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Do emotions affect strategic sophistication?

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Abstract

Anger is a negative emotion commonly experienced by all human beings, and it has proven effects on human cognition. Research in this field has shown that cognitive abilities diminish on angry individuals, what has been called “the depth of thought effect”. This paper finds a causal relationship from anger to the strategic sophistication of subjects in a laboratory setting. Our experimental design consists of an emotion-induction treatment and a beauty contest to measure the strategic sophistication of participants. Treated subjects report to be angrier and choose significantly higher numbers in the game, consistent with a negative effect of anger on strategic sophistication.

1 Introduction

Emotions are more than a discussion in psychology, and have received increasing interest from economic and behavioral research in the last decades. Specifically, there has been a revival of topics such as the role of emotion in decision-making, the neural bases of emotion, and the interaction of cognition and emotion (Loewenstein, 2000). These turn out to be very important variables when studying individuals involved in the economy as long pointed out by Keynes (1936).

Anger is a negative emotion commonly experienced by all human beings, and it has proven effects on human cognition (Lerner et al, 2003; Lerner and Tiedens, 2006; Loewenstein, 1996). Research in this field has shown that cognitive abilities diminish on angry individuals, what has been called "the depth of thought effect". Economic choices need an amount of reasoning, even for the commonest of them. Hence, it is important for economists to analyze the factors that affect individual strategic sophistication, which implies depth of reasoning and thinking inductively (Carpenter et al, 2013).

The contribution of this paper lies in proving a causal relationship from anger to strategic sophistication in a laboratory setting. We ask if inducing anger can affect the strategic sophistication of subjects in a context demanding a high level of reasoning. Our prior, based on theory and contributions from previous research, is that anger negatively affects the strategic sophistication of a person.

Our experimental design consists of an emotion-induction treatment and a beauty contest to measure the strategic sophistication of participants. Based on our hypothesis, we expect that participants in the treatment group, who should be angrier, guess higher numbers on average in the beauty contest. Consistent with our hypothesis, treated subjects report to be angrier (reported anger in the treated group is 0.46 standard deviations higher than in the control group) and choose significantly higher numbers in the game (on average they guess numbers 7.56 points higher, 42% more than control subjects).

2 Related literature

2.1 Strategic sophistication

Strategic sophistication is important because it is linked to economic behavior. Strategic sophistication refers to the extent to which players' consider the structure of a game and other players' incentives before deciding on their strategy (Crawford et al, 2013). In this definition three cognitive abilities stand out: first, the agents must iterate to determine, for instance, how best to compete; second, they have to induct to do well in different settings; and third, they need to assess the strategic sophistication of others (what really matters here is how clever the other

players are) (Carpenter et al, 2013). The former two are related to mathematical skills, whereas the skill involved in the latter is still an open question (Brañas-Garza et al, 2012).

Cognitive skills are related to strategic sophistication. Therefore, choosing a strategy requires processing information, inductive and iterative thinking, and forming beliefs on the strategic sophistication of rivals. Consequently, strategic sophistication implies depth of thought.

2.2 Anger affects strategic decisions

Lerner and Tiedens (2006) review the impact of anger on judgment and decision-making. They describe two important effects that we can find in the literature about anger. The first is the attention effect, and the second is the depth-of-processing effect. The latter suggests that angry individuals base their judgment and decisions on a "rule of thumb"; this is typically called "peripheral" or "heuristic" processing.

Han et al (2007) present the Appraisal-Tendency Framework (ATF) and show evidence of how it affects consumer decision-making. Basically, the ATF approaches how and why specific emotions carried over from the past shape future judgment and choices. In this work, the authors show anger is defined by the appraisal pattern of high certainty and individual control. This is the mechanism behind heuristic information processing in angry individuals (Tiedens and Linton, 2001). Besides, Lerner and Small (2008) contribute evidence in support of anger's tendency to trigger automatic, low-effort thought. All in all, as angry people feel certain and in control of the situation, their strategic decisions are based on simple rules and there is little space for strategic sophistication.

Last but not least, a visceral factors perspective can also be relevant to understand why and how anger affects human economic behavior. Loewenstein (2000) defines visceral factors as referring "to a wide range of negative emotions (e.g., anger, fear), drive states (e.g., hunger, thirst, sexual desire), and feeling states (e.g., pain), that grab people's attention and motivate them to engage in specific behaviors" (p. 426). Anger as a negative emotion is considered a visceral factor. Loewenstein (2000) submits that immediately experienced visceral factors have a disproportionate effect on behavior and tend to "crowd out" virtually all goals other than that of mitigating the visceral factor. When angry, individuals are concentrated on mitigating or solving the situation or stimulus that caused this emotion, so that they will not think deeply when making a decision.

