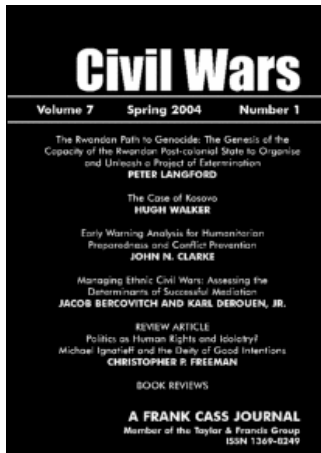


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Fighting Fire with Fire? How (Not) to Neutralize an Insurgency

MICHAEL G. FINDLEY AND JOSEPH K. YOUNG

From as early as the Roman Empire to the present day, governments have grappled with how best to respond to political violence from organized insurgent groups. In response to insurgent groups, some governments have emphasized a direct military response or what is often called 'attrition'. Other states have stressed a softer, political strategy or what is often called the 'hearts and minds' approach. Either approach places the population at the center of a struggle between the government and violent dissidents. Despite numerous works emphasizing either 'attrition' or 'hearts and minds', few theoretical studies have attempted to compare their relative success. Using an agent-based computational model, we examine which approach is more successful at quelling insurgencies and find that a hearts and minds approach is superior to an attrition strategy. We illustrate the model with insights from the Iraqi insurgency and, more generally, the model has implications for other insurgencies, such as in Chechnya.

In the fall of 2003 US secretary of Defense Donald Rumsfeld distributed a memo that asked aides whether the US government had some metric for evaluating the global war on terror.¹ He famously enquired whether, 'we are capturing, killing or deterring and dissuading more terrorists every day than the madrassas and the radical clerics are recruiting, training and deploying against us'.² Rumsfeld expressed two classic concerns of any state facing an insurgency. How do states measure success against an insurgency? What is the most effective way of combating guerrilla warfare, the weapon of choice of most insurgents?

Explanations for the efficacy of counterinsurgency rely on either a 'war of attrition' or 'hearts and minds' explanation. Attrition approaches focus on raising the costs associated with supporting an insurgency whereas hearts and minds concentrate on providing benefits for supporting the authorities. In Vietnam, for example, the attrition approach was used in an attempt to raise the costs associated with supporting the insurgents. Ultimately, attrition was largely unsuccessful at deterring support for the insurgents. In contrast, attrition approaches have been successful in pacification of guerrilla movements such as the US response to Native Americans and the Peruvian episode with the Shining Path. The hearts and minds approach, or an emphasis on providing benefits rather than imposing costs, was successful in the British counterinsurgency campaign during the Malayan Emergency, but was less successful in stabilizing Burma before and after World

War II. Despite significant and important work addressing the success and failure of counterinsurgency and insurgency, much of the evidence used to support one approach over another is based on non-random case selection, anecdotal evidence, and ad hoc assertions about when one approach will be more effective than another.

In this paper, we analyze which counterinsurgent approach – ‘hearts and minds’ or attrition – is more effective at reducing the strength of an insurgency, by formally modeling the interaction of insurgents, counterinsurgents, and the population. We pay particular attention to insurgent and counterinsurgent use of these strategies towards the population. In contrast to other formal work in this area, we explicitly model the insurgents and counterinsurgents in addition to members of the population.³ We simulate (computationally) a model consisting of three categories of actors: insurgents, counterinsurgents, and the population. In the simulations, we carefully vary characteristics of these individuals to explore the resulting dynamics of their behavior.

Key among the characteristics, we focus on the distribution of commitment to the insurgency among the members of the population. We contend that varying degrees of commitment arise in the population based on different cultural, religious, or ideological backgrounds and experiences. Commitment, and how it is distributed, within a society helps explain why some insurgencies succeed while others fail. In short, this commitment is not just a binary indicator of which side an individual supports, but rather a continuous measure – heterogeneous across individuals – that differentiates intensity of support for an insurgency. Because previous theoretical and case work have not adequately controlled for commitment levels, this model provides useful insights into the relative strengths and weaknesses of counterinsurgent and insurgent strategies.

The model contains many of the important characteristics of the actual dynamics of insurgent and counterinsurgent interactions and is intended to complement, not displace, existing approaches. The results of the model indicate that a hearts and minds approach is more effective at quelling insurgencies than an attrition strategy. The hearts and minds strategy consistently outperforms the attrition approach, but the level of its impact depends on the population’s commitment to the insurgency. Comparing across different results, the hearts and minds approach yields surprisingly robust, yet somewhat counterintuitive, findings. The model generates implications both for scholarly work and policy decisions, which we discuss in the paper. Most importantly, this research applies to insurgencies or guerrilla wars, which many observers consider the most prevalent type of conflict in the post-Cold War era.⁴ As situations from Iraq to Chechnya persist, or where conditions are ripe for the use of insurgency, the need to understand how best to respond becomes increasingly salient.

We begin by defining insurgency and discussing why previous attempts to account for the success of counterinsurgent strategies have led to inconsistent outcomes. Next, we use an agent-based model of the interaction among the population, insurgents, and counterinsurgents to determine which approach to combating insurgency is more effective. After discussing the results, we probe the

applicability of the model to the current insurgency in Iraq. In the final section, we investigate policy implications from the model, discuss other cases of insurgency, and suggest extensions to the model.

