Journal of Experimental Political Science (2023), **10**, 279–298
doi:10.1017/XPS.2023.10

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

An Experimental Test of the Effects of Fear in a Coordination Game

Abraham Aldama[1*], Deshawn Sambrano[2], Mateo Vásquez-Cortés[3] and Lauren E. Young[4]

[1]Vote Rev, New York, NY, USA, [2]Department of Psychology, Harvard University, Cambridge, MA, USA, [3]Department of Political Science, Instituto Tecnológico Autónomo de México, Mexico City, Mexico and [4]Department of Political Science, University of California, Davis, CA, USA
*Corresponding author. Email: aaldama@sas.upenn.edu

Abstract
Cognitive appraisal theory predicts that emotions affect participation decisions around risky collective action. However, little existing research has attempted to parse out the mechanisms by which this process occurs. We build a global game of regime change and discuss the effects that fear may have on participation through pessimism about the state of the world, other players' willingness to participate, and risk aversion. We test the behavioral effects of fear in this game by conducting 32 sessions of an experiment in two labs where participants are randomly assigned to an emotion induction procedure. In some rounds of the game, potential mechanisms are shut down to identify their contribution to the overall effect of fear. Our results show that in this context, fear does not affect willingness to participate. This finding highlights the importance of context, including integral versus incidental emotions and the size of the stakes, in shaping effect of emotions on behavior.

Keywords: coordination; lab experiment; fear; emotion; global game

A rich literature in cognitive, social, and political psychology has analyzed the effect of emotions on preferences, beliefs, and ultimately decision-making in situations involving risk and social interactions (Albertson and Gadarian 2015; Brader 2005; Damasio 1994; LeDoux 1996; Lerner and Keltner 2000, 2001; Valentino et al. 2011). In particular, recent research analyzes the role of emotions in contentious politics in general and in social movements in particular (Aldama, Vásquez-Cortés and Young 2019; De Dreu and Gross 2018; Pearlman 2016; Aytac, Shiumerini and Stokes 2017; Young 2019, 2021). However, we still have limited evidence on the mechanisms by which emotions affect risky collective action, whether emotions affect behaviors, and how emotions' effects vary across contexts.

This article adds to this literature by formalizing and testing predictions about the effects of fear in a situation of risky collective action. We use a global game to

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formalize the trade-off between taking and abstaining from a risky action. The payoff of the risky action depends on both the actions of other players and chance, while if players abstain, they receive a specific payoff with certainty.[1]We then probe two well-established mechanisms through which fear may be affecting this decision: increases in pessimism and risk aversion (Lerner and Keltner 2001; Lerner et al. 2003; Callen et al. 2014; Young 2019). We further disaggregate the increase in pessimism into two distinct mechanisms: (a) that fear may increase pessimism about the state of the world, which we call fundamental uncertainty, and (b) that fear might increase pessimism about other players' actions or strategic uncertainty. The second channel we explore is an increase in risk aversion, which may make people less likely to participate when the stakes are higher by making the utility function more concave.

We design a lab experiment to test the effects of fear through these three mechanisms.[2] We induce fear in a random subset of participants using a video clip from a horror film and a short, loud unexpected noise played randomly during the game.[3] After the emotion induction, participants play 15 rounds of a two-player global game. In this game, players receive a signal of the cost of failed cooperation and decide whether to participate or not.[4] We then test whether fear increases pessimism about a signal of the payoffs they will receive, increases pessimism about the participation of others in the risky collective action, or increases risk aversion.

We do not find that the fear inductions cause changes in the level of participation in risky collective action in the global game. Participants assigned to the fear treatments were no more or less likely to participate in risky collective action. There is some evidence that participants were slightly more likely to participate when the stakes were higher, but only in full information rounds, which may be consistent with a "nothing-to-lose" effect discussed in Aldama, Vásquez-Cortés and Young (2019).

This project makes three contributions to the literature on emotions and collective action. First, we contribute additional evidence about the causal effects of emotions on a number of economic and political behavioral outcomes, including, among others, participation in collective action (Young 2019), social sanctioning (Reuben and Van Winden 2008; Hopfensitz and Reuben 2009), generosity (Kirchsteiger, Rigotti and Rustichini 2006), and trust (Albertson and Gadarian 2015; Dunn and Schweitzer 2005; Myers and Tingley 2016). Our results suggest that the effects of emotions discussed in this literature may be more context-dependent than is typically assumed. While past research has found that fear affects risk perceptions and preferences in real-world settings or scenarios (Lerner et al.

[1]For canonical examples of global games, see Carlsson and Van Damme (1993), Morris and Shin (2003, 2004).

[2]Additional information about the selection and validation of emotion stimuli is available in the Appendix: 10.

[3]Our video induction builds on a large literature showing the effectiveness of similar videos in inducing emotions (Hubert and de Jong-Meyer 1991, Ray and Gross 2007; Renshon, Lee and Tingley 2015), and the noise stimuli is similar to Pattwell et al. (2012).

[4]To avoid framing effects, we use neutral terminology in the instructions and subjects choose between action A and action B.

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2003; Albertson and Gadarian 2015; Young 2019), we do not find such effects on a behavioral outcome in a more abstracted risky decision.

Second, we contribute to a literature on the psychological drivers of cooperation. While the literature on fear has tended to focus on individual perceptions and behaviors, the literature on trust and cooperation has focused on mobilizing emotions like anger and happiness, and has generally found mixed results (Dunn and Schweitzer 2005; Capra 2004). Myers and Tingley (2016) find using a mediation analysis that anxiety reduces trust. Mobilizing emotions have also been found to affect contributions to public goods and prosocial sanctioning (Kirchsteiger, Rigotti and Rustichini 2006; Hopfensitz and Reuben 2009; Joffily et al. 2014; Drouvelis and Grosskopf 2016). We extend this literature to the negative and generally demobilizing emotion of fear.