3 Experiment

3.1 Method

A total of 143 subjects (53.85% men, 46.15% women) participated in the study. All were students from the Universidad de San Andres. They were mostly students of economics, behavioral science and business administration, and a few were students of finance and engineering. Only 10 of the 143 subjects had previously participated in a lab experiment. They were motivated to participate by the chance of winning extra points in a future exam. 20 winners of the p-beauty contest won the prize.

Students were divided into sessions of 13 to 17 students. The experiment took place in the computer laboratory of the university, and took about 20 to 35 minutes to complete. During the experiment, participants were not allowed to use phones or any electronic devices other than the computer we had provided, to talk loudly or to somebody other than the experimenter, and to look at other participants' computers.

As the experiment began, the subjects entered the lab, sat in front of a computer, and received detailed instructions from the experimenter. Those instructions stressed that subjects could take all the time they needed to complete each of the stages of the experiment.

In the first stage, participants were asked to provide basic personal data (sex, cohort, university ID and major). These variables are used as controls later. Then subjects had to respond to the three questions in the Cognitive Reflection Test (Frederick, 2005). This is also an important control, because it measures IQ, and is negatively correlated with the guess in the p-beauty contest (Brañas-Garza et al., 2012; Carpenter et al., 2013). Moreover, various authors such as Frederick (2005) have suggested that IQ is related to a better control of emotions.

In the second stage, each participant had to fulfill the following task:

> *"We would like you to describe in general things that make you feel [ANGRY/RELAXED]. It is okay if you don't remember all the details, just be specific about what exactly it is that makes you [ANGRY/RELAXED] and what it feels like to be [ANGRY/RELAXED]. Please describe the events that make you feel MOST [ANGRY/RELAXED]. These experiences could have occurred in the past or will happen in the future. If you can, write your description so that someone reading it might even feel [ANGRY/RELAXED]."*

The treatment group received the version with "ANGRY", whereas the control group saw the version with "RELAXED". Treatment was randomly assigned to half of the subjects within each session. This method for inducing emotions is borrowed from Valentino et al. (2008). Several prior studies (e.g., Lerner et al, 2003; Strack et al, 1985; Tiedens and Linton, 2001; Small and Lerner, 2008; Groenendyk, 2016) have shown the success of this method for inducing emotions and how self-reflective writing successfully elicits target emotions.

After completing the task, subjects played a p-beauty contest game. The instructions of the game can be found in the Appendix. Participant guesses in the game constitute our main variable, *Strategic Sophistication*. The p-beauty contest, also called Guessing Game, is routinely used to measure strategic sophistication (Brañas-Garza et al., 2012; Carpenter et al., 2013; Sbriglia, 2008). The guesses or choices in this game correlate negatively with strategic sophistication, so a higher number means less sophistication.

Finally, in the last task subjects were asked to report how angry they were. Participants had 4 options ranging from 0 to 3, 0 being not angry and 3 being intensively angry (Groenendyk, 2016). The answers to this task were used to test whether the emotion-induction procedure worked for the treatment group. Once finished, the participants were free to leave. After all sessions were concluded, all participants were informed if they had won or not the game.

