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

Abraham Aldama†, Deshawn Sambrano‡, Mateo Vásquez-Cortés§, Lauren Young¶

November 23, 2020

Abstract

Theory predicts that emotions should affect political decisions around risky collective action. However, little existing research has attempted to parse out various mechanisms by which emotions might affect collective action. 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 using a lab experiment where participants are randomly assigned to an emotion induction procedure. In some rounds of the game, potential mechanisms are shut down to parse their relative contribution to the overall effect of fear. We present results from 32 sessions in two different labs showing that in this context fear actually does not affect willingness to participate. This null finding highlights the importance of context, including integral versus incidental emotions and the size of the stakes, in shaping their effects.

*We thank the International Federation for Research in Experimental Economics for funding for this project. 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 and audiences at APSA, MPSA, SPSA, the Winter Experimental Social Science Institute, and the Behavioral Models of Politics conference. 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 memory of Becky Morton, without whose guidance would have never been possible.

†Corresponding Author. Postdoctoral Fellow, Center for Social Norms and Behavioral Dynamics, University of Pennsylvania.

‡PhD Candidate, Department of Psychology, Harvard, University.

§Assistant Professor, Department of Political Science, Instituto Tecnológico Autónomo de México.

¶Assistant Professor, Department of Political Science, University of California, Davis.

Introduction

At the height of the Great Depression, in 1933, during his first inaugural address, Franklin D. Roosevelt famously quipped that there is nothing to fear but fear itself. Roosevelt's statement sought to steel the nerves of the American public in the face of the Great Depression. He believed that by being afraid, citizens would take actions that would worsen the already dire economic situation. Roosevelt recognized that emotions, especially fear, affect political and economic behavior. Many years later, 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, a burgeoning area of 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, 2015, 2019).

This article adds to this literature by formalizing and testing predictions about the effects of fear in a situation of risky collection mobilization. We use a global game to formalize the tradeoff between abstaining from mobilizing against an authoritarian regime (an action for which they receive a specific payoff with certainty) and mobilizing (a risky action in which the payoff depends on the actions of other players and chance).[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). We further disaggregate the increase in pessimism into two distinct mechanisms: (a) that fear may increase pessimism about the state of the

[1] For canonical examples of global games see Carlsson and Van Damme (1993); Morris and Shin (2003, 2004); for a recent overview of their application to regime change see Shadmehr (forthcoming).

world, and (b) that it might increase pessimism about other players' actions. In the case of (a) an increase in pessimism may make people believe that mobilizing is more costly than warranted by the available information. In the case of (b), independently of how costly people believe mobilization will be, they might believe that others are less likely to participate. The second channel we explore is an increase in risk aversion, which through making utility functions more concave, might make people less likely to participate when the stakes are higher.

We design a lab experimental methodology to test the effects of fear through these three mechanisms. We induce fear in a random subset of participants using a clip from a horror film (Hubert and de Jong-Meyer, 1991; Ray and Gross, 2007; Renshon, Lee and Tingley, 2015) and short, loud unexpected noises played randomly during the game. 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 *mobilize* or not.[2] 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 mobilization, or increases risk aversion.

Ultimately, we do not find that the fear inductions cause changes in the level of mobilization in the global game experiment. Participants assigned to the fear treatments were no more or less likely to mobilize in any of the three types of rounds. There is some evidence that participants were slightly more likely to mobilize when the stakes were higher, but only in noiseless rounds, which may be consistent with a "nothing to lose" effect discussed in Aldama, Vásquez-Cortés and Young (2019).

This project makes contributions to two distinct literatures. First, our experiment contributes additional evidence about the causal effects of emotions on a number of economic and political behavioral outcomes, including, among others, participation in

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

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). Unlike much of the previous literature that focuses on how emotions such as guilt, anger, and happiness may increase prosocial behavior, in this project we seek to understand whether the emotion of fear may decrease participation in a different behavior, namely participating in risky collective action. Coercive actors like autocrats, mafias, and terrorists often try to scare their critics out of taking action against them. This study aims to unpack how the emotional effects of coercive violence might work in an abstracted version of such conflicts.[3] Our results suggest that the effects of emotions discussed in this literature may be more context-dependent than is typically assumed. Second, we contribute to a growing literature using 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.

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 findings and avenues for further research.

[3]Indeed, recent lab experimental evidence confirms that people do strategically induce emotions in competitive situations (Gneezy and Imas, 2014).

Emotions and Decision Making

Emotions are patterned chemical and neural responses to a stimulus that elicit physiological and subjective changes to motivate a behavioral responses in order to deal with the relevant events (Frijda, 1994; Damasio, 1994). Threatening stimuli often evoke two physiological responses. One which is particularly relevant to the current study, is the sympathetic-adrenomedullary (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).