Finally, we make two more methodological contributions. We contribute to an economics literature that uses lab experiments in which participants play global games with varying precision in the information that players receive (Cornand 2006; Cabrales, Nagel and Armenter 2007; Treviño and Szkup 2015). We build on this literature by including an emotion induction and analyzing its impact on participants' decision-making. In addition, we analyze salivary α-amylase as an indicator of the sympathetic-adreno-medullary axis (SAM) response (Buchanan, Bibas and Adolphs 2010). By doing so, our study contributes to evidence on biological and psychophysiological measures in political decision-making (Ksiazkiewicz and Jung 2020), which has mostly focused on skin conductance (Hibbing, Baker and Herzog 2021; Settle et al. 2020).

The rest of the article is organized as follows. We first provide an overview of the theoretical underpinnings for the mechanisms we posit through which the emotion might affect decision-making. Next, we present the game that subjects play in the lab. Then, we discuss the experimental design for our project, followed by the results of the experiment. We conclude by discussing the implications and generalizability of our findings and avenues for further research.

Emotions and decision-making

Emotions are patterned chemical and neural responses to stimuli that elicit physiological and subjective changes to motivate a behavioral responses in order to deal with the relevant event (Frijda 1994; Damasio 1994). Threatening stimuli often evoke a SAM response. The SAM response is characterized by changes in heart rate, skin conductance, and pupil dilation and can be measured with free salivary α-amylase (Buchanan, Bibas and Adolphs 2010).

The existing literature suggests multiple channels through which fear may impact decisions to participate in risky collective action. Experimental studies in both psychology and economics show that emotions, in particular fear, influence risk perceptions (Johnson and Tversky 1983; Lerner and Keltner 2000, 2001; Lerner et al. 2003) and risk aversion (Guiso, Sapienza and Zingales 2018; Cohn et al. 2015; Young 2019). First, if fear affects risk perceptions it should influence (a) beliefs about a payoff-relevant state of the world or, in an independent manner, it should affect (b) beliefs about how likely it is that other players will take a risky action

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(Johnson and Tversky 1983; Lerner and Keltner 2000, 2001; Lerner et al. 2003). In the case of (a), an increase in pessimism may make people believe that participating in the risky action is more costly than warranted by the available information. In the case of (b), independently of how costly people believe taking the risky action will be, they might believe that others are less likely to participate. Though related, these are distinct channels. In game theoretic terms, the first channel is through perceptions of fundamental uncertainty, while the latter is through perceptions of strategic uncertainty.

Finally, if fear affects risk aversion, then it changes the concavity of the citizens' utility functions, making it more likely that players choose the safer choice by lowering the value of their certainty equivalent. Aldama, Vásquez-Cortés and Young (2019) develop a theoretical model of how these effects of fear would influence the decision to join a protest or revolution.

Model

Consider a game in which there are two players deciding whether they want to participate in risky collective action, such as citizens deciding whether to mobilize to bring down an incumbent regime or investors seeking to increase the value of a security. As a running example, we will use the language of mobilization against an incumbent regime. The citizens' goal, replacing the regime, will only be achieved if both of them participate or *mobilize*. If the regime remains in place, that is, the status quo remains, the citizens will obtain a payoff of $-c$, with $c \in \mathbb{R}$. This is a measure of how costly it is for the citizens to have the regime in place. The greater c is, the worse it is for them to have the regime prevail. Failure of the regime will result in a positive payoff of R for both citizens. The greater R is, the more citizens would benefit from regime change. Mobilizing has a cost of θ, which is unknown to both citizens. This captures the idea that even if the regime fails they do not know whether they will suffer physical injury (or worse) if they join the mobilization against the regime. Payoffs are summarized below in Table 1. Although the citizens do not know the true value of θ, they know that it is drawn from a normal distribution with mean y and variance $1/\alpha$ (precision α), that is,

$$\theta \sim N(y, 1/\alpha).$$

Moreover, note that it is possible that $\theta < 0$, which allows the payment structure to also capture the fact that the regime might co-opt the opposition. This means that there might be cases in which the opposition is better off by mobilizing even if they fail to replace the incumbent regime.

Once θ is realized, independent signals are privately drawn for each citizen. The signals provide additional information to the citizens. These may come, for instance, from their knowledge of previous mobilizations, public pronouncements by the regime, or whether they observe the regime using intimidation tactics, which might be observed by citizens on the news or social media. The signal each citizen receives is a noisy signal of θ. In particular, each citizen receives a signal

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Table 1
Payoff Summary of the Game

		Player 2	
		Mobilize	Abstain
Player 1	Mobilize	$R - \theta, R - \theta$	$- \theta, -c$
	Abstain	$-c, -\theta$	$-c, -c$

$$x_i = \theta + \varepsilon_i$$

where ε_i is normally distributed with mean 0 and variance $1/\beta$ (precision β). Citizens' posterior beliefs about the θ are derived by Bayes' rule. In particular, given a signal x_i, a citizen's posterior expectation of θ is normally distributed with mean γ and precision $\alpha + \beta$, where $\gamma = \frac{\alpha y + \beta x_i}{\alpha + \beta}$.[5]

The equilibrium consists of a cutoff signal for citizens $x_i = k$.[6] Citizens using a cutoff strategy will choose to mobilize if upon receipt of their private signal they believe that θ is sufficiently low and will abstain from doing so if they believe it is sufficiently high.

