American Political Science Review (2024) 118, 3, 1158–1173
doi:10.1017/S0003055424000078

Anger and Political Conflict Dynamics

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Emotions shape strategic conflict dynamics. However, the precise way in which strategic and emotional concerns interact to affect international cooperation and contention are not well understood. We propose a model of intergroup conflict under incomplete information in which agents are sensitive to psychological motivations in the form of anger. Agents become angry in response to worse-than-expected outcomes due to actions of other players. Aggression may be motivated by anger or by beliefs about preferences of members of the other group. Increasing one group's sensitivity to anger makes that group more aggressive but reduces learning about preferences, which makes the other group less aggressive in response to bad outcomes. Thus, anger has competing effects on the likelihood of conflict. The results have important implications for understanding the complex role of anger in international relations and, more generally, the interplay between psychological and material aims in both fomenting and ameliorating conflict.

INTRODUCTION

Political conflict arouses strong emotions that shape and are shaped by conflict (Bar-Tal, Halperin, and De Rivera 2007). Anger, in particular, is a powerful emotion in conflict settings (Petersen and Zukerman 2010), influencing the conduct of state diplomacy and foreign policy (Hall 2011; McDermott 2014a). For example, U.S. officials have noted how Putin's "angry and frustrated" mood impacted his ruthless approach toward Ukraine following Russia's surprisingly poor performance in its March 2022 invasion.[1] Similarly, Chinese officials expressed a "demonstrably angry response" involving aggressive military drills around Taiwan following the unanticipated visit of Taiwanese Vice President William Lai to the United States in August 2023, highlighting Taiwan's status as a "deeply emotive issue" for China.[2] In September 2021, French policymakers described themselves as "angry and bitter" when Australia reneged on a $65 billion submarine contract favoring a U.S. deal, a move condemned as a "betrayal" by the French Foreign Minister and leading France to temporarily recall its U.S. ambassador.[3]

These examples illustrate the role of emotions in shaping leaders' foreign policy making, which can help us understand fundamental problems in international relations, such as the security dilemma (Bleiker and Hutchison 2008; Crawford 2000). For instance, angry individuals tend to have more aggressive preferences (Berkowitz 1990; Scherer 1999), sacrifice material payoffs to punish offenders (Carlsmith, Darley, and Robinson 2002), and process information in a more biased way (Valentino et al. 2008; Weeks 2015). Thus, anger could heighten security dilemmas and lead to conflict spirals (Hymans 2006; Jervis 1986; Jervis, Lebow, and Stein 1989).

Analyzing exactly how emotions like anger shape conflict is complex, however, because emotional and strategic factors interact in these settings. Conflict is a strategic outcome but much of behavioral political science is individualistic (Kertzer et al. 2022; Powell 2017). Yet emotions have social effects (Parkinson 1996), such as on communication (Morris and Keltner 2000) and intergroup interactions (Van Kleef et al. 2008). In international relations, emotional dynamics help leaders signal intentions through international diplomacy (Wong 2016), foster cooperation in peace talks (Holmes and Yarhi-Milo 2017), and drive patterns of ethnic violence in civil wars (Balcells 2010; Petersen 2002). We address this social aspect of emotions by incorporating them into a game theoretic model, a tool tailored to analyzing social interactions. In this way, we bridge the gap between game theoretic and behavioral work in order to build a theory that is both

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Received: July 06, 2022; revised: September 19, 2023; accepted: January 17, 2024. First published online: February 26, 2024.

[1] See https://apnews.com/article/ussia-ukraine-war-us-view-of-putin-1271f76008b3e639df6ff21e3644e339
[2] See https://www.reuters.com/world/asia-pacific/china-says-military-held-naval-air-combat-readiness-patrol-around-taiwan-2023-08-19/; https://www.reuters.com/world/asia-pacific/why-is-china-so-angry-about-taiwan-vice-presidents-us-trip-2023-08-19/
[3] See https://www.reuters.com/world/asia-pacific/why-is-china-so-angry-about-taiwan-vice-presidents-us-trip-2023-08-19/

psychologically realistic and strategically rich. Van Kleef et al. (2008, 17) illustrate the need for combining these strengths, noting that, "In situations where people depend on each other for their outcomes, the question of how expressions of anger influence conflict development is of the utmost importance for a complete and thorough understanding of behavior in social conflict."

In this paper, we develop a formal model of anger and political conflict, utilizing psychological game theory (Battigalli and Dufwenberg 2009; Geanakoplos, Pearce, and Stacchetti 1989). We enhance the "conflict cycles" model of Acemoglu and Wolitzky (2014) with insights from psychological research on anger, emphasizing a cognitive appraisal approach where agents become angered due to negative outcomes they attribute to others' intentional actions (Frijda 1993; Lazarus 1991; 1999; Roseman 1996; Scherer 1999; Zajonc 2000). This complements existing work in international relations that incorporates the role of emotions (Acharya and Grillo 2019; Renshon, Lee, and Tingley 2017) or endogenous preferences more generally (Haynes and Yoder 2022) in leader foreign policy-making.

Building on work by Scherer (1988) and Battigalli and Dufwenberg (2009), we posit that negative outcomes are those falling short of expectations, fostering stronger reactions when trust is breached, thus creating endogenous preferences. This approach situates our theory firmly within the psychological game theory field (Battigalli and Dufwenberg 2009; Geanakoplos, Pearce, and Stacchetti 1989). In our model, anger motivates actors to seek punitive actions, deriving psychological satisfaction not just from their gains but from the losses inflicted on others, a phenomenon backed by empirical studies (García-Ponce, Young, and Zeitzoff 2023; Haidt 2003; Johnson 2009; Wayne 2023). This relative preference perspective also naturally integrates the concerns of the security dilemma where relative gains often obstruct cooperation (Grieco, Powell, and Snidal 1993).

Our model illustrates that anger can influence conflict through both direct and indirect strategic pathways stemming from emotional and informational dynamics. While anger often incites more aggressive behavior, it can also reduce the informational impact of a group's choices, potentially decreasing the opposing group's aggression due to muted informational repercussions of adverse outcomes: another group's negative actions may be indicative of their inherently hostile nature or simply due to temporarily induced anger. We also show that the effects of anger are self-regulating; anger cannot foster perpetual conflict, as individuals would adjust their expectations over time, thereby neutralizing the anger-triggering effect of bad outcomes.

Our approach augments the study of issues like security dilemmas (e.g., Kydd 2005) by examining the role emotions play in shaping preferences within this type of strategic environment. We complement existing behavioral research on the stimulating role of emotions in conflict (García-Ponce, Young, and Zeitzoff 2023; Kertzer and Tingley 2018; McDermott 2017; Zeitzoff 2014) by elucidating the indirect strategic implications of anger in conflict settings. Furthermore, this work contributes to the burgeoning literature on conflict dynamics using behavioral modeling approaches (Acharya and Grillo 2019; Siegel 2011) and empirical studies in behavioral international relations (Hafner-Burton et al. 2017; Kertzer and Rathbun 2015; Masterson 2022; Renshon, Lee, and Tingley 2017). It highlights the complementarity of political psychology and formal theory for understanding conflict dynamics.