INSURGENCY AND COUNTERINSURGENCY

In discussions of insurgency, the terms insurgency, rebellion, guerrilla warfare, and terrorism are often used interchangeably. To be clear in an argument about the nature of insurgency, the distinctions among these terms must be elucidated. Insurgency is protracted political-military conflict over control of the state or some portion thereof using irregular military forces. This definition has several important aspects.⁵ Insurgents pursue both military and political means to achieve their goal of replacing the sovereign authority.⁶ Guerrilla warfare, or what is commonly referred to as 'small war' tactics, is one means to achieving this end.⁷ What differentiates insurgents from terrorists is that the latter have different goals.⁸ Terrorism can thus be a tactic of an insurgent group. It also can be a tactic of a non-insurgent group who intends only to affect policy or reach a particular target audience rather than seek regime change. Most insurgents practice some form of terrorism, however, terrorists need not be insurgents.

For the purposes of this study, insurgency and counterinsurgency are used to describe the individuals involved in each side.⁹ If rebellion is the act or process, insurgents are those taking part in the process. The same logic holds for authority. Individuals representing authority who combat insurgents are the counterinsurgents. Therefore, rebellion and authority may be used when citing the event, process, or act, but individuals or agents will be referred to as insurgents or counterinsurgents.¹⁰ Although common usage of the terms terrorists, insurgents, guerrilla warfare, and rebellion are synonymous, it is important to distinguish among the terms in developing a model of insurgency. For this model, the term insurgent refers to an individual involved in making rebellious claims against the state who might use guerrilla tactics or terrorism. A counterinsurgent is an individual agent of the state attempting to battle the insurgent and thus retain control of the population.

Beyond being an audience, insurgents need the population for two main reasons. First, insurgents need supplies and safe havens. Second, the population provides recruits for the struggle. Policymakers are concerned with breaking these support links and leaving the insurgents without their basis for operations.

Insurgencies receive support internally from the population as well as externally from donor states, diaspora and other sources. Models of insurgency often only assume that a government faces a threat to internal security from within its borders. Modern insurgency, however, has both an internal and transnational character.¹¹ Since at least the Cold War, the United States understood that the flow of weapons, people, and money can come from external sources to an internal cadre or organization supported by a local 'infrastructure'.¹² Although both external and internal support are present for most viable insurgencies, the internal support or 'infrastructure', could be the critical component explaining the rise or fall of the

insurgency.¹³ We acknowledge the role that external support and transnational factors play in insurgency, but focus on internal dynamics. In the modeling section of the paper, we discuss this choice and how external forces might be modeled in future studies. In the next section, we identify contending explanations for pacifying an insurgency and discuss the support for, and critiques of, each of these approaches.

COMPARING THE STRATEGIES

The two approaches that scholars and practitioners have generally used to explain effective insurgency and counterinsurgency are the ‘hearts and minds’ and the ‘war of attrition’ approaches. Clearly, these two strategies are not mutually exclusive. Counterinsurgent operations typically comprise elements of both hearts and minds and attrition strategies. Yet, frequently one approach is used more than the other, such as the attrition strategy in Vietnam.¹⁴ In what follows, we separate the two approaches to understand their core logics, but then develop a model in which actors pursue both strategies to differing extents.

Hearts and Minds

According to the ‘hearts and minds’ perspective, modernization and social disruption in the developing world cause a shock to the social system of the population. Deprivation and inequality are principle sources of discontent for the population that provide fertility for insurgency. Therefore, people need basic economic improvements, security, and freedom from previous abuses.¹⁵ The core of this theory is that winning a war against insurgency requires shifting popular attitudes, sympathies, and support away from the insurgents and towards the government. The primary concern is then providing benefits to the population.

Early works, such as the US Marine Corps’ *Small Wars Manual* emphasize kindness and sympathy towards the population rather than force. Recent analyses build on these previous works and apply them to modern cases.¹⁶ Some argue for subsidizing the peasants rather than punishing them.¹⁷ These improvements must improve the overall perception of the government or authority.¹⁸ In this framework, the ‘strategic center of gravity’ is the support of the people.¹⁹ Since modernity is the cause of disruption, pulling the center of gravity closer to the government requires provision of security and modern benefits such as political rights and reduced government corruption.²⁰ In sum, hearts and minds places more emphasis on political methods for defeating insurgency rather than military means.

Critics of this approach claim that where insurgency has destabilized public space and led to a breakdown of state security like in South Vietnam, however, building schools, bridges, and ditches likely cannot compensate. Leites and Wolf claim that economic improvements may affect the utility calculations of the population, but an income effect may outweigh and offset the effects of the change in expected utility.²¹ That is, economic improvements may lead to extra income for the population which they can use to ‘buy’ security from the insurgents. Insurgents can also ‘tax’ these improvements, steal them, or destroy them leading to greater

opportunities for control.²² In the French military theorist David Galula's framework, the aid sent to 'pink' areas (contested areas) or 'red' areas (insurgent held areas) may succumb to the process Leites and Wolf describe.²³ Without some measure of security in a society, the population will remain uncommitted to the legal authorities. In short, these benefits are not enough to ensure support for the authorities.

