# Materazzi effect and the strategic use of anger in competitive interactions

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**We propose that individuals use anger strategically in interactions. We first show that in some environments angering people makes them more effective in competitions, whereas in others, anger makes them less effective. We then show that individuals anticipate these effects and strategically use the option to anger their opponents. In particular, they are more likely to anger their opponents when anger negatively affects the opponents' performances. This finding suggests people understand the effects of emotions on behavior and exploit them to their advantage.**

Zinedine Zidane is considered one of the greatest soccer players of all time, leading the French team to victory in the 1998 World Cup and the 2000 European Championship. In the 2006 World Cup in Berlin, the French team did well under Zidane's leadership and reached the finals, where it played against the Italian team. This game was to be the last of Zidane's career before his retirement from soccer.

The score was 1:1 and the game went into overtime. With 10 min left, Marco Materazzi, an Italian defender, pulled Zidane's shirt. Zidane responded with, "If you want my shirt that badly, I'll give it to you at the end of the match"—nothing out of the norm, the usual trash talk between rival team members. Then Materazzi shot back: "I'd prefer your whore of a sister." Zidane lost it and headbutted Materazzi in the chest. This move was Zidane's last on-field act as a soccer player.

The game went on to penalty kicks without Zidane—the French team's best kicker—and the Italian team won. Both Zidane and Materazzi will likely be remembered more for this headbutt than anything else either did in his career. Instead of leaving in glory as a second-time World Cup champion, Zidane became a parody, and Materazzi, a hero.

What happened to Zidane during those few seconds? Did Materazzi anger him strategically, expecting the strong reaction? What is clear is that the Italian team's chance of winning the game increased significantly as a result of Materazzi's insult.

In this paper, we explore the strategic use of emotions, particularly anger, in interactive situations. We outline and test predictions regarding when the use of anger benefits the offender and when it backfires. Our main argument is that angering others affects their behavior, either helping or hurting performance; individuals understand these effects and use anger strategically in interactions.

Recent work has shown that emotions have a substantial effect on economic behavior and decision making (1–6). For example, individuals are kinder to others to avoid feelings of guilt (7–9) and make more conservative investment choices when anxious or afraid (10, 11).

Feelings of anger have been shown to be important factors in social punishment (12–15). Angered individuals are more willing to reject offers in an ultimatum bargaining game and consequently make less money (16, 17). Anger also significantly affects behavior in the repeated prisoner's dilemma games (18, 19) and power-to-take games (20). In addition, people are more willing to become angry when they expect to face situations that require aggressive behavior (21).

Importantly, intentionality of the offense seems to be an important factor necessary for anger to be induced (22). Individuals are significantly more likely to punish an intentionally hurtful choice than if the same choice was made unintentionally. The difference in negative reciprocity is primarily driven by an increase in anger when the hurtful act was viewed as intentional (23, 24).

Being able to express anger through other channels appears to mitigate the need to punish unfair treatment, with individuals significantly less likely to punish when they are able to communicate their feelings to the offender (25). In addition, strategic use of the appearance of anger seems to have substantial influence on the behavior of others, increasing the other party's initial offers in ultimatum bargaining games and concessions in negotiations (26–29).

Little work, however, has been done to explore how people in strategic interactions exploit the behavioral impact of experienced emotions such as anger. To test whether individuals anger others strategically, we designed an experiment where two players are matched and compete in one of two games. Before the competition, one is randomly chosen to have the option to anger his opponent. One of the games is strength-based, where we expected angered individuals to be more successful; the other game is more cognitively demanding, where anger is expected to have a negative effect on performance. In turn, we hypothesized that in the mental game angering one's opponent benefits the offender, whereas in the strength game, it may backfire.

