Affective Motivations for Violence in Insurgent Warfare

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Theorists and practitioners of war have long understood that individual acts of violence have both tactical and affective (or emotion-based) motivations. Despite this wide recognition, the lack of measurable non-tactical motives for wartime violence has prevented both empirical and more sophisticated theoretical advances. We draw from psychological research on emotion's effects human judgments and behaviors to develop an affective stimulus theory of political violence. We test the theory by assessing the effect(s) of temperature on the type and frequency of insurgent attacks against international forces during the recent Iraq and Afghanistan wars and, separately, hostile civilian attitudes toward Coalition forces in Iraq. To establish credibly causal estimates, we disaggregate attack types and leverage curfew hours during the war to preclude possible alternative relationships between these variables. We also show that insurgents who engage counterinsurgents in direct fire combat at higher temperatures are more likely to die. The substantive effects of temperature on both insurgent violence, their fatality rates, and hostile civilians attitudes are large. Finally, through this piece, we introduce the U.S. Defense Department's full and official record of Iraq War insurgent violence carried out against American, Iraqi, and other Coalition partners' forces throughout that conflict, heretofore unavailable to members of the academic research community.

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Overview

Violent sub-state conflict[1] is widespread. In 2014, a majority of countries were targeted in violent attacks by non-state actors, and sub-state conflicts are estimated to have cost the world economy roughly $14.3 trillion (Institute for Economics & Peace 2015). Currently, one individual out of every 122 in the world is "a refugee, internally displaced, or seeking asylum" as a result of "persecution, conflict, generalized violence, or human rights violations" (UNHCR 2014).

Although human civilization has over several millennia produced and refined various institutional arrangements that have reduced the level and varieties of violence to which an average individual is exposed during her or his lifetime (Pinker 2011), violent conflict remains a perennial feature of human group interaction. Particular technological innovations raise the possibility that sub-state conflict will persist well into the 21st century. The spread of information and communication technologies have increased the prevalence of sub-state conflict by facilitating the efforts of non-state actors to mobilize against more powerful state opponents (Pierskalla and Hollenbach 2013; Manacorda and Tesei 2016; Diamond 2010), and the proliferation of improvised explosive devices favors rebel organizations facing militarily superior government competitors. This is, in large part, because they pose a "difficult balance-of-costs problems. It is unsustainable [for governments to invest] billions of dollars to fight a technology that costs the other side tens of dollars" (Singer 2012).

Despite the significance of sub-state conflict, much remains unknown about the behavior of its participants – namely, combatants and the civilians they affect. The dominant current of conflict studies treats both groups of individuals as strategic actors whose wartime behaviors result from the pursuit of instrumental politico-military strategies. Yet, research in this field says little about the way in which human psychology – and emotional state specifically

[1] Generally defined as terrorism, civil war, and insurgency.

– shapes their attitudes and behaviors and ultimately conflict processes themselves.

This omission is surprising. Emotion runs high during conflict. Combatants and civilians are often chronically exposed to violence and the threat of death. Wartime destruction leaves many individuals unemployed and forces families to cope without electricity and running water. It is well established in psychology that individuals' affective states[2] alter their cognitive tendencies, specifically affecting their judgments and choices and how they process information (Han et al. 2007; Clore et al. 1994; Schwarz and Clore 1983; Schwarz and Bless 1991). For instance, affective state has been shown to affect a variety of cognitive outcomes including assessments of risk (Lerner and Keltner 2001, 2000); causal judgments (DeSteno et al. 2004); assessments of value (Lerner et al. 2012); and depth of thought (Tiedens and Linton 2001).

In this article, we construct an affective stimulus theory in which affect re-enters the causal chain of violent political action as a separate effect from its role in shaping preferences. Drawing from the literature on emotion referenced above as well as a large body of literature that ties ambient temperature to feelings of hostility and aggression (Anderson et al. 1997; Ranson 2012; Anderson 2001; Dodge and Lentzner 1980; Kenrick and MacFarlane 1986; Reifman et al. 1991; Gamble and Hess 2012; Rotton and Cohn 2000a, 2001; Pilcher et al. 2002; Vrij et al. 1994b; Nathan DeWall and Bushman 2009; Gockel et al. 2014b), we hypothesize and find evidence that during periods of conflict, ambient temperature affects combatants' feelings of hostility and, ultimately, how and when they elect to initiate attacks.

We first demonstrate that Iraqi males' support throughout the Iraq war for violent attacks on the country's multi-national occupying forces varied predictably with ambient temperature. We then show that ambient temperature and actual insurgent violence followed almost precisely the same non-linear pattern, suggesting that temperature's effect on the production

[2]Within the body of psychological research, scholars including (Forgas 1992) consider the terms "affect" and "emotion" as synonyms while others including (Forgas 1992) distinguish between them. Such distinction is unnecessary for this research project, and we, therefore, follow (Forgas 1992) in the use of these terms.

of insurgent violence is mediated largely by affective state. Finally, using data on insurgent violence in Afghanistan, we show that, consistent with expectations, insurgents are more likely to perish in attack they carry out at hotter temperatures.

Finally, through this piece, we introduce the U.S. Defense Department's full and official record of Iraq War insurgent violence perpetrated against American, Iraqi, and other Coalition partners' forces. We also use previously unreleased data from a major, multi-million dollar monthly survey carried out by a local Iraqi survey firm throughout the Iraq War. The survey covered most months of war and elicited responses from some 175,000 Baghdad citizens.

Acts of Violence in Political Conflicts

The dominant current of recent political science treats both combatants and civilians as strategic actors during periods of conflict and presumes that their actions reflect their respective pursuit of rationally calculated political and military strategies. de Mesquita (2013), for instance, conceptualizes insurgents' choice of targets as a rational response to an insurgent organization's environment. Furthermore, a wide variety of scholars have produced empirical evidence consistent with such assumptions (Berman et al. 2011). For instance, Kalyvas and Balcells find strategic and political motivations in violence against non-combatants in civil war settings (Kalyvas 1999; Kalyvas et al. 2006; Balcells 2011). Under this line of scholarship, civilian harm inflicted by combatants that does advance their strategic goals should be rare and, to the extent that it occurs, unintentional. With few exceptions, which come primarily from psychologists who have focused on violent conflict (Bar-Tal et al. 2007; Canetti-Nisim et al. 2009), psychological influences on individuals' behaviors during conflict are, as Gartzke (1999) indirectly argues, relegated to the error term.

Within the literature on terrorism, more attention has been paid to the extent to which this form of violence can be considered a rational tactic in pursuit of goals. One side holds that terrorist violence is purely instrumental and the result of a rational calculation on the part of political actors reacting to their strategic environment (Kydd and Walter 2006; Pape 2006). The opposing view holds that "active terrorists arguably stray from narrow self-interest and rational expectations, and suicidal terrorists probably violate both" (Caplan 2006). Psychologists who have been involved in the rehabilitation of former terrorists propose that there are strong affective components to perpetrating violence against non-combatants (Horgan 2004). Between the two theoretical extremes is the view that individuals join violent groups for affective reasons but perpetuate their groups' strategic goals with instrumental violence. For instance, Posen (1993) and Kalyvas (2003) argue that affective–in this case, ethnic–grievances can motivate strategic behavior.

Strategic and affective violence are of course not exclusive of one another. Scholars have acknowledged the possible dual effect of both instrumental and affective sources of violence in wartime settings without specifying how the two combine. In practice, theories guiding empirical research set aside affective sources of violence as potentially irrelevant and difficult to measure. In Kalyvas' conception, "[p]eople involved in the production of political violence appear to lack the kind of 'extreme' personality features that tend to correlate with expressive violence" (Kalyvas et al. 2006: p. 25). Furthermore, "[i]t is extremely difficult to uncover with an acceptable level of accuracy the individual motives behind violent acts" (Greenstein and Polsby 1975: p. 75). Instead, the literature has given combatants the benefit of the doubt and interpreted their behavior as manifestations of rational behavior in pursuit of their goals.

Such an emphasis on instrumental motivations is misplaced. Human behavior in non-war settings suggests that the manifestation of affectively motivated violence is more common than acknowledged. Some political scientists have embarked on empirical research programs that account for psychological biases, with a focus on the implication for the literature's rationality assumption (Sasley 2010; Ross 2013). McDermott (2004b) argues that affective and strategic behavior sources are not zero sum: "emotion is part of rationality itself, and that the two are intimately intertwined and interconnected processes, psychologically and neurologically" (p. 693). Insofar as emotions (in our terminology, affective factors) have behavioral consequences in the realm of violence, they are the first reason to expect that not all political violence will be purely instrumentally motivated. So far, this research program in the study of politics has focused on affective contributions to the formation of political preferences, rather than the role of affect in shaping short-term behavior.

Furthermore, affective factors have been shown empirically to operate in "least likely" domains. For instance, economic activity is influenced by weather factors for non-agricultural reasons. Measuring cloud cover, Saunders (1993) found that the performance of the New York Stock Exchange was negatively affected by unpleasant weather in New York City. The "economic effect produced is surprisingly large, considering that the weather event that influences the psychological mood is such a minor one" (Saunders 1993: p. 1345). Despite strong economic incentives to make purely instrumental decisions, the psychological effects of weather partially determined traders' behavior.

The role of affect has never been entirely absent from conflict scholarship. Clausewitz argued that hostile feelings must be distinguished from hostile intentions and that the former are incited through the process of fighting (Von Clausewitz et al. 2011: p. 137-8). We suspect that the overwhelming empirical and theoretical emphasis on strategic and tactical motivations for acts of violence stems from the inherent difficulty of measuring affect observationally in conflict settings. It has been an assumption of necessity.

Affect, cognition, and behavior

The role of affective and instrumental motivations in shaping behavior has been understood differently over time and across disciplines. Despite frequent conceptualizations as opposing forces in psychology and political science, affective factors and instrumental motivations are better understood as jointly producing observed behavioral outcomes. Our motivating question concerns the point in the causal chain at which affect and instrumental motivations combine. The political science literature already recognizes the role of affect in preference formation, at the causal chain's origin. We argue that affect re-enters the chain as a separate and non-trivial effect much closer to the behavior's manifestation.