A number of experimental studies in both psychology and economics show that emotions, in particular fear, influence perceptions of risk (Johnson and Tversky, 1983; Lerner and Keltner, 2000, 2001; Lerner et al., 2003) and risk aversion (Guiso, Sapienza and Zingales, 2013; Cohn et al., 2015).[4] In political science, recent research shows that the emotion of fear increases perceptions of the risk of repression and risk aversion among supporters of the opposition in Zimbabwe, an electoral autocracy with a history of state repression (Young, 2019). This literature thus suggests various channels through which fear may impact decisions to participate in risky collective action. First, if fear affects risk perceptions it should influence beliefs about a payoff-relevant state of the world or, in an independent manner, it should affect beliefs about how likely it is that other players will take a risky action. Second, 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.

Despite strong expectations from the literatures on emotions in psychology and

[4] However, in most of these cases fear was compared to another emotion such as anger rather than to a neutral control.

neuroscience, there is less empirical evidence about the effects of fear on cooperation and trust in behavioral games or in the real world. Several past studies analyzing trust, an important precursor to collective action related to optimism about others' actions, have found mixed results. Myers and Tingley (2016) find that anxiety reduces trust. However, the main effects of the emotion treatments in the Myers and Tingley (2016) experiment are null results; the finding that anxiety reduces trust is based on a mediation analysis which finds that anxiety is significant mediator of the negative effects of the treatment on trust. Earlier work also produced mixed results regarding the effects of other emotions on trust, with some studies showing large effects of emotions like anger and happiness (Dunn and Schweitzer, 2005), while others found that emotions had no effect on trust (Capra, 2004). The existing literature on cooperation has largely focused on mobilizing emotions such as happiness and anger, and to a lesser extent sadness. These have also been found to have effects on 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 build on this literature by analyzing the impact of the emotion of fear in a global game of regime change in the lab.

Model

Consider a game in which there are two citizens that want to bring down an incumbent regime. The regime will only be replaced if both citizens mobilize. If the regime remains in place, i.e. 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 players. 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. Although the citizens do not know the true value of θ, they know that it is drawn from a a normal distribution with mean y and variance $1/\alpha$ (precision α), i.e.,

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

Moreover, note that 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.

Table 1: Payoff Summary of the Game

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

Once θ is realized, independent signals are privately drawn for each player. 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 intimidatory tactics, which might be observed by citizens on the news or social media. The signal each player receives comes is a noisy signal of θ. In particular, each player receives a signal

$$x_i = \theta + \varepsilon_i$$

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 chose 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

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

where k is the cutoff of the other player (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 the signal she received. We must note that:

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

Thus, with some simple algebra, equation 1 becomes

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

[5]For a discussion of how citizens might update their signals

[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.

From equation 2, note that since both α, $\beta > 0$, the left hand side is strictly increasing in 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

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.

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

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 $\alpha = \beta = y = 1$, substitute these values and the equilibrium condition that $k = x_i$ into equation 2, which then becomes

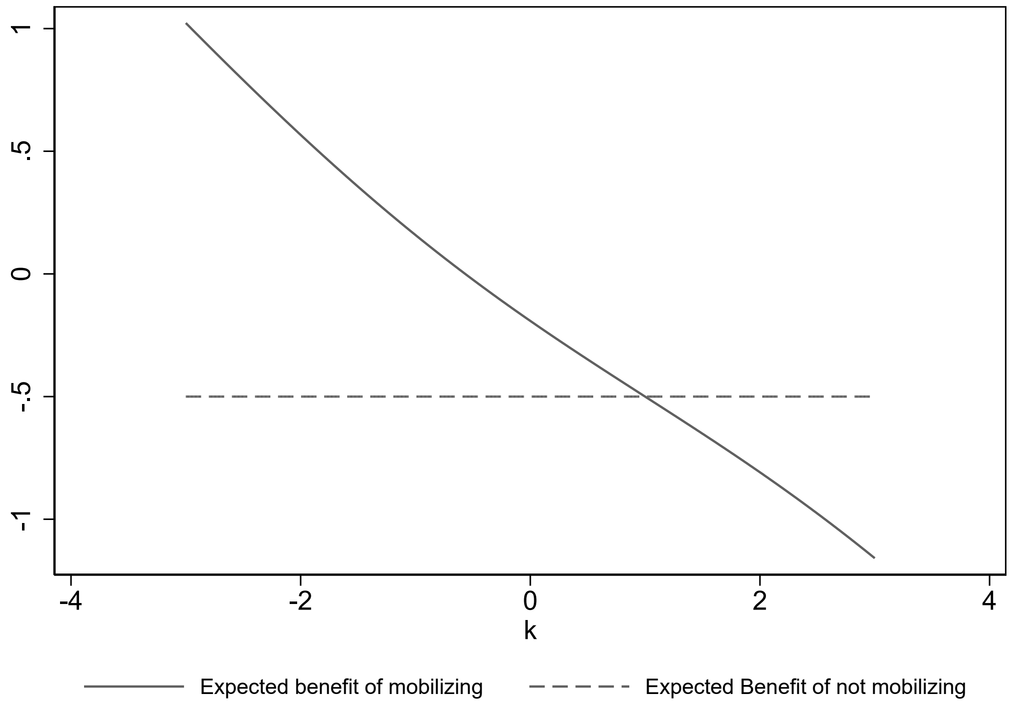
$$R\Phi[\frac{2}{3}(k - \frac{1+k}{2})] - \frac{1+k}{2} > -c \tag{3}$$

Which upon further analysis becomes

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

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

Figure 1: Equilibrium cutoff



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 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.[7] 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.