To identify the effect of anger and rule out alternate explanations, we also introduced treatments with a delay between the potentially angering action and the subsequent competition. Given prior evidence on the temporal dynamics of emotions (30), we expected the behavioral effects of anger to diminish after individuals had a chance to "cool off." Particularly, we

## Significance

**Emotions play a critical role in social interactions and decision-making. We present evidence that individuals understand the behavioral effects of emotions, particularly anger, and use them strategically in interactions. In our study, individuals competed on a task, and one of them was given the opportunity to anger the other. The first task was strength-based, where we expected anger to improve performance. Other participants competed on a mental task in which we expected anger to impair performance—angering one's opponent here may benefit the offender. Anger affected behavior in line with our predictions. Importantly, individuals seemed to anticipate this reaction and took the strategic opportunity to anger their counterpart significantly more in the mental task than in the strength task.**

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hypothesized that angered and nonangered individuals would behave similarly in both games after the delay. Further, if individuals anticipate the mitigating effects of delay, the strategic advantage of angering one's opponent differentially between the two games should also be weakened.

## Experiment

**Strength Game.** In the strength game, participants competed on the total force they could produce over time by squeezing a hand dynamometer that measured handgrip strength in Newtons. Research has shown that anger positively affects performance on such strength-based tasks (31).

We recruited male undergraduates ($n = 140$) from a university-wide subject pool to participate in this experiment. Randomly paired participants competed twice in a game of strength by gripping the dynamometer for two 1-min rounds. They were told that one of the two rounds would be randomly chosen and the individual who exerted the most total force would win \$5, and the other would receive nothing. Participants did not learn of the outcome until the end of the experiment. (See *SI Appendix* for all instructions.)

After the first round, one individual in each pair was told that our behavioral laboratory had a number of boring administrative tasks to complete and that he was given the opportunity to choose how long his opponent would stay after the experiment to work on these tasks. We termed the chosen individual the decision-maker (DM) and his opponent the worker. The DM could choose to make the worker stay between 0 and 20 min, in 5-min intervals. The DM received an additional, relatively small amount of \$0.50 for every 5 min he assigned to the worker (maximum of \$2), whereas the worker received no additional compensation.

We informed the DM that the worker would know the choice and incentives he faced, as well as the decision he made, before beginning the second round of the strength game. Note that the maximum earnings for making the worker stay was \$2 compared with the prospective earnings of \$5 from winning the subsequent competition.

In the delay condition, the DM and worker were both told that after the DM's choice was revealed there would be 10-min break where each would complete an unrelated task before beginning the competition.

Once the worker was informed of the DM's choice, they competed in the strength game either without a break (no delay), or after a 10-min filler task of neutral anagrams (delay).

The DM's choice served as our anger manipulation. We ran a test that confirmed that workers who had to stay after the experiment for longer amounts of time were angrier than those who had to stay for less time or not at all, and that DMs anticipated this effect (*SI Materials and Methods*, Dataset S1).

We predicted that those who were angered between rounds—assigned to stay for an extended period after the experiment—would perform better in the strength game than those not angered.

***Results.*** For our analysis, we used the ratio $R$ between the total force exerted in rounds 2 and 1 as the dependent measure. Examining ratios allows us to minimize the effects of individual characteristics such as physical fitness.

In line with our prediction, workers in the no delay treatment who were assigned the full 20 min ($M = 1.24$) performed better than workers assigned less time [$M = 0.97$; $t(38) = 2.91$, $P = 0.006$]. Workers assigned 10 min ($M = 0.98$) behaved similarly to those assigned 0 min [$M = 0.96$; $t(19) = 0.11$, $P = 0.92$]. In turn, the 10-min group performed worse than those assigned the full 20 min [$t(29) = 2.25$, $P = 0.032$].

As predicted, in the delay treatment, workers performed similarly, irrespective of whether 20 min or less than 20 min was assigned [$M = 0.93$ vs. $M = 0.91$, respectively; $t(28) = 0.16$, $P = 0.87$]. Further, those assigned the full 20 min in the delay treatment performed significantly worse than those assigned 20 min in the no delay treatment [$t(29) = 2.82$, $P = 0.009$].

Given these findings, angering one's opponent in the strength game with no delay would not be strategically smart because angered participants performed better than those who were not. Using our data, we can examine the chances of winning in expectation when facing the median DM. Our results indicate that assigning 20 min to the worker in the no delay treatment cost the DM \$1.45 in expectation relative to assigning less minutes—a significant difference [$t(38) = 2.17$, $P = 0.036$]. In contrast, assigning 20 min in the delay treatment did not cost the DM any more in expectation than assigning less minutes [−\$0.34; $t(28) = 0.36$, $P = 0.72$]. Fig. 1*A* shows expected returns of the DM for each condition relative to the expected return if he had the same probability of winning or losing (\$2.50) (*SI Materials and Methods*).

