypotheses, two simple mediation models were conducted. In the first model, rival derogation was treated as the outcome variable. In support of Hypothesis 1, being in the resource scarcity condition positively predicted state envy (a -path: $B = 0.51$, $SE = 0.22$, $t = 2.32$, $p = .022$). State envy positively predicted rival derogation (b -path: $B = 0.43$, $SE = 0.05$, $t = 9.57$, $p < .001$), supporting Hypothesis 2. Without the mediator in the model (i.e., the total effect), condition positively predicted rival derogation (c -path: $B = 0.31$, $SE = 0.15$, $t = 2.12$, $p = .036$), which was reduced to non-significance with the mediator included in the model (i.e., the direct effect; c' -path: $B = 0.11$, $SE = 0.11$, $t = 0.80$, $p = .426$). In support of Hypothesis 3, the indirect effect was significant ($B = 0.22$, $SE = 0.09$, 95% LLCI = 0.04, ULCI = 0.41). See Fig. 3 for mediation model and standardized estimates.

In the second model, self-promotion was entered as the outcome variable. Like the first model, and in line with Hypothesis 1, condition predicted state envy (a -path: $B = 0.51$, $SE = 0.22$, $t = 2.32$, $p = .022$). In support of Hypothesis 2, State envy positively predicted self-promotion (b -path: $B = 0.11$, $SE = 0.33$, $t = 3.45$, $p = .001$). However, neither the total

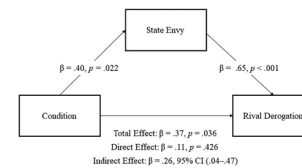


Fig. 3 Indirect effect of state envy on resource scarcity and rival derogation. *Note.* Simple mediation model ($N = 5000$ bootstrap samples); β = standardized regression coefficients; CI = confidence interval; condition coded: 0 = control condition, 1 = resource scarcity condition; partially standardized effect provided for indirect effect

effect (c -path: $B = -0.02$, $SE = 0.85$, $t = -0.25$, $p = .805$) or the direct effect (c' -path: $B = -0.08$, $SE = 0.08$, $t = -0.94$, $p = .349$) were significant. Nonetheless, the indirect effect was significant ($B = 0.06$, $SE = 0.03$, 95% LLCI = 0.01, ULCI = 0.13), with the directional shift in the strength of the effect potentially indicating a suppression rather than a mediation effect. See Fig. 4 for model and standardized estimates.

General Discussion

Research on women's intrasexual competition has disproportionately focused on competition for mates, with much less work examining potential links between resource availability and rival derogation and self-promotion (Blake, 2022; Bradshaw & DelPriore, 2022).

Envy may have evolved, in part, to motivate compensatory action (such as intrasexual competition) in response to unfavorable social comparisons or conditions that pose a threat to one's reproductive fitness. In this manner, envy likely "has played an important role in humans' quest for the resources necessary for successful survival and reproduction over the course of evolutionary time" (Hill & Buss, 2008, p. 60). Importantly, envy can be conceptualized as both a stable individual trait that might interact with evolutionarily relevant social-ecological parameters (Study 1), as well as a malleable state that might help to explain how experiencing resource scarcity influences attitudes toward intrasexual competition (Study 2; Arnocky et al., 2016).

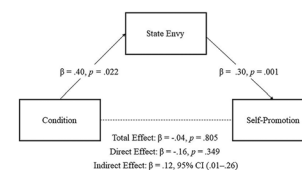


Fig. 4 Indirect effect of state envy on resource scarcity and self-promotion. *Note.* Simple mediation model ($N = 5000$ bootstrap samples); β = standardized regression coefficients; CI = confidence interval; condition coded: 0 = control condition, 1 = resource scarcity condition; partially standardized effect provided for indirect effect; dotted line indicates a non-significant path

Results from Study 1 showed that heterosexual young adult women primed with recalling times when they experienced resource hardships held more positive attitudes toward derogating rivals when they were simultaneously average or high in dispositional envy, but not when they were low in trait envy, relative to the control condition. Results from Study 2 showed how being primed with resource scarcity (versus the control condition) was indirectly related to more favorable attitudes toward rival derogation via heightened state envy. These findings accord with previous research where conditions of resource scarcity have been linked with girls' and women's same-sex competition, aggression, and rival derogation (Benenson et al., 2008; Campbell et al., 1998; Griskevicius et al., 2009; Hurst, 2018). Although previous research has shown that when resources are unequally distributed, women engage in greater self-promotion behavior (Blake & Brooks, 2019; Blake et al., 2018), results from our priming study were less clear, and could indicate a suppressor effect of induced envy upon the link between scarcity and self-promotion.