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 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 using empirical data, we use an experimental design that allows us to compare the decisions of subjects who are experiencing the emotion of fear to those of otherwise similar subjects 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

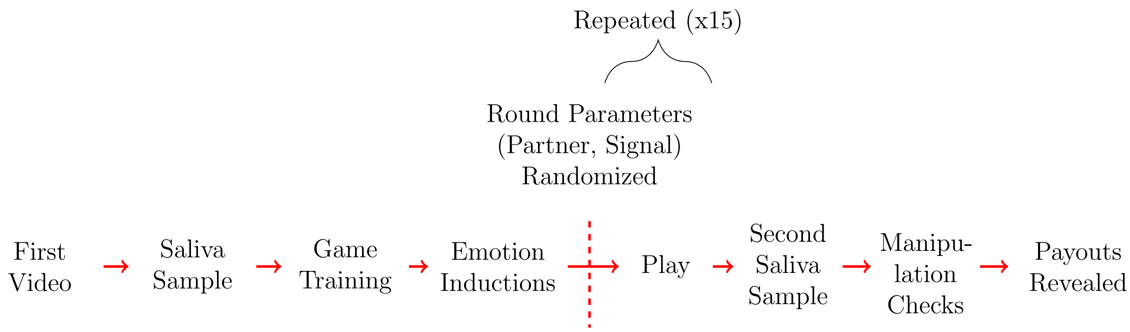
[7] This prediction holds under most conditions, although in some cases a nothing to lose effect prevails (Aldama, Vásquez-Cortés and Young, 2019).

preexisting pools, primarily composed of undergraduate students. The experiment was implemented using z-Tree (Fischbacher, 2007). Sessions lasted about 60 minutes and subjects were paid on average 16 dollars. After proving consent, in the experiment, subjects first watched a relaxing seven minuted 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. Third, participants were randomly assigned to carry out a task 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 noiseless game with a human. Finally, participants answered a few questions about their current emotional state and how they played the game that serve as robustness and manipulation checks. 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 we use a scary video. 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 participants' self-reported levels of fear. In the control treatment subjects were asked view an educational video about the solar system. The fear treatment is similar to those used in previous

[8]We choose a randomized incentive scheme based on evidence that 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



studies to create specific emotions in subjects, such as anxiety (Westermann et al., 1996; Lench, Flores and Bench, 2011). After receiving the corresponding treatment subjects were paired with another player and, based on the given parameters, players received a signal of the strength of the regime x_i, and were then asked whether they wish to *mobilize* or *abstain*.[9] After each round subjects were randomly rematched. Subjects 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 global game to disentangle the possible mechanisms by which fear could affect mobilization. In our standard rounds, participants play 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 other rounds, subjects play against a computer that always plays *optimal* strategies. This eliminates the possibility that the effect of fear might work through pessimism about other players' actions. In a third

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

type of round, 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

The nature of our experimental design enables us to estimate the effect of a number of parameters of interest. Specifically, we test first for the overall effect of fear on mobilization decisions, 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. Those quantities and the strategies that we will use to estimate them are described in this section.

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

[10] Although this changes the nature of the game, and conditional on the value of θ 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.

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 average treatment effect of fear across individuals and rounds.

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

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 average treatment effect attributable to $M1$, expectations about others' actions.

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

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:

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

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, $\epsilon_{i,t}$ is the error term.

The second potential channel $M2$ 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 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 to estimate the ATE of channel M2.

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

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

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

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. While we calculate an ATE for each payoff spread (i.e., the $ATE_{spread=1.5}$, ..., $ATE_{spread=5.5}$), 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:

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

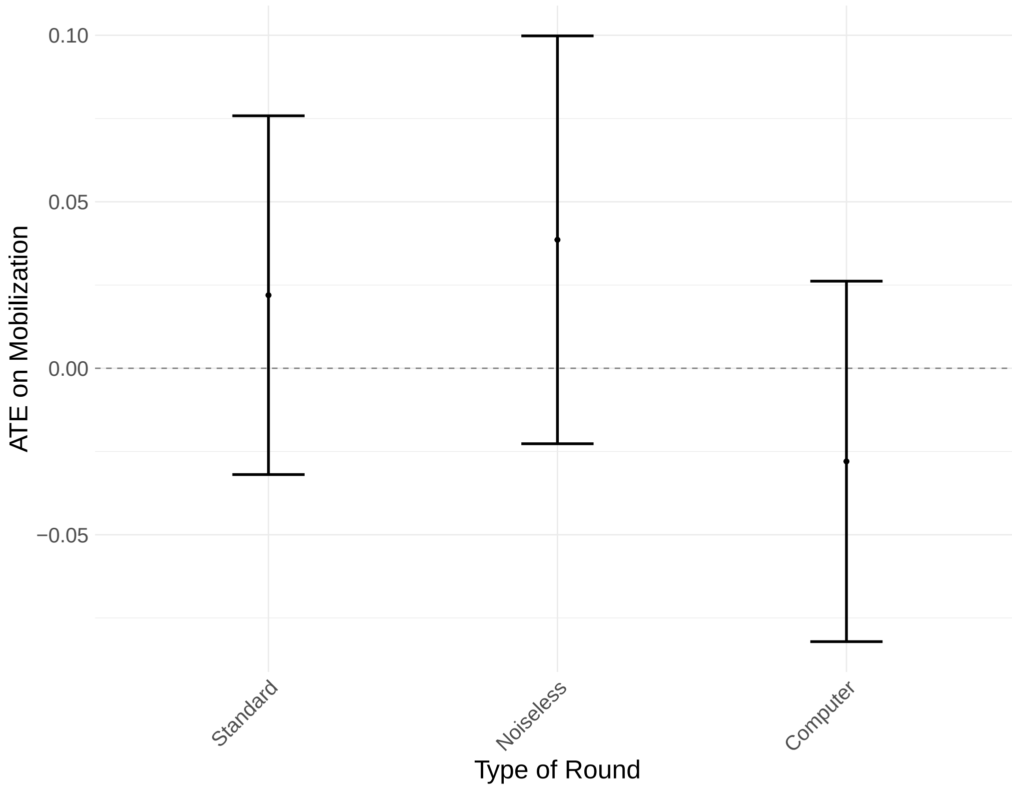
where $Fear_i$ is a dummy variable that takes a value of 1 if the subject is assigned to the fear emotion induction and $Spread_i$ is a measure of the spread of the payoffs for the round that vary from 1.5 to 3.5 experimental currency units. The coefficient β_2 estimates the extent to which the effect 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 alpha-amylase as an indicator of the sympathetic-adrenomedullary (SAM) response (Buchanan, Bibas and Adolphs, 2010).

Results

In this section we present results for 32 sessions and a total of 432 subjects. The results of a simple linear probability model of the decision to mobilize are 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. In all of the three cases results show no distinguishable impact of fear on mobilization. This holds even true if we include demographic covariates and controls for other parameters in the round in the regression as controls as we show in the Appendix.

Figure 3: Effect of Fear on Mobilization



This is also confirmed in the the analyses presented in Tables 3 and 4, in which we present the estimate of the differential effect of fear in our standard rounds and the rounds played with a computer and with complete information, respectively. 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 impact of fear.

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.

Table 3: Differential Effect of Fear in Computer Rounds

	Dependent variable: Mobilization		
	(1)	(2)	(3)
Treatment × Computer round	−0.042	−0.042	−0.040
	(0.033)	(0.034)	(0.035)
Treatment	0.022	0.024	0.022
	(0.028)	(0.028)	(0.031)
Computer round	0.020	0.020	0.020
	(0.027)	(0.027)	(0.027)
Signal		0.014	0.009
		(0.012)	(0.013)
Female			0.028
			(0.023)
Age			0.004*
			(0.002)
Average Pre-treatment mobilization			0.237***
			(0.048)
Constant	0.613***	0.611***	0.383***
	(0.021)	(0.021)	(0.056)
Observations	3,744	3,744	3,604
R^2	0.0005	0.001	0.014

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 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 exception to this is that in the noiseless 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 noiseless 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