EMOTIONS IN INTERNATIONAL CONFLICT

The importance of emotions is implicit in many theories of international relations (Crawford 2000; Kertzer 2017). For example, fear underlies the security dilemma (Rathbun 2007) and anxiety is central to state behavior under ontological (in)security (Kinnvall and Mitzen 2020). The construction of emotion as separate from reason in decision-making has also been challenged by IR scholars, who now more frequently understand emotions as a complementary and perhaps critically important part of decision-making, including in foreign policy (McDermott 2014b; Renshon and Lerner 2012). For example, emotions can help convey intentions in international diplomacy (Holmes and Yarhi-Milo 2017; Wong 2016), potentially obviating risks of conflict.

Anger, however, is an emotion primarily thought to fuel and *exacerbate* international conflict (Bar-Tal, Halperin, and De Rivera 2007; Petersen and Zukerman 2010). For example, anger is linked to support for the use of military force (Cheung-Blunden and Blunden 2008; Fisk, Merolla, and Ramos 2018; Skitka et al. 2006), retributive counterterror policies (Liberman 2013; Wayne 2023), preferences for punitive justice in criminal prosecution (García-Ponce, Young, and Zeitzoff 2023), intergroup prejudice (DeSteno et al. 2004), and the perpetration of ethnic violence in civil conflicts (Balcells 2010; Claassen 2016; Petersen 2002). Anger can also heighten interstate conflict, stoking state rivalries and exacerbating territorial conflict by increasing citizens' risk acceptance and loss aversion (Lim and Tanaka 2022; Zhou, Goemans, and Weintraub 2023).

Anger also shapes the behavior of political elites. States' anger at past "national humiliations" may increase aggressive, status-seeking behaviors in the future (Corbetta 2022) and state leaders' construction of certain political issues as "anger-inducing" can threaten the precipitous escalation of diplomatic conflicts (Hall 2011). Anger may also impact diplomatic behavior *incidentally* (Renshon and Lerner 2012), with leaders' moods influencing which lessons of history they draw on in foreign policy-making (McDermott 2004), and diplomats' personal feelings shaping how they define and pursue the national interest (Keys and Yorke 2019). However, despite the centrality of anger in decision-making, decision-makers tend to be "very bad at predicting how they will feel and act in an alternate emotional state" (McDermott 2004, 698),

making it difficult to anticipate future preferences once their emotions change (Loewenstein 1996).

Formalizing Anger

Anger is thought to affect both preferences and information processing (Mintz, Valentino, and Wayne 2021). We focus here on the effect of anger on preferences, though we consider the effects of anger on information processing in section "Informational Effects of Anger."

Anger's role in shaping preferences is linked to the perceptions that trigger it. Cognitive appraisal theorists have found that individuals are most likely to experience anger when they deem an event to be negative (i.e., against their interests) and purposefully caused by another (Lazarus 1991; Roseman 1996; Scherer 1999). Anger is also a moral emotion, elicited not simply when a negative event occurs, but when that event is seen as *unfair* (Haidt 2003). As such, anger is related to assessments of the other's character or intentions: individuals are more likely to experience anger when they perceive the actions of another to be unjust or their motivations illegitimate.[4]

A challenge in formally modeling anger-triggering perceptions is establishing the benchmark for negative events. We assume, consistent with previous work, that individuals gauge an event as negative if it falls short of the *expected* outcome (Scherer 1988). The frustration-aggression hypothesis posits that barriers to achieving an *expected* gratification lead to aggression (Berkowitz and Harmon-Jones 2004; Dollard et al. 1939). Battigalli and Dufwenberg (2009) concur, emphasizing the role of expectations in evaluating outcomes. Empirical data underpin this *context-dependent* perception of anger: greater discrepancy between expectations and reality boosts the likelihood of anger (Benistant and Suchon 2021; Persson 2018). This phenomenon is visible in the escalation of violence following unanticipated losses in various contexts (Barnhart 2020; Card and Dahl 2011) and explains the frequency of interpersonal anger toward liked and respected others, where unmet high expectations foster disappointment and anger (Averill 1983).

Once triggered, anger fosters a desire to punish perceived wrongdoers, driven more by psychological satisfaction than material benefits (Carlsmith, Darley, and Robinson 2002; Lerner and Keltner 2001; McDermott, Lopez, and Hatemi 2017). This is because anger promotes deontological thinking, where actions adhere to moral rules rather than consequences (García-Ponce, Young, and Zeitzoff 2023). Angry individuals may prioritize "nonmaterial stakes" and be willing to forgo material gains to ensure wrongdoers face repercussions (Hall 2021). This behavior is evident in ultimatum bargaining games where unfair yet materially beneficial offers are often rejected, a tendency that is reduced when anger is mitigated (Pillutla and Keith Murnighan 1996; Srivastava, Espinoza, and Fedorikhin 2009). Fairness heuristics, which are central to anger, can also influence decisions to escalate diplomatic disputes to war (Gottfried and Trager 2016). Broadly, anger alters actor *preferences*, leading to dissatisfaction with benefits received by the adversary and potentially engendering cycles of retaliatory political violence (Gollwitzer et al. 2014; Liberman and Skitka 2017; Pagano and Huo 2007).

However, to fully understand how anger shapes conflict decision-making, we should place anger in a strategic context: how does anger shape the dynamic interaction between strategic actors in conflict? This is the question we address in this paper.

MODELING INTERGROUP CONFLICT

The specific effect of anger on conflict dynamics depends on the strategic context, including the material payoffs and informational environment.

Here, we are particularly interested in understanding how agents' anger—and the potential of others to become angry—affects strategic behavior in conditions of uncertainty, where agents can take either aggressive or conciliatory action, but these actions may be potentially misperceived by others. Below, we emphasize three applied contexts that fit this strategic setting, though the model is an abstract representation of a variety of important political contexts. Specifically, we focus on a setting with the following features:

- *Cooperation.* Players can engage in either cooperative or aggressive behavior toward one another.
- *Coordination.* There is potential for mutual gains from joint cooperation but players do not want to cooperate unilaterally.
- *Mistrust.* There is uncertainty about players' preferences with some players never wanting to cooperate.
- *Misperceptions.* The other side's actions are imperfectly observed.

Another feature of our model, which is also realistic but less essential to the results, is that interactions occur over a long time horizon but individual agents are short lived. This iterative interaction with agents that change across rounds parallels the real world context of interstate diplomacy where the same states interact multiple times with no clear end point in sight, but the specific state leaders, security officials, or diplomats experience turnover.

Our model most directly builds on the literature on security dilemmas in international relations (Acharya and Ramsay 2013; Jervis 1978; Kydd 1997; 2005). A security dilemma is a situation in which actions taken by side A to increase its own security leads side

[4] Moreover, anger promotes rumination, making it persist longer (Verduyn and Lavrijsen 2015), increasing its potential influence on political decision-making. Even when the physiological response to anger fades, the feeling of anger can persist (Damasio 2004), such as in the case of state anger over "national humiliations," which can last for decades (Barnhart 2020).