In studies of political behavior, affect has typically been invoked to explain errors and deviations from *correct* or *rational* actions. Mercer (2005) argues instead that *all* acts will have a combination of emotional and cognitive sources. To illustrate with the case of the weather-sensitive Wall Street traders, it would be inconsistent to describe them as affectively motivated on cloudy days and instrumental actors free from such influences on sunny days.

One approach to integrating this finding into political science research has been to acknowledge that both affect and instrumentality combine to produce the preference structures within which human agents will seek to maximize their payoffs. While elegant and minimally disruptive to most theories and methodologies, this superficial form of integration presents limitations for many research areas and returns psychological factors back in a black-boxed version of preference structure production. That may be appropriate in some circumstances. In others, it is tantamount to ignoring these insights into human affect and cognition. As a consequence, this indeterminate conception of their formation makes the resulting preferences so fluid as to be meaningless. If even the most fleeting chemical, biological, or environmental stimulus can shuffle preference orderings, the concept loses its analytical value.

In addition, equating affective influences with preference restructuring creates a problem of inconsistent preferences over time. Individuals may later regret actions taken under the influence of strong affective factors as being inconsistent with their self-identified true preference structure. Therefore, unless individuals purposefully seek out the preference-reordering stimulus (perhaps by consuming alcohol or other drugs before committing violence), we should treat external stimuli that change behavior as a phenomenon distinct from instrumental acts seeking to optimize a set of rational and affective values.

Ambient Temperature as Affective Cause of Violence

Psychologists, sociologists, criminologists, and cognitive scientists have identified a variety of factors that can lead individuals to engage in affective violence. To test whether any of them explain substantively meaningful variations in violence, we require a purely affective explanatory variable whose impact on individuals can be measured robustly.

Of the identifiable non-instrumental sources of violence, ambient temperature offers several methodological and empirical advantages for testing in wartime. First, combatants are invariably exposed to changes in ambient temperature. The vast majority of fighting in wars occurs outdoors, even if available electricity allows some to avoid exposure to battlefield temperatures. Second, in statistical testing, there is no risk of reverse causality. Third, temperature can be objectively and precisely recorded, and temperature records are ample for many conflict settings. Fourth, ambient temperatures vary significantly over time in many settings.

Temperature as a source of violent behavior has been theorized and empirically investigated by psychologists, criminologists, sociologists, and other scholars for centuries (Anderson 1989). The resulting voluminous body of observational and experimental evidence points to a causal effect that is statistically significant, substantively large, and expected to take a specified nonlinear functional form. The temperature-conflict relationship has been identified at many points on a spectrum that spans spontaneous violence amongst individuals up to organized group violence.

Short fuse stimuli: temperature and violence by individuals

The tendency of individuals to behave more violently at higher temperatures has been well established empirically, leaving "little doubt or controversy about the existence of a heat-violence relation in real-world data" (Anderson et al. 2000: p. 67). Anderson et al. (1997) find that temperature is positively correlated with "serious and deadly assault even after time series, linear year, poverty, and population age effects were statistically controlled" while property crime, which is unrelated to ephemeral changes in aggressive tendencies, shows no such covariation with temperature. Ranson (2012) concurs, demonstrating that the effect is immediate and does not persist. Studies that "measure temperature at the exact time that aggressive behaviors occurred" corroborate earlier findings by Anderson (2001) that "[t]emperature has a strong positive effect on criminal behavior, with little evidence of lagged impacts." Criminological analyses of law enforcement records have similarly found that much variation in violent offenses can be explained by temperature (Dodge and Lentzner 1980). Empirical research on aggression–a broader measure than violence–accords with these observational findings (Kenrick and MacFarlane 1986).

While the evidence for the temperature-violence relationship is preponderant, disagreement persists over its functional form. Does every temperature increase bring with it more violence? Or does the effect diminish, possibly even reverse, after a threshold is reached? Gamble and Hess (2012) conclude the latter, finding that "daily mean ambient temperature is related in a curvilinear fashion to daily rates of violent crime with a positive and increasing relationship between temperature and aggravated crime that moderates beyond temperatures of 80°F [26.67°C] and then turns negative beyond 90°F [32.22°C]."[3]

The effects of elevated temperatures on human behavior have also been tested experimentally. Without enabling actual violence by research subjects, researchers test the effect

[3]The main arguments over the functional form are found in Cohn and Rotton (1997), Rotton and Cohn (2000a), Rotton and Cohn (2001), Anderson et al. (2000), and Anderson and Anderson (1984).

of treatments on indicators that are precursors of affective violence. In these laboratory settings, hotter temperatures have been shown to produce increases in verbally reported hostile attitudes, impaired cognitive performance, and experience of generally negative emotional states (Anderson et al. 1995; Pilcher et al. 2002).[4] These experiments have included measures of intermediate steps expected to contribute to the causal mechanism. For instance, Vrij et al. (1994a) demonstrate that police officers discharged more bullets in a shooting simulator at higher temperatures. In a recent experiment, Nathan DeWall and Bushman (2009) find that reference to extreme temperature is sufficient to evoke aggressive thoughts. Similarly, in hotter experimental environments, subjects were more likely to judge a murderer's motive as one of passion rather than as premeditated and calculated act (Gockel et al. 2014a).

In sum, the overwhelming evidence holds that individuals will be inclined to more violence at certain temperature ranges. This makes temperature a purely affective motivation for violence that can demonstrate a non-tactical component of violence, as long as the temperature at the time of the attack was recorded.

Affective Stimulus Theory of Political Violence

Extending the previously recognized role of affect in long-term preference formation, we offer a theory in which affect enters the causal chain a second time as a transient stimulus and a distinct co-determinant of behavior. The magnitude of the behavior change caused by these stimuli–as compared to the baseline expectation of instrumental implementation of long-term preferences–may be slight in individual cases, but nevertheless accumulate, ultimately shaping the nature of political phenomena. We call this the affective stimulus theory of

[4]Humans are not the only organisms that react aggressively to heat. For instance, coral reef fish and sea turtles are more aggressive at higher temperatures (Biro et al. 2009).

political violence.

Sources of violence can be divided into underlying conditions and proximate stimuli. Conditions are more difficult to study empirically because they are often invariant, while proximate stimuli produce timely and potentially measurable changes in an outcome of interest. This is true for both affective and instrumental motivations, but this problem has not inhibited research into the latter to the extent it has with the former. The reason to focus on affective stimuli is that it offers empirical traction. An inherent limitation is that it cannot provide insight into whether affective *conditions* have a substantively stronger effect than affective *stimuli*, or how it compares to instrumental factors.

In the case of violence in insurgency settings, some of the affective stimuli acting on the combatant will make violent behavior more likely, while others diminish this likelihood. Together, affective factors enhancing or inhibiting propensity for violence combine with instrumental factors doing the same, culminating in the observed violent act–or the unobserved restraint. In turn, these individual-level effects aggregate to determine the type and frequency of violence in a war. Depending on the circumstances, this could set the course of conflict by influencing the likelihood of escalation and contagion of conflict or by setting in motion events that lead to a reshaping of preferences for the affected actors.

Affective stimulus theory is concerned with violence in wartime, where combatants have the means and a social license from a relevant reference group to commit violence. Following Kalyvas, it does not assume that every act of violence carried out in a political environment that incentivizes violence is properly classified as a political act. Instead, a proportion of the violence is non-strategic (and not at the direction of the political group) and should not be assumed to be so, let alone taken as an unproblematic revealed preference. Affective stimulus theory further follows McDermott and Mercer in rejecting a binary, either-or relationship between affective and instrumental determinants of behavior. In addition to their role at the beginning of preference formation, we believe that affective factors enter the causal chain a second time at the moment of engagement in the form of a transient stimulus.

This combination of instrumental and affective motivations for violent behavior, both of which may constrain or make violence more likely, is at the heart of the affective stimulus theory. It is congruent with theoretical developments in psychology, where it is no longer assumed that "any particular act of aggression has only one primary goal" (Bushman and Anderson 2001: p. 274). Instead, multiple factors combine in the person and the situation to create the act of aggressive violence (Anderson and Bushman 2002).

The distinction between preference-forming affect and action-shaping affective stimuli can be expressed by example. For the former, people may have their political views shaped by identification with their own ethnic group and act upon those preferences with a variety of peaceful and non-peaceful behaviors, from voting to rioting. However, when deciding to act violently or non-violently in any given moment, affective factors act upon the individual once more. We would expect this to account for much variation in behavior when interacting with members of different ethnic groups.

Literature on the effects of individuals' affective states and on their judgments and decisionmaking provide evidence that affective stimuli are both more pervasive than commonly believed and, importantly, operate on individuals' judgments and behaviors in ways in which they do not recognize. It is well established in psychology that individuals' emotions alter their cognitive tendencies. In addition to affecting judgments and choices, emotions have also been shown to alter the way in which individuals process information (Han et al. 2007; Clore et al. 1994; Schwarz and Clore 1983; Schwarz and Bless 1991).

Importantly, scholars have discovered that emotions predictably influence judgments and choices that are "normatively irrelevant" to the source(s) of such emotions (Han et al. 2007). For instance, as Han et al. (2007) explain, emotions like anxiety, which "[are] defined by appraisals of uncertainty and lack of individual control," affect assessments of risk that are unrelated to the source of anxiety. This process occurs non-consciously[5] and thus typically outside the "control" of rational calculation.

Affective stimuli do not govern human behavior alone because they face a number of constraints and competing influences. Individuals are pushed and pulled to and from certain behaviors by affective and instrumental factors, both of which can originate internally or externally. McDermott (2004a) separates (dis-)incentives for violence: motivations and limits can be endogenous or exogenous to the potentially violent person. Endogenous limits on committing violence include aversion, ability, and ethical reservations. Combatants also face exogenous restraints and incentives. If the act is carried out on behalf of an organization, a portion of the motivation will originate in the group's organizational incentive structure and internal social dynamics.