Note that if citizen i mobilizes, she will always receive θ and will receive R if the other citizen also mobilizes. Hence, citizen i will mobilize if she believes that the other citizen will mobilize with high enough probability. In particular, she will mobilize if

$$\mathbb{E}[Mobilize|x_i, k] = R \times Pr(x_{-i} < k|x_i) - \mathbb{E}[\theta|x_i] > -c \quad (1)$$

where k is the cutoff of the other citizen (which in equilibrium will be equal to her own cutoff), and $Pr(x_{-i} < k|x_i)$ is the probability with which citizen i believes that that citizen $-i$ will receive a signal smaller than k conditional on the signal she received. We must note that:

$$x_{-i}|x_i \sim N\left(\gamma, \frac{1}{\alpha + \beta} + \frac{1}{\beta}\right).$$

Thus, with some algebra, equation 1 becomes

$$R\Phi\left[\frac{1}{\frac{2\beta + \alpha}{\alpha\beta + \beta^2}}\left(k - \frac{\alpha y + \beta x_i}{\alpha + \beta}\right)\right] - \frac{\alpha y + \beta x_i}{\alpha + \beta} > -c, \quad (2)$$

where Φ represents the standard normal distribution function. From equation 2, note that since both α and $\beta > 0$, the left-hand side is strictly increasing in

[5]For a discussion of how priors based on a normal distribution are updated according to Bayes' rule when receiving a signal that comes from a normal distribution, see DeGroot (2005).

[6]See, for instance, Morris and Shin (2003) or Carlsson and Van Damme (1993) for a discussion of the equilibrium strategies of these kinds of games.

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Table 2
Experimental Parameters

	Option 1	Option 2	Option 3	Option 4	Option 5
y	1	1	1	1	1
α	1	1	1	1	1
β	1	1	1	1	1
R	1	2	3	4	5
c	0.5	0	−0.5	−1	−1.5

k and strictly decreasing in x_i. Thus, as noted by Morris and Shin (2003) the game has a unique equilibrium in cutoff strategies in which $k = x_i^*$.

Experimental parameters and predictions

We implement this game in the lab, with participants playing the game under different parametrizations for a number of rounds. In each round of the experiment, the values of the parameters of the model are independently randomly drawn from the five options presented in Table 2.

Note that while $y = \alpha = \beta = 1$ for all cases, the pair $\{R, c\}$ changes from round to round to have different stakes for the game. Given $\alpha = \beta = y = 1$, we can substitute these values and the equilibrium condition that $k = x_i$ into equation 2, which then becomes

$$R\Phi\left[\frac{2}{3}\left(k - \frac{1+k}{2}\right)\right] - \frac{1+k}{2} > -c \tag{3}$$

Which upon further analysis becomes

$$R\Phi\left[\frac{k-1}{3}\right] - \frac{1+k}{2} > -c$$

Figure 1 graphs the left-hand side, the expected benefit of mobilizing, and the right-hand side of this equation, the expected benefit of not mobilizing, for various values of k for $R = 1$ and $c = 0.5$. It shows that for these values, the unique cutoff is $x_i = k = 1$. The results remain unchanged for the rest of the set of parameters. Hence, a citizen that is fully rational (and has common knowledge of rationality) should choose to mobilize if she receives a signal smaller than 1 and should abstain if it is larger than 1. However, given our theoretical discussion, we expect that subjects that are in a state of fear would abstain at lower values of the signal. Moreover, given fear's tendency to make people amplify risks, we expect that this effect would be amplified if they believe that other players will also abstain at lower values of the signal, whether this is caused by an increase in fundamental or strategic uncertainty. Aldama, Vásquez-Cortés and Young (2019) model these effects as people believing the signal is higher than it actually is (an increase in fundamental uncertainty) and as people believing that other players are more likely to make

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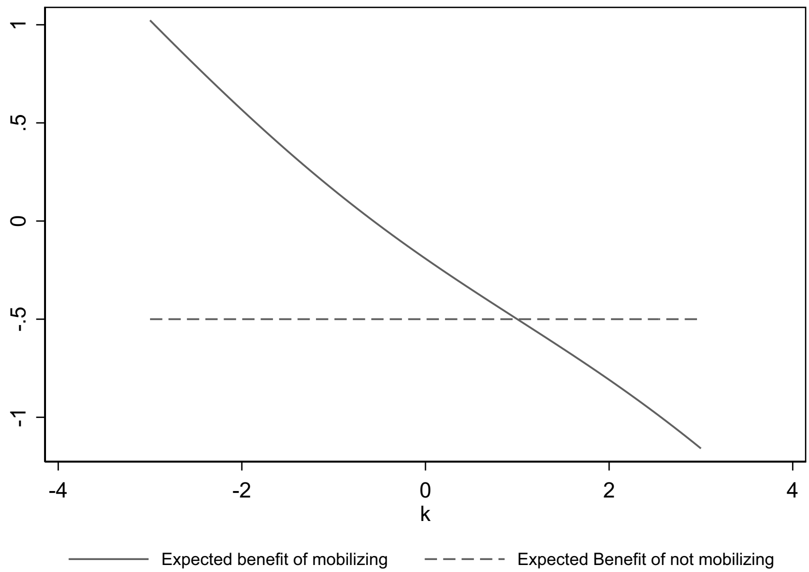

Figure 1
Equilibrium Cutoff.

mistakes when deciding to mobilize (an increase in strategic uncertainty). Clearly, both effects would demobilize people.

Finally, to the extent that fear increases risk aversion, we would expect that at higher stakes the effects of fear would be stronger. To see why this is the case, consider the following simple example. Let the utility over the material payoffs be $u(\pi) = 3 + \pi$, where π represents the corresponding material payoffs depicted in Table 1 when people are not afraid. Suppose that as a result of an increase in risk aversion when people are afraid, their utility is given by $u(\pi) = (3 + \pi)^{0.6}$. A generalized form of equation (1) reveals that in both option 1 and option 5 in Table 2, without fear the cutoff would be given by $k = 1$. However, in the case with fear, the cutoff in option 1 is $k = .98$ and $k = .72$ for option 5, revealing that is more likely for subjects in the fear condition not to mobilize in option 5 than in option 1. Though generally increases in risk aversion also lead to less mobilization, particularly under higher stakes, Aldama, Vásquez-Cortés and Young (2019) also note that increases in risk aversion can lead to greater mobilization if they lead to a "nothing-to-lose" effect. This effect prevails if a player's utility is so affected by fear that the expected payoffs for the status quo become very similar to those of mobilizing and failing to replace the regime.

