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Collaboration and Gender Focality in Stag Hunt Bargaining

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Abstract: Knowing the gender of a counterpart can be focal in the willingness to collaborate in team settings that resemble the classic coordination problem. This paper explores whether knowing a co-worker's gender affects coordination on the mutually beneficial outcome in a socially risky environment. In an experimental setting, subjects play a one-shot stag hunt game framed as a collaborative task in which they can "work together" or "work alone." We exogenously vary whether workers know the gender of their counterparts pre-play. When gender is revealed, female players tend to gravitate to collaboration and efficient coordination regardless of the knowledge. Males, when knowingly paired with another male, tend to collaborate less, and thus, are less likely to coordinate on the Pareto optimal outcome. These results demonstrate one way that gender focality can lead to inefficient outcomes and provide insight for organizations looking to induce collaboration among workers.

Keywords: stag hunt; gender; coordination; focality; teamwork; collaboration

JEL Classification: C72; D90; D70; D81

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1. Introduction

Gender differences in strategic scenarios are widely discussed in the literature, with females generally considered as more prosocial, compromising, and cooperative, yet more sensitive to risk, relative to males [1–4]. Predispositions for cooperative behavior are shown to be robust under group selection [5,6]. Babcock et al. [7] demonstrate how females "volunteer" into tasks with low upside relative to males while perception of "status" in a counterpart can impact coordination, per Eckel and Wilson [8].

This paper explores whether knowing a counterpart's gender can impact an agent's willingness to collaborate with a counterpart otherwise foreign to them—thus, inducing coordination on a payoff-dominant outcome. The economic environment following the COVID-19 pandemic motivates this inquiry as people are compelled to work remotely and have limited interaction with their co-workers and teams. Workers are routinely thrown into work groups with others knowing little about them but a name or bio that may signal gender. Is gender focal in such collaborative settings? To explore, we ran an online experiment in which players engaged in a symmetric one-shot stag hunt game (SH), framed as a collaborative task. For some, the gender of their counterpart was revealed as male or female. We analyze whether such information induces a move to or from efficient coordination.

Beginning with Schelling [9], the literature shows how information is essential to drawing socially efficient outcomes in strategic settings involving coordination [10–14]. There is some reason to suspect that gender information is focal. Holm [15] demonstrates that a counterpart's gender appeared to be a coordination signal in battle of the sexes games. That study proposes that such a signal can lead to what appears to be discrimination of females by both genders. However, the author does not explore a practical, collaborative setting with a trade-off between personal benefit and mutual gain through cooperation. We could find no paper exploring gender focality in a stag hunt-like environment. Others note some instances of individuals miscoordinating—gravitating towards a sub-optimal outcome—with gender information. In other non-cooperative games, Kümmerli et al. [16] suggest that women are more likely to choose "cooperative" strategies, males defect out of greed, and females defect out of fear. Datta Gupta et al. [17] find that men opt to compete less against other men than against women when gender information is made salient. Sutter et al. [18] find that gender pairing systematically impacts behavior, leading to lower efficiency when counterparts have the same gender relative to when they have mixed pairs. If players in our framed stag hunt have the same intuition as the literature, gender may serve as a focal cue for the players as they judge the shared social norms, predisposition to cooperativeness, risk appetite, or impulsiveness of the partner.

2. Materials and Methods

Online work groups and other team settings often resemble the classic coordination problem. Stag hunt is a useful model for team-based collaboration: willingness to coordinate on a collaborative outcome leads to higher gains. We focus on the two Nash equilibria in pure strategies for how players behave. One involves each player choosing to work together, coordinating on a mutually (or socially) beneficial outcome, and one predicts each player chooses to work alone for a diminished, but guaranteed, payoff. This coordination is sub-optimal yet relatively safer for each player. We consider collaboration and cooperation as semantically the same (as leading coordination on the Pareto efficient outcome), despite nuanced differences in the classification of non-cooperative game theory. We opted against using mixed strategies or Bayesian Nash equilibrium as solution concepts for this study out of practicality. However, in each, increased collaboration would lead to increased mutual gains on average. Another benefit of using the SH model is that it is easy for players to understand.

In our experiment, each worker answered a series questions, including those about basic demographics, including gender, contrasting with Holm [15]. The Qualtrics instrument was listed as a human intelligence task (HIT) on the Amazon Mechanical Turk board. We verified 545 US MTurk workers through competency checks and bot filters. We observed an almost perfect gender balance in each experimental group, with the mean age about 38 years. To explore facets of the choice and isolate the treatment effect, we measured players' predisposition to cooperativeness using the Tang [19] CCSS Scale. Considering the relationship between risk preferences and strategic choice documented in Büyükboyacı [20], we had players choose a gamble from five lottery options following the Eckel and Grossman [21] method and asked workers about their guesses about the counterpart's risk attitudes. Experimental instructions, protocol, and supplemental resources and notes can be found online at https://drive.google.com/drive/folders/1vYWkYRJ_icP0eMlvgB7CR5aKfgUZ6y3m?usp=sharing. Hypotheses and design were pre-registered at https://aspredicted.org/em4bx.pdf accessed on 17 June 2020 (see Supplementary materials).