Theories of group social dynamics have been researched in social psychology and relate to the changes in individual behavior produced through social interactions with other group members (Sullivan 2009: p. 482). In the case of insurgents primed for violence, this would include the difference in the level of expected violence between an insurgent being in position by himself or with other combatants. These social factors could amplify rather than dampen the production of violence.

As a separate group-based category of exogenous variables, combatants face organizational restraints. Study of these dynamics in international relations descend from Allison's organizational process paradigm and includes the factors identified by organizational theories, including the principal-agent problem, operational codes, and internal competitive dynamics (Graham and Zelikow 1971). Shapiro (2013) describes the efforts of organizations employing terrorist tactics to calibrate and control the level of violence perpetrated by their combatants. In a prominent case, an Al Qaeda in Iraq commander was asked to decrease

[5]Indeed, scholars have found that the effects of incidental emotions are diminished when affected individuals are made aware of their cognitive predispositions (Lerner et al. 2015; Schwarz and Clore 1983; Palamarek and Rule 1979).

the level of violence, beheadings in particular, for the sake of the organization's strategic objectives (Shapiro 2013: p. 38).

While these disparate research programs have advanced our understanding of the nature of the affective and instrumental inputs that produce behavior, much remains unknown about their interaction and what the ratio between the two is, and how it changes in reaction to third variables, or at what point stimuli emerge to form conditions. We do not propose to penetrate that black box, but here turn to predictions about changes in behavior expected by affective stimulus theory in response to a purely affective input. We next subject our theory's implications to an empirical test with data from the recent conflict between insurgents and international counterinsurgents in Iraq, where we find that the affective stimulus of temperature shaped the form and frequency of political violence.

To test the implications of the affective stimulus theory, we follow Anderson in the expectation that the patterns in the relationship between temperature and violence suggest that neither the effect of greater opportunity for violent crime resulting from rising temperatures as advanced by Dodge and Lentzner (1980) and Rotton and Cohn (2000b) nor socio-cultural factors fully account for the temperature-violence link (Anderson et al. 2000: p. 68). If ambient temperature affects combatants physiologically, the findings discussed above provide implications for patterns of violence that should be observed in wartime. Instead, temperature appears to act directly on individuals' levels of affective aggression (although they are unlikely to consciously recognize this to be the case), rendering them more likely to act violently.

Contribution of individual-level temperature effects to combat patterns

If the affective stimulus theory of political violence in civil warfare is accurate, we would expect to observe the following in the behaviors of civilians and combatants. First, and most fundamentally, as in non-combat settings, indivduals exposed to or involved in the production of conflict (including but not limited to combatants) should express levels of hostility that vary with their exposure to ambient temperature.

Hypothesis 1 *During periods of conflict, individuals' expressions of hostility vary with ambient temperature.*

Following the large and well established body of evidence in psychology linking affective state to individuals' judgments and behaviors, we expect this hypothesis to be true so long as such individuals' conscious attention is not directed toward temperature's effect on their affective state.

For the remaining hypotheses, because our testing strategy exploits data from an insurgency, they are centered around this particular form of conflict.

Hypothesis 2 *Combatants attack more frequently at higher temperatures.*

The extant literature remains divided over whether violence displays decreasing returns to temperature above a threshold. Laboratory and observational data in support of such a relationship tend to cluster around an inflection point of 32°Celsius.

Hypothesis 3 *Attack frequency increases up to a threshold temperature, above which it decreases.*

Strategic considerations can moderate aggressive tendencies provoked by specific temperature ranges. When carrying out attacks that are closely directed by senior combatants, insurgents should show little or no response to temperature. On the other hand, individual insurgents whose manner of attack provides significant autonomy over decisions such as when and how intensely to engage enemy targets should vary their behavior with temperature.

Hypothesis 4 *Frequency of attack types over which individual combatants exercise discretion varies with temperature; those subject to organizational constraints do not.*

Finally, if elevated ambient temperature prompts combatants to engage in conflict with greater impulse, we expect such behavior to generate greater costs for the aggressing party than it would otherwise incur.

Hypothesis 5 *Attack types over which insurgents exercise significant autonomy are more likely to result in insurgent casualties when carried out at higher ambient temperatures.*

Strategic interaction as alternative explanation

The psychological literature provides a potential alternative explanation for an observed temperature-violence relationship. The skeptical counter-point to observational studies of crime patterns is known as "routine activity theory" and emphasizes the potential for human interaction to turn violent when, as Rotton and Cohn (2000b) argue "contact appears to be a necessary [even if insufficient] condition for violence and aggression" (p. 652). It is plausible that the behavior of insurgents' targets vary with temperature could therefore account for an observed relationship between temperature and wartime violence.

Strategic interactions and physiological effects are not mutually exclusive, but empirically distinguishable. However, one implication of the strategic interaction explanation is that the relationship should only exist for targets whose movement is a function of temperature. As discussed in greater detail below, during the Iraq war, this meant that the movement of the insurgents' targets should not have varied when the civilian population was confined to their homes by a curfew.

Hypothesis 6 *Frequency of attacks varies with temperature at night.*

Empirical Strategy

In this section, we carry out three general sets of tests to explore the relationship between temperature, aggression, and violence during periods of intense political violence. First, although the relationship between temperature and aggression has been well established in previous research, we begin by confirming that this relationship manifests within a conflict setting by exploring the relationship between ambient temperature and attitudes amongst combat-age male citizens in Baghdad during the recent Iraq War.

Second, we test whether insurgent violence varies with temperature in a manner consistent with previous findings linking temperature and violence. This second set of tests involves analyzing the temperature-violence relationship in a variety of ways, all of which are consistent with a causal effect of temperature on violence mediated through psychological response.

Finally, we test whether insurgent attacks undertaken at higher temperatures during the ongoing Afghanistan conflict have been more likely to result in battlefield fatalities for their perpetrators than those undertaken at cooler temperatures.

Data

Before turning identification and statistical testing, we first introduce the primary datasets we use in the subsequent analyses. (Relevant covariates, however, are described in the subequent section on statistical testing.)

Insurgent Violence

Data on insurgent violence comes from three sources. Throughout the Afghanistan and Iraq wars, Coalition forces and their Afghan and Iraqi partners maintained records of significant activities (SIGACTs). These include instances of insurgent violence that engaged Coalition and/or Afghan/Iraqi forces directly (e.g. an improved explosive device (IED) attack on an American patrol) or which these forces observed (e.g. an attack on civilians by insurgents). They also tracked non-violents incidents of insurgent activity such as the discovery of IEDs and weapons caches and instances of hoax IEDs (non-IED objects planted by insurgents but designed to give the appearance of such).

For the ongoing Afghanistan conflict, SIGACTs data was secured and prepared by Shaver and Wright (2016). Although the data covers most years of the ongoing conflict, we utilize data covering the period between January 2010 through October 2014, during which the International Security Assistance Force (ISAF) led by the United States tracked casualty outcomes of violent insurgent engagments with ISAF/Afghan military and police forces.

For the Iraq War, a limited set of SIGACTs data covering the period from February 2004 to February 2009 was released previously by Berman et al. (2011). In 2014, the Pentagon released exclusively to the authors its full dataset of Iraq war SIGACTS, which covers the period December 2003 through the end of December 2011, when the final set of American forces completed their withdrawal from Iraq, formally ending Operation Iraqi Freedom. This dataset, which contains a total of 253,286 observations, has not yet been made public and is being introduced to the academic community for the first time through the publication of this article.

The two Iraq War dataset share many common characteristics but differ in several key respects. Both dataset include the precise, georeferenced location of each recorded insurgent attack (expressed in military grid reference system (MGRS) coordinates). Thus, the location of each attack can be identified within several meters of accuracy. Second, both datasets include the date on which each such attack occurred as well as the general category of attack (direct fire, indirect fire, or improvised explosive device).

Yet, the datasets differ in ways that are central to the empirical tests later introduced. First, the first set of data released includes precise details on the specific weapons type used in attacks carried out against Coalition and Iraqi forces. Thus, for instance, an attack perpetrated by an insurgent using a rocket-propelled grenade is identified as such in addition to being assigned to the more general classification of "direct fire". (Attacks using rifles and other small arms would also, for instance, qualify as direct fire attacks.) Unfortunately, this more specific attack-type description is absent from the complete Iraq War dataset. However, the second dataset contains two key variables that the first does not. Specifically, the actual time of insurgent attack is recorded. Often these entries are specific to the actual minute of attack. Additionally, the full dataset includes previously unreleased details on the target of attack. Frequently identified targets of attack include bases, convoys, patrols, observation posts, and traffic control points.

Civilian Attitudes

Survey response data reflecting civilian attitudes toward the use of violence and a wide variety of other topics was collected by the Independent Institute for Administration and Civil Society Studies (IIACSS), a local survey firm operating under U.S. military contract, throughout the Iraq War. The survey initiative solicited responses from approximately 175,000 citizens who reside across Baghdad's ten neighborhoods (technically, *mahalas*), themselves divided into 467 survey blocks (depicted in Figure 1). The firm collected a very wide variety of data on respondent attitudes and demographics including, most notably, their attitudes toward the use of violence against American forces. The data was first introduced by Klor et al.

Figure 1: Insurgent Attacks Plotted Against IIACSS' Survey Blocks in Baghdad City (2016).

Identification and Testing Strategies

Temperature and Aggressive Ideation During Conflict

If temperature's effect on violence that has been identified in various settings is driven by changes in perpetrator hostility, then a corresponding relationship between ambient temperature and this variable should also be observed. The detailed IIACSS survey data provides an opportunity to empirically test this expectation. In particular, we expect that when indicating whether they support violent attacks on American forces, respondents are more likely to answer in the affirmative at higher ambient temperatures.

Specifically, we test following equation using both ordinary least squares and bayesian logistic regression to generate an association between Baghdad's recorded daily high temperature and citizen support for violent attacks on Coalition forces in the country: $P(Y_i = 1|T_j, S_i) = logit^{-1}(\alpha_i + \beta T_{t,i} + \gamma Z_i + \psi V_{j_i,k_i} + \rho_{j_i} + \upsilon_{k_i})$. We also test the following non-monotonic specification to allow for declining support for violence at particular temperatures: $P(Y_i = 1|T_j, S_i) = logit^{-1}(\alpha_i + \beta_1 T_{t,i} + \beta_1 T_{t,i}^2 + \gamma Z_i + \psi V_{j_i,k_i} + \rho_{j_i} + \upsilon_{k_i})$.