Figure 1

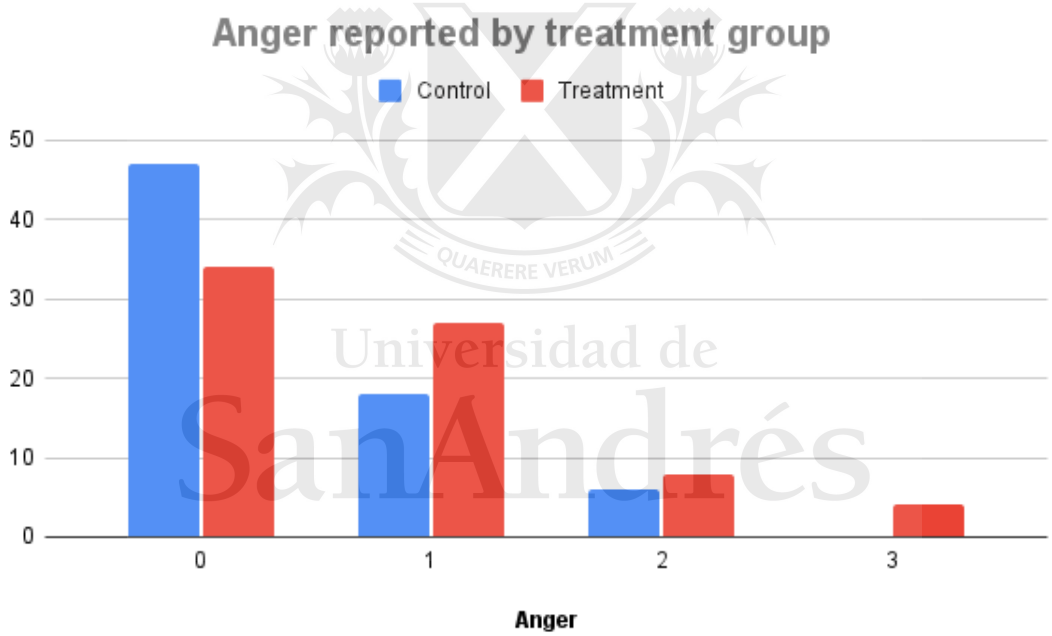

Table 1

Control variable	Difference between experimental groups	T-test p-value
Sex	-0.0344288	0.6822
Age	-0.0043036	0.9702
CRT score	-0.4323161	0.0125

4 Identification strategy

Given randomization, the causal effect of anger on strategic sophistication can be obtained from a simple regression using Ordinary Least Squares (OLS):

$$Guess_{is} = \alpha + \eta * Treatment_{is} + \varphi * X_{is} + \beta_s + \epsilon_{is} \quad (1)$$

where $Guess_{is}$ is the number guessed by subject i in session s, and $Treatment_{is}$ is a dummy variable that takes value 1 if subject i is treated. Therefore, η is the parameter of interest that measures the causal effect. X_i includes our control variables (age, sex and CRT score) and β_s represent sessions fixed effects. The latter is necessary because, as explained before, we randomized within session (strata).

To verify whether treatment and control groups are similar in all pre-treatment characteristics, we tested for differences in each control variable (by means of a two-sided t-test). Detailed results can be found in Table 1. Sex and age on average are similar between groups, but the CRT score is not. That being said, it will be important to include the latter variable as a control variable to improve the efficiency of our estimation.

Table 2

VARIABLES	(1) Angry	(2) Angry	(3) Angry
Treatment (=1 if treated)	0.279**	0.334**	0.339***
	(0.123)	(0.129)	(0.129)
Right answers in CRT		-0.126**	-0.142**
		(0.0580)	(0.0628)
Constant	0.298**	0.396***	0.416
	(0.143)	(0.149)	(0.283)
Observations	143	143	143
R-squared	0.115	0.142	0.155
Controls	No	No	Yes
Mean of dependent variable (control group)	0.423	0.423	0.423

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions include session (strata) fixed effects. Control variables include sex and age.

5 Results and discussion

5.1 Emotion-induction procedure

Based on the anger reported by participants, there is evidence that the emotion-induction procedure worked properly and, on average, was successful in inducing the desired emotion in the treatment group. In Figure 1, we can see that the treatment group has more angry people, and reports being angrier, than the control group. In Table 2 we can observe the results of estimating equation (1) but with $Angry_{is}$ as the dependent variable instead of $Guess_{is}$:

$$Angry_{is} = \alpha + \eta * Treatment_{is} + \varphi * X_{is} + \beta_s + \epsilon_{is} \quad (2)$$

In the three regressions we can confirm that, on average, the treatment group reported being 0.339 points more angrier than the control group, *ceteris paribus*. This also could be seen as treatment group reports to be 80% angrier than control group.