All workers were told they would be matched with another MTurker and randomly assigned to one of three experimental conditions. In the control group, all workers were given no gender information about their counterpart. For the two treatment groups, the gender of their partner was revealed explicitly as male (treatment-male) or female (treatment-female). We opted against gendered name labels as in Holm [15] to avoid deception and confounds.

Workers then engaged in a one-shot stag hunt game (strategy profiles and payoffs in Table 1), where the strategies were framed as a collaborative task; the choice of strategies was to "Work Together" (stag) or "Work Alone" (hare). The interaction occurred asynchronously, similar to the "strategy method" commonly used in economic experiments involving game theory. Typically, it involves eliciting strategies by asking each player how they would act in each role in a game (for example, in an ultimatum game with roles of Proposer and Responder). After these actions are recorded for each player, matches are made randomly and payoffs determined. Thus, the interaction occurs asynchronously instead of in real-time (such as in a lab setting). A priori, one might believe that asynchronous and synchronous interactions would lead to different behavior; however, this is not the case empirically [22]. All responses were anonymous and unobserved by other subjects. Once data were collected, we randomly gender-matched corresponding to treatment (e.g., what they were told about the gender of their counterpart) to avoid deception. After completing both phases, workers received a completion code and were paid their earnings. Ad hoc power tests ($\delta > 0.5, power = 0.8, \alpha = 0.05$), indicated a target of 540–600 subjects. The mean time commitment was 10 min. Workers earned a USD 0.25 participation fee and subsequently a bonus of up to USD 1.40 depending on the game's outcome and choice over lotteries. As economists, we took concerns for equitable compensation seriously and considered this factor in the design. As this study was not funded by a grant, it involved the tradeoff between the perception of "fair" wages and sample size. We calculated the expected value of any compensation at just under US $5/h (below $7.25/h, but well above the median pay on MTurk). Assuming players all coordinate on the optimal equilibrium in the game (which occurred over 90% of the time), the upper bound of payment is US $9.90/h and the lower bound is US $7.20/h. Payments are clearly described before workers commit. Attrition for this study involves workers that (1) did not complete the entire protocol and (2) those observations that we identified as suspect/bots. For 597 observations collected, we experienced such losses 52 times, representing 8.7% of the data. However, we removed these observations from the final analysis of 545 players (what we call the "full sample").

Table 1. Collaboration-framed Stag Hunt.

		Player *j*	
		"Work Together"	**"Work Alone"**
Player *i*	**"Work Together"**	USD 0.75, 0.75	USD 0, 0.25
	"Work Alone"	USD 0.25, 0	USD 0.25, 0.25

We hypothesized that conditional on knowing their counterpart is female, people would be more likely to choose the strategy to "work together" (thus, coordinating on the efficient outcome) compared to knowing they are male or to not knowing. The intuition for this hypothesis comes from the literature pointing to the perception that females are more likely to engage in prosocial behavior and may be more cooperative on average than males (e.g., [1–4]). Predispositions for cooperative behavior are often connected to in-group dimensions [5,6], suggesting that female-female groups would coordinate on the efficient outcome at a high rate. If a player has beliefs that females are more likely to gravitate to the socially optimal equilibrium, then it is reasonable to expect that player to do the same in turn. If one believes that players have a preference for female counterparts, then they are more likely to try to coordinate in a similar fashion. Such scenarios may be considered socially risky [23]; thus, we considered the possibility that players' risk attitudes would matter and that the perception of a counterpart's preferences could influence expectations (following Büyükboyacı [20]). We ultimately dropped this measure as only a player's "guess" after it yielded no meaningful effect. We also implemented the Brief Barratt Impulsiveness Scale (BBIS) [24] and measured patience using the Duclos and Khamitov [25] method. However, we dropped these measures from analysis in the interest of parsimony.