B to take adverse actions to increase its own security out of concern about the intentions of side A. Cooperation, coordination, and mistrust are canonical in models of the security dilemma. In particular, these models emphasize the role of mistrust. The conflict cycles model we adopt from Acemoglu and Wolitzky (2014) adds the component of misperceptions, long a concern of conflict scholars (Jervis 1986). A consequence of misperceptions when combined the first three features is that conflict might precipitate from misunderstandings: a negative misperception fuels mistrust since it is compatible with the belief that the other side is hostile.[5] This serves as a useful context in which to study the effect of anger both because it is widely applicable and because emotional responses may intensify the effects of misperceptions and, as we show, interact in unexpected ways with mistrust.

Arms races are one important application of security dilemmas and fit well here.[6] Players engage in cooperation (refraining from arming) or aggression (arming). There is also a coordination incentive since players benefit from mutually refraining from arming but prefer to be armed if their rivals are armed. Furthermore, there is mistrust since players do not know whether a rival arms with hostile intentions. Misperceptions are also common in armaments where secrecy can lead to misinterpretation of actions (Levy 1983). Concrete examples from recent history illustrate how emotional responses of leaders can affect arms negotiations, such as in the exchange of heated personal attacks between then U.S. President Donald Trump and North Korean leader Kim Jong Un during nuclear negotiations between those two countries (Cha and Katz 2018).

The long-run nature of interactions in our model also suggests applications to enduring interstate rivalries. Here, the cooperation incentive acknowledges that, even in enduring rivalries, conflict is costly relative to mutual restraint. There are also assumed to be coordination incentives in this setting. For instance, Kadera (2001) assumes that "nation X is increasingly conflictual toward nation Y because nation Y is increasingly conflictual toward nation X" (60). Mistrust is also an essential feature of international rivalries (Maoz and San-Akca 2012). As Colaresi and Thompson (2002) note, an important aspect of rivalries is that they "mistrust the intentions of their adversaries" (263). Our interest in anger in this setting is consistent with other theoretical accounts that rely on notions of "a sense of grievance" and "feelings of hostility" (Morey 2011), for which we provide more microfoundations.

The model may also apply to domestic contexts such as ethnic conflict. The repeated and relatively anonymous nature of interactions in our model calls to mind models of interethnic cooperation in repeated games (Calvert 1995; Fearon and Laitin 1996; Larson 2017) or in one shot games with random interaction (Schnakenberg 2014). In these settings, there are explicit benefits to cooperation. Furthermore, parts of this literature build on the idea of mistrust in the sense of private player types with some unlikely to cooperate with the other group (Schnakenberg 2014) or on misperception in the sense of imperfect observations about the history of play (Fearon and Laitin 1996; Larson 2017). Furthermore, existing work emphasizes how emotions drive ethnic conflict (McDoom 2012) and intergroup conflict more generally (Mackie, Devos, and Smith 2000). Notably, the security dilemma framework has been applied to ethnic conflict, emphasizing especially the role of mistrust (Kydd 2000; Posen 1993; Weingast 1998).

Behavioral Game Theory in Politics

Our work also contributes to the growing literature incorporating behavioral assumptions into formal models of political phenomena (e.g., Acharya, Blackwell, and Sen 2018; Bendor, Kumar, and Siegel 2010; Feddersen, Gailmard, and Sandroni 2009; Little 2019; Minozzi 2013; Penn 2008; Siegel 2011) and research on context-dependent preferences (e.g., Agranov et al. 2017; Alesina and Passarelli 2019; Kahneman and Tversky 1979).

Methodologically, our paper is most related to those that endogenize preferences through some psychological mechanism. The main examples in international relations are Acharya and Grillo (2019) and Haynes and Yoder (2022). Acharya and Grillo (2019) considers endogenous "disappointment" as a foundation for audience costs, a phenomenon where politicians are punished for making a threat and then backing down. As with anger in this paper, disappointment is triggered when an outcome is not in line with an agent's expectations. Though our paper is methodologically related to this work, we focus on a different application and on the agents actively engaged in conflict. Haynes and Yoder (2022) focus on a strategic setting very similar to ours but the modeling of endogenous preferences differs in two important ways. First, preferences in our model are endogenous in the sense of depending on strategies in a way that is incorporated into the solution concept using psychological game theory. In contrast, Haynes and Yoder (2022) let preferences change only as a function of past actions, in a manner much more similar to the alternative model we explain in section "Comparison to Naive Anger Preferences." Second, the model in Haynes and Yoder (2022) allows for positive and negative preference adaptations which are not important for the purpose of our paper.[7]

[5] The way we use the terms "mistrust" and "misperception" is consistent with a survey by Acemoglu and Wolitzky (2023) and with the usage of mistrust in Kydd (2005).

[6] See especially the spiral model in Kydd (2000).

[7] Some applied work outside of international relations also uses the sort of context-dependent preferences used in this paper (Grillo 2016; Grillo and Prato 2023; Leontiou, Manalis, and Xefteris 2021).

Finally, our work also relates to models of reciprocity using psychological games (Dufwenberg and Kirchsteiger 2004; Rabin 1993). Agents motivated by reciprocity prefer to be kind to agents who they perceive as kind and unkind to agents they perceive as unkind. To model anger, we focus on the negative side of reciprocity, that is, the desire to be unkind in response to perceived unkindness. Anger has been related to preferences for negative reciprocity, particularly across identity groups (Bicskei, Lankau, and Bizer 2016), so our perspective is in line with this research.

THE MODEL

Sequence and Game Play

Consider a game between overlapping generations of agents from two groups, A and B, interacting over an infinite time horizon with time indexed by $t \in \{0, 1, \dots\}$. In each period t, one player is active ("player t") and, for $t > 0$, the active player chooses an action $x_t \in \{c, a\}$ ("conciliatory" or "aggressive") toward player $t-1$ and an *intended action* $y_t \in \{c, a\}$ toward player $t+1$. Player 0 only chooses an intended action y_0 toward player 1. In odd periods, the active player is from group A; and in even periods, the active player is from group B, so all actions are directed toward members of the opposite group.

In any period $t > 0$, player t learns a *result* $\tilde{y}_{t-1}$. The observed result is stochastic but depends on the intended action in that $\Pr[\tilde{y}_{t-1} = a | y_{t-1} = a] = 1$ and $\Pr[\tilde{y}_{t-1} = a | y_{t-1} = c] = \pi$. In short, aggressive intentions will lead to aggressive results, but conciliatory intentions may, with some probability (π), mistakenly also lead to aggressive results. Player 0 gets no signal and simply chooses an intended action.

Player t learns her own type and the result $\tilde{y}_{t-1}$ but nothing else about the history of the game. Agents do not learn about any interactions that came before and also do not know how much time passed before she became active (i.e., agents do not know the value of t).[8] This assumption incorporates the poor information and high degree of uncertainty about adversaries' present and past actions that often exists in conflict contexts (Ramsay 2017), but this assumption is relaxed in section "More Information about History." Following Acemoglu and Wolitzky (2014), we formalize ignorance of calendar time by assuming that each player at $t > 0$ has an improper uniform prior over time periods, which implies that the prior probability of observing a particular value of $\tilde{y}_{t-1}$ is equal to the long-run probability of that outcome.