**Duel Game.** The second game was designed to be more cognitively demanding, where optimal performance required computation and patience. Given evidence on the detrimental effect of anger on depth of processing and self-restraint, we predicted that anger would impair performance in this game (32, 33).

Randomly paired male participants played a computerized duel game ($n = 120$). Before the game was played, a set of instructions

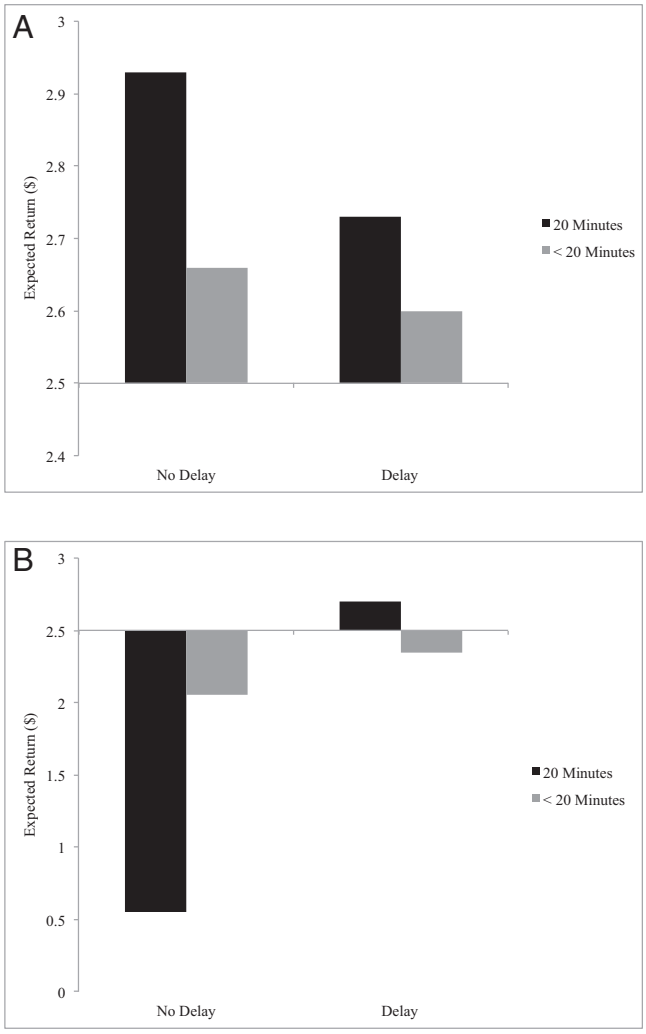


**Fig. 1.** Decision maker's expected return in Strength Game: (*A*) Individuals who angered their opponents stood to earn significantly less in the strength game, but only when the opponent did not have the opportunity to cool off. Decision maker's expected return in Duel Game: (*B*) Individuals who angered their opponents stood to earn significantly more in the duel game, but only when the opponent did not have the opportunity to cool off.

was given to each participant and read aloud. The same anger manipulation was used as in the strength game, with one player chosen at random to be the DM and his opponent the worker. Participants were matched into either the delay or no delay treatment. After the DM made his choice and the worker learned of it, the two competed in the duel game.

In the computerized game, participants started 20 steps apart with one bullet, meaning each had one chance to shoot his opponent. Period 1 started with player 1 making the choice to either "step forward" or "shoot," while player 2 waited for him to decide. If player 1 chose to step forward, period 2 would begin and the distance between the players would decrease by one step (from 20 to 19). Player 2 would then face the same choice, and so on until one of the players chose to shoot. The players were told the probability of hitting their opponent in every period. This probability increased monotonically as the distance between the two players decreased. If players were 20 steps apart, the probability was 0. The probability went up by 0.03125 until period 16, when it was 0.5, and then went up by 0.125 until period 20, when it was 1.

If a player shot and hit his opponent, he would get \$5 and his opponent \$0; if he missed, he would get \$0 and his opponent \$5. A participant won the game if he shot and successfully hit his opponent or if his opponent shot and missed him.