Although we describe this model in terms of citizens mobilizing against an authoritarian regime, it can be generalized to a wide range of situations in which more than one decision-maker is considering engaging in potentially action against a singular opponent who can selectively punish. This also describes situations in which civilians consider taking collective action against criminal organizations or workers considering reporting an abusive employer. One key assumption is that

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the actions of players are at least partially visible to the regime, which enables it to impose costs conditional on individual mobilization decisions.

Experimental design

To test the predictions of this model, we use an experimental design that allows us to compare the decisions of participants who are experiencing the emotion of fear to those of otherwise similar participants in a neutral emotional state. We carried out the experiment in the labs of a large private university in the northeast and a large public university on the west coast. We recruited participants from their preexisting pools, primarily composed of undergraduate students. The experiment was implemented using z-Tree (Fischbacher 2007). Sessions lasted about 60 min, and participants were paid on average 16 dollars. After providing consent, participants first watched a relaxing seven-minute video clip, after which we took a saliva sample in order to measure their levels of α-amylase, a salivary enzyme that serves as an index of noradrenergic activity (Nater and Rohleder 2009; Raio et al. 2013; van Stegeren et al. 2006). Second, to build familiarity with the game, a member of the research team read the instructions out loud, and participants played five practice rounds.[7] Third, participants were randomly assigned at the session level to watch a video intended to either induce a state of fear or keep them in a neutral emotional state. Finally, participants played 15 rounds of the game in which we vary key parameters in order to shut down some of the channels by which fear might influence behavior. In random order, participants played three sets of 5 rounds of the game: a standard global game with a human, a standard global game with a computer, and a full information game with a human. Finally, participants answered a few questions about their current emotional state and how they played the game. After all measurement, the sum of three randomly selected rounds (one from each condition) is paid out, and the participants' payouts revealed.[8] Figure 2 shows the timing of the game for participants.

To induce a mild state of fear in a random sample of our sessions, we used a video clip from a horror film. We pre-tested the video on both Amazon Mechanical Turk and with a sample of subjects from one of the experimental pools and found in both pilots that the video significantly increased self-reported levels of fear. Participants in the treatment condition also heard loud unexpected noises during three randomly selected rounds. In the control treatment, subjects watched a typical placebo video about the solar system. Both videos were of the same length, about seven minutes. The fear treatment is similar to those used in previous studies to create specific emotions (Westermann et al. 1996; Lench, Flores and Bench 2011). After receiving the corresponding treatment, participants were paired with another player and, based on the given parameters, the participants received a signal of the strength of the regime x_i and were then asked whether they wished to *mobilize*

[7]The full instructions are in Appendix 9.

[8]Randomly selecting one round to be paid out enables the use of large incentives and produces similar behavior to a setup in which all rounds are incentivized (Starmer and Sugden 1991; Beattie and Loomes 1997; Cubitt, Starmer and Sugden 1998).

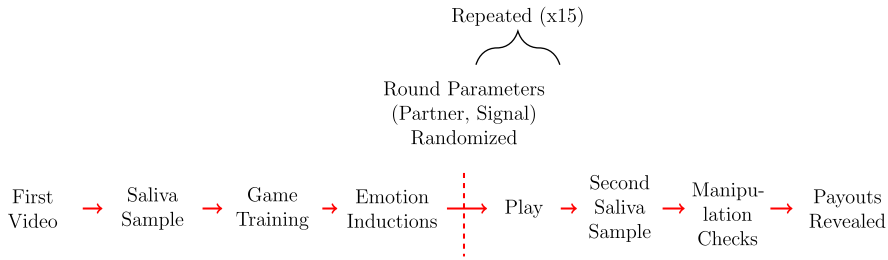

Figure 2
Timing of Play During the Experiment.

or *abstain*.[9] After each round, participants were randomly rematched. Participants do not receive feedback until the end of the game to eliminate the possibility that learning the outcomes of each round would affect participants' moods in subsequent rounds.

Randomization occurs at the session level, and participants know that they are all watching the same video. This implies that participants have common knowledge that others are also experiencing the same treatment that they receive.

We use three different versions of the game to disentangle the possible mechanisms by which fear could affect mobilization: standard, computer, and full information. In each session, participants play a set of five rounds of each version of the game, the order of which is randomly assigned. In *standard rounds*, participants know that they are playing with another human who has viewed the same treatment video. Thus, their behavior could be affected by pessimism about the signal, pessimism about others' behavior, or risk aversion. However, in the *computer rounds*, participants play against a computer that always plays *optimal* strategies, that is, it will play mobilize for sufficiently low signals. This eliminates the possibility that the effect of fear might work through pessimism about other players' actions. In the third type of round, *full information* participants receive the true value for θ, which eliminates the potential mechanism of pessimism about its true value.[10] Finally, in order to analyze whether fear reduces mobilization by increasing risk aversion, the values of R and c are varied together to vary the stakes of the game while maintaining the same equilibrium prediction. If fear increases risk aversion, we should see that people are less likely to mobilize when the stakes of the game are higher.

Analysis

This experimental design enables us to estimate several parameters of interest. Specifically, we test first for the overall effect of fear on mobilization decisions

[9] In the experiment, neutral language is used: participants are asked whether they prefer to do action A or action B.

[10] Although this changes the nature of the game, and conditional on the value of the equilibrium prediction changes, on average we would expect to see the same mobilization levels than in the global game if fear has no effect.

and then use the variations in the game to test for the relative importance of several potential mechanisms by which fear could reduce cooperation. For each quantity of interest, we estimate the average treatment effect (ATE) with and without demographic and round controls.