Attrition

Whereas adherents of a hearts and minds approach focus on ameliorating political concerns and providing economic benefits to the population, proponents of an attrition approach argue for imposing costs as a deterrent to supporting insurgents.²⁴ This approach has been used in a variety of settings and across time from Vietnam to Algeria to El Salvador. This approach privileges a strong military and a focus on punishing the population for supporting insurgents.

To pursue an attrition strategy, governments need to maintain strong militaries to ensure security for their population. The problem is that the police or military in weak states, which are usually the targets of insurgency,²⁵ are often mercenaries rather than professional soldiers: they are undisciplined and poorly trained. To attempt to end insurgency, the authorities use this military. Governments in weak states often have little choice but to pursue repression strategies.²⁶ Abuses, crimes by the military and police, and intrusive searches may contribute, however, to the population's fears and lead to the unintended consequence that the population leans towards the insurgency for security.

The war of attrition argument is consistent with Kriger's contention that populations have different motives than ideological commitment in explaining their participation and support for insurgents.²⁷ This approach is premised on the belief that populations will respond to behavioral methods. That is, they will support or reject the rebels based upon the costs associated with either decision. Leites and Wolf applied this logic to the Vietnam insurgency, and outlined a strategy for implementing a war of attrition.²⁸ They viewed the population as strictly rational actors in an Eastonian system of inputs and outputs.²⁹

Because this approach assumes that the imposition of costs primarily explains the behavior of the population, economic development and inequality are not central concerns. Rather the perception of which side is winning is paramount. The peasant's concern, then, is to avoid heavy losses that would occur by supporting the potential loser. Because potential success alters expected utility calculations, members of the population will tend to support the side they believe has the greatest likelihood of victory. The side that is perceived to dominate the means of coercive control will garner the greatest support from the population. Implementation of the approach in Vietnam led to massive punishment of North Vietnam through an extensive bombing campaign in an attempt to increase the costs of resistance. In addition, the repression of civilian populations in the south of the country was an attempt to separate the guerrillas from the population and reduce the supply chains of the insurgents.³⁰ Although this approach failed in Vietnam, overwhelming force

and wars of attrition have been cited as successful in other cases such as the Argentine 'Dirty War' from 1976 to 1977.³¹ In addition, insurgency in the United States by native populations was neutralized with this tactic.³²

In sum, an attrition approach posits that members of the population are responsive to increases in cost. According to adherents of this perspective, raising the costs for supporting insurgents is the best way to reduce support for insurgencies. The proponents of an attrition perspective argue that a hearts and minds approach will be unsuccessful because of the inattention to cost structures.

Counterinsurgents, the Population, and the Insurgents

To model the relationship among counterinsurgents, the population, and insurgents, it is necessary to specify how they interrelate. Mao Tse-tung articulated the relationship between the populace and insurgents likening the former to water and the latter to the fish that inhabit it.³³ As insurgents often employ guerrilla tactics, such as avoiding direct confrontation with the counterinsurgents, using hit-and-run violence, and utilizing small irregular groups, they are difficult to discern from the general civilian population. Guerrillas frequently strike quickly and then melt into the background. Counterinsurgents understand this relationship and are broadly faced with two options: increase the costs of being or supporting an insurgent, or targeting the 'hearts and minds' of the population.³⁴

The relationship between insurgents and the population can be depicted as the insurgents being a subset of the population. In addition, potential insurgents come from the set of civilians. These potential insurgents might originate in the domestic population or from abroad through various ties such as ethnicity. Counterinsurgents target both insurgents and potential insurgents.³⁵ In present day Iraq, for example, this distinction is often blurred. A US Army staff sergeant involved in the operations stated this rule plainly, 'we have to treat [all people] as insurgents, unless they prove otherwise, you don't know who to trust'.³⁶ The critical question is whether targeting the insurgents in a war of attrition *creates more insurgents than it destroys*. When counterinsurgents engage insurgents, they generally have military superiority. In other words, when counterinsurgents meet insurgents they invariably reduce the overall supply of current insurgents. The unintended consequence of this interaction is a possible increase in the mobilization of potential insurgents into actual insurgents. If the counterinsurgents target the insurgents in a sea of civilians, it is very likely that some civilians will be terrorized or become 'collateral damage'. Excessive violence by police and the military has been recognized as an important factor leading to increased support for insurgencies in many cases including El Salvador in the late 1970s and early 1980s, the Tamil Tigers of Sri Lanka in the 1980s as well as Bangladesh in 1971.³⁷

We argue that how members of the population respond to costs or benefits depends upon their commitment to the insurgency. Factors that likely account for different levels of commitment include religion, culture, previous bad experiences with the government, or ideological consistency with the insurgents. We conceive of commitment, based on these factors, as the *degree* to which a civilian supports the

insurgency or government. Commitment affects how civilians respond to costs or benefits supplied by the government and insurgents. It can be conceived of along a single dimension with the poles indicating complete support for either the government or insurgents. Locations in between the poles indicate an individual who leans either towards the insurgents or government.³⁸ A civilian's degree of commitment, which can be represented by their location on this line, can be altered by receiving benefits or suffering costs. The insurgents and counterinsurgents are located at the poles and are generally unaffected by the actions of others while struggling to bring groups closer to their position.