Because we seek to assess the effect of temperature on aggressive ideation amongst individuals most representative of combatants, we let i represents male respondents $\{1, \ldots, p\}$ of fighting age. j and k denote Baghdad neighborhoods $\{1, \ldots, q\}$ and month of response $\{1, \ldots, r\}$, respectively.[6] $Y_{t,i}$ is a binary indicator assigned a value of 1 for respondents who answer affirmatively the question "Do you support attacks against: Multi-National Forces?" and a value of 0 otherwise.[7] Daily temperature high is denoted $T_k \in \mathbb{R}$. Z_i is vector of individual respondent controls and include each respondent's reported income, education level, age, and household size. Neighborhood fixed effects conrol for time-invariant characteristics specific each neighborhood. Similarly, by absorbing across-time variation, month-of-response indicators reduce potential bias by permitting estimates of interest to be derived on the basis of within-month date variation.

Predicted probabilities of support for attacks on Coalition forces for the range of weekly hours indicated worked observed within the study data are calculated $\mu = 1/n \sum_{i=1}^{n}$

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[6]Month fixed effects are used intstead of week fixed effects because, given that surveys were carried out during fixed periods during each month of the survey, there is limited within-week variation in survey responses that can be compared. Nevertheless, estimates on temperature and temperature squared in a week fixed effects model are statistically significant at the 99% level.

[7]Although direct questions on sensitive topics can elicit biased responses, we are not particularly concerned in this case. First, respondents were permitted to provide an answer of "Don't Know" to this question. Even with this option, more than 50% of participants nonetheless provided a direct ("yes" or "no") answer to the question. Thus, there is no indication that respondents sought to avoid answering this question. Second, although American forces financed the initiative, IIACSS' Iraqi enumerators introduced themselves to respondents as unaffiliated researchers, which should have alleviated concern over the destination of the survey data. Finally, and perhaps most importantly, even if respondents feared answering this question because of possible retaliation by Coalition/federal government forces or insurgents, this should result in a shift in the baseline response but not in changes in response to temperature level.

$(e^{(X_i^T \phi)} / (e^{(X_i^T \phi)} + 1))$ $\forall$ work hours $h \in [50 \text{ and } 116]$. Confidence intervals at the 95% significance level are generated using quasi-Bayesian Monte Carlo simulation.

We carry out a second test to check the results of this exercise. Although survey respondents were interviewed in their houses, the general lack of electricity throughout the Iraq War ensures that for most respondents, daily measures of ambient temperature closely approximate actual temperature levels to which individuals were exposed during interviews. However, wealthier citizens were more likely to have access to private generators and fuel with which to power fans or air-conditioning units, amongst other household appliances. We, therefore, expect that in replicating this exercise with a subset of respondents that excludes those who report the highest income levels, results should intensify (because the inclusion of wealthy citizens in the original sample may have attenuated results if these individuals were not actually subject to the treatment).

Because coefficients of interest in generalized linear models may be biased by the inclusion of fixed effects, we also test the equivalent linear probability models, clustering standard errors at the neighborhood. More stringent tests in which in which survey block (a small geographic unit of identification) and week fixed effects are substituted for neighborhood and month fixed effects.

Temperature and Wartime Violence

Highly detailed data on insurgent violence collected from the urban centers of Baghdad and Basrah by U.S. forces during the recent Iraq war paired with data on temperature and relevant covariates provides an opportunity to empirically test the hypotheses relating temperature to insurgent violence. Covariation in daily insurgent attack and temperature levels can be evaluated to determine whether insurgents undertake greater numbers of attacks on hotter or cooler days. If such a relationship exists, we can further establish whether its estimated functional form is linear or curvilinear (hypotheses 2 and 3).

Whether attacks over which individual combatants exercise significant discretion vary with temperature while those subject to organizational constraints do not (hypothesis 4) can be identified by exploiting variation in daily temperature and insurgent attacks in which specific weapons are employed. Weapons employed by insurgents during the Iraq war varied in their characteristics, which can be divided into two general classes for this purpose.

The first class is mobile weaponry. It includes small arms, rocket propelled grenades (RPGs), and hand grenades. Insurgents enjoyed significant discretion in the use of these weapons, which are designed to be fired by a single individual and are accordingly small and mobile. They can be rapidly and, in the case of small arms, repeatedly directed against both stationary and mobile targets. While these weapons can be employed during highly coordinated offensive measures such as planned ambushes, their use was not restricted to such organizational engagements during the Iraq conflict. If individual combatants are influenced by temperature as posited by the affective stimulus theory, temperature and frequency of these labor-intensive attacks should covary.

The second class is strategic weaponry, encompassing mortars, vehicle-borne improvised explosive devices (VBIEDs), suicide vests, and other weapons whose use was usually strictly governed by the insurgent organization operating in Iraq. Unlike mobile weaponry, many of these are single-use and, especially in the case of car bombings and suicide vests, are typically used in highly planned operations in which the location and timing of the attack are determined in advance by senior combatants. While an individual combatant will ultimately exercise responsibility for the detonation, this discretion exists within narrow temporal and geographic bounds proscribed by operational planning.

The simultaneous bombings of the United Nations' headquarters, Jordan's embassy, and Iraq's parliament were all perpetrated with such weapons (Roberts 2003; bbc 2003, 2007). Mortar fire in and around Iraq's major urban areas was also constrained in a way that small arms fire was not. Lethal Coalition counter-mortar measures forced combatants to plan their attacks carefully in order to avoid detection. Mortar operators also typically worked in teams, so no single individual exercised sole discretion over when to fire. If temperature acts on the production of insurgent violence by affecting only individual combatants, the frequency with which such organizationally constrained attack types are employed should not vary with temperature, except perhaps through unmeasured covariates.

Multiple strategies can determine whether an observed relationship between temperature and the intensity of insurgent violence is explained exclusively by routine Coalition movements. First, during the Iraq conflict, improvised explosive devices (IEDs) were frequently directed against moving targets. If changes to the behavior of the targets of violence account for observed covariation in temperature and violence levels, daily IED frequency should vary directly with temperature.

A second approach exploits information about the timing of the insurgent attacks. During daylight hours, troops observing a population-centric counterinsurgency doctrine would seek contact with civilians. If civilians were more likely to gather in public places in particular temperature ranges, counterinsurgents may be expected to have left their forward operating bases during such periods, rendering themselves more vulnerable to attacks. However, nighttime Coalition patrols in and around Baghdad are unlikely to be correlated with temperature. First, a nighttime curfew was in effect in Baghdad for the entirety of the study period. Civilians found in violation faced the potential use of deadly force by Coalition forces. Mansoor (2008) describes the dangers civilians violating curfew faced:

> "A squad from Task Force 1-37 Armor established an observation post to look for enemy vehicles attempting to plant IEDs along Abi Talib Street in al-Shaab. A vehicle, in violation of the curfew... approached at high speed. The sergeant in charge ordered his soldiers to stop the car. The problem was that the car was going 60-70 mph and the squad lacked means of halting it... The soldiers, believing they were under attack, opened fire. A woman and her teenage daughter were killed; the father and his two sons wounded. It turned out that the family was heading to the hospital to get treatment for one of the boys, whose asthma had flared up."

Nighttime counterinsurgent patrols in the city are therefore highly unlikely to have varied with civilian movement, which itself was highly constrained. Second, supply convoys traveling at night, which accounted for much of the counterinsurgent's nighttime activities, did not vary their activities with temperature. Quite the opposite occurred: the relatively slow moving vehicles that made up these convoys were susceptible to IED attacks, and convoy operators were therefore directed by the military to "[vary] routes and times" as a means of evading such attacks (Center 2005).

Following the strategic interaction explanation, nighttime attacks should not vary with temperature because patrol movement is effectively held constant. However, nighttime temperatures vary across time and Iraqi insurgents remain active at night. Affective stimulus theory would therefore predict variation in attacks and temperature at night. Importantly, a finding that temperature and nighttime attacks remain correlated in Baghdad over the study period would lend direct evidence in support of the affective hypothesis.

Each theory's respective observable implications diverge in their expected association between temperature and attack types directed against military forces on patrol. Provided that both dynamics do not operate concurrently, only one of these identified differential effects should emerge. However, if both dynamics are at play, because small arms fire was often directed against patrols, then only evidence in support of behavioral target changes can be identified. Table 1 summarizes the expected changes in the frequency of attacks over which individual combatants exercise significant discretion and IED attack given the existence of either or both theories.

Effect type	Affective Stimulus	$\neg$ Affective Stimulus
Strategic Interaction	Δ IA, Δ PA	Δ IA, Δ PA
$\neg$ Strategic Interaction	Δ IA, $\neg$ Δ PA	$\neg$ Δ IA, $\neg$ Δ PA

Table 1: Observable Implications
(Individual and patrol attacks are denoted IA and PA, respectively)

Day-Level Analysis

Using ordinary least squares regression, we estimate the relationship between incidents of insurgent violence and temperature with an autoregressive model. A series of alternative model specifications are introduced to test alternative hypotheses that might account for an observed temperature-violence relationship as well as to test the robustness of these primary model results. Specifically, we test the following linear and quadratic equations:

$$Y_{t,i} = \vartheta D_{t,i} + \sum_{j=1}^{m^*}(\alpha_j Y_{t-j,i} + \beta_j D_{t-j,i}) + \varrho' V_{t,i} + \upsilon_v + e_{t,i}$$

$$Y_{t,i} = \vartheta D_{t,i} + \varphi D_{t,i}^2 + \sum_{j=1}^{m^*}(\alpha_j Y_{t-j,i} + \beta_j D_{t-j,i}) + \varrho' V_{t,i} + \upsilon_v + e_{t,i}$$

where t, v, and i denote days $\{1, \ldots, m\}$, weeks $\{1, \ldots, n\}$, and cities $\{1, \ldots, p\}$, respectively. Logged per capita insurgent attacks using mobile weaponry are denoted by $Y_{t,i} \in \mathbb{R}^+$ (Berman et al. 2011).[8] Daily temperature highs are given by $D_{t,i} \in \mathbb{R}^+$ (National Climatic Data Center).[9]

While the distributions of incidents of insurgent violence and per capita incidents of insurgent violence are both positively skewed, that of logged per capita attacks is less so and is therefore used in the primary specification. Because temperature is serially correlated, to account for the possible influence of correlation between previous temperature values and that of present violence, the vector $\sum_{j=1}^{m^*} \beta_j D_{t-j,i}$ is included in the model. Similar logic applies to previous violence values, which may affect the levels of violence insurgents produce in the

[8]Because many observations take a value of 0, we log the per capita incidents after adding one to the variable.