The main outcome of interest is whether the participant chooses to mobilize. We hypothesized that participants assigned to the fear treatment should be less likely to mobilize than those in the control group. For each participant, we observe 15 different mobilization decisions in 15 slightly different scenarios. To test for the main effect of fear, we use the results of the rounds in which we do not shut down any of the potential channels (i.e., the five rounds in which players are paired with a human and there is noise on the signal). $Y_{i,t,standard}(T)$ therefore represents the decision of individual i in round t of the five standard rounds in condition $T \in \{0, 1\}$, where 1 is the fear treatment and 0 the control. It takes a value of 1 if i plays *Mobilize* and 0 is she does not. ATE_T represents the ATE of fear across individuals and rounds.

$$ATE_T = E[Y_{standard}(1)] - E[Y_{standard}(0)] \tag{4}$$

We estimate the ATE using a linear probability model in which the individual decision to mobilize is the dependent variable and includes round fixed effects. We carry out analysis at the level of the participant-round. Because randomization occurs at the session level, we cluster standard errors by session.

Second, we test for potential channels by which fear could reduce mobilization by examining variations of the game. The first potential mechanism, $M1$, is pessimism about how partners will behave. To test whether fear makes people pessimistic about what their human partner will do, we test (1) the effect of fear in the rounds in which someone is paired with a computers, and (2) whether the effect of fear is larger in the standard rounds in which the participant is paired with a human than in those in which she is paired with a computer. The first effect is obtained analogously to that in equation (4), estimated using the rounds in which players are paired with a computer. The second, ATE_{M1}, represents the portion of the ATE attributable to $M1$, expectations about others' actions.

$$ATE_{M1} = (E[Y_{standard}(1)] - E[Y_{standard}(0)]) - (E[Y_{computer}(1)] - E[Y_{computer}(0)])$$

The portion of the total effect that we will attribute to expectations about how other humans will behave is captured in the difference in mobilization between the 5 standard rounds and the 5 rounds in which the participant plays against a computer. This effect is recovered by β_2 in the following linear probability model:

$$Y_{i,t} = \alpha + \beta_0 Computer_t + \beta_1 Fear_i + \beta_2 Fear_i \times Computer_t + \varepsilon_{i,t}$$

where $Computer_t$ is an indicator of whether someone was facing a computer in that round and $Fear_i$ and indicator that the subject was in the treatment condition, $\varepsilon_{i,t}$ is the error term. The second potential channel is pessimism about the signal that participants receive. Similar to the above case, we estimate both whether this channel is at play and the effect that fear has when we shut down the channel. The first is done by comparing participants' decisions in the treatment condition to those in the control condition when there is no noise in the signal. For the latter, we compare the effect in the standard rounds in which the participant receives a

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noisy signal (a signal drawn from a normal distribution around the true strength of the regime) to those in which they receive a true signal.

$$ATE_{M2} = (E[Y_{standard}(1)] - E[Y_{standard}(0)]) - (E[Y_{fullinfo}(1)] - E[Y_{fullinfo}(0)])$$

This quantity of interest is obtained by estimating β_2 in the following regression:

$$Y_{i,t} = \alpha + \beta_0 FullInfot + +\beta_1 Fear_i + \beta_2 Fear_i \times FullInfo_t + \epsilon_{i,t}$$

Third, fear could reduce mobilization by increasing risk aversion. We test for changes in risk aversion by testing whether fear has a larger effect on rounds with higher spreads between the payoffs for winning and losing. We randomize the payoffs such that each participant gets a randomly selected payoff scheme in each round. $ATE_{spread=1.5}$ $ATE_{spread=5.5}$ Because we predict that the ATE will reduce linearly with the increase in the spread if fear increases risk aversion, our main test of whether the effect of fear is larger for higher payoff spreads will be based on regression analysis that allows us to use the full variation in the payoffs across rounds:

$$Y_{i,t} = \alpha + \beta_0 Spread_{i,t} + \beta_1 Fear_i + \beta_2 Fear_i \times Spread_t + \epsilon_{i,t}$$

where $Fear_i$ is a dummy variable that takes a value of 1 if the subject is assigned to the fear emotion induction and $Spread_i$ is a measure of the spread of the payoffs for the round that vary from 1.5 to 3.5 experimental currency units. The coefficient β_2 estimates the extent to which the effect of the fear treatment varies based on the spread of the payoffs.

In addition to these substantive analyses, we carry out several manipulation checks. Our main manipulation check tests whether the treatment successfully induced fear without inducing substantively large levels of other emotions using self-reported levels of six emotions after all rounds were played. In addition to these self-reports, we also analyze salivary α-amylase as an indicator of the SAM response (Buchanan, Bibas and Adolphs 2010).

Results

In this section, we present results for 32 sessions and a total of 432 subjects. The estimated ATE on the decision to mobilize is presented in Figure 3. The results are presented by type of round, including the normal global game, the game played with a computer, and the rounds with complete information played with a human. We present the estimate with 95% confidence intervals. In all of the three cases, there is no detectable impact of fear on mobilization. This holds even if we include demographic covariates and controls for other parameters in the round in the regression as controls as we show in Appendix 2.

We estimate similar null effects in the full information rounds and computer rounds and find no differential effect of fear across the three types of rounds. These analyses are presented in Table 3. Fear does not differentially impact participants' decisions when they know the other player's strategy with certainty and when they know the regime's strength with certainty. This suggests that blocking the channels of strategic and fundamental uncertainty does not change the effect of the fear treatment.

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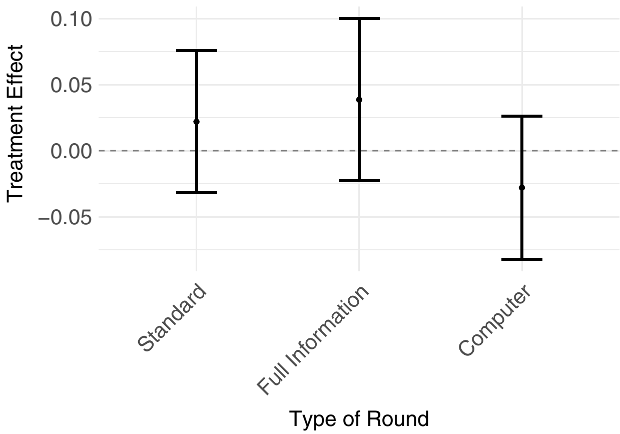

Figure 3
There is No Effect of the Fear Treatment on Mobilization.