Types, Material Payoffs, and Strategies

Player t has a type $\theta_t \in \{H, F\}$ ("Hostile" or "Friendly"). Hostile types have a dominant strategy of aggression. In terms of material payoffs, Friendly types prefer to match the action of the other player. The proportion of Hostile types in group $j \in \{A, B\}$ is ρ_j. Players' types are private information. Additionally, players are uncertain about the proportion of Hostile types in each group, denoted ρ_A and ρ_B. We assume for each $j \in \{A, B\}$ that ρ_j takes a value of either $\underline{\rho}$ or $\bar{\rho} > \underline{\rho}$. For both groups, the prior probability that $\rho_j = \bar{\rho}$ is μ_0. We typically assume that $\bar{\rho} = 1$ and $\underline{\rho} = 0$, so that any group is made of either all Hostile types or all Friendly types. This is in line with Acemoglu and Wolitzky (2014) and leads to the clearest exposition of results, though the proofs of Propositions 1 and 2 are for general values of $\bar{\rho}$ and $\underline{\rho}$.[9]

Each player $t > 0$ gets a material payoff of $v_t = u(x_t, \tilde{y}_{t-1}, \theta_t) + u(y_t, x_{t+1}, \theta_t)$, where u describes the payoff from each of the two interactions in which that player participates. We set $u(a, a) = 0$ and $u(c, c) = 1$, representing the idea that all players, including Hostile types, would materially prefer the situation in which both players are conciliatory to the situation in which both players are aggressive. Friendly players prefer coordination. If the other player is aggressive, the payoff to acting conciliatory is $-s$, where $s > 0$ represents a cost of unilaterally taking a conciliatory action. Finally, the payoff to acting aggressive when the other player is conciliatory is $r(\theta_t)$, where $r(F) < 1 < r(H)$. Thus, Friendly types prefer to reciprocate conciliatory behavior but Hostile types always prefer aggression. Players' payoffs depend on their own chosen actions and the *result* of the actions (but not the intended action) of the other players. That is, player t's payoffs are a function of $\tilde{y}_{t-1}$ rather than y_{t-1}: players are materially affected by aggressive outcomes even if they were the result of mistakes. Figure 1 summarizes the material payoffs to a given player.

We analyze equilibria in which all members of the same group use the same type-dependent strategy. A strategy σ_j for group j maps types θ_t and results $\tilde{y}_{t-1}$

FIGURE 1. Material Payoffs of Player t from Interactions with Players $t-1$ and $t+1$

Game with $t-1$

	a	c
a	0	$r(\theta_t)$
c	$-s$	1

Game with $t+1$

	a	c
a	0	$r(\theta_t)$
c	$-s$	1

Note: Parameter values are $s > 0$ and $r(F) < 1 < r(H)$.

[8] Player 0 knows that $t = 0$ because she does not see any result $\tilde{y}_{t-1}$ but all other agents are uncertain about how many periods have passed.

[9] We do not provide a separate proof for Proposition 3 in this more general case, though continuity implies that the result holds as long as $\bar{\rho} - \underline{\rho}$ is large enough.

into probabilities of playing $x_t = a$ and $y_t = a$. Each strategy is an element of the set $\Sigma = [0,1]^8$ since it prescribes probabilities of two different actions each across four different information sets. The strategy for group A is denoted σ_A, the strategy for group B is denoted σ_B, and a strategy profile is simply $\sigma = (\sigma_A, \sigma_B) \in \Sigma^2$.

Psychological Motivations

We augment the model described above with psychological motivations to understand how anger affects the onset and continuation of conflict. As we have discussed, empirical research in political psychology has found that anger is most likely when agents observe a negative difference between expected and actual outcomes that they attribute to the actions of another person (Lazarus 1991; Roseman 1996; Scherer 1999). Anger also shapes agents' preferences by increasing their psychological payoff when the adversary's material payoff decreases (Carlsmith, Darley, and Robinson 2002). Anger therefore links preferences with conjectures about players' strategies, which leads us toward psychological game theory. Our approach follows Battigalli, Dufwenberg, and Smith (2019) with modifications to account for incomplete information.

We define a psychological game by directly modeling players' conjectures about others' strategies.[10] Let $b_t^j \in \Sigma$ be player t's conjecture about group j's strategy. That is, for some pair of strategies $\sigma'_A \in \Sigma$ and $\sigma'_B \in \Sigma$, $b_t^A = \sigma'_A$ and $b_t^B = \sigma'_B$ means that player' t thinks that members of group A use the strategy σ'_A and members of group B use the strategy σ'_B.

In our psychological game, a player may become angry when $\tilde{y}_{t-1} = a$. The extent of that anger depends on the payoff she expected to receive and how much she blames player $t-1$ for this undesirable outcome (Battigalli, Dufwenberg, and Smith 2019). Since player t's best possible material payoff from the interaction with $t-1$ is 0 when $\tilde{y}_{t-1} = a$, anger is proportional to the ex ante expected payoff from the interaction with $t-1$ multiplied by the probability that player $t-1$ chose $y_{t-1} = a$. We therefore define the anger level β of player t from group j as shown in Equation 1. That is, a player's anger is zero if they see a good outcome ($\tilde{y}_{t-1} = c$). If they see a bad outcome ($\tilde{y}_{t-1} = a$), two factors determine their anger level. The first factor is the deviation between the agent's expected outcome and the observed outcome. Since the best payoff when $\tilde{y}_{t-1} = c$ is 1 and the best payoff when $\tilde{y}_{t-1} = a$ is zero, the deviation from expectations after getting a bad signal is equal to the prior probability that $\tilde{y}_{t-1} = c$ given players' conjectured strategies. The second factor is whether the negative outcome was caused by the actions of the other player. However, since player t never observes y_{t-1}, our actual evaluation of player t's anger level in the solution involves calculating $\Pr[y_{t-1} = a | \tilde{y}_{t-1} = a, b_t^j, b_t^{-j}]$, as in Equation 1.[11]

$$\beta_t(\tilde{y}_{t-1}, y_{t-1}; b_t^j, b_t^{-j}) := \begin{cases} \Pr[\tilde{y}_{t-1} = c | b_t^j, b_t^{-j}] \Pr[y_{t-1} = a | \tilde{y}_{t-1} = a, b_t^j, b_t^{-j}], & \text{if } \tilde{y}_{t-1} = a, \\ 0, & \text{if } \tilde{y}_{t-1} = c, \end{cases} \tag{1}$$

Endogenous Preferences and Solution Concept

Each player's decision utility incorporates material payoffs and psychological motivations. The decision utility for player t is

$$u_t(x_t, y_t, \tilde{y}_{t-1}; b_t^j, b_t^{-j}) = \underbrace{\mathbb{E}[v_t | x_t, y_t, \tilde{y}_{t-1}, b_t^j, b_t^{-j}]}_{\text{Expected material payoff}} \underbrace{-\alpha_j \mathbb{E}[\beta_t(\tilde{y}_{t-1}, y_{t-1}; b_t^j, b_t^{-j})(v_{t-1} + v_{t+1})]}_{\text{Expected psychological payoff}} \tag{2}$$

for $j \in \{A, B\}$. That is, each player maximizes her own expected material payoff minus a psychological payoff that depends on her anger level and the material payoffs of the players with whom she interacts. The parameter $\alpha_j \geq 0$ measures the weight placed on psychological motives. The players' preferences are endogenous in the sense that they depend (through β_t) on the players' conjectures about the strategies being employed in the game.[12]