[9]Attacks can also be measured in counts, we, therefor, also use quasi-poisson and negative binomial regressions to generate associations between the variables of interest. The primary estimating equations are: $E(Y_{t,i}| \sum_{j=1}^{n} Y_{t-j,i}, D_{t,i}, V_{t,i}) = e^{(\sum_{j=1}^{n} \varphi_j Y_{t-j,i} + \beta D_{t,i} + \xi V_{t,i} + \phi_v)}$ and $E(Y_{t,i}| \sum_{j=1}^{n} Y_{t-j,i}, D_{t,i}, V_{t,i}) = e^{(\sum_{j=1}^{n} \varphi_j Y_{t-j,i} + \beta D_{t,i} + \gamma D_{t,i}^2 + \xi V_{t,i} + \phi_v)}$. Modified specifications of the equations test hypotheses 3 and 4. Mean expected counts of insurgent violence for the range of annual average temperature values observed in the study data are calculated as follows: $\mu = 1/n \sum_{i=1}^{n} (e^{(X_{t,i}^T \phi)}) \ \forall \ d \in$ [5°C and 50°C], where $X_{t,i}^T \phi = \varphi Y_{t-j,i} + \beta D_{t,i} + \xi V_{t,i} + \phi_v$. We generate confidence intervals at the 95% significance level with a quasi-Bayesian Monte Carlo simulation.

present period, which is captured by the vector $\sum_{j=1}^{m^*} \alpha_j Y_{t-j,i}$. The value m^* is selected amongst possible lag lengths m that minimizes the Bayesian information criterion score.

Week fixed effects minimize possible omitted variable bias that the controls themselves do not eliminate. Because model estimates may be biased by including lagged values of the dependent variable and spatial fixed effects (Angrist and Pischke 2008), we do not include a city indicator. As a robustness check, we replicate model results using a city-week fixed effects model that excludes lagged values of insurgent violence.

Finally, the vector $V_{t,i}$ contains time-variant, city-level control variables, including the number of U.S. battalions deployed (Lee 2012). The remaining variables are described in turn. The nature of the relationship between temperature and violence levels precludes simultaneity, and a causal interpretation is valid so long as no omitted variables bias estimates of ϑ. Variables of concern and the method for dealing with each are described in turn:

Hours of Daylight: Longer days are warmer. To account for the possibility that more (or fewer) attacks occur in warmer weather because greater numbers of daylight hours affect insurgents' opportunity to attack, we include daily daylight hours in the model (Astronomical Applications Department).

Meteorological Conditions: Some insurgent tactics may be influenced by weather patterns related to temperature. For instance, mortars are affected by air density, as well as wind speed and direction (Manual). Sandstorms reportedly provided cover to insurgents firing rockets and mortars against Coalition positions in Baghdad (Samuels 2008). Vector $V_{t,i}$ therefore includes data on visibility ("mean visibility for the day in miles to tenths"); wind speed ("[m]aximum sustained wind speed reported for the day in knots to tenths"); and precipitation (total "rain and/or melted snow... reported during the day in inches and hundredths") (National Climatic Data Center; Manual).

Hours of Power: Temperatures in Baghdad and Basrah reach extreme highs. During the study period, maximum temperatures extended into the low 50s°C. As temperatures increased, especially at such high levels, electricity demand for cooling is likely to have increased concurrently. The Iraqi Government and its Coalition partners were unable to maintain a regular supply of electricity during the study period.[10]

Community dissatisfaction with the government's inability to supply electricity, particularly during warmer periods when lack of electricity may have been most salient, may have facilitated an increase in insurgent attacks either by either diminishing the willingness of community members to share intelligence about insurgents with Iraqi and Coalition forces or by increasing their motivation to participate in the insurgency. To contend with this possibility, the number of hours of power supplied per day is also included in $V_{t,i}$.

Seasonal Factors: Early findings associating ambient temperatures with violent crime levels were initially challenged on the basis that seasonal factors might account for statistical results: "temperatures are highly related to seasonal events such as vacation time, students being out of school, and alcohol consumption, events that might influence crime rates" (Anderson 1987). While patterns of alcohol consumption are not appreciably relevant to patterns of insurgency in predominately Muslim Iraq, whether schools are in session may be one such confounding factor. There is some evidence from modern insurgencies that students in recess are recruited to assist insurgents (O'Connell and Benard 2006; Ki-moon et al. 2013). Nor can we discount other seasonal factors whose possible salience is not readily apparent. Because the model includes week fixed effects, inferences are drawn only through within-week comparisons and should not be affected by any such long-run processes.

Finally, to account for possible remaining serial correlation amongst the residuals, standard errors presented are both heteroskedasticity and autocorrelation consistent.

[10]This was a consequence of various factors. Sanctions imposed on Saddam Hussein's regime led to the deterioration of the national grid. Further damage was inflicted upon the electrical system during the U.S. invasion and subsequent insurgency when electrical infrastructure became a strategic target.

Hour-Level Nightime Analysis

A stricter testing strategy involves exploiting data on time of attack to asses whether the hypothesized temperature-violence relationship manifests at the hour-level during nighttime curfew period in Baghdad. Although testing the hypothesis on this more limited set of data limits the external validity of estimates, such approach is the most likely to capture a causal effect of temperature on violence. In particular, temperature is hypothesized to affect aggression very quickly. Adopting the hour as the unit of analysis allows us to test for near immediate associations between temperature and violence. Furthermore, in this approach, by including day fixed effects, inferences are drawn from hourly comparison within single days. Finally, by restricting the sample to Baghdad's curfew period, civilian movements that might otherwise affect insurgent targeting are effectively held constant.

Similar to the day-level analysis, we test the following equations using count models[11]: $E(Y_h^t | \sum_{j=0}^{23}(Y_{h-j}, D_h, M_h')) = e^{(\sum_{j=0}^{23}(\alpha_j Y_{h-j} + \vartheta_j D_h + \beta_j M_h') + \upsilon_d)}$, where h and d denote hour of the day and date, respectively. Insurgent violence given by Y. (t denotes violence type: $\{All, DirectFire, IndirectFire, IED\}$.) D denotes mean hourly temperature. M is vector of meteorological variables. For violence subset models, $\sum_{j=0}^{23}(\beta_j OtherTypes_h')$ is included as control.

Incidence of Insurgent Casualties

Finally, to test whether insurgents are more prone to suffer casualties when they carry out attacks at higher ambient temperatures, we use both ordinary least squares and bayesian logistic regression. We use the estimating equations presented in the preceding day-level analysis, with several key differences. First, we adopt individual insurgent attacks as the

[11] At the hour level, the data are highly skewed to observations of 0. Thus, unlike in previous tests, linear probability models are unlikely to be appropriate in this case.

unit of analysis. Second, we replace the outcome variable with the incidence of insurgent casualties. Finally, observations are drawn from violence carried out in any of Afghanistan's fifteen most violent districts, which account for approximately half of all ISAF-documented violence that has occurred in the country during the ongoing conflict.[12]

Results

Overview

We find overwhelming evidence that ambient temperatures affect both expressed hostility amongst individuals in combat settings as well as the actual production of violence during conflict. Remarkably, the relationship between temperature and both expressed hostility amongst male Iraqi citizens and the actual production of violence by the country's insurgents are extremely similar. Both expressed hostility and insurgent attacks over which combatants exercise significant individual discretion increase in ambient temperature. For temperatures above the nineties, both attitudes and attacks descrease consistently.

Temperature and Expressed Hostility

In both the monotonic and non-monotonic models, ambient temperature and support for the use of violence against Coalition forces in Iraq are positively associated. In the latter, however, attack support appears to diminish above temperature in the nineties. These results are presented in Figure 2.

Furthermore, as expected, this relationship is dependent upon income level. When all fighting-age male respondents are included in the sample, irrespective of stated income level, results are attenuated both in terms of statistical and scientific magnitude. However, when

[12]We limit the set of observations we use to these districts because temperature data is not available for all areas of the country.

those individuals who indicate earning $300 per month or more (roughly, the top quarter of respondents) are excluded from the analysis the results are more pronounced (see also Figure 2.) The result is consistent with the expectation that a temperature-hostility relationship might not be observed or might be attenuated if individuals with the highest income levels and, therefore, the most likely to have access to fans, air conditioners and the fuel and generators needed to run them.

Temperature and Insurgent Violence

Day-Level Results

The primary regression returns a negative but statistically insignificant association between temperature and insurgent violence perpetrated with mobile weaponry (Table 2). The quadratic specification is highly significant in all models, and the estimated relationship is consistent with hypothesis (2): returns to insurgent attacks are positive for temperatures below approximately 30°C, and negative at temperatures above that value.

This finding is particularly striking given how closely it matches the pattern of violent crime and temperature identified in previous research (Gamble and Hess 2012). Such finding is precisely what would be expected if temperature influences patterns of observed violence through direct effects on individuals who, themselves, react in a consistent and predictable fashion. This phenomenon is observed in Dallas, Texas, where temperatures are nearly ten degrees cooler, on average, than Baghdad and Basrah, and it is apparent from our results.