We also analyze participants' decisions at varying spreads of the payoffs. Contra the expectations that there would be differential effects at different payoff spreads, as observed in Figure 4, we find that the effect of fear is generally null as the stakes of the game increase. The exception to this is that in the full information rounds, changing the stakes does change people's response to the treatment. At higher differences between R and $-c$, people become mobilized.

The mobilizing effect of fear in full information rounds at higher stakes may be driven by the elimination of fundamental uncertainty. When players know the regime's strength with certainty, other mechanisms, in particular a nothing-to-lose effect, play a large role in determining people's actions. To see this, it is important to note that in the complete information game, as the payoff differences increase, so does the probability of having two equilibria in pure strategies. Thus, while there is no fundamental uncertainty in this case, there is more strategic uncertainty as the differences in the bayodds for Mobilizing and Abstaining increases. (Mobilize, Mobilize) will be an equilibrium if $R + c \geq \theta$. Hence, the probability that (Mobilize, Mobilize) is an equilibrium is given by $Prob(\theta) \leq R + c = \Phi(R + c - 1)$, where Φ is the cumulative distribution function of the standard normal. A similar logic aplies to calculating the probability that (Abstain, Abstain is an equilibrium, which is given by $1 - \Phi(c - 1)$. This is summarized in Table 4, which shows the probability of (Mobilize, Mobilize) and (Abstain, Abstain) being equilibria in our game.

As it can be appreciated in the table, as we go from Option 1 to Option 5, the probability that both action profiles are equilibria increases. As noted previously, one of the mechanisms through which fear may operate is an increase in risk aversion. In this case, we would expect that when the probability of multiple equilibria increases, which occurs as we increase the difference between R and $-c$, subjects in the fear condition would be more likely to choose the action corresponding to the risk dominant equilibrium, (Abstain, Abstain), than those in the control condition. However, as we see in Figure 4, we obtain the opposite result, which suggests that as

Table 3
There is No Differential Effect of the Fear Treatment in Computer and Noiseless Rounds

	Dependent variable: Mobilization					
	(1)	(2)	(3)	(4)	(5)	(6)
Fear Treatment	0.022	0.016	0.016	0.022	0.016	0.015
	(0.028)	(0.027)	(0.028)	(0.028)	(0.027)	(0.028)
Computer Round	0.020	0.012	0.012			
	(0.027)	(0.023)	(0.023)			
Treatment ×	−0.050	−0.038	−0.037			
Computer Round	(0.032)	(0.027)	(0.027)			
Noiseless Round				0.017	0.009	0.008
				(0.017)	(0.022)	(0.022)
Treatment ×				0.017	0.032	0.028
Noiseless Round				(0.036)	(0.040)	(0.043)
Signal		−0.066***	−0.071***		−0.068***	−0.072***
		(0.010)	(0.010)		(0.009)	(0.010)
Female			0.032			0.019
			(0.023)			(0.023)
Age			0.002			0.002
			(0.002)			(0.002)
Pre-Treatment			0.243***			0.269***
Cooperation			(0.054)			(0.039)
Intercept	0.613***	0.680***	0.479***	0.613***	0.682***	0.485***
	(0.021)	(0.021)	(0.057)	(0.021)	(0.022)	(0.043)
Observations	3,760	3,760	3,620	3,760	3,760	3,620
R^2	0.001	0.038	0.054	0.002	0.035	0.050

Note: *p < 0.1; **p < 0.05; ***p < 0.01
Standard errors clustered at the session level in parentheses.
The dependent variable is the mobilization rate by participant during standard and computer (columns 1–3) or noiseless (columns 4–6) rounds. Signal is the value of the signal of the regime's strength, randomly assigned at the individual level. Average pre-treatment mobilization is the average mobilization rate by participant during the five pre-treatment rounds. Female is a dummy indicating gender and age is the participant's age. The unit of analysis is the participant-round.

the spread increases, a "nothing-to-lose" effect may kick in when the pessimism channels are shut down. This result may be in line with the prediction of Aldama, Vásquez-Cortés and Young (2019), who present a model in which if fear only acts by changing the concavity a people's utility functions, under some conditions, it will mobilize people against the regime. Previous accounts in the literature suggest that in some cases, fear may indeed have mobilizing effects and take riskier actions (Salman 1994; Lohmann 1993), particularly when there is strategic

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Table 4
Experimental Parameters and Equilibrium Probabilities

	Option 1	Option 2	Option 3	Option 4	Option 5
R	1	2	3	4	5
c	0.5	0	−0.5	−1	−1.5
$R + c$	1.5	2	2.5	3	3.5
Prob (M, M) is eqm	0.69	0.84	0.93	0.98	0.99
Prob (A, A) is eqm	0.69	0.84	0.93	0.98	0.99