Beliefs μ_t for each player map realizations of θ_t and $\tilde{y}_{t-1}$ to beliefs about ρ_A and ρ_B. An equilibrium is a profile of strategies $\sigma* = (\sigma_A^*, \sigma_B^*)$, conjectures b_t^A and b_t^B for each player, and beliefs μ_t for each player which satisfy the following:

1. Both groups' strategies maximize each player's expected decision utility given conjectures b_t^A and b_t^B and beliefs μ_t: $\sigma_j^*(\theta_t, \tilde{y}_{t-1}) \in \arg\max_{\sigma \in \Sigma} \mathbb{E}_{\mu_t}[u_t(x_t, y_t, \tilde{y}_{t-1}; b_t^j, b_t^{-j})]$ for all $j \in \{A, B\}$ and all t.
2. For every t, μ_t is consistent with Bayes rule given conjectures b_t^A and b_t^B at any information set on the path of play.

[10] Most of the psychological games literature uses the term "beliefs" to describe players' conjectures about strategies of other players. We avoid this terminology to avoid confusion with beliefs about player types.

[11] Appendix B of the Supplementary Material gives illustrative examples computing anger for three different conjectures about player strategies.

[12] Appendix A of the Supplementary Material provides an illustration of the solution concept in a simpler game.

TABLE 1. Notation from the Model

Groups, players, and types		
Model notation	Values taken	Interpretation
A, B	–	Group labels for the two groups
t	$0, 1, \ldots$	Represents time periods ("time t" as well as the player active in that time period ("player t")
θ_t	H, F	Player t's type. H is "Hostile." F is "Friendly."
ρ_A, ρ_B	$\underline{\rho}$ or $\bar{\rho}$	Proportion of group A (B) members who are Hostile (H) types. $\bar{\rho} = 1$ and $\underline{\rho} = 0$ in the main analysis.
μ_0	$(0, 1)$	Probability that $\rho_j = \bar{\rho}$ for either group $j \in \{A, B\}$.
Actions, outcomes, and material payoffs		
Model notation	Values taken	Interpretation
x_t	c or a	Action taken by player t toward player $t-1$. c is "conciliatory." a is "aggressive."
y_t	c or a	*Intended* action taken by player t toward player $t+1$.
$\tilde{y}_t$	c or a	*Result* of action taken by player t toward player $t+1$. Equal to a if $y_t = a$ but a noisy signal when $y_t = c$.
π	$(0, 1)$	The probability that an action $y_t = c$ mistakenly results in $\tilde{y}_t = a$.
v_t	$\mathbb{R}$	The material payoff of player t. Sums per-interaction payoffs of interactions with players $t-1$ and $t+1$.
u_t	$\mathbb{R}$	Per interaction payoff of player t. See Figure 1.
$r(\theta_t)$	$r(F) < 1 < r(H)$	Type-specific payoff to acting aggressive when another player is conciliatory.
s	$\mathbb{R}_+$	The cost of acting conciliatory when the other player is aggressive (the payoff is $-s$)
Strategies and beliefs		
Model notation	Values taken	Interpretation
σ_A, σ_B	Mixed strategies	Strategies for group A and group B, maps to probabilities of choosing $x_t = a$ and $y_t = a$.
μ_t	$(0, 1)$	Posterior beliefs of player t about $\Pr[\rho_j = \bar{\rho}]$ for the other group
Psychological payoffs		
Model notation	Values taken	Interpretation
b_j^t	Same as σ_j	Player t's conjecture about group j's strategy (for each $j \in \{A, B\}$).
β_t	$\mathbb{R}_+$	Player t's anger as a function of $\tilde{y}_{t-1}$, conjectured strategies, and beliefs about prior actions.
α_j	$\mathbb{R}_+$	Weight placed on psychological payoffs relative to material payoffs for members of each group j.

Note: For functions, "values taken" gives the range of the function.

3. Conjectures and strategies are consistent: $b_t^A = \sigma_A^*$ and $b_t^B = \sigma_B^*$ for all t.

If $\alpha_A = \alpha_B = 0$, then psychological preferences are irrelevant and this definition corresponds to perfect Bayesian equilibrium. Otherwise, the equilibrium concept follows psychological sequential equilibrium which is developed in Battigalli and Dufwenberg (2009) and Battigalli, Corrao, and Dufwenberg (2019). Table 1 summarizes the mathematical notation and interpretation for each quantity in the model.[13]

ANALYSIS

As in Acemoglu and Wolitzky (2014), we assume prior beliefs are favorable enough that Friendly types would choose conciliation when their beliefs are equal to the prior, for instance, at time 0.

Assumption 1. $\mu_0 \leq \frac{1-(1+s)(\pi+(1-\pi)\underline{\rho})}{(1+s)(1-\pi)(\bar{\rho}-\underline{\rho})}$.

Assumption 1 is an upper bound on agents' beliefs. The effect of this assumption is that Friendly types choose conciliatory actions in the absence of negative information about the other group. Otherwise, aggression would be the default action for all players. Assumption 1, therefore, focuses our analysis on cases in which conciliatory actions are possible and anger may affect actors' behavior.

[13] The requirement that conjectures and strategies are consistent is implicit in Nash equilibrium and all of its refinements, though it is not typically stated in this way. For instance, the sense in which Nash equilibrium strengthens dominance as a solution concept is the leap from requiring that players best respond to *some* conjecture about other players' strategies to requiring the players' best respond to *correct* conjectures about other players' strategies. Thus, this requirement imposes correct beliefs in exactly the same way as Nash equilibrium.

Foundational Results

Our first result lays out the structure of equilibria and mirrors results in Acemoglu and Wolitzky (2014).[14] First, Hostile agents are always aggressive. Friendly types prefer to reciprocate conciliatory and aggressive actions so Friendly types match x_t to the result of the previous action. To choose an action y_t toward player $t+1$, Friendly agents t update their beliefs about the probability player $t+1$ is Hostile. If player $t+1$ is likely to be Hostile, then conciliatory actions are unlikely to be reciprocated and the agent should choose aggression. If player $t+1$ is likely to be Friendly, then the agent should try a conciliatory action in hopes of reciprocation. Therefore, Friendly types are conciliatory when the result of the previous action was conciliatory since they believe Friendly types in the other group are more likely. When the result of the previous action was aggressive, Friendly types may be aggressive. Proposition 1 states the result.

Proposition 1. *Under Assumption 1, the following are true of any equilibria:*

- *Hostile types play* $x_t = a$ and $y_t = a$ *at any information set.*
- *Friendly types at any time* $t > 0$ *play* $x_t = \tilde{y}_{t-1}$.
- *Friendly types play* $y_t = c$ *when* $\tilde{y}_{t-1} = c$ *or when* $t = 0$.
- *Friendly types from group* j *choose* $y_t = a$ *with some probability* $p_j \in [0,1]$ *when* $\tilde{y}_{t-1} = a$.