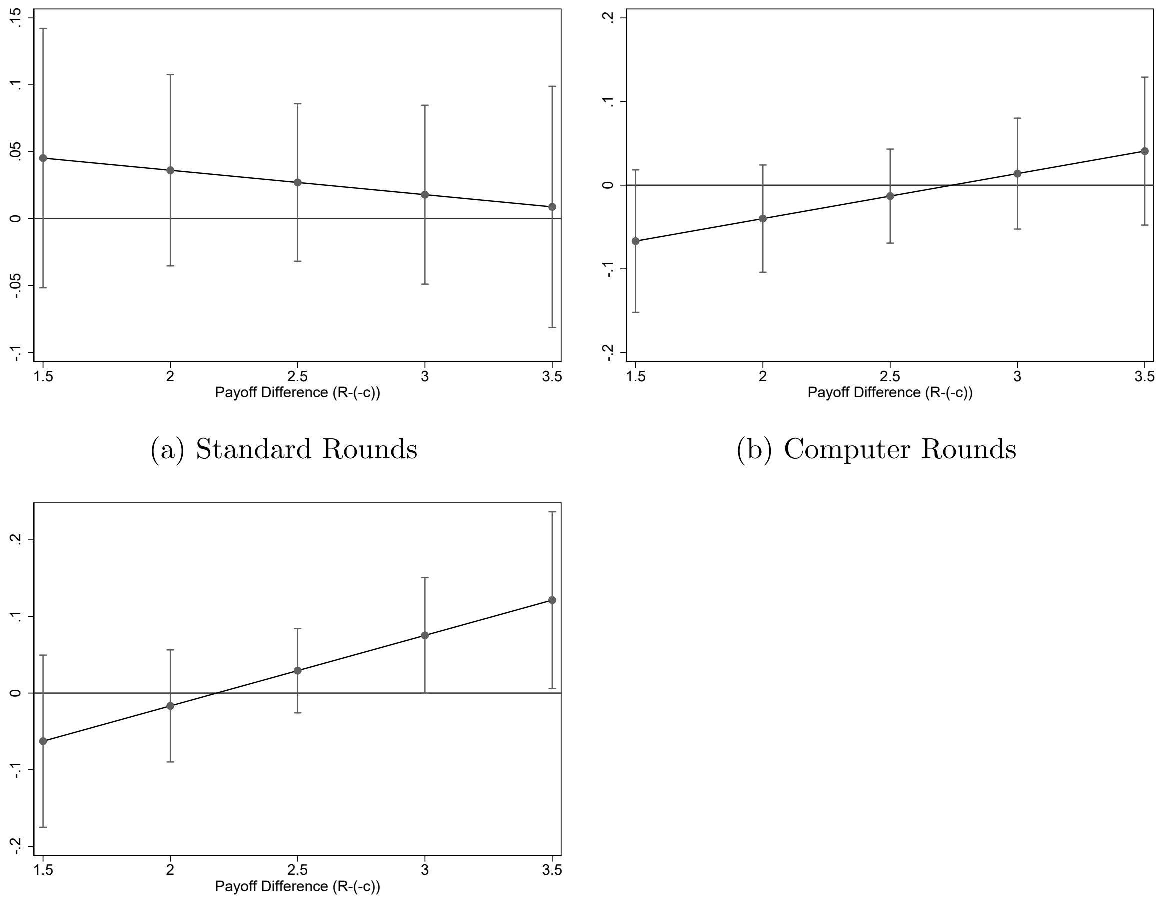
Table 4: Differential Effect of Fear in Noiseless Rounds

	Dependent variable: Mobilization		
	(1)	(2)	(3)
Treatment × Noiseless round	0.016	0.016	0.015
	(0.037)	(0.036)	(0.039)
Treatment	0.022	0.020	0.017
	(0.028)	(0.026)	(0.027)
Noiseless round	0.018	0.019	0.018
	(0.017)	(0.017)	(0.017)
Signal		−0.013	−0.021
		(0.015)	(0.015)
Female			0.020
			(0.024)
Age			0.002
			(0.002)
Average Pre-treatment mobilization			0.255***
			(0.037)
Constant	0.613***	0.614***	0.409***
	(0.021)	(0.020)	(0.044)
Observations	3,746	3,746	3,606
R^2	0.002	0.002	0.016

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 noiseless 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.

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, strategic uncertainty is increasing in the difference in payoffs of Mobilizing and Abstaining. (Mobilize, Mobilize) will be an equilibrium if $R - \theta \geq -c$. This can be rewritten as $R + c \geq \theta$. Hence the probability that (Mobilize, Mobilize)—or

Figure 4: Effect of Fear on Mobilization at Different Payoff Spreads



(a) Standard Rounds

(b) Computer Rounds

(c) Noiseless Rounds

(M, M) for short— 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 applies to calculating the probability (Abstain, Abstain)—or (A,A) for short— is an equilibrium, which is given by $1 - \Phi(c - 1)$. This is summarized in Table 3, which shows the probability of (M, M) and (A) 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,

Table 5: 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

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 6, we obtain the opposite result. This result may be in line with a "nothing-to-lose effect" (Aldama, Vásquez-Cortés and Young, 2019), which we discuss in the following section.

First, in the complete information games, as noted above, there seems to be a small demobilizing effect at low levels of the spread between R and c and a mobilizing effect at higher levels. This suggests that as the spread increases a "nothing to lose" effect may kick in (Aldama, Vásquez-Cortés and Young, 2019) when the pessimism channels are shut down. As the difference between the payoff that people obtain from mobilizing and removing the regime and standing idle increases, fear may increase people's willingness to mobilize if fundamental uncertainty, i.e. uncertainty about payoffs is eliminated. This is consistent with the theoretical results 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 uncertainty Kugler, Connolly and Ordóñez (2012). Our results dovetail with those of Szkup and Treviño (2019), 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.