3. Results

In this section, we present the results of our analysis of players' behavior in our framed stag hunt interaction, conducted using Stata (v16, College Station, TX, USA) and Python (SciPy, https://www.scipy.org, open source) statistical packages. Given the PSNE predictions, we considered high levels of collaboration in our study to be plausible. We treat the binary choice of player i selecting the "work together" strategy as gravitation to the Pareto-dominant coordination. Mean collaboration in our sample is near 90% in each experimental condition, which indicates that coordination at the optimal outcome was quite common (randomization into pairs can vary, thus, we do not report realized strategy profile percentages). Capraro et al. [26] document evidence that players in similar games may demonstrate preferences for efficiency (that is, coordination on the efficient equilibrium); such preferences could account for the collaboration levels we observe. Our first primary result is that female players consistently choose the strategy "work together" more often relative to males across all conditions. Figure 1 illustrates the gender differences in mean collaboration by treatment. Comparing mean collaboration in the full sample, females choose the risky strategy ("work together") more often than males by 7.74 percentage points (Fisher's exact $p < 0.01$). Similarly in the control, females choose the cooperate strategy 5.77% more often than males (Fisher's exact $p = 0.021$). When players know their counter part is female, females choose the "work together" strategy 7.02% more often than males (Fisher's exact $p = 0.047$). We observe the greatest difference in mean cooperation when players are told their counterpart is male; females collaborate 11.58% more than males on average (Fisher's exact $p = 0.009$). These differences suggest that the perception of cooperativeness may matter to the decision to work together. While females may be uniformly collaborate, male-male pairs collaborate less often when gender is revealed. Female workers avoiding the risk-dominant outcome (work alone) under such an environment is somewhat surprising (given the literature), yet suggests females may be more prosocial or collaborative on average than males.

Regression analysis can isolate the effects of our intervention, controlling for other factors that might predict cooperation in our sample. The dependent variable Collaborate is a binary indicator for playing the strategy "work together." The key predictors are Treatment-Male for players being told they were paired with a male, Treatment-Female if told they were paired with a female, and the binary indicator Female. We included the Eckel and Grossman [21] Risk Tolerance lottery choice and the Tang [19] Coopscore. The cooperativeness scores for females are higher (4.96, sd 0.736) are higher than that of males on average (4.74, sd 0.848, $p < 0.01$), consistent with the narrative in the literature.

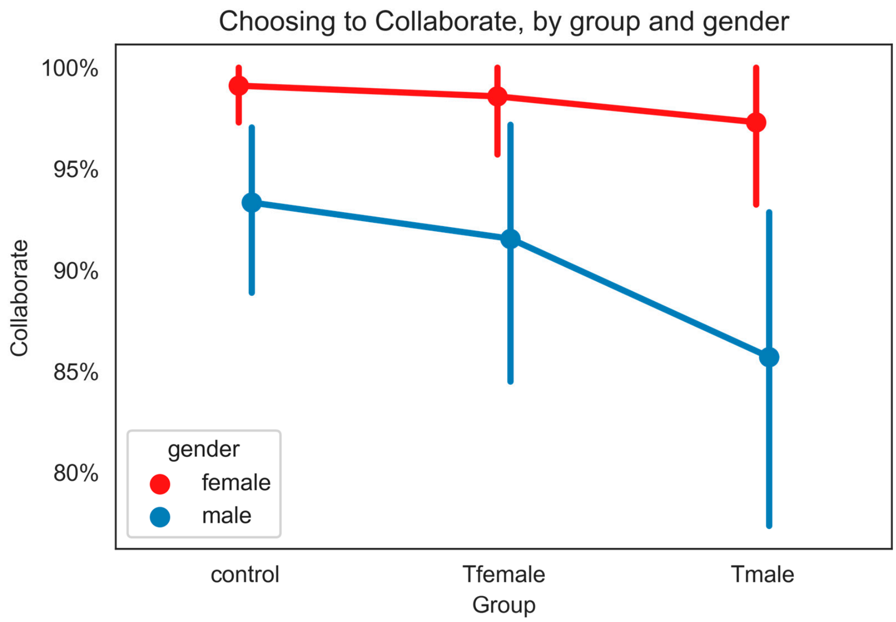

Figure 1. Percentage and standard errors for workers choosing to collaborate ("work together" strategy), by treatment and gender. Gender differences are statistically significant in each experimental condition (Fisher's exact test).

Table 2 presents logit estimates with Model 1 using the full sample. Given the binary nature of the dependent variable, we estimated using heteroskedastic standard errors. We hypothesized that when male workers are told they are paired with females, they would cooperate more often than in the absence of that information and that when females are knowingly paired with females, they are expected to cooperate more often. However, neither hypothesis is supported by the regression results. There was no treatment-effect when players were informed they were paired with a female. Consistent with the results in Figure 1, we observe that females are far more likely to cooperate than males on average ($p < 0.001$). However, when told they are paired with males, players were significantly more likely to work alone ($p = 0.047$).