Proposition 1 makes no reference to anger and these results can be explained solely using expectations of material payoffs. This is because anger nudges agents in the same direction as their beliefs: agents are only angry when $\tilde{y}_{t-1} = a$, so anger strengthens the tendency to respond to aggression with more aggression but does not affect actions taken when $\tilde{y}_{t-1} = c$.

Proposition 1 leaves open the question of whether *certain conflict* can occur. Suppose Friendly types from both groups are always aggressive when $\tilde{y}_{t-1} = a$ (i.e., $p_A = p_B = 1$). Then the long-run probability of an aggressive outcome in a particular time period is one: we must eventually observe $\tilde{y}_{t-1} = a$ even if by mistake, after which all players choose $y_t = a$ in every period. Proposition 2, however, shows that this cannot happen in equilibrium.

Proposition 2. *Under Assumption 1 there cannot be certain conflict in equilibrium: some Friendly types must play* $y_t = c$ *following* $\tilde{y}_{t-1} = a$ *with positive probability.*

To explain Proposition 2, recall that two mechanisms cause Friendly types to be aggressive toward the next player following $\tilde{y}_{t-1} = a$. First, an informational mechanism might lead to aggression because Friendly agents update their beliefs that members of the opposite group are Hostile. Second, an emotional mechanism might lead to aggression because an aggressive result causes a Friendly type to prefer punishing the other group. A situation of certain conflict would eliminate both of these mechanisms. The informational mechanism is eliminated because, since players have limited knowledge about the past and the probability of conflict is one regardless of players' types, observing $\tilde{y}_{t-1} = a$ reveals nothing about whether the opposite group is Hostile. Therefore, since this is the only event the player observes, the player's beliefs are equal to her prior which, by Assumption 1, implies she chooses conciliation. The emotional mechanism is eliminated because anger requires a gap between observed and expected outcomes. In a situation of certain conflict, $\tilde{y}_{t-1} = a$ is the expected outcome so it does not generate an angry response.

Proposition 2 demonstrates how our approach to modeling anger constrains agents' behavior. Though anger has the straightforward consequence of making agents more aggressive, the model cannot simply predict any level of conflict in a trivial manner by increasing the influence of anger. This is methodologically useful because it gives the model falsifiable empirical content that also reflects the real-world tendency of conflicts to ebb and flow, pause and recur (Goertz, Jones, and Diehl 2005; Mason et al. 2011). As we will later show in Proposition 4, a simpler alternative approach to modeling anger would not have this key feature.

Effects of Sensitivity to Anger

The next results concern the effects of anger. We show that *both* groups change their behavior when one group is made more sensitive to anger (i.e., when α_j increases for some group j). In applications, we can think of changing α_j in different ways. If trait-based anger varies across individuals (Kassinove et al. 2002; Keys and Yorke 2019) or social groups (Gault and Sabini 2000; Matsumoto, Yoo, and Chung 2010; McDermott 2015; Phoenix 2019), then we can interpret comparative statics on α_j as a way to compare predictions across settings where decision-makers vary according to these traits. In experiments, changes in α_j may be generated by priming treatments designed to induce subjects to think more about anger (Banks and Valentino 2012; Wayne 2023; Zeitzoff 2014). In policy-making settings, variation in α_j may be generated by differences in personality of various leaders (George and George 2019; Horowitz, Stam, and Ellis 2015; Saunders 2011) or of institutional structures that emphasize more centralized decision-making by a single leader versus slow deliberation across a bureaucracy (Greenstein 1967; Hafner-Burton et al. 2017; Powell 2017) which, if the effects of anger depend on quick unitary action, may generate differences in practice in sensitivity to anger. Thus, a flexible interpretation of the model can lend itself to a variety of applications.

Changing a group's sensitivity to anger has two effects on the behavior of the players. First, changing one group's sensitivity to anger directly makes members of that group more aggressive by giving them more

[14] The proofs for all propositions are in Appendices C–F of the Supplementary Material.

punitive preferences when they experience an aggressive outcome. Second, changing one group's sensitivity to anger has an indirect effect on members of the *other* group. This effect runs in the opposite direction: increasing one group's sensitivity to anger makes Friendly members of the other group *less* aggressive. Proposition 3 states the result.

Proposition 3. *Increasing α_j for group j increases the probability that Friendly members of that group choose $y_t = a$ after observing $\tilde{y}_{t-1} = a$ and decreases the probability that Friendly members of the other group choose $y_t = a$ after observing $\tilde{y}_{t-1} = a$.*

Why does increasing one group's sensitivity to anger make the other group less aggressive? It is not because anger necessarily has a deterrent effect (Sell, Tooby, and Cosmides 2009). Rather, our model highlights a different core mechanism for how one side's anger can affect the other's behavior: the information conveyed by aggression from Friendly types. When a player observes an aggressive outcome, they update in favor of the other group being Hostile, and therefore become more aggressive. Now consider an increase in α_A, which makes *Friendly* group A members more aggressive. This reduces the informational effect of an aggressive outcome so Friendly group B members are then less likely to be swayed into aggression through changing beliefs. The other side could have acted aggressively because they were Hostile; but they also could have acted aggressively because they were simply temporarily angry. Furthermore, since increasing α_A increases the likelihood that a group B member experiences an aggressive outcome, aggressive outcomes induce a less severe anger response, as the gap between expectations and outcomes is smaller. Agents *expect* that the other side may be more likely to choose aggression. Both mechanisms lead in the direction of less aggression from one group when the other is known to be sensitive to anger.

We offer four additional remarks on the interpretation of Proposition 3. First, the results track the distinction between intrapersonal effects of anger, which refer to the influence of an emotion on the person experiencing it, and interpersonal, which refer to the effects on individuals with whom the person interacts (Morris and Keltner 2000; Van Kleef et al. 2008). The result also demonstrates a countervailing effect of anger in strategic interactions. When a group is known to be more sensitive to anger, their aggressive actions are more likely to be forgiven rather than retaliated against. One way to think about the direct and indirect effects of anger in our model is that the direct effects are the effects of anger and the indirect effects are the effects of others' *beliefs* about anger. In this sense, it would be unambiguously good for group j if others believed that they are more sensitive to anger. This fits observed deliberate attempts by states to construct certain issues as anger-inducing to preempt confrontation (Hall 2011). Since the results demonstrate that an agent has some benefit from being believed by other players to be susceptible to anger, one may ask whether a Friendly group has an *ex ante* incentive to increase its susceptibility to anger. The answer is no, as Corollary 1 shows.

Corollary 1. *Increasing α_j for a Friendly group j increases the long-run probability that a random member of group j observes an aggressive outcome in the period in which they are active.*

Corollary 1 follows from the proof of Proposition 3 but we provide a separate proof in the appendix for completeness. The reasoning for why increased susceptibility to anger increases the total probability of conflict despite decreasing the likelihood of retaliation by the other group lies in the relationship between the probability of conflict and the likelihood of retaliation. If a player from group A becomes *less* likely to observe an aggressive outcome then she becomes *more* likely to retaliate, both because the aggressive outcome is more informative that the other group may be Hostile and because the aggressive outcome makes her more angry. The same is true for players from group B. What happens then if the value of α_A is increased? Since group A members are more angry, they are now indifferent between conciliatory and aggressive actions at higher values of this probability, which means increasing α_A must increase the likelihood that group A members observe an aggressive outcome. This finding also complements extant empirical research on the consequences of either being too quick to anger (e.g., angry more often) or faking anger in negotiations, which can increase adversary intransigence (Côté, Hideg, and Van Kleef 2013; Wong 2019), though through different mechanisms than we show here.