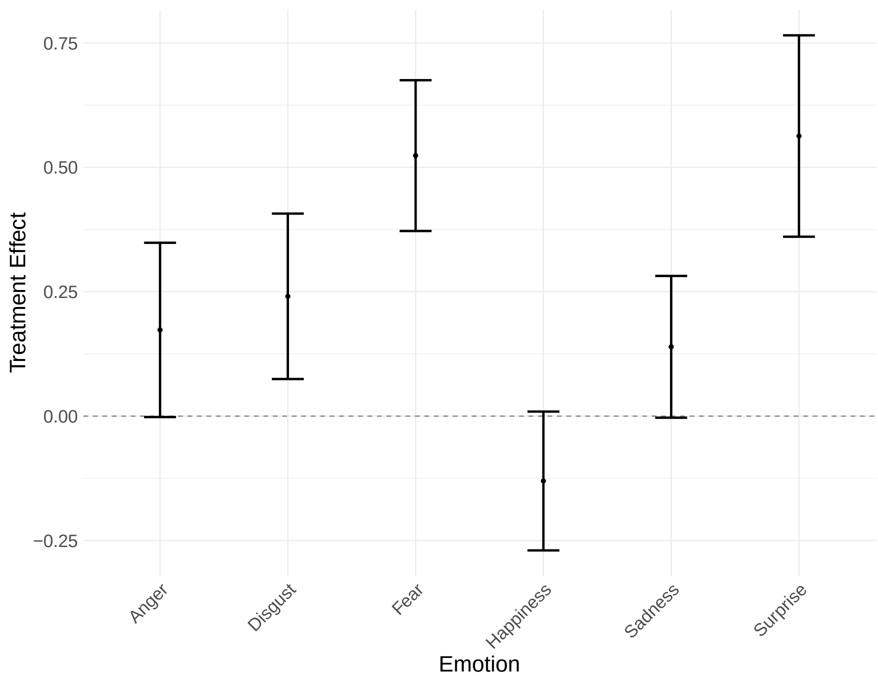
Discussion

Overall, in this lab experiment, fear does not have a strong effect on decision to take a risky action in either an incomplete information or a complete information 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 a form of emotion induction based on film and audio clips that has been found in large numbers of past experiments to effectively induce emotions (Westermann et al., 1996; Lench, Flores and Bench, 2011). Second, using self-reported measures of emotions on a four-point scale in both pilots and 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 treatments did not cause significant differences in chemical markers of the SAM response associated with fear, as measured by salivary alpha-amylase (Nater et al., 2005; Nater and Rohleder, 2009). Results in Appendix C show that participants in the treatment group did not have higher levels of the enzyme at the end of the experiment. This combination of findings on our manipulation check could be driven

Figure 5: Effect of Treatment on Emotions



by a few patterns. First, participants could be providing the response that they think the experimenter wants to receive on the self-reports. We think this is unlikely because we do observe increases across several negative emotions that are less obviously targeted by the treatments. Second, it is possible that our α-amylase analysis is simply underpowered: a short film and audio clips is 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). Taken together, these results suggest that the fear treatments 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 B we show that participants do indeed 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, 2019).

Ultimately, it seems most likely that in this experiment fear had little effect on mobilization because the effect of fear is conditioned by context in several critical ways. First, this experiment focuses on what affective scientist 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 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) (Young, 2019), recent work has emphasized the importance of more context-specific emotions in politics (Greene and Robertson, 2020; Mattingly and Yao, 2020). 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 affected the effect of fear. While we are ultimately interested in understanding the 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, 2020). In this experiment, participants in Western 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 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 encourage participants to try to shut down the effects of emotions like fear in order to make calculated decisions.

References

Albertson, Bethany and Shana Kushner Gadarian. 2015. *Anxious Politics: Democratic Citizenship in a Threatening World*. Cambridge University Press.

Aldama, Abraham, Mateo Vásquez-Cortés and Lauren Elyssa Young. 2019. "Fear and citizen coordination against dictatorship." *Journal of Theoretical Politics* 31(1):103–125.

Aytac, S. Erdem, Luis Shiumerini and Susan C. Stokes. 2017. "Protests and Repression in New Democracies." *Perspectives on Politics* 15:62–82.

Beattie, Jane and Graham Loomes. 1997. "The Impact of Incentives upon Risky Choice Experiments." *Journal of Risk and Uncertainty* 14(2):155–168.

Brader, Ted. 2005. "Striking a Responsive Chord: How Political Ads Motivate and Persuade Voters by Appealing to Emotions." *American Journal of Political Science* 49:388–405.

Buchanan, Tony, David Bibas and Ralph Adolphs. 2010. "Salivary α-amylase levels as a biomarker of experienced fear." *Communicative & integrative biology* 3(6):525–527.