Compared to men, women have greater obligatory parental investment (Reyes & Klug, 2021; Shackelford & Goetz, 2009; Trivers, 1972), are more important for the survival and well-being of their offspring (Campbell, 1999), and invest more heavily in their grandchildren (Pollet et al., 2007), suggesting that attaining reproductively relevant social (e.g., status) and economic resources represents a key adaptive problem driving women's competition (Blake, 2022; Bradshaw & DelPriore, 2022; Hrdy, 2013; Rosvall, 2011; Stockley & Bro-Jørgensen, 2011). Envy can function in a sex-differentiated manner to alert individuals to resources that facilitate survival and reproductive success and when people are being outperformed for those valued limited resources (Hill & Buss, 2006, 2008). Previous work indicates that, more than men, women envy others who are physically attractive, popular, socially savvy, have financially successful mates, come from high status and wealthy families, and have a more stylish appearance (DelPriore et al., 2012). When economic resources are in short supply and perceived as more valuable, envy may promote a desire to derogate rivals and self-promote over qualities such as physical appearance, popularity, social grace, and family wealth. In these contexts, the benefits of more risky and aggressive forms of intrasexual rivalry, such as rival derogation, may increase, because economic resources are more difficult to acquire.

However, surprisingly, in Study 1, only women lower in dispositional envy in the resource scarcity condition held more positive attitudes toward self-promotion intrasexual competitiveness. This unexpected finding could be a function of the Dispositional Envy Scale (DES; Smith et al., 1999), which is the most widely cited measure for capturing trait envy. The DES appears to tap into malicious envy

as opposed to benign envy (Lang & Crusius, 2015); both of which can be experienced upon making unfavorable social comparisons with others (van de Ven et al., 2012). Benign versus malicious envy are characterized by variance in the deservingness of the advantage (van de Ven et al., 2012). Malicious envy involves attempting to bring a rival down by "denigrating the advantage of the other" (Lang & Crusius, 2015, p. 285), whereas benign envy involves attempts to bring oneself up to the level of the advantaged comparator (Lang & Crusius, 2015). From this perspective, those who are maliciously envious and who are asked to reflect on past resource scarcity would be more prone to endorse attitudes in favor of harming others (i.e., rival derogation), whereas this interaction might not be observed in relation with self-promotion, because self-promotion does not necessitate maliciousness. Rather, self-promotion likely maps on to benign envy, which is not as well captured by the DES.

This appears to be supported by the bivariate correlations in this study, whereby DES scores were more strongly correlated with rival derogation ($r = .52, p < .001$) than with self-promotion ($r = .23, p < .01$). As a post hoc test of this hypothesis, we further examined an unpublished data set of North American heterosexual women's MTurk responses, $N = 274$, $M_{age} = 39.72$, $SD = 13.10$, range = 18–60) containing these measures (Vaillancourt & Davis, 2021). Benign envy correlated more strongly with self-promotion ($r = .51, p < .001$) than with rival derogation ($r = .15, p < .01$), whereas malicious envy correlated more strongly with rival derogation ($r = .67, p < .001$) than with self-promotion ($r = .30, p < .001$). Perhaps if we had used an alternative measure of envy, such as the Benign and Malicious Envy Scale (BeMaS; Lang & Crusius, 2015), we would expect an interaction between resource scarcity and benign envy in predicting self-promotion and an interaction between resource scarcity and malicious envy in predicting rival derogation. It is also possible that benign envy might relate more to efforts aimed at bettering oneself for one's own sake (e.g., "I'd like to be more attractive"), rather than fitting squarely within a framework of intrasexual rivalry ("I'd like to be more attractive than other women"). Kristofferson et al. (2018) argued that benign envy "is associated with a lack of hostility toward the envied other given the relative lack of ego threat that often accompanies benign envy" (p. 231). From this view, self-promotion efforts, such as resource scarcity motivated appearance enhancement observed in the "lipstick effect" (Hill et al., 2012), may be more a manifestation of effort aimed at intersexual selection than intrasexual competition. Further, perhaps women who are prone to envy are more likely to compete intrasexually by derogating rivals, whereas those lower in envy might opt for the less interpersonally risky strategy of self-promotion. Research has demonstrated that those high in trait self-esteem tend to be lower in both benign and malicious envy