Figure 2

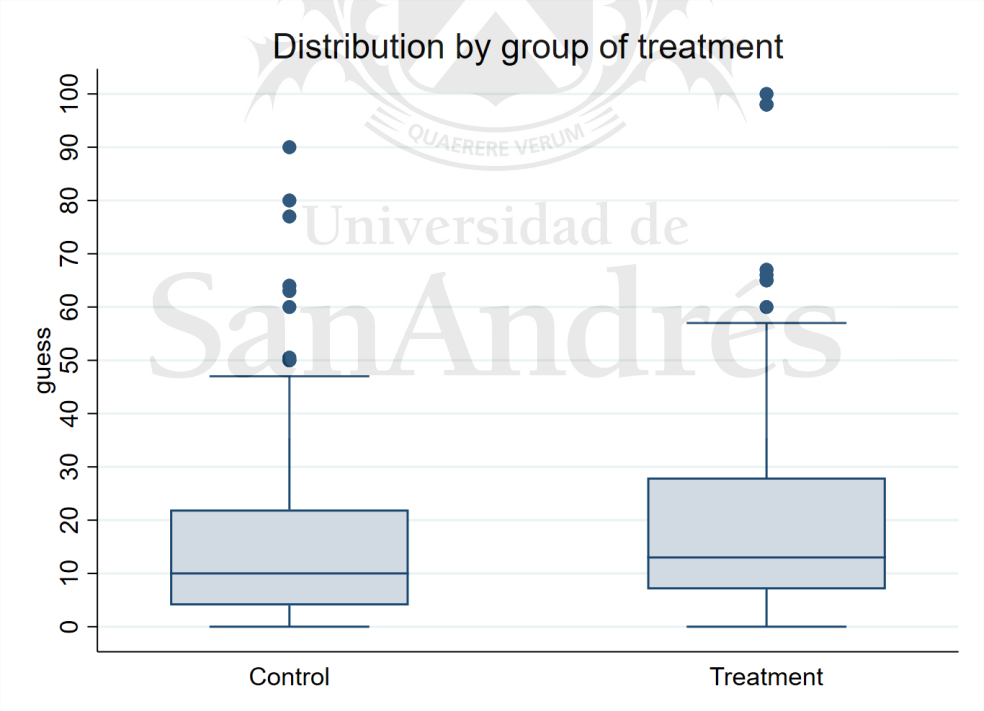

Figure 3

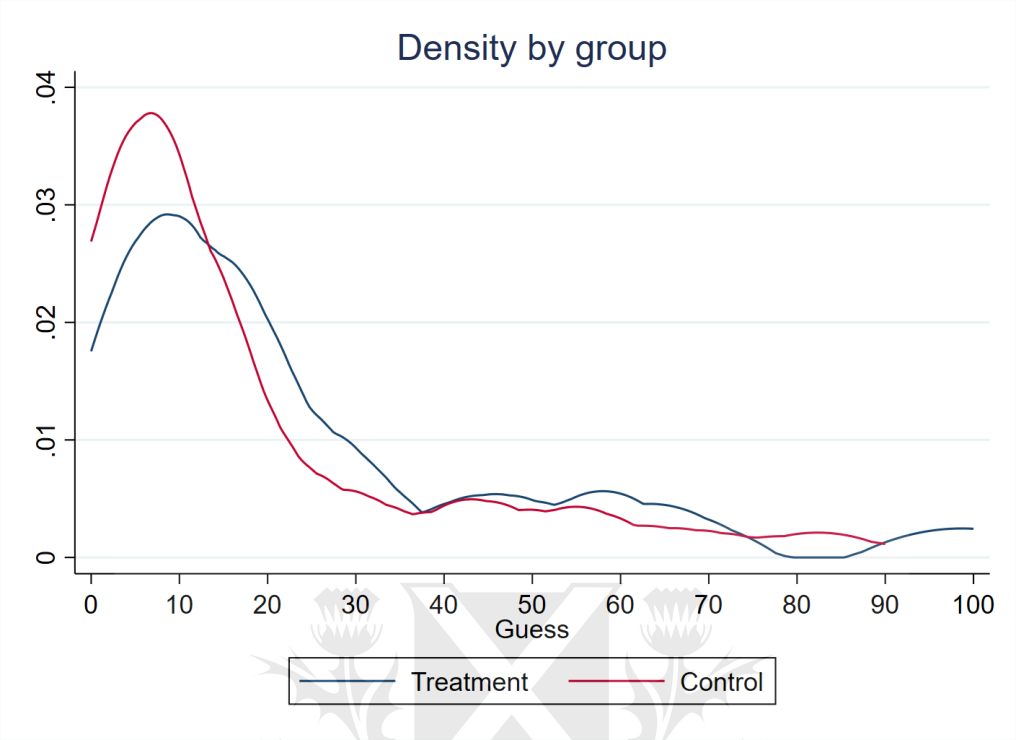

Table 3

VARIABLES	(1) Guess	(2) Guess	(3) Guess
Treatment (=1 if treated)	6.086*	7.673**	7.556*
	(3.644)	(3.765)	(3.863)
Right answers in CRT		-3.649*	-3.416
		(2.126)	(2.445)
Constant	7.363**	10.22***	12.74*
	(3.172)	(3.633)	(6.993)
Observations	143	143	143
R-squared	0.188	0.213	0.223
Controls	No	No	Yes
Mean of dependent variable (control group)	17.796	17.796	17.796