Traditionally, in the initial phases of insurgency, an urban elite is needed to mobilize the population.³⁹ In the Internet age, physical contact might be less important. Even in this networked age of warfare, however, a 'cyber-elite' is necessary as a hub for establishing resistance to the state. In the context of Iraq, these cyber-elites came from the ex-Baathist military and Jihadis from abroad and quickly spread their message to other groups who opposed the creation of a US-backed state. Early on, the network of insurgents is highly centralized and will fail without this hub (the urban/cyber elite). Once a viable insurgency is established, however, the structure can resemble a diffuse decentralized network. At this point, one could say that the network is a 'pure' network in which the failure of any one node is not that important.⁴⁰ That is, there are numerous hubs such that the failure of one does not necessarily jeopardize the others. To establish a vibrant, decentralized insurgent network, and then maintain that network, insurgents need to attract and retain the population's support.

Population members' decisions to cross the threshold to become a member of the insurgency are likely affected by two important factors. First, contact with insurgents is a necessary condition as the population needs an alternative 'frame' to the incumbent authority.⁴¹ Second, the indiscriminate killing of civilians leads potential insurgents to cross the threshold into active support.⁴²

Aside from the above logic detailing how commitment shifts occur, context can also matter. Kalyvas explores the logic of massacres in Algeria and finds that contested areas are often the sites of massacres by the insurgents as well as the counterinsurgents.⁴³ In rebel-held areas and government strongholds, massacres and indiscriminate violence are less likely in places where an area faces an uncertain outcome. The reason for this escalation of violence in contested areas is the desire by both insurgents and the government to deter defection. Both sides attempt to make defection by a member of the population to the other side a costly action. Insurgent control of an area as well as government authority is often maintained through a mixture of costs and benefits.

Returning to Rumsfeld's question, attrition and hearts and minds offer competing visions for how to reduce the number of insurgents. Examples and anecdotal evidence – much of it very insightful – have been marshaled on both sides to show the superiority of each strategy. Yet, we are often left without a structured means of comparing the two. Based on the available theoretical arguments, the unintended consequence of the indiscriminate killing of civilians changes the commitment level

of insurgents and pushes others into becoming active insurgents. Because the government imposes unacceptable costs on some members of the population, the insurgency becomes the more viable option. Providing benefits to a population may be the best response for counterinsurgents as it avoids this ‘insurgent creation’ mechanism. Yet, as noted previously, providing benefits also runs the risk of indirectly supporting the insurgency.

Furthermore, where commitment to insurgency is high, *neither* strategy may be particularly successful. Based on our discussion of commitment as well as other theories and evidence from the literature, we identify the following propositions that we then explore through simulation and an application of the model to the Iraqi insurgency.

HEARTS AND MINDS PROPOSITION:

Proposition 1: *When counterinsurgents pursue a strategy that is based on increasing **benefits**, the number of insurgents will **decrease**.*

ATTRITION PROPOSITION:

Proposition 2: *When counterinsurgents pursue a strategy that is based on increasing **costs**, the number of insurgents will **decrease**.*

COMMITMENT PROPOSITIONS:

Proposition 3a: *When a population’s commitment to an insurgency is **high** and counterinsurgents pursue a strategy that is based on increasing **costs**, the number of insurgents will **increase**.*

Proposition 3b: *When a population’s commitment to an insurgency is **high** and counterinsurgents pursue a strategy that is based on increasing **benefits**, the number of insurgents will **increase**.*

Proposition 3c: *When a population’s commitment to an insurgency is **high** and counterinsurgents pursue a strategy that is based on increasing **benefits**, the number of insurgents will increase, **but at a lower rate than based on a costs strategy**.*

In the next section, we use an agent-based computational model of insurgency and counterinsurgency to distinguish which approach is more successful. Adjusting the strategy of the counterinsurgents and insurgents, and the commitment level of the population allows us to explore the above propositions to evaluate the relative success of counterinsurgent strategies. In the final sections, we apply the model to the Iraqi insurgency and then discuss theoretical and policy implications and possible extensions to the model.

AN AGENT-BASED APPROACH

Empirical analysis provides a useful means to understand the relative merits of hearts and minds versus attrition approaches. Case studies, in particular, have generated many important insights. Yet given that they do not typically compare across numerous cases, understanding the strengths and weaknesses of the hearts and minds versus the attrition approaches in a variety of settings is difficult. Moreover, obtaining valid and reliable information about interaction at the individual level, or even observing the 'commitment' of a population, is complicated. Given this, we construct a stylized agent-based computational model to explore the dynamics of insurgency in various settings. Modeling civil and ethnic violence using agent-based models is not unprecedented in studies of political mobilization and violence that seek to analyze behavior at the individual level and in insurgency generally.⁴⁴ This agent-based model is not intended to substitute for empirical approaches, but rather to offer a complementary perspective.