The reason for the countervailing effects of anger in our model are also distinct from the existing deterrence logic of anger (Sell, Tooby, and Cosmides 2009). In our model, it is not just that being susceptible to anger makes one appear "tougher" (Sinaceur and Tiedens 2006), unpredictable (McManus 2019), less open to compromise (Van Kleef, De Dreu, and Manstead 2004), or prone to aggression (Fessler 2010), but rather, that susceptibility to anger makes it difficult to interpret aggressive actions as indicative of one's type. If a player is certain that another's actions are evidence that they are inherently Hostile, they should expect future aggression regardless of their own actions, and so would likely choose aggression. If, however, the player knows that the other is susceptible to anger, choosing a conciliatory response may induce their opponent's future cooperation.

Another effect of anger in our model is that choices may depend on factors that are irrelevant to material payoffs. For example, Friendly types are more aggressive when $r(H)$ is larger because increasing $r(H)$ increases the benefit that a Hostile player receives from a conciliatory action, which reduces the psychological component of that agent's utility: they do not like to see those who acted aggressively receive a benefit. This cannot happen with no sensitivity to anger: once an agent has the right prediction about how Hostile types will behave, the value of $r(H)$ is irrelevant to the decision.

MODEL EXTENSIONS

Our model makes a number of simplifying and substantive assumptions. Next, we consider how these various analytic choices may affect our results by pursuing several model extensions. Though many extensions of the model are potentially productive for future work, we prioritize analyses that either clarify the consequences of our psychological games framework or respond to key parts of the political psychology literature on anger that are not already addressed by the baseline model.

Comparison to Naive Anger Preferences

A feature of anger in our model is that cognitive appraisals are anchored to expectations. This assumption is rooted in behavioral research findings but also complicates the analysis. In order to show why modeling anger using psychological game theory produces insights that differ from what could be gained by a simpler approach in which preferences are fully exogenous as in a standard model, we compare our model to one that is identical except for this feature.

Thus, consider the following modification to our basic model. The decision utility for player t is

$$u_t(x_t, \tilde{y}_{t-1}) = \mathbb{E}[v_t|x_t, y_t, \tilde{y}_{t-1}] - \alpha_j \hat{\beta}(\tilde{y}_{t-1}) \mathbb{E}[v_{t-1} + v_{t+1}] \quad (3)$$

where $\hat{\beta}(a) = 1$ and $\hat{\beta}(c) = 0$. This model, which we refer to as *naive anger*, requires no deviation from standard game theoretic tools since preferences over outcomes do not depend on conjectures. Rather, players simply get angry whenever they see aggression. However, we highlight one important way in which naive anger cannot capture the same behavior as the more empirically grounded conceptualization of context-dependent anger in our model.

Proposition 4. *There exists* $\alpha^* > 0$ *such that, if* $\alpha_A > \alpha^*$ *and* $\alpha_B > \alpha^*$ *then the long-run probability of conflict is one in the naive anger model.*

Proposition 4 shows that *certain conflict* can occur with naive anger for high enough values of α_A and α_B. As Proposition 2 showed, this is not possible in our main model. Thus, the model of context-dependent anger reaches a different conclusion than the naive anger model on the question of whether anger can cause permanent intractable conflict. Our model is thus more realistic on this point: as Acemoglu and Wolitzky (2014) discuss, even most long and ongoing conflicts are better described by periods of aggression and nonaggression than by constant aggression. This is supported by empirical work on long term rivalries and civil wars. For instance, Goertz, Jones, and Diehl (2005) emphasize a "punctuated equilibrium" pattern to conflicts with significant wait times in between conflicts which depend on the history of the relationship. It is also common to use hazard models to predict the duration of peaceful spells between episodes of conflict recurrence in civil war settings (Mason et al. 2011).

More Information about History

In our main model, we assumed agents have relatively poor information: agents receive a signal of the action taken at time $t-1$ and nothing else. This parallels much of the uncertainty that occurs in real-world conflict. However, in some conflicts—such as in longstanding rivalries or recurrent bouts of ethnic conflict—groups may have more information about the past behavior of their adversaries which could shape behavior. For example, research on collective memories in conflict has showcased the importance of long-distant past actions on present conflict attitudes and behavior (Rozenas and Zhukov 2019; Wayne, Damann, and Fachter 2023).

In Appendix G of the Supplementary Material, we pursue an extension of the model in which agents have more information about the history of play. A key result is that agents' propensity toward aggression may depend on the history of the game in ways that are not rationalized purely by informational effects. For instance, agents who observe no aggressive actions in the past raise their expectations, which strengthens their anger response when a bad outcome is observed. This may happen even if they are fully convinced that the other group is Friendly. For example, after the Wikileaks scandal that publicized U.S. efforts to spy on its allies, German officials reacted with outrage, asserting "There is a palpable sense of betrayal in Germany over this, across the political spectrum, with calls for retaliatory action […] To many, it feels as if post-war German democracy's nurturing elder brother, the United States, turned out to be Big Brother" (Busch 2014). One interpretation of these events is that knowledge that a group is Friendly (or an ally) does not preclude actors from pursuing an aggressive response out of anger, and may in fact make this action more likely.

Concern for Others' Beliefs

In our model, anger is based on beliefs about actions: agents are angry when outcomes are worse than expected for reasons attributed to the actions of other players. Another notion of anger may also have agents consider the intentions of other players as part of their cognitive appraisals (Petersen 2010). This means individuals should be particularly angry when they assess the negative actions against them to be unjust or undeserved (Pillutla and Keith Murnighan 1996) or as violating key values (Hall 2017). For instance, in a security dilemma context, leaders may forgive Friendly types' aggression when they believe it to be defensively motivated due to beliefs the adversary holds about her *own* actions or preferences, but not if aggression is seen as evidence of an adversary's inherently Hostile, territorial-aggrandizing preferences (Jervis 1978).

Along these lines, Battigalli, Dufwenberg, and Smith (2019) provide a model of "anger blaming intentions" in which agents rely on second-order beliefs. In the anger blaming intentions model, an agent's anger depends on how much she expects that other players

believed that they were reducing her payoff when choosing their action. In our model, we can think about the difference as follows: if I perceive the aggressive actions of the other player to be due to their poor character (e.g., they are a Hostile type), this should make agents angrier than if those same actions are attributed to Friendly types who are simply responding to past aggression. Aggressive action by the other side may be seen as more morally justifiable and therefore less anger-inducing when it is attributed to the other side's beliefs. Formally, agent t will be less angry when they believe that player $t-1$ took an aggressive action believing her to be a Hostile type than if player $t-1$ took the same action believing her to be a Friendly type. In Appendix H of the Supplementary Material, we consider this model allowing players' anger to be reduced to the extent that the action could have been justified by the belief that player t was a Hostile type. The results establish that the main insights from the baseline model also hold for a model in which agents have concern for others' beliefs, but that the effect of anger are lessened, since players will be potentially more forgiving of aggression.