The magnitude of the reported effect is significant. Holding all other factors constant, for temperatures below roughly 30°C, approximately one additional attack is associated with every two degree temperature increase (Figure 3). Above this threshold, this relationship is effectively reversed. Importantly, however, because weapons over which combatants exercise significant discretion were frequently used in complex and highly planned operations during

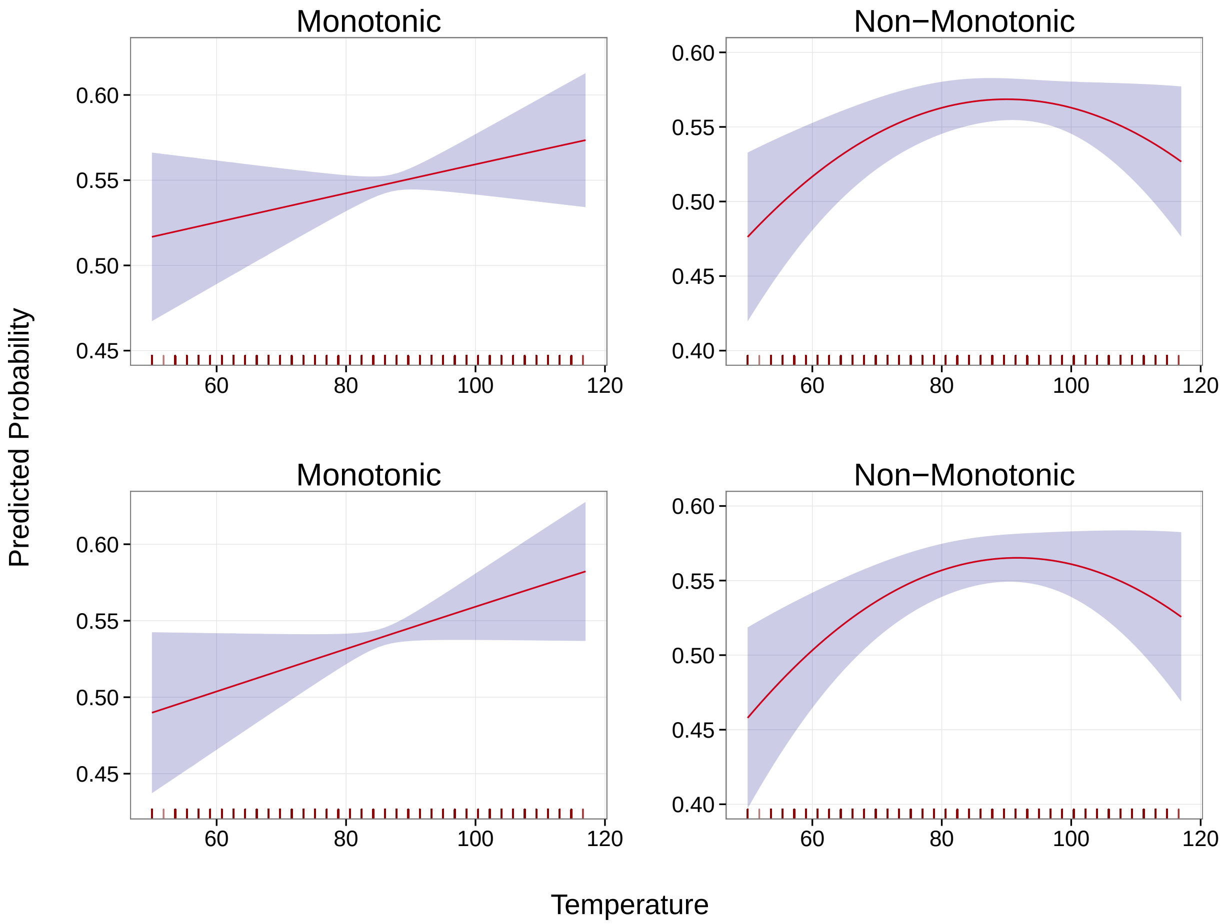

Figure 2: Predicted Probability of Expressed Support for Violent Attacks on American Forces Amongst Baghdad Citizens During the Recent Iraq War. Monotonic and Non-monotonic Model Results are presented in the columns one and two, respectively. Row one results are based on all sampled respondents. Row two results are based on the subset of respondents who report household income of less than $300 per month. (95% Confidence Intervals)

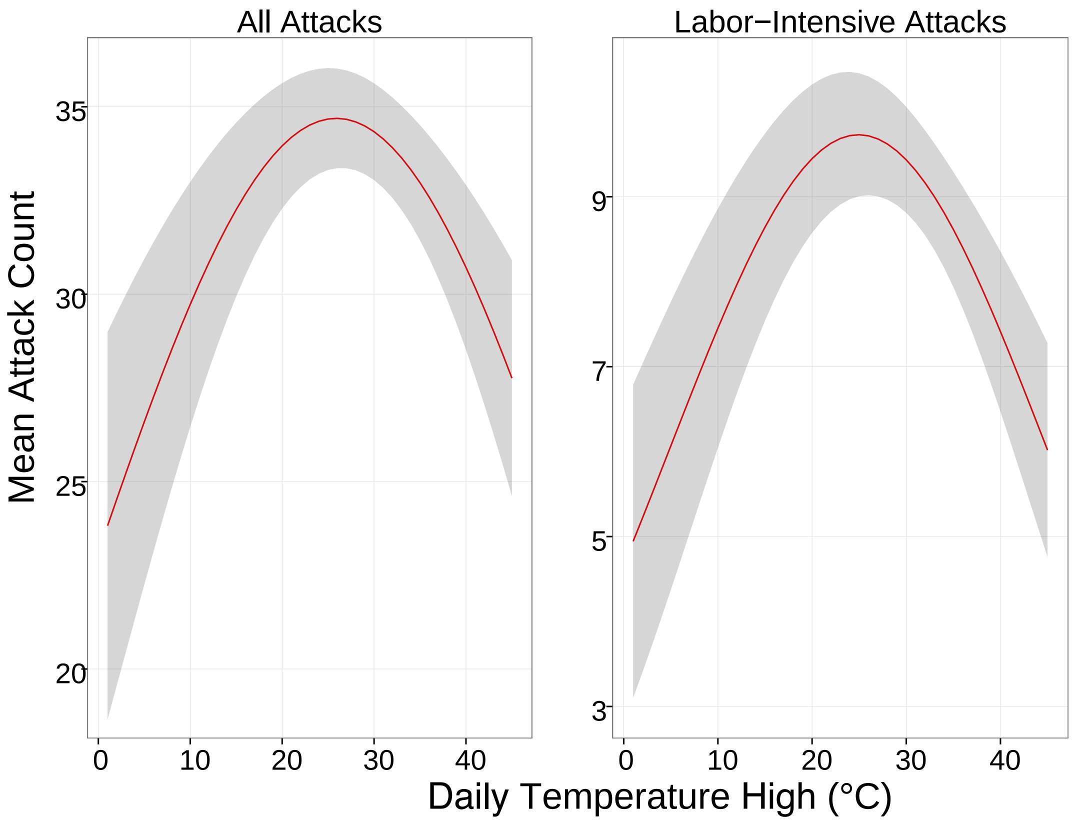

Figure 3: Mean Expected Daily Number of Attacks and Temperature (95% Confidence Intervals)

the Iraq war, results relating temperature to patterns of insurgent violence carried out with mobile weaponry are likely attenuated. Thus, as significant as this relationship appears, there is reason to suspect that it is in fact greater.

Results with attack-specific data are consistent with the affective stimulus theory (Table 1). While attack types over which individual combatants exercise the greatest levels of operator discretion are significantly associated with temperature (Column 4), strategic attacks are uncorrelated with temperature (Column 3). The results do not reflect expectations under the strategic interaction explanation. Incidents of IED attacks are uncorrelated with temperature (Column 5). Furthermore, nighttime incidents of insurgent violence are strongly associated with temperature (Column 7). Results are robust to removing outlier observations (Table 5) as well as with quasi-Poisson and negative binomial regression (Tables 3 and 6, respectively).

Hour-Level Results

Hour-level results are also consistent with expectation. Direct fire attacks are estimated to increase with temperature while other attack types are not. Unlikely the day-level analysis, the linear specification in statistically significant while the quadratic specification is not. This is not surprising, given that nighttime temperatures are consistently well below same-day daytime temperatures. Thus, the extreme temperature values associated with both declining hostility and violence at the day level are not realized in this sample. These results are presented in Table 4.

Temperature and Incidence of Insurgent Casualties

As expected, incidence of insurgent casualties in direct fire engagements increase in ambient temperature while these incidence for IDF and IED engagements do not. Insurgents who engaged ISAF and/or Afghan government forces in direct fire combat at higher temperatures were more likely to die than those who did so at cooler temperatures.