The goal of the model is to simulate the consequences that follow from a reasonable set of assumptions about insurgency and counterinsurgency. More precisely, the model explores how a population's level of commitment and the strategies employed by counterinsurgents and insurgents affect the strength of an insurgency. The costs of maintaining the insurgency and the benefits it provides contribute to agents' levels of commitment, and changes in commitment then affect the overall strength of the insurgency.

We evaluate the expectations of the model by carrying out computational 'experiments'. A baseline model begins with low levels of commitment among the population. Then, to explore propositions 1–3, we progressively increase the aggregate distribution of commitment and the use of costs or benefits strategies.⁴⁵ The environment for the agent based model is an interactive simulation that takes place on a 'grid' or 'lattice' whereon agents move spatially and interact with other agents. Interaction among the agents is the model's central dynamic. More specifically, the model explicitly captures how counterinsurgents and insurgents interact with each other and with the population as they attempt to weaken or strengthen (respectively) the insurgency. Yet the model also captures a spatial dimension representing geographic clustering of agents.

Any model is a simplification of reality; this one is not unique. Certain complications, such as heterogeneity among insurgent groups (i.e., multiple insurgent groups) and the effect of third party audiences known to be associated with the relative rise or decline in numbers of insurgents, are captured only indirectly in this model. This is not to say that such factors are unimportant. As discussed above, recent research has shown that the transnational dimension of insurgency is an important factor in explaining the success or failure of insurgency. This model's focus, however, is directed towards understanding the role of a population's commitment. Extensions of the model could usefully address some of these factors more explicitly and, in the conclusion, we discuss possible results if one were to incorporate factors such as foreign involvement.

*The Agents*⁴⁶

Three types of actors are represented in the model: insurgents, i^λ , counterinsurgents, i^κ , and civilians (or the population), i^π . Galula keenly observes that ‘In any situation, whatever the cause, there will be an active minority for the cause, a neutral majority, and an active minority against the cause.’⁴⁷

Insurgents, i^λ , represent the smallest set of agents in the simulation.⁴⁸ The reason for this is simple: even when regime change may be a public good the majority of the population wants, insurgency is generally carried out by a small portion of the population. According to Lichbach, the population of a state consists of two types of people who make up possible insurgents.⁴⁹ First, there is a majority of the population with grievances who remains quiescent. Lichbach estimates this to be around 95 per cent of the total aggrieved. Next, there are individuals who act collectively against the authorities. This group is estimated at about 5 per cent of the aggrieved population, which is not meant as an absolute measure of participation. The point of the 5 per cent rule is that a minority organizes against the regime and this is a small part of a larger group that has legitimate complaints against the status quo.⁵⁰

Maintaining an insurgency requires a small group willing to bear the costs of the public good, or what Olson called a ‘privileged’ group.⁵¹ This group must also be able to deny the greater public good of security from the population and provide an alternative set of authority to the government in power. As their ability to provide selective incentives to participants of the movements increase, so will their ability to attract new members.⁵² Arguably the vast majority of a population during insurgency remains neutral.⁵³

The population or civilians, i^π , make up the largest set of agents. As previously argued, this is consistent with both theory and evidence.⁵⁴ The population is generally disposed to neutrality. Their main goal is to remain in the middle and support whichever side looks to be the next sovereign authority. Because the current government already has the means of coercive control, the burden of conversion falls more heavily on insurgents than counterinsurgents. Conversion to insurgency is analogous to being under insurgent control.

Counterinsurgents, i^κ , are agents of the regime who attempt to quell the insurgency by neutralizing insurgents and keeping the population from converting to

TABLE I
SUMMARY OF NOTATION

Symbol	Meaning
π	Population
λ	Insurgents
κ	Counterinsurgents
χ	Agent Commitment
ϕ	Vision
R	Responsiveness
θ	Threshold for Switching Groups
B, C	Benefits/Costs

the insurgency. The number of counterinsurgents exceeds the number of insurgents, but is far less than the size of the population. Furthermore, the number of counterinsurgents is far more stable than the number of insurgents, because they do not easily melt in and out of the population. In this model, then, the approximate breakdown is 5 per cent insurgents, 85 per cent population, and 10 per cent insurgents with the first two allowed to change in number.

Agents are heterogeneous in their level of commitment to the insurgency, $\chi_i \in [0, 1]$, such that insurgent commitment, $\chi_i^\lambda \in U[0.8, 1]$, counterinsurgent commitment $\chi_i^\kappa \in U[0, 0.2]$, and the population's commitment $\chi_i^\pi \in N[0, 1]$.⁵⁵ This setup ensures that, *ex ante*, all insurgents are highly committed (with levels between 0.8 and, the maximum, 1.0), counterinsurgents are not committed⁵⁶ (levels between 0, the minimum, and 0.2), and members of the population vary widely (i.e., between 0 and 1) with the vast majority around the mean of 0.5.⁵⁷ This framework also comports with the theoretical expectations outlined previously. Importantly, by giving each agent its own level of commitment, it can then update that commitment level with each interaction.