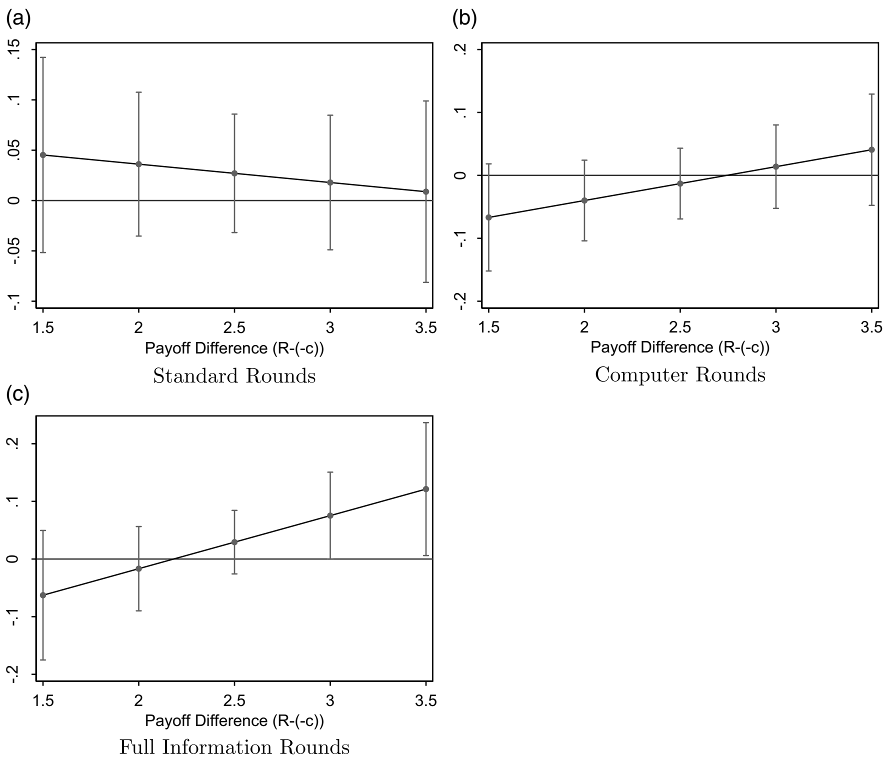

Figure 4
The Effect of the Fear Treatment on Mobilization Depends on the Payoff Spreads In Full Information Rounds.

uncertainty (Kugler, Connolly and Ordóñez 2012). Our results dovetail with those of Szkup and Treviño (2020), who find that at low levels of fundamental uncertainty sentiments may cause people to become over-optimistic. Our results show that this is only the case when payoff differences are large enough.

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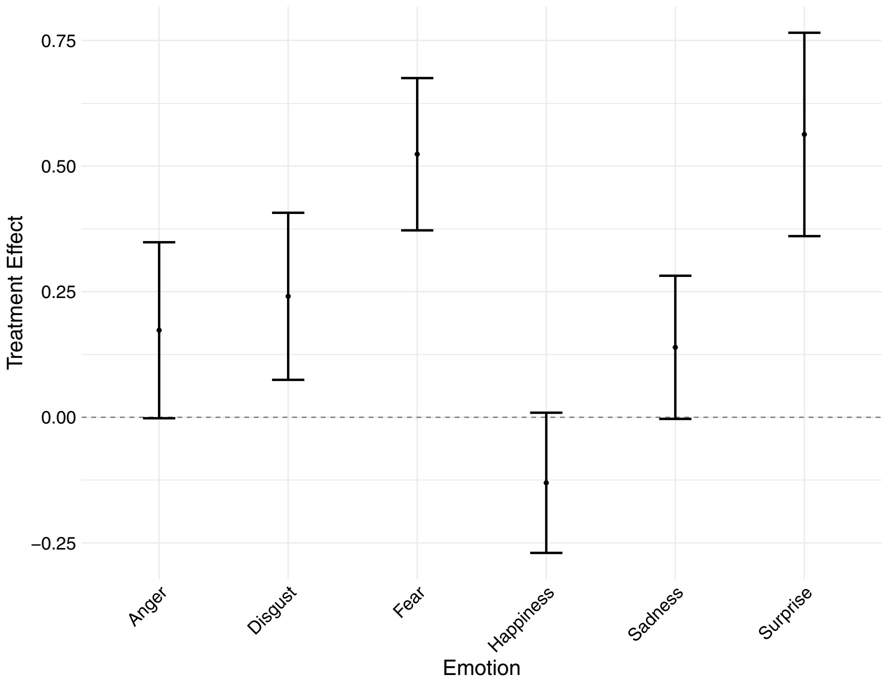

Figure 5
Effect of Treatment on Emotions.

Discussion

Overall, in this lab experiment, fear does not have a strong effect on the decision to take a risky action in a coordination game. Why might this be the case given the strong theoretical expectations that fear should affect mobilization through pessimism and risk aversion?

First, it is possible that the treatments did not induce sufficient or precise levels of fear. We think this is unlikely to explain the null results for several reasons. First, we used an emotion induction based on film and audio clips that has been found in many past experiments to effectively induce emotions (Westermann et al. 1996; Lench, Flores and Bench 2011; Pattwell et al. 2012). Second, using self-reported measures of emotions on a four-point scale in our experimental sample, we show in Figure 5 that the fear treatments significantly increased self-reported fear. We find that, on average, participants' report being half a point more afraid in the treatment condition. Other negative emotions are also induced by the treatments, sometimes at statistically significant levels, but fear and surprise are induced in much larger magnitudes than other emotions like anger and sadness that might have different effects on mobilization decisions.

However, the treatment did not significantly increase salivary α-amylase (Nater et al. 2005; Nater and Rohleder 2009). Results in Appendix 4 show that participants in the treatment group had slightly higher levels of the enzyme at the end of the

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experiment, on average, but the result is not statistically distinguishable from zero.[11] This combination of findings on our manipulation check could be driven by a few patterns. First, participants could be providing the response that they think the experimenter wants to receive on the self-reported measures. However, we do observe increases across several negative emotions that are less obviously targeted by the treatments and thus less likely to be affected by demand effects. Second, our α-amylase analysis could be under-powered: a short film and audio clips are not expected to induce an extremely strong SAM response, salivary α-amylase is noisy, and we are only able to run this test on about 70% of our sample (298 participants). Calculating the minimum detectable effect ex-post based on the realized sample size and variance in our data, we could only detect an effect of 15 U/ml or greater on α-amylase, about twice as large as our observed estimate. Taken together, these results suggest that the fear treatments likely did induce a mild state of fear and that this fear dominated other emotions.