To determine whether this effect was gender-driven, we separated the sample by gender (Table 2, Models 2 and 3). We observe no significant factor impacting the decision to cooperate in the female player sample. That is, female-female and female-male pairs cooperate at similar levels regardless of the intervention. However, there are differences in the male-only sample. In male-male pairs when that information is revealed, players are less likely to choose to play "work together" ($p = 0.041$). Thus, our second key result suggests no treatment-effect when workers are informed they are paired with female, and a strong negative treatment effect on male collaboration when they knowing engage with males. We interpret this result as a male perception that male "co-workers" were less likely to behave prosocially and that gender was focal in a way we had not expected. This result suggests that gender is focal, but in a way that can be inefficient. However, we note that convergence to the socially efficient outcome is robust as collaboration remains quite high under all conditions. Coop score is the score assigned to a worker based on their responses to the Tang [19] assessment measuring overall propensity to cooperate in general settings. We opted to use this measure as a control to better isolate the treatment effect of our intervention on coordination on the cooperative equilibrium. One would expect the coefficient to be a positive and a significant predictor of collaboration, as we observe. Risk preference is not a strong predictor.

Table 2. Probability of Worker Playing "Work Together" in Framed Stag Hunt.

	(1) Full Sample	**(2) Females**	**(3) Males**
Treatment-male pairs	−0.904 **	−1.112	−0.881 **
	(0.441)	(1.251)	(0.401)
Treatment-female pairs	−0.253	−0.480	−0.235
	(0.502)	(1.510)	(0.539)
Female worker	1.826 ***		
	(0.556)		
Risk Tolerance	0.208 *	0.035	0.235 *
	(0.122)	(0.189)	(0.139)
Coop score	0.632 ***	0.402	0.675 ***
	(0.196)	(0.445)	(0.215)
Intercept	−0.782	1.487	−1.052
	(1.029)	(2.958)	(1.117)
N	545	255	290

Notes: Results from logit regression estimated with heteroskedastic standard errors in parentheses. Dependent variable is binary, taking value of 1 if worker played "Work Together" in framed Stag Hunt Game—our collaboration measure. Model 1 includes the full sample, Model 2 restricts the sample to include only female workers, and Model 3 restricts the sample to males workers. Primary independent variables, Treatment-female and Treatment-male are binary indicators. Risk tolerance is the Eckel and Grossman [21] lottery choice (L = 1–5); Coop score uses the Tang [19] scale. * ($p < 0.05$), ** ($p < 0.01$), *** ($p < 0.001$).

4. Discussion and Conclusions

Higher levels of cooperation take an economy (even in the form of a dyadic team) to a socially efficient point. This paper contributes by demonstrating that information about gender can be focal and reduce collaboration in environments where information about co-workers is otherwise limited. Male-male teams coordinated on the socially efficient outcome less often, while females uniformly chose the collaborative strategy—even in a risky environment (e.g., at risk of being exploited [16]). This observation was a bit surprising, as we recognized the potential for a male-male benefit—where same people likely associate with each other (as in, McPherson et al. [27]) and it "pays to be a man" (following Grossman et al. [28]).

There are a few explanations for our results. Workers may have different expectations about the likelihood of men and women to choose the efficient strategy and such expectations may differ across gender. If this is the case, players statistically discriminate, as described in Holm [15]. It is also plausible that males have a preference for working with females to coordinate efficiently with females but not with males (exhibiting a mere distaste of or animus for men). Such would resemble a Eckel and Grossman [29] "chivalry" story where males demonstrate a willingness to collaborate as a cross gender gesture. It is indeed possible that gender-preference mismatches lead to reduced collaboration among male-male pairings, consistent with Sutter et al. [18]. In other settings, endogenous sorting impacts productivity (related to collaboration) through task preferences for task type [30] or social preferences [31]. Disentangling the effect of expectations from preferences is not an advantage of our design. However, our analysis of the perception risk preferences seems to rule out differential expectations of risk preferences as a driver.

Our study has some limitations, such as being susceptible to bias as the result of our frames and wording. However, we conjecture that such effects would tend to mute our main results, not invalidate them. Our MTurk sample has limited generalizability. This experiment was conducted during the 2020 COVID-19 pandemic when other subject pools were unavailable. Furthermore, workers did not have the expectation that their gender was private information. Our work provides motivation for further exploration into the exact mechanism driving our results (expectations vs. preferences), elicitation of player's beliefs about gender and strategy choice, the repeated game environment, and the focality of ethnicity.

Supplementary Materials: Experimental instructions, protocol, and supplemental resources and notes can be found online at https://drive.google.com/drive/folders/1vYWkYRJ_icP0eMlvgB7CR5aKfgUZ6y3m?usp=sharing. Hypotheses and design pre-registered at https://aspredicted.org/em4bx.pdf accessed on 17 June 2020.

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Data Availability Statement: Data available on request.

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