This is important because we have argued that interactions among the agents affect levels of commitment over time; commitment is not just an initial condition that then remains constant. Commitment is also not an aggregate group parameter invariant across individuals, but rather is heterogeneously distributed in the population. Finally, based on this setup, agents can switch groups based on the provision of benefits, or imposition of costs, as well as the individual level of commitment, which updates over time.

Interaction

Individual agents occupy cells on a grid of defined size and move randomly about it. That is, agents move randomly in their von Neumann neighborhood, which is comprised of the four cells immediately above, left, right, and down from the cell in question. Insurgents and counterinsurgents are endowed with vision, denoted by ϕ_i^λ and ϕ_i^κ respectively that are not equal. Whereas insurgents are at least somewhat familiar with the terrain and the local population, counterinsurgents typically are not. Insurgents are better aware of who the members of the population are, as insurgents are often drawn from the population in which they currently interact. Because insurgents know the local terrain and population, in the model they see two cells out in their neighborhood whereas counterinsurgents only see one cell in any direction.⁵⁸ When insurgents 'see' other agents, they cease to move randomly and either target or pursue members of the population in order to influence them, or flee from counterinsurgents to avoid being targeted.

When counterinsurgents interact with insurgents, the insurgents are either neutralized or, with a very small probability ($p < 0.001$), they die. When an insurgent is neutralized, it becomes a member of the population and is assigned a new level of commitment.⁵⁹ As such, counterinsurgents always attempt interaction with insurgents, but insurgents flee whenever possible. Because the counter-insurgency is typically more stable than the insurgency, often with a formal military

and bureaucratic structure, counterinsurgents do not switch type. In the current Iraqi conflict, for example, the US influence is relatively stable over time and any changes are due more to US decision-making rather than insurgent effectiveness.

If located adjacent to members of the population, an insurgent or counterinsurgent targets the civilian, in which case the two agents engage in an interaction. The interaction is comprised of three steps: insurgents and counterinsurgents (1) impose costs or provide benefits, which (2) alter the population member's commitment level, and (3) the population member updates group membership by either (a) joining the insurgency or (b) remaining in its groups.⁶⁰ In reality, a member of the population could change its level of commitment without an explicit interaction with an insurgent or counterinsurgent. We contend, however, that *interaction* is one of the primary means by which the population changes its commitment, and thus we focus the formal model on this.

When counterinsurgents or insurgents interact with members of the population, they provide benefits or costs in an attempt to influence the population. The benefits and costs provided to the population represent benefits such as security, resources, or shelter, and costs such as death, harassment, or lack of support in order to influence the strength of the insurgency.⁶¹ Both counterinsurgents and insurgents can provide a mix of costs and benefits, but we assume that one strategy is used more than the other for various reasons such as inflexible bureaucratic procedures. To explore the two options in more detail, we explicitly vary the extent to which counterinsurgents and insurgents provide benefits or impose costs to understand the relative efficacy of the hearts and minds and the attrition approaches.

Once costs have been imposed or benefits provided, members of the population update their commitment accordingly. When members of the population receive benefits, they update their commitment closer to the agent that provided the benefit. More precisely, when $\chi_i < \chi_j$, then members of the population update their commitment such that:

$$\chi_{i,t+1} = (R_i \cdot (\chi_j - \chi_i)) + \chi_{i,t}. \quad (1)$$

When $\chi_i > \chi_j$, then agents update their commitment such that:

$$\chi_{i,t+1} = \chi_i - ((\chi_i - \chi_j) \cdot R_i). \quad (2)$$

When $\chi_i = \chi_j$, then no updating occurs. R represents an agent's level of responsiveness and captures the extent to which its commitment can fluctuate. Agents not very responsive to costs do not move very far from their previous level of commitment, agents more responsive move further. For the runs reported here, agents have a low level of responsiveness ($R \in U[0, 0.33]$) in order to isolate carefully the effects of benefits, costs, and commitment levels.⁶²

As an example, if a member of the population has $\chi_{i,t}^\pi = 0.3$ and it receives benefits from an insurgent with $\chi_{j,t}^\lambda = 0.7$, and the population member has a responsiveness rate, $R_i^\pi = 0.2$, then the member of the population would update its level of commitment to $\chi_{i,t+1}^\pi = 0.38$ (i.e., $(0.2 \cdot (0.7 - 0.3)) + 0.3 = 0.38$).

When members of the population exceed the threshold $\chi_i^{\pi} \geq \theta$, the member of the population switches and becomes an insurgent. Consistent with the definition of insurgent commitment discussed above, $\theta = 0.8$

When members of the population suffer costs, they move further away from the agent imposing the costs, or are neutralized. As noted earlier, abuses, intrusive searches, and crimes by counterinsurgents may lead to the unintended consequence that the population leans towards the insurgency for security. 'If the state responds by escalating its own repressive violence and expanding its targeting, it may eventually induce an increase in active support for the rebel opposition.'⁶³ Thus, counterinsurgents must balance the provision of benefits against the costs needed to neutralize insurgents and possible recruits. In this model, if counterinsurgents impose costs, then members of the population react negatively and become more committed to the insurgency.