In moving from the coolest operating temperatures to those within the nineties, the predicted probability of insurgents suffering at least one fatality for a given attack increases

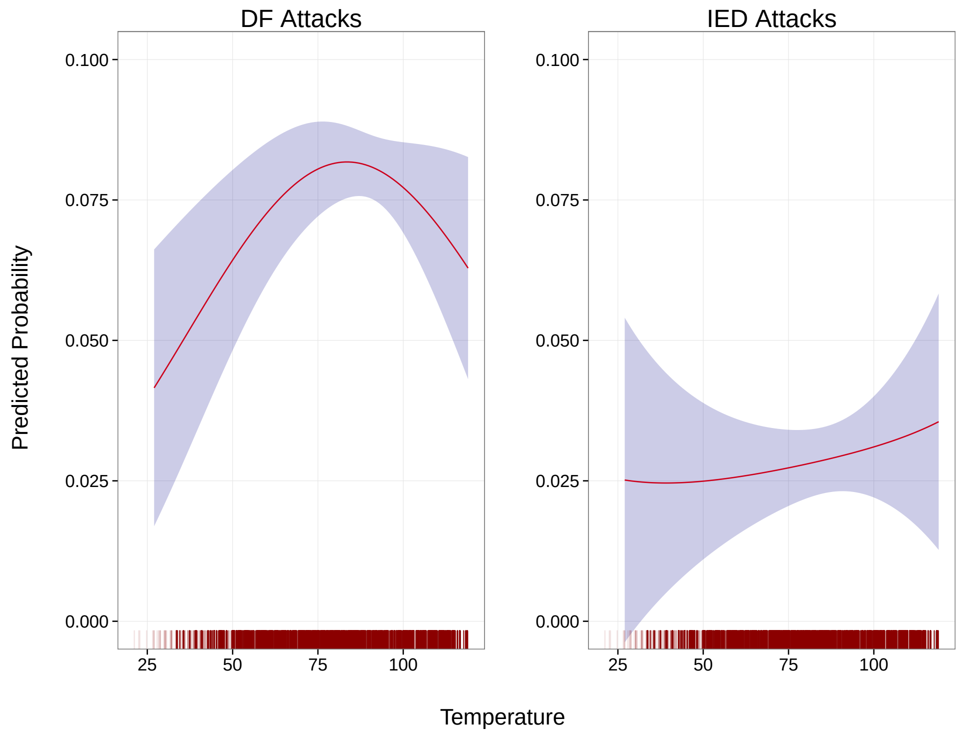

Figure 4: Predicted Probability of One or More Insurgent Casualty for a Given Direct Fire Engagement with ISAF/Afghan Government Forces and Temperature (95% Confidence Intervals)

by approximately 4% (Figure 4). (See also Tables 5 through 7.) In Afghanistan, where ISAF forces have documented approximately 50,000 incidents of direct fire attacks during the ongoing conflict, this relationship suggests that a substantial number of Taliban fighters have been affected.

More importantly, however, the finding provides yet another piece of evidence consistent with a direct psychological effect of temperature on conflict.

Scope

Several notes on scope are warranted. Assuming that entry into and exit from an insurgent organization requires more than 24 hours, the study's design allows us to draw inferences about the *intensive* margins of violence as a function of daily temperature. We measure changes in the frequency of attacks carried out by a fixed number of insurgents that are already willing to, and capable of, committing violence against their adversary.[13] Because our theory is unrelated to the recruitment of new fighters to violent organizations or previously peaceful groupings opting for violent tactics, we do not not measure *extensive* marginal effects.

The case-specific nature of the data raise questions relating to the external validity of these findings. The events recorded in the database reflect the actions of an insurgency in a highly asymmetric contest with counterinsurgent forces. If anything, we would expect temperature's effect on insurgent violence to be less pronounced in such asymmetric situations, where counterinsurgents with access to airpower, heavily armored vehicles, and precise artillery might force insurgents to adopt a greater level of discipline than they otherwise might in more symmetric conflicts. Furthermore, sampling from Iraq's major urban settings serve as a hard test for the affective stimulus theory: that such results obtain in a setting with extreme average daily ambient temperatures (an average above 32°C) and are nevertheless consistent with findings connecting temperature and violent crime in areas where such temperatures tend to be much lower suggests that the theorized phenomenon is not an artifact of particular settings but instead a consistent feature of anthropological violence.

As with the observational psychological research that established the temperature-violence connection, we test the wartime relationship in urban settings in Iraq and Afghanistan. Rural combat dynamics may vary, making it difficult to control for the possibility of a tactical incentive to adjust attack patterns to ambient temperature.

[13] An individual can carry out an attack without organizational support, but the odds of operational success are smaller.

Long fuse conditions: temperature and group violence

The findings about short-term motivations for violence provides microfoundational evidence for the observed long-term link between climate and violence. The current debate on temperature and group conflict emerged largely with the finding that hotter annual temperatures are associated with increased civil war incidence in sub-Saharan African states (Burke et al. 2009). Hsiang et al. (2013)'s meta-analysis of studies on the link between violence and climate extends this finding. Incorporating the results of 60 prior studies, they find that "for each 1 standard deviation (1σ) change in climate toward warmer temperatures or more extreme rainfall, median estimates indicate that the frequency of interpersonal violence rises 4% and the frequency of intergroup conflict rises 14%" (p. 1).

This line of inquiry frequently assumes that the effect works through temperature's economic effects, especially agriculture. However, these do not account fully for the observed temperature-conflict link. Bollfrass and Shaver (2015) extend Burke et al. (2009)'s findings and examine the annual incidence of insurgent violence and temperatures globally. The province-level analysis shows that temperature is positively associated with greater likelihood of conflict in areas of the world with and without croplands.

In contrast to this active research program on long-term weather conditions, there has been no analysis of short-term temperatures and group conflict dynamics. The abundance of literature on the violence-inducing effects of temperature at the individual level and the empirical finding that sub-state violence retains its association with temperature in non-agricultural areas of the world combine to suggest that past conflict research may focus too narrowly on only long-term, large-scale mechanisms (Bollfrass and Shaver 2015). Instead, we theorize that an observed temperature-conflict correlation in non-agricultural areas of the world partly reflect aggregate and emergent patterns of affective violence.

Conclusion

Relatively high ambient temperatures induce more aggressive behavior in vehicles, homes, bars, and in the streets. This affective effect persists when individuals are placed in an organized group conflict setting. Our findings show that violence in wartime shares such affective motivations with its quotidian counterparts of human aggression. As demonstrated with a dataset of Iraqi insurgent attacks on international counterinsurgent forces, attacks whose initiation is in the hands of individual insurgents are strongly correlated with ambient temperatures. The magnitude of the effect challenges the view that "individual motivations alone are unlikely to result in large-scale violence over a long period of time" (Kalyvas et al. 2006: p. 26). Attack types that are subject to greater organizational deliberation and control do not share this correlation.

These findings inform scholarship and policy in the realm of sub-state violence and the security implications of changes in the earth's climate. Knowledge of the temperature range in which combatants are more likely to engage in affective violence should be useful to military planners and for the preparation of climate change adaptation policies. For those investigating the causal mechanisms underlying the relationship between changes in temperature and group violence, we hope to have demonstrated the importance of non-agricultural channels. In contrast to the extant literature's focus on longer term macro-level factors, a potential second causal channel operates through individuals and takes effect within the span of a day. These findings might be incorporated in future models predicting the economic, political, and social effects of a changing climate.

Temperature is not the sole affective factor that is likely to contribute to an act of violence. By itself, temperature variation may be responsible for a relatively small amount of wartime violence. By confirming the affective stimulus theory, the findings add evidence to the high likelihood that other affective stimuli shape the type and frequency of political violence. These remain difficult to measure in observational settings, but we hope our results encourage such additional investigations.

The statistically and substantively large contribution of a purely affective factor, ambient temperature, to political violence raises questions for scholarship on civil war, insurgency, and ethnic violence. Instead of assuming that any observed violence is instrumental in nature, the conditions under which violence manifests can be better understood if potential affective sources are not assumed away. Instrumental and affective motivations mix to create violent outcomes. As we have demonstrated, the contribution of affect to this complex mixture can be large in statistical and substantive terms. Our theoretical contribution to the understanding of affect on violence is to distinguish between the point at which it co-determines behavior alongside instrumental factors. The first is through preference formation, which has been acknowledged in the literature. The second is through immediate affective factors that shape the intentions and behaviors at the point of decision.

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Table 2: Day-Level Temperature on Logged Incidents of Insurgent Violence (per capita), OLS

	Insurgent Attacks						
	(All)	**(All)**	**(Strategic)**	**(Labor-Intensive)**	**(IED)**	**(Base)**	**(Nighttime)**
Temperature	**−0.001**	**0.007***	**0.001**	**0.006****	**−0.0002**	**0.004***	**0.001***
	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)	(0.002)	(0.0004)
Temperature (squared)		**−0.0001****	**−0.00001**	**−0.0001****	**−0.00001**	**−0.0001***	
		(0.00005)	(0.00001)	(0.00003)	(0.00003)	(0.00003)	
Hours of Daylight	0.00001	0.00001	−0.000	0.00001	0.000	−0.000	0.000
	(0.00001)	(0.00001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Battalions	0.029	0.029	0.066***	0.108***	0.029*	−0.031	0.233***
	(0.035)	(0.035)	(0.016)	(0.027)	(0.014)	(0.022)	(0.027)
Constant	−0.495	−0.347	0.032	−0.396	0.008	0.014	−0.197
	(0.368)	(0.371)	(0.101)	(0.239)	(0.188)	(0.231)	(0.157)
Vector of Lagged Dependent Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector of Meteorological Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day-of-Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,195	2,195	2,195	2,195	2,195	2,201	2,201
R^2	0.899	0.900	0.593	0.734	0.840	0.565	0.779
Adjusted R^2	0.890	0.890	0.553	0.708	0.825	0.522	0.757

Note: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Note: Heteroskedasticity and autocorrelation consistent standard errors

Table 3: Day-Level Temperature on Incidents of Insurgent Violence (In Counts), Quasi-Poisson

	Insurgent Attacks						
	(All)	**(All)**	**(Strategic)**	**(Labor-Intensive)**	**(IED)**	**(Base)**	**(Nighttime)**
Temperature	**−0.0005**	**0.037*****	**0.010**	**0.071*****	**0.006**	**0.063**	**0.022*****
	(0.003)	(0.009)	(0.040)	(0.017)	(0.014)	(0.035)	(0.006)
Temperature (squared)		**−0.001*****	**−0.00002**	**−0.001*****	**−0.0001**	**−0.001**	
		(0.0001)	(0.001)	(0.0003)	(0.0002)	(0.001)	
Hours of Daylight	0.0001*	0.00005	−0.0002	0.0001*	0.0001**	0.00001	−0.0001
	(0.00003)	(0.00003)	(0.0001)	(0.00005)	(0.00004)	(0.0001)	(0.0001)
Battalions	−0.022***	−0.022***	−0.079***	−0.004	−0.024**	−0.008	0.058***
	(0.003)	(0.003)	(0.022)	(0.006)	(0.008)	(0.008)	(0.009)
Constant	0.816	0.729	11.566	−3.967	−2.919	−0.562	−16.650
	(1.363)	(1.355)	(5.925)	(2.364)	(2.243)	(3.996)	(9,388.876)
Vector of Lagged Dependent Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector of Meteorological Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day-of-Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,195	2,195	2,195	2,195	2,195	2,195	2,201