Because there are only two outcomes, win or lose, and conditional on the payoffs, each player had an optimal strategy that was independent of risk attitudes: step forward until the probability reached 0.5 and then shoot. Particularly, given that players made decisions in alternating periods, the worker's optimal strategy was to choose to step forward in periods 1 through 15 and to shoot in period 17 and above (*SI Materials and Methods*).

Given the expected effect of anger on depth of reasoning and patience, we predicted that angered participants would be more likely to behave suboptimally than those not angered: they would be more likely to shoot first (and too early).

***Results.*** If the worker shot first, he did so significantly earlier than period 17 in both the no delay [$M = 13.11$; $t(16) = 4.78$, $P < 0.001$) and delay [$M = 13.4$; $t(9) = 2.86$, $P = 0.02$] treatments. There was no significant difference between the delay and no delay treatment in what round the shot was fired.

In line with our prediction, angered individuals in the no delay treatment were more likely to shoot first and too early than those who were not angered. Workers assigned the full 20 min shot first 70% of the time, whereas those assigned less time shot first 25% of the time [$t(30) = -2.66$, $P = 0.01$].

In the delay treatment, there was no significant difference in the tendency to shoot first whether 20 min or less than 20 min was assigned [38% vs. 33%, respectively; $t(26) = 0.22$, $P = 0.83$]. Additionally, those assigned 20 min without delay were more likely to shoot first than those assigned 20 min with delay [$t(32) = 2.11$, $P = 0.04$].

Given that angered individuals were more likely to make a suboptimal choice, it follows that angering one's opponent in the duel game with no delay was strategically smart. This finding is in contrast to the strength game, where angered individuals performed better. In fact, assuming the DM follows his optimal strategy, by assigning 20 min to the median worker in the no delay treatment, he stood to gain \$0.28 in expectation relative to assigning less minutes [$t(30) = 2.66$, $P = 0.01$]. In contrast, assigning 20 min in the delay treatment did not change expected payoffs relative to assigning less [\$0.13; $t(26) = 1.32$, $P = 0.20$]. Fig. 1*B* shows expected returns of the DM for each condition relative to the expected return if he had the same probability of winning or losing (\$2.50) (*SI Materials and Methods*).

**Anger as a Strategy.** Our results suggest that anger affected performance differently depending on the game, impairing performance in the duel game and enhancing it in the strength game. These behavioral effects were mitigated, however, when individuals had an opportunity to cool off before competing.

Using anger strategically implies that individuals should be more willing to anger opponents when it increased their chances of winning. Particularly, DMs in the duel game with no delay should assign more minutes to the workers than in the strength game. Our results are consistent with this prediction. In the strength game, 45% of workers were assigned the full 20 min, whereas in the duel game 63% of workers were assigned the full time. In contrast, 20% of workers in the strength game were assigned no time compared with 6% of workers in the duel game.

A regression analysis confirms the differential tendency to anger between games. DMs playing the duel game assigned workers significantly more minutes than those playing the strength game ($\beta = 3.41$, $P = 0.045$). These results suggest that individuals anticipated the behavioral effects of anger and used them strategically—they were more willing to anger their opponents when it had a detrimental effect on performance.

Individuals also seemed to anticipate the mitigating influence of delay on anger's behavioral effects. Particularly, in the treatments where the DM was told there would be a break between the worker learning of the minutes assigned and the competition, the type of game no longer had a significant effect on the number of minutes assigned ($\beta = 0.29$, $P = 0.46$).

## Conclusion

Our findings suggest that anger has discernible behavioral effects that depend on the context: anger had a positive effect on performance when the game involved strength and a negative effect when the game was more mental. Individuals seemed to understand these effects, choosing to anger opponents more when competing in the latter than the former. This finding suggests that participants offended strategically.

Although we focus primarily on anger, one can apply our findings to other emotions as well. For example, recent work has demonstrated the positive influence of guilt on charitable behavior (34). Organizations looking to maximize donation revenues can exploit these emotional effects by strategically inducing guilt in potential donors. Additionally, given the significant effects of emotions on behavior, our findings suggest that incorporating emotions such as anger into models of strategic interactions would provide better understanding of such environments.

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