We argue that when insurgents inflict costs on members of the population, the reaction is not always that the population switches towards the counterinsurgency.⁶⁴ Civilians are often targeted in order to keep them from actively supporting counterinsurgents. In other words, insurgents can use targeting to discourage defection even if out of fear. The resulting culture of fear can, at the very least, neutralize members of the population or even generate their support. In Vietnam, it was only after rebels won support out of fear that they could begin offering rewards for support.⁶⁵ Ford argues, furthermore, that whereas counterinsurgents need the active support of the population, insurgents need only create neutrality in order to be successful.⁶⁶ Thus, when insurgents inflict costs on members of the population, the population members are 'neutralized' and a new level of commitment is drawn for them based on the initial distribution of commitment.⁶⁷

Evaluating the Model

Our concern in this paper has been with the relative efficacy of hearts and minds versus attrition approaches to prosecuting and combating an insurgency. We have argued, moreover, that the success or failure of the two approaches is likely dependent on the commitment of the population. To evaluate the argument, we vary two key parameters in an agent-based computational setting: (1) the provision of benefits and costs by counterinsurgents and insurgents to members of the population and (2) the initial distribution of commitment within the population. (A summary of model inputs and results appears in Table 2.) Note that these results are not meant to be point predictions, but rather to generate intuition about the likely consequences of the use of hearts and minds versus attrition strategies given different distributions of commitment.

Counterinsurgents and insurgents provide benefits and costs to the population with an emphasis on one strategy over the other. To be sure, they never exclusively pursue one strategy, but rather they privilege one over the other. In Experiments 1, 3, and 5, they provide benefits to the population a high proportion of the time (on average, around 80 per cent of the time). In Experiments, 2, 4, and 6, they impose costs roughly the same proportion of the time. These strategies are not pursued in

TABLE 2
SUMMARY OF INPUTS AND RESULTS FOR THE EXPERIMENTS

Run	Commitment	Benefits/Costs	Outcome
	χ	B, C	$\% \Delta \text{in } \lambda$
1	Low	Benefits	-93%
2	Low	Costs	+42%
3	Normal	Benefits	-92%
4	Normal	Costs	+140%
5	High	Benefits	+38%
6	High	Costs	+200%

Number of Agents (425); Vision ($\phi^{\lambda} = 2, \phi^{\kappa} = 1$).

Agent Distribution ($\lambda \approx 5\%, \pi \approx 85\%, \kappa \approx 10\%$).

Threshold ($\theta = 0.8$); Death occurs with $p < 0.001$.

Responsiveness ($R \in [0, 0.33]$).

isolation, however. As discussed in Proposition 3, the commitment levels of population members vary and this variance has an impact on the success or failure of the different strategies. In these experiments, therefore, the provision of costs and benefits is conditioned on the distribution of commitment, which ranges from low (right skewed distribution), medium (normal distribution), and high (skewed left distribution).

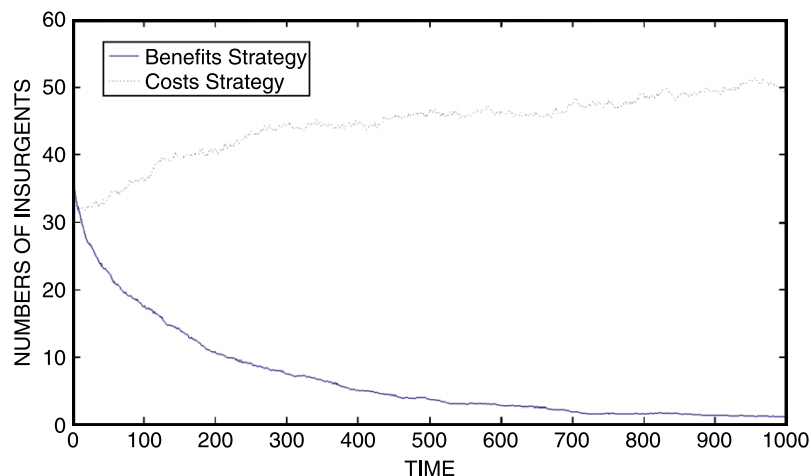
We hold several parameters constant for all runs including the number of each type of agent, the vision of agents, the threshold at which members of the population switch to the insurgency, and the geographical landscape.⁶⁸ The model is run for 1,000 time steps and each experimental condition is replicated 30 times.

MODEL RESULTS

The first two experiments are designed to evaluate Propositions 1 and 2, or whether providing benefits or costs is better for reducing the strength of an insurgency. They also establish a useful benchmark for comparison with later experiments that rely on different parameter configurations (See Figure 1 and Table 2 for summaries of results). The results of Experiment 1 are consistent with the expectations of a 'hearts and minds' argument (Proposition 1). When the population has a low level of commitment and counterinsurgents pursue a strategy of increasing benefits, the number of insurgents decreases over time and eventually converges towards zero. As a percentage, there is a 93 per cent decrease in the number of insurgents. Experiment 2, on the other hand, does not accord with the 'attrition' Proposition (2), because the number of insurgents actually increases, although the increase is modest. There is a 42 per cent increase in the number of insurgents in this case. Based on these experiments, one conclusion is that a hearts and minds approach is more successful than an attrition strategy. Yet this result may simply be a function of the low level of initial commitment.