Note: *p<0.05; **p<0.01; ***p<0.001

Table 4: Hour-Level Temperature on Baghdad Nighttime Attacks, Quasi-Poisson

	Insurgent Attacks							
	(All)	**(All)**	**(DF)**	**(DF)**	**(IDF)**	**(IDF)**	**(IED)**	**(IED)**
Mean Temperature	**0.019***	**−0.009**	**0.026***	**0.074**	**0.075**	**0.245**	**−0.018**	**−0.193****
	(0.009)	(0.045)	(0.011)	(0.056)	(0.073)	(0.342)	(0.011)	(0.061)
Mean Temperature (squared)		**0.0002**		**−0.0003**		**−0.001**		**0.001****
		(0.0003)		(0.0004)		(0.002)		(0.0004)
Constant	6.754*	−10.070	−5.435	−19.332*	−11.138	−26.317	−6.650	−4.637
	(2.642)	(6.648)	(3.454)	(8.437)	(31,735.080)	(25,270.090)	(4,339.678)	(4,307.583)
Date Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector of Lagged Dependent Variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector of Lagged Temperatures	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meteorological Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other Violence Controls	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,139	14,139	14,139	14,139	14,139	14,139	14,142	14,142

Note: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Table 5: Day-Level Temperature on Logged Incidents of Insurgent Violence (per capita), Outliers Removed

	Insurgent Attacks						
	(All)	**(All)**	**(Strategic)**	**(Labor-Intensive)**	**(IED)**	**(Base)**	**(Nighttime)**
Temperature	**−0.001**	**0.013***	**0.001**	**0.008****	**0.0002**	**0.006***	**0.001***
	(0.002)	(0.006)	(0.001)	(0.003)	(0.002)	(0.003)	(0.0005)
Temperature (squared)		**−0.0002***	**−0.00001**	**−0.0001*****	**−0.00000**	**−0.0001***	
		(0.0001)	(0.00002)	(0.00004)	(0.00003)	(0.00004)	
Hours of Daylight	0.000	0.000	−0.000	0.000	0.000***	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Battalions	0.042	0.041	0.077***	0.144***	−0.103***	−0.049	0.282***
	(0.066)	(0.066)	(0.019)	(0.034)	(0.024)	(0.028)	(0.033)
Constant	−0.438	−0.171	0.018	−0.502	−1.205***	−0.032	−0.393
	(0.657)	(0.668)	(0.116)	(0.302)	(0.268)	(0.289)	(0.203)
Vector of Lagged Dependent Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector of Meteorological Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day-of-Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,195	2,195	2,195	2,195	2,195	2,195	2,201
R^2	0.894	0.894	0.573	0.716	0.835	0.555	0.746
Adjusted R^2	0.883	0.884	0.530	0.687	0.819	0.511	0.721

Note: *p<0.05; **p<0.01; ***p<0.001

Note: Heteroskedasticity and autocorrelation consistent standard errors

Table 6: Day-Level Temperature on Incidents of Insurgent Violence (In Counts), Negative Binomial

	Insurgent Attacks						
	(All)	**(All)**	**(Strategic)**	**(Labor-Intensive)**	**(IED)**	**(Base)**	**(Nighttime)**
Temperature	**−0.001**	**0.047*****	**0.025**	**0.081*****	**0.007**	**0.064**	**0.020****
	(0.003)	(0.009)	(0.041)	(0.016)	(0.013)	(0.060)	(0.008)
Temperature (squared)		**−0.001*****	**−0.0003**	**−0.001*****	**−0.0001**	**−0.001**	
		(0.0001)	(0.001)	(0.0003)	(0.0002)	(0.001)	
Battlions	−0.024***	−0.024***	−0.071***	−0.005	−0.024***	−0.004	0.064***
	(0.003)	(0.003)	(0.020)	(0.005)	(0.007)	(0.011)	(0.010)
Hours of Daylight	0.0001***	0.0001**	−0.0003*	0.0001**	0.0001**	0.00000	−0.0001
	(0.00002)	(0.00002)	(0.0001)	(0.00004)	(0.00004)	(0.0001)	(0.0001)
Constant	−0.636	−0.339	17.168**	−5.280*	−3.415	−0.130	−26.041
	(1.270)	(1.267)	(6.117)	(2.148)	(1.972)	(6.301)	(3,072,297.000)
Vector of Lagged Dependent Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vector of Meteorological Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day-of-Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,195	2,195	2,195	2,195	2,195	2,195	2,201

Note: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Table 7: Incidence of Insurgent Casualties per Insurgent-ISAF Direct-Fire Engagement on Temperature in Afghanistan's 15 Most Violent Districts, Jan 2010 - Feb 2014, Linear Probability Model

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)	(6a)	(6b)
Temperature	**−0.0001****	**−0.001**	**−0.0002**	**0.0002**	**0.001***	**0.004****	**0.001***	**0.006****	**0.001**	**0.005****	**0.001**	**0.006****
	(0.0001)	(0.001)	(0.0001)	(0.001)	(0.0003)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Temperature (squared)		**0.00000**		**−0.00000**		**−0.00002***		**−0.00003***		**−0.00003***		**−0.00003***
		(0.00000)		(0.00001)		(0.00001)		(0.00002)		(0.00001)		(0.00001)
ISAF Casualty											0.048*	0.049*
											(0.028)	(0.028)
ISAF Wounded											0.030**	0.030**
											(0.012)	(0.012)
Constant	0.085***	0.102***										
	(0.007)	(0.029)										
District Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	No	No	No	No	Yes	Yes	No	No	No	No	No	No
Day Fixed Effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Hour-of-Day Fixed Effects	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Meteorological Controls	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Observations	36,099	36,099	36,099	36,099	36,099	36,099	36,099	36,099	36,099	36,099	36,099	36,099
R^2	0.0001	0.0001	0.012	0.012	0.034	0.034	0.083	0.083	0.095	0.095	0.096	0.096
Adjusted R^2	0.0001	0.0001	0.011	0.011	0.027	0.027	0.035	0.035	0.047	0.047	0.047	0.048

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$
Standard errors clustered at the district

Table 8: Incidence of Insurgent Casualties per Insurgent-ISAF Indirect-Fire Engagement on Temperature in Afghanistan's 15 Most Violent Districts, Jan 2010 - Feb 2014, Linear Probability Model

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)	(6a)	(6b)
Temperature	**0.0005*** (0.0003)	**−0.003** (0.003)	**0.00002** (0.0003)	**−0.0004** (0.003)	**0.001** (0.001)	**0.002** (0.002)	**−0.002** (0.001)	**0.005** (0.005)	**−0.002** (0.001)	**0.004** (0.005)	**−0.002** (0.002)	**0.005** (0.005)
Temperature (squared)		**0.00002** (0.00002)		**0.00000** (0.00002)		**−0.00000** (0.00001)		**−0.00004** (0.00003)		**−0.00004** (0.00003)		**−0.00004** (0.00003)
ISAF Casualty											−0.045 (0.075)	−0.046 (0.074)
ISAF Wounded											−0.023 (0.039)	−0.023 (0.039)
Constant	0.035 (0.026)	0.153 (0.100)										
District Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	No	No	No	No	Yes	Yes	No	No	No	No	No	No
Day Fixed Effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Hour-of-Day Fixed Effects	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Meteorological Controls	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Observations	2,561	2,561	2,561	2,561	2,561	2,561	2,561	2,561	2,561	2,561	2,561	2,561
R^2	0.001	0.002	0.041	0.041	0.155	0.155	0.490	0.490	0.497	0.497	0.497	0.497
Adjusted R^2	0.001	0.001	0.036	0.036	0.060	0.060	0.080	0.080	0.078	0.078	0.075	0.076

*p<0.1; **p<0.05; ***p<0.01
Standard errors clustered at the district

Table 9: Incidence of Insurgent Casualties per Insurgent-ISAF IED Engagement on Temperature in Afghanistan's 15 Most Violent Districts, Jan 2010 - Feb 2014, Linear Probability Model

	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)	(5a)	(5b)	(6a)	(6b)
Temperature	**−0.00000**	**−0.00004**	**0.00001**	**−0.0001**	**−0.00002**	**0.001**	**−0.001***	**0.0002**	**−0.001****	**0.0004**	**−0.001***	**0.0003**
	(0.0001)	(0.001)	(0.0001)	(0.0005)	(0.0002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Temperature (squared)		**0.00000**		**0.00000**		**−0.00000**		**−0.00001**		**−0.00001**		**−0.00001**
		(0.00000)		(0.00000)		(0.00000)		(0.00001)		(0.00001)		(0.00001)
ISAF Casualty											0.035***	0.035***
											(0.012)	(0.012)
ISAF Wounded											0.013***	0.013***
											(0.004)	(0.004)
Constant	0.017***	0.018										
	(0.006)	(0.026)										
District Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week Fixed Effects	No	No	No	No	Yes	Yes	No	No	No	No	No	No
Day Fixed Effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Hour-of-Day Fixed Effects	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Meteorological Controls	No	No	No	No	No	No	No	No	No	No	Yes	Yes
Observations	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189	10,189
R^2	0.000	0.00000	0.002	0.002	0.037	0.038	0.186	0.187	0.190	0.190	0.193	0.193
Adjusted R^2	−0.0001	−0.0002	0.001	0.001	0.011	0.011	0.024	0.024	0.026	0.026	0.029	0.029

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$
Standard errors clustered at the district

Table 10: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Difference in Casualty	48,915	0.064	0.258	−1	1
Insurgent Casualty	48,915	0.068	0.251	0	1
ISAF Casualty	48,915	0.004	0.061	0	1
ISAF Wounded	48,915	0.024	0.154	0	1
Temperature	38,660	87.174	18.361	26.800	118.800
Temperature2	38,660	7,936.431	3,069.315	718.240	14,113.440
Visibility	38,641	5.924	1.207	0.300	10.000
Maximum Wind Speed	38,627	11.003	4.527	1.900	40.000
Hour of the Day	48,915	12.304	4.958	0	23