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions include session (strata) fixed effects. Control variables include sex and age.

5.2 Experiment

Figure 2 shows the distribution of the guesses by treatment group. In the control group, guesses are between 0 and 90, and the median value is 10. For the treatment group, on the other hand, guesses range from 0 to 100, and the median is 13.5. Furthermore, Figure 3 presents the empirical densities for both experiment groups. We can observe that in the control group the participants are concentrated below 15, whereas observations in the treatment group are more dispersed throughout the 0-100 interval.

Since the guess in the p-beauty contest and strategic sophistication correlate negatively, a higher guess means less strategic sophistication. Based on the distributions and densities of each experimental group, there is evidence that suggests that angry people are less strategically sophisticated than neutral people are.

Table 3 presents the estimation results from OLS regressions with and without controls. We can see that in our preferred specification in column (3) the coefficient of interest is positive and statistically significant. We interpret that, on average, treated participants guessed numbers 7.56 points higher in the p-beauty contest than control participants, *ceteris paribus*. In other words, Treatment group guesses are on average 42% higher.

Therefore, these results are supportive of our hypothesis, meaning that anger diminishes strategic sophistication in individuals. As mentioned before, this was expected because anger affects the depth of thought, leading to decision-making based on heuristics.

The treatment group results are quite similar to those from people with the lowest score in the CRT (individuals who have 0 correct answers) reported in previous studies. For instance, in this study the treatment group mean guess was 23.2, while in Carpenter et al. (2013) the mean guess was 22.4 for people who scored 0 in the CRT. Additionally, in Fehr and Huck (2015), the authors show that people with this score select numbers across the entire interval and tend to behave as if choosing the number randomly. Hence, anger triggers low effort thought that is similar to choosing a number randomly, without thinking it over (Lerner and Small, 2008).

In the first and second columns of Table 3 we can see simple regressions between guess and treatment, the former without any controls and the latter controlling only for IQ (CRT scores). The first coefficient is statistically significant, positive and similar in magnitude to the other columns. When controlling for IQ, the coefficient becomes more statistically significant, suggesting that controlling for IQ is relevant to measure the causal effect. This means that among two people with the same IQ, where one is angrier than the other, the angrier individual will be less sophisticated.

6 Conclusion

Anger is a negative emotion and is usually responsible for generally automatic and low-effort decisions. In this paper, we have proved that anger causes a reduction in individuals' strategic sophistication. As a result, given that strategic sophistication is related to economic behavior and decisions, angry people, on average, will not be able to make better economic decisions than if they remained neutral (i.e., not affected by emotions). Our results lend support to the idea that, in order to do better economically, it could be necessary to learn how to manage our emotions. Thus, it is important for economists to keep studying the different impacts of emotions in our economic life and the extent to which individuals can manage to control those emotions.

Han et al (2007) argue that happiness has the same appraisal pattern of high certainty and individual control as anger. Tiedens and Linton (2001) in a series of four studies show that anger, happiness and disgust are high certainty emotions that increase heuristic processing. In addition, relative to other negative emotions, fear and sadness have opposite appraisal patterns, leading to contrary effects. When experiencing fear or sadness, people are uncertain about events and have situational control rather than individual control. In consequence, we expect that replicating the experiment with happiness and disgust would produce similar results, and that, conversely, opposite results would obtain if experimenting with fear and sadness. Extending the present experiment to consider other emotions is an interesting avenue for future research.

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A Game instructions

Lea atentamente las instrucciones que siguen. Tómese todo el tiempo que necesite. Cualquier duda que tenga, diríjala al encargado del experimento.

En este juego se le pide que elija un número entre 0 y 100 (inclusive). El ganador del juego será el alumno cuyo número elegido esté más cerca de la mitad del promedio de las elecciones de todos los alumnos participantes.