(see Vrabel et al., 2018). Perhaps women higher in self-esteem have fewer real or perceived reasons to envy other women and would thus opt more toward highlighting their own value instead of deriding others'. Some circumstantial evidence supports this. Arnocky et al. (2016) showed that self-perceived mate value correlated positively with some appearance enhancement efforts, such as skin tanning and using appearance enhancement products and services. However, in those same models, dispositional envy also positively predicted those behaviors. Future research might benefit from testing intrasexual competition decision-making using a forced choice paradigm and exploring whether women lower in envy are more apt to choose self-enhancement (versus rival derogation) efforts in the face of resource scarcity.

Nonetheless, it is notable that a similar pattern across studies emerged, whereby both trait and state envy shared stronger relations with rival derogation in comparison to self-promotion. Unlike the DES (Smith et al., 1999), the measure of state envy (Hill et al., 2011) employed in Study 2 better captured feelings in line with both malicious (e.g., "hostile," "inferior," and "resentful") and benign envy (e.g., "longing for what another has," motivation to improve," and "wishful"). Perhaps then, heightened envy, regardless of whether it is malicious or benign, maps onto rival derogation more readily than self-promotion. Future research is needed to address this question.

Limitations

The present studies were limited by its reliance on Western and mostly Caucasian women from an undergraduate student (Study 1) and community samples (Study 2). Study 2 was also limited in that most participants were currently in long-term romantic relationships. Therefore, it would be beneficial to examine these dynamics among more cross-culturally diverse and non-WEIRD demographics outside of North America, as well as evenly sample single and romantically partnered young adults. Given that we were interested in specific predictions about resource scarcity, we did not include a third condition of resource abundance in this study. However, given that a recently published paper showed that women perceived others as more competitive under conditions of abundance (Bradshaw et al., 2022), it would be interesting to determine whether resource abundance priming might also influence women's same-sex competition. We were also primarily interested in broad attitudinal shifts in competitiveness. Researchers might extend beyond intrasexual competitiveness as an attitude to determine whether resource priming influences overt

competitive behavior, such as aggression against a sexual rival in a laboratory game (e.g., Arnocky et al., 2019).

The benefits of cooperation and the costs of selfish behavior would presumably be greater in contexts wherein economic resources are sparse. However, those who were raised in low socioeconomic environments, where resource availability is lower, tend to be more impulsive, risk-prone, and focused on satisfying their own needs and temptations (Griskevicius et al., 2013). Moreover, circumstances of economic inequality relate to less interpersonal trust and cooperation (Camera et al., 2020; Sánchez-Rodríguez et al., 2022). Therefore, in future work, it might also be fruitful to retrospectively assess women's childhood socioeconomic circumstance to see if this moderates the relations between the availability of economic resources and intrasexual competition.

Conclusions

Several researchers have recently emphasized the salience of women's competition with same-sex others over social and material resources, which is an underappreciated and understudied aspect of women's evolved psychology (Blake, 2022; Bradshaw & DelPriore, 2022). Some evidence shows how the availability of economic resources influences girls' and women's same-sex rivalry for valued social and reproductive resources; however, there is limited experimental work on the topic, and the results have been mixed (Benenson et al., 2008; Bradshaw et al., 2022; Griskevicius et al., 2009; Hurst, 2018). Furthermore, it is uncertain what emotional mechanisms might help to account for the putative links between conditions of resource scarcity and women's intrasexual competition. We add to this growing literature by showing how experimentally priming women with the scarcity of economic resources encourages more risky forms of intrasexual competition (rival derogation), but only among women higher in dispositional envy. We furthered showed how state envy may be a proximate mechanism that explains why experiencing resource scarcity increases women's attitudes toward rival derogation. These results demonstrate how the availability of resources in the local social-ecological environment influences women's competition dynamics via the expression of emotions like envy.

Author Contribution S. Arnocky conceptualized the design and collected the data, and S. Arnocky and A. Davis conducted analyses and wrote the manuscript, with consultation and editing by T. Vaillancourt.

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Declarations

Ethics Approval This research was performed in accordance with the Canadian tri-council policy statement on ethical conduct for research involving humans – TCPS 2. Approval was granted by the Ethics Committee of Nipissing University (file: 101912 – 30439).

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent to Publish Participants provided consent for data to be published.

Conflict of Interest The authors declare no competing interests.

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