Informational Effects of Anger

Our models considered the effects of anger on preferences, but the behavioral literature has demonstrated that anger also affects information processing. Angry individuals may become less receptive to new information (Valentino et al. 2008), more likely to rely on superficial cues (Bodenhausen, Sheppard, and Kramer 1994; Tiedens and Linton 2001), and more susceptible to motivated reasoning (Weeks 2015).[15] Hence, beliefs are tied to emotions, "where emotion constitutes and strengthens a belief and makes possible a generalization about an actor that involves certainty beyond evidence" (Mercer 2010, 2). Angry individuals are more likely to attribute harmful intent to the actions of others and therefore recommend harsher punishment (Goldberg, Lerner, and Tetlock 1999). Attributing negative outcomes to the actions of others can then induce more anger (Allred 2000). Therefore, anger can become self-reinforcing as angry individuals seek out or process more anger-inducing content (Huddy et al. 2021).

In Appendix I of the Supplementary Material, we incorporate the effects of anger on information processing using the modeling framework of motivated reasoning (Little 2019; Little, Schnakenberg and Turner, 2022; Little 2021), but incorporating a psychological dynamic in which anger-based motivated reasoning is only triggered by a deviation from expected payoffs. We show that the main results apply to this case, indicating that context-dependence and increased aggression are the main features that drive the results, rather than whether anger is more likely to affect preferences or information search.

[15] Anger has also been shown to increase risk-taking (Lerner and Keltner 2001), which, in turn can shape policy-making (McDermott 2017), a phenomenon we do not explore in depth here.

CONCLUSIONS AND IMPLICATIONS

We analyzed a dynamic psychological game of intergroup conflict, illustrating how emotions can play a systematic role in shaping diplomacy and political conflict. Our approach, which combines game theoretic tools with insights from political psychology, helps bridge the gap between behavioral studies, which are largely individual, and theoretical modeling, which until recently has relied largely on assumptions that discount a systematic role for emotions in strategic environments. This approach enabled us to explore the strategic implications of becoming angry or facing an angry decision-maker in a conflict context.

We explain various effects of anger on conflict dynamics. In Proposition 1, we demonstrate that increasing anger can increase individuals' incentive to take aggressive action but this effect has limits: anger cannot on its own lead to perpetual conflict since its effect is limited by the expectations of the players. In repeated interactions, once players recognize their opponents are Hostile, they *expect* aggression and do not feel betrayed by it. This suggests that anger on its own is not a sufficient explanation for persistent conflict, bolstering research on, for example, the origins of ethnic conflict that argue that "ancient hatreds" and "ethnic passions" in fact have limited power to explain ethnic violence (Lake and Rothchild 1996). Rather, other strategic aspects of the environment such as uncertainty over type, mistrust and the potential for misperception due to noisy signals act *in concert with anger* to foment or ameliorate conflict.

In Proposition 2, we show how the indirect effect of anger may be to decrease the aggressiveness of another group by reducing the extent to which negative outcomes lead to negative inferences about players' preferences. These results highlight the complex interplay between emotional and strategic considerations in conflict settings. Anger increases the individual desire to punish others and so can engender conflict, but, at the interpersonal level, knowing about *others'* propensity to feel anger may actually trigger more conciliatory behavior that reduces the likelihood of conflict. This parallels other findings regarding potential effects for leaders negotiating foreign policy when they are perceived of as being somewhat "mad" in their preferences (McManus 2019), quick to anger (Wong 2019), or as potentially beholden to angry, domestic constituents (Brandt, Colaresi, and Freeman 2008). However, this strategy is not without risk, as empirical research also suggests that "faking anger" in negotiations is quite difficult to do in practice and may increase the intransigence of the other side (Côté, Hideg, and Van Kleef 2013), perhaps due to their own "psychological reactance" to angry demands (Powers and Altman 2023). In short, anger can foment conflict, but it can also ameliorate it. This work thus highlights an alternative, informational mechanism for the potential

reparative effects of anger on interpersonal and intergroup relationships (Averill 1983; Halperin et al. 2011).

Another innovation of our work is to incorporate behavioral research suggesting that emotional responses are driven by contextual factors that shape expectations. That is, anger is driven by a gap between expectations and observed outcomes. This suggests that, in situations where anger is suspected to drive conflict spirals, the potential remedies may be different from what we may otherwise expect. For instance, in a different context, Lindstädt and Staton (2012) emphasize the role of managing expectations to avoid backlash. This may be a feature of communication strategies during crises, where over-promising may be punished. Similarly, as in Grillo and Prato (2023), actors may be rewarded when they overstate their potential threat and then hold back. Though we do not explicitly model communication prior to action, these strategies may apply here. Furthermore, this way of modeling anger provides a potentially different role for compensation of harms in ameliorating conflict. In our model, compensating harms (say, through side payments) would not necessarily change an agent's beliefs about the motivations of the other group, but could ameliorate conflict by bringing outcomes more in line with expectations. These remedies are potentially fruitful avenues for future work.

More generally, this work demonstrates the value of incorporating empirically grounded assumptions about the emotions motivating preferences into game theoretic models to better understand the interplay between individuals and their strategic environment. While we focus on the security dilemma and other similar applications here, our modeling approach may be productively used for various other applications, such as in the study of protest. Emotions, including anger, are often theorized to motivate collective action in this setting (Pearlman 2013). Existing formal models of protest contrast material versus psychological payoffs primarily with respect to whether or not rewards are rivalrous (Bueno de Mesquita and Shadmehr 2023). For emotions like anger, our work suggests value in a psychological game theory approach to modeling the antecedents of emotional states.

Similarly, though in this paper we explored how one emotion—anger—can affect strategic conflict behavior, other emotions may have distinct effects on conflict dynamics. Fear, for example, is also crucial in conflict contexts. Though fear is also a negatively valenced emotion, it is engendered by different appraisals regarding relative strength and intentionality (Roseman 1996) and, as such, leads to distinct motivations (Wayne 2023), attitudes (Skitka et al. 2006), and information-processing tendencies (Parker and Isbell 2010). Positive emotions like hope (Cohen-Chen et al. 2014) and empathy (Baker 2019) have also been shown to play an important role in conflict settings, but their impact on the strategic choices of actors is not well understood. Exploring the distinct implications of these other core conflict emotions to strategic behavior is thus an important task for future research.

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit https://doi.org/10.1017/S0003055424000078.

ACKNOWLEDGMENTS

The authors thank Avidit Acharya, Pierpaulo Battagli, Taylor Carlson, Martin Dufwenberg, Ted Enamorado, Dana Foarta, Todd Hall, Andrew Kydd, Andrew Little, Christopher Lucas, William Nomikos, Michael Olson, Carlo Prato, Emily Ritter, David Siegel, Dustin Tingley, Steven Webster, Shuren Zheng, and participants in the University of Illinois Political Science Department Seminar, the Stanford University Graduate School of Business Political Economy Seminar, and the Online Peace Science Colloquium.

CONFLICT OF INTEREST

The authors declare no ethical issues or conflicts of interest in this research.

ETHICAL STANDARDS

The authors affirm this research did not involve human subjects.

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