Cabrales, Antonio, Rosemarie Nagel and Roc Armenter. 2007. "Equilibrium Selection through Incomplete Information in Coordination Games: An Experimental Study." *Experimental Economics* 10(3):221–234.

Callen, Michael, Mohammad Isaqzadeh, James D Long and Charles Sprenger. 2014. "Violence and Risk Preference: Experimental Evidence from Afghanistan." *The American Economic Review* 104(1):123–148.

Capra, C Monica. 2004. "Mood-driven Behavior in Strategic Interactions." *The American Economic Review* 94(2):367–372.

Carlsson, Hans and Eric Van Damme. 1993. "Global Games and Equilibrium Selection." *Econometrica* pp. 989–1018.

Cohn, Alain, Jan Engelmann, Ernst Fehr and Michel André Maréchal. 2015. "Evidence for Countercyclical Risk Aversion: An Experiment with Financial Professionals." *The American Economic Review* 105(2):860–885.

Cornand, Camille. 2006. "Speculative attacks and informational structure: an experimental study." *Review of International Economics* 14(5):797–817.

Cubitt, Robin P, Chris Starmer and Robert Sugden. 1998. "On the Validity of the Random Lottery Incentive System." *Experimental Economics* 1(2):115–131.

Damasio, Antonio. 1994. *Descartes' Error: Emotion, Reason and the Human Brain*. Putnam.

De Dreu, Carsten KW and Jörg Gross. 2018. "Revisiting the form and function of conflict: neurobiological, psychological and cultural mechanisms for attack and defense within and between groups." *Behavioral and brain sciences* pp. 1–76.

Drouvelis, Michalis and Brit Grosskopf. 2016. "The Effects of Induced Emotions on Pro-Social Behaviour." *Journal of Public Economics* 134:1–8.

Dunn, Jennifer R and Maurice E Schweitzer. 2005. "Feeling and Believing: The Influence of Emotion on Trust." *Journal of Personality and Social Psychology* 88(5):736.

Egami, Naoki and Erin Hartman. 2020. "Elements of External Validity: Framework, Design, and Analysis.".

Fischbacher, Urs. 2007. "z-Tree: Zurich toolbox for ready-made economic experiments." *Experimental economics* 10(2):171–178.

Frijda, Nico H. 1994. Emotions are Functional, Most of the Time. In *The Nature of Emotion: Fundamental Questions*, ed. Paul Ekman and Richard J Davidson. Oxford University Press.

Gneezy, Uri and Alex Imas. 2014. "Materazzi Effect and the Strategic Use of Anger in Competitive Interactions." *Proceedings of the National Academy of Sciences* 111(4):1334–1337.

Greene, Samuel A. and Graeme Robertson. 2020. "Affect and Autocracy: Emotions and Attitudes in Russia after Crimea." *Perspectives on Politics* .

Guiso, Luigi, Paola Sapienza and Luigi Zingales. 2013. "Time Varying Risk Aversion." *NBER Working Paper* (19284).

Heinemann, Frank, Rosemarie Nagel and Peter Ockenfels. 2004. "The Theory of Global Games on Test: Experimental Analysis of Coordination Games with Public and Private Information." *Econometrica* 72(5):1583–1599.

Henrich, Joseph, Steven J Heine and Ara Norenzayan. 2010. "Most people are not WEIRD." *Nature* 466(7302):29–29.

Hopfensitz, Astrid and Ernesto Reuben. 2009. "The Importance of Emotions for the Effectiveness of Social Punishment." *The Economic Journal* 119(540):1534–1559.

Hubert, Walter and Renate de Jong-Meyer. 1991. "Autonomic, neuroendocrine, and subjective responses to emotion-inducing film stimuli." *International Journal of Psychophysiology* 11(2):131–140.

Joffily, Mateus, David Masclet, Charles N Noussair and Marie Claire Villeval. 2014. "Emotions, Sanctions, and Cooperation." *Southern Economic Journal* 80(4):1002–1027.

Johnson, Eric J. and Amos Tversky. 1983. "Affect, Generalization, and the Perception of Risk." *Journal of Personality and Social Psychology* 45(1).

Kirchsteiger, Georg, Luca Rigotti and Aldo Rustichini. 2006. "Your Morals Might Be Your Moods." *Journal of Economic Behavior & Organization* 59(2):155–172.

Kugler, Tamar, Terry Connolly and Lisa D Ordóñez. 2012. "Emotion, decision, and risk: Betting on gambles versus betting on people." *Journal of Behavioral Decision Making* 25(2):123–134.

LeDoux, Joseph. 1996. *The emotional brain: The mysterious underpinnings of emotional life*. Simon and Schuster.

Lench, Heather C, Sarah A Flores and Shane W Bench. 2011. "Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: a meta-analysis of experimental emotion elicitations." *Psychological bulletin* 137(5):834.

Lerner, Jennifer S. and Dacher Keltner. 2000. "Beyond Valence: Toward a Model of Emotion-Specific Influences on Judgement and Choice." *Cognition and Emotion* 14(4):473–493.