Second, is it possible that we do not find an overall effect of fear because participants did not understand the games or were not playing strategically. Again, we think that this explanation is unlikely. In Appendix 3, we show that participants do seem to be responding in a utility-maximizing way to the randomly assigned parameters in the game, particularly the signal of the strength of the regime. The probability of mobilization in both the treatment and control groups in all three types of rounds is lower at higher signals of regime strength. In addition, majorities of people in all conditions (treatment vs. control, and the three types of rounds) make rational decisions, as defined by whether they decide to mobilize or not in a way consistent with the equilibrium strategy profile, at similar rates, and use similar thresholds for deciding whether to mobilize or not (Heinemann, Nagel and Ockenfels 2004; Szkup and Treviño 2020).

Third, it would be possible that even if the treatment itself is not having an effect on people's choice, it could be having an effect that is mediated through how much self-reported fear participants experienced (or surprise for that matter, since it is also increased by the treatment). We address this issue in Appendix, where we show that not only is there no treatment effect of our intervention but also that there is no effect that is mediated by fear, surprise, or an additive index of both.

Fourth, it could be that fear's effect washes away during the 15 rounds that people play. We address this in Appendix 7, where we consider only results in the first set of five rounds. Results show that though the point estimate of the effect is negative, it is not statistically significantly different from zero.

Ultimately, it seems most likely that in this experiment fear had little effect on the decision to participate in risky collective action because the effect of fear is conditioned by context. This experiment focuses on what affective scientists describe as incidental emotions, or emotions that are independent of the choice at hand and thus have seemingly no reason to influence the decision (Phelps, Lempert and Sokol-Hessner 2014). This type of emotion is contrasted from integral emotions in which the affective response is derived from the choice options themselves. An example of integral emotions would be fear or anger induced by thinking about

[11]Moreover, results in 5 show that increases in measured salivary amylase do not predict choices in the standard rounds.

https://doi.org/10.1017/XPS.2023.10 Published online by Cambridge University Press

the decision to overthrow an authoritarian government that cannot be disentangled from the overall decision. While some studies have found that even incidental emotions can change political behavior and decision-making (although at lower levels than emotions more related to the choice at hand) (e.g., Young 2019), recent work has emphasized the importance of more context-specific emotions in politics (Greene and Robertson 2020; Mattingly and Yao 2022). Future work along these lines should investigate whether integral affect alters these types of choices.

Similarly, it is possible that the context of the choice to mobilize or abstain in an abstracted lab experiment modified the effect of fear. While we are ultimately interested in understanding the effect of fear on people's decisions to participate in risky collective action, including mobilization decisions of citizens confronted by a coercive regime, the external validity of the findings depends on the treatment, context, participant population, and measurement strategy (Egami and Hartman 2022). In our context, participants may, for example, not react pessimistically about the fundamental state of the world, whereas in a more naturalistic setting they would. In this experiment, participants in university labs were given an abstracted choice between "Action A" and "Action B." It is quite possible that "WEIRD" participants making decisions in a lab with relatively small financial rather than political stakes may be less affected by fear than participants in authoritarian regimes making explicitly political decisions (Henrich, Heine and Norenzayan 2010). Both the type of participant and the type of context may shape the extent to which participants to try to shut down versus learn from the effects of emotions like fear in order to make decisions.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/XPS.2023.10

Data Availability. Support for this research was provided by the International Federation for Research on Experimental Economics. The data, code, and any additional materials required to replicate all analyses in this article are available at the Journal of Experimental Political Science Dataverse within the Harvard Dataverse Network, at: doi: https://doi.org/10.7910/DVN/BZ6IFP

Acknowledgements. We thank the International Federation for Research in Experimental Economics (IFREE) for funding. For comments and suggestions, we thank Bethany Albertson, Eric Dickson, Erno Hermans, Aleksander Ksiazkiewicz, Brad LeVeck, Gwyneth McClendon, Rebecca Morton, Nikos Nikiforakis, Pietro Ortoleva, Liz Phelps, Ernesto Reuben, audiences at APSA, MPSA, SPSA, WESSI, the Behavioral Models of Politics conference, and three anonymous reviewers. For excellent research assistance, we thank María Curiel, Spencer Kiesel, Giacomo Lemoli, Taylor Mattia, Aliesha Overton, Daniel Simmons, and Nicolas Warren. This paper is dedicated to the memory of Becky Morton, a dedicated mentor without whose guidance our research would have never been possible. Replication data for this article can be found in Aldama et al. (2022).

Conflicts of Interest. The authors declare no conflict of interest.

Ethics Statement. This study was approved by the Institutional Review Boards at New York University (10-8117), Columbia University (IRB-AAAQ8608), and UC Davis (1198017). In addition, the authors affirm that the research described in this article adheres to APSA's Principles and Guidance for Human Subjects Research. In particular, we did not use deception in this research. We induced a negative emotion in our treatment group, which can be considered a very minimal harm in this context. Participants were given the following information during the consent process to enable them to make an informed decision about whether they wanted to participate in the research given that minimal harm:

> "As part of this research project you will be asked to watch a video which may or may not contain material that some people consider frightening and you may experience negative emotions. Even though you may experience these emotions in your everyday life, please be aware of your own sensitivity to frightening videos when deciding whether to participate. If you have anxiety issues or are concerned that a frightening scene might cause you difficulty you may not want to participate in this study. Although you will receive no direct benefits, this project may help the researchers better understand the decision-making process of individuals in many common situations."

Participants signed a physical consent form with this information before beginning the experiment. Participants were compensated for three randomly drawn rounds of play, with winnings that averaged $16. This amount was above the minimum wage for one hour of work in New York and California at the time of the experiments and is similar to the hourly wage for undergraduate RAs. At UC Davis, they were also given an extra credit point in a political science class (not taught by the UC Davis investigator) for participating.

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Cite this article: Aldama A, Sambrano D, Vásquez-Cortés M, and Young LE (2023). An Experimental Test of the Effects of Fear in a Coordination Game. *Journal of Experimental Political Science* **10**, 279–298. https://doi.org/10.1017/XPS.2023.10