Lerner, Jennifer S. and Dacher Keltner. 2001. "Fear, Anger, and Risk." *Journal of Personality and Social Psychology* 81(1):146–159.

Lerner, Jennifer S., Roxana M. Gonzalez, Deborah A. Small and Baruch Fischhoff. 2003. "Effects of Fear and Anger on Perceived Risks of Terrorism: A National Field Experiment." *Psychological Science* 14(2):144–150.

Lohmann, Susanne. 1993. "A Signaling Model of Informative and Manipulative Political Action." *American Political Science Review* 87(2):319–333.

Mattingly, Daniel and Elaine Yao. 2020. "How Propaganda Manipulates Emotion to Fuel Nationalism: Experimental Evidence from China." *Working Paper, Yale University* .

Morris, Stephen and Hyun Song Shin. 2003. Global Games: Theory and Applications. In *Advances in Economics and Econometrics: Theory and Applications*, ed. L. Hansen M. Dewatripont and S. Turnovsky. Cambridge University Press.

Morris, Stephen and Hyun Song Shin. 2004. "Coordination risk and the price of debt." *European Economic Review* 48(1):133–153.

Myers, C. Daniel and Dustin Tingley. 2016. "The Influence of Emotion on Trust." *Political Analysis* 24:492–500.

Nater, Urs M and N Rohleder. 2009. "Salivary alpha-amylase as a non-invasive biomarker for the sympathetic nervous system: current state of research." *Psychoneuroendocrinology* 34(4):486–496.

Nater, Urs M, Nicolas Rohleder, Jens Gaab, Simona Berger, Andreas Jud, Clemens Kirschbaum and Ulrike Ehlert. 2005. "Human salivary alpha-amylase reactivity in a psychosocial stress paradigm." *International Journal of Psychophysiology* 55(3):333–342.

Pearlman, Wendy. 2016. "Narratives of Fear in Syria." *Perspectives on Politics* 14(01):21–37.

Phelps, Elizabeth A, Karolina M Lempert and Peter Sokol-Hessner. 2014. "Emotion and decision making: multiple modulatory neural circuits." *Annual review of neuroscience* 37:263–287.

Raio, Candace M, Temidayo A Orederu, Laura Palazzolo, Ashley A Shurick and Elizabeth A Phelps. 2013. "Cognitive emotion regulation fails the stress test." *Proceedings of the National Academy of Sciences* 110(37):15139–15144.

Ray, Rebecca D and James J Gross. 2007. "Emotion elicitation using films." *Handbook of emotion elicitation and assessment* 9.

Renshon, Jonathan, Jooa Julia Lee and Dustin Tingley. 2015. "Physiological arousal and political beliefs." *Political Psychology* 36(5):569–585.

Reuben, Ernesto and Frans Van Winden. 2008. "Social Ties and Coordination on Negative Reciprocity: The Role of Affect." *Journal of Public Economics* 92(1):34–53.

Salman, Ton. 1994. "Challenging the City, joining the city: The Chilean pobladores between social movement and social integration." *Bulletin of Latin American Research* 13(1):79–90.

Shadmehr, Mehdi. forthcoming. "Multiplicity and Uniqueness in Generalized Regime Change Games." *Journal of Politics* .

Starmer, Chris and Robert Sugden. 1991. "Does the Random-Lottery Incentive System Elicit True Preferences? An Experimental Investigation." *The American Economic Review* 81(4):971–978.

Szkup, Michal and Isabel Treviño. 2019. "Sentiments, strategic uncertainty, and information structures in coordination games." *Working Paper* .

Treviño, Isabel and MIchael Szkup. 2015. "Information acquisition in global games of regime change." *Journal of Economic Theory* 160:387–428.

Valentino, Nicholas A, Ted Brader, Eric W Groenendyk, Krysha Gregorowicz and Vincent L Hutchings. 2011. "Election Night's Alright for Fighting: The Role of Emotions in Political Participation." *The Journal of Politics* 73(01):156–170.

van Stegeren, Anda, Nicolas Rohleder, Walter Everaerd and Oliver T Wolf. 2006. "Salivary alpha amylase as marker for adrenergic activity during stress: effect of betablockade." *Psychoneuroendocrinology* 31(1):137–141.

Westermann, Rainer, Kordelia Spies, Günter Stahl and Friedrich W Hesse. 1996. "Relative effectiveness and validity of mood induction procedures: a meta-analysis." *European Journal of Social Psychology* 26(4):557–580.

Young, Lauren E. 2015. "Mobilization under threat: Emotions and opposition mobilization in a repressive regime." Presented at EPSA 2015.

Young, Lauren E. 2019. "The psychology of state repression: Fear and dissent decisions in Zimbabwe." *American Political Science Review* 113,1:140–155. Working paper, Columbia University.