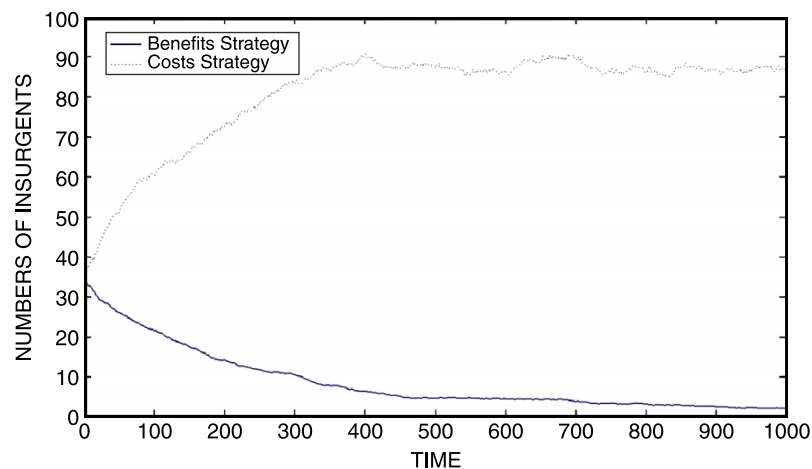
Experiments 3 and 4 capture the effects of pursuing the different strategies, when the population's commitment is distributed normally (rather than low).⁶⁹ Increasing

FIGURE 1
NUMBERS OF INSURGENTS GIVEN *LOW* INITIAL COMMITMENT



the level of commitment *should* result in an increase in the number of insurgents irrespective of strategy (costs *or* benefits). Surprisingly, although the costs strategy indeed produces more insurgents, the provision of benefits remains remarkably successful at decreasing the overall number of insurgents. In this case, employing a benefits-based strategy decreases the number of insurgents by 92 per cent, whereas a costs-based strategy increases the number of insurgents by 140 per cent – a substantial disparity. This somewhat counterintuitive finding lends even more support to a hearts and mind approach.

FIGURE 2
NUMBERS OF INSURGENTS GIVEN *NORMAL* INITIAL COMMITMENT



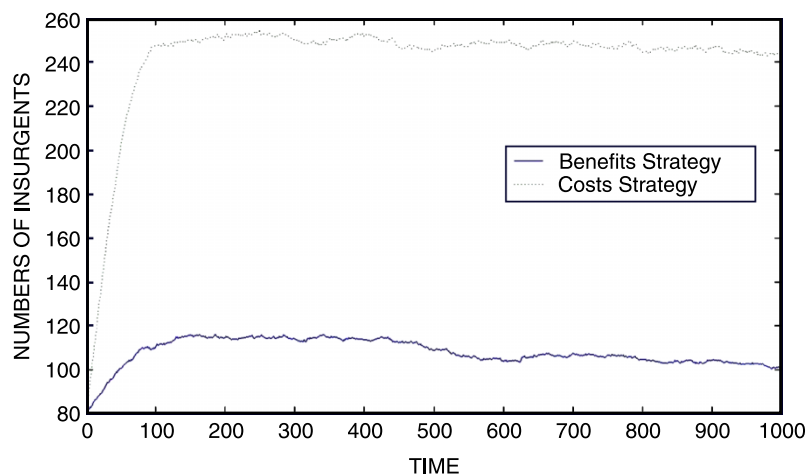
Finally, we consider the effects of the various strategies when a population is highly committed (see Proposition 3).⁷⁰ The results of Experiments 5 and 6 lend support to Propositions 3a, 3b, and 3c. The logic is that if a population is highly committed, no strategy may be successful at quelling the insurgency, *but one strategy might be better than the other*. In this case, insurgents increase under both the benefits (38 per cent) and costs (200 per cent) scenarios. Thus, although the insurgents grow in strength (in both scenarios), pursuing a strategy of providing benefits, limits the growth of the insurgency better than an attrition strategy.

Based on these experiments, the hearts and minds strategy outperforms the attrition strategy regardless of the distribution of commitment of the population. At high levels of commitment, the effect may be indistinguishable as both techniques do little to dampen the growth of an insurgency. Field-Marshal Sir Gerald Templer, the 1952–54 architect of the successful British counterinsurgency in Malaya, who famously said ‘The answer lies not in pouring more troops into the jungle but in the hearts and minds of the people’, claimed that ‘the shooting side of the business is only 25 per cent of the trouble. The other 75 per cent lies in getting the people of this country behind us.’⁷¹ The results of these experiments suggest that strategies based on providing benefits used in places like Malaya outperform strategies based on attrition such as the French experience in Algeria.

THE IRAQI INSURGENCY

Although our work provides support for the hearts and minds approach, looking at contemporary cases and the distribution of commitment among members of the population in these locations can help us confirm or infirm some of the evidence from the agent-based model. The Iraq case allows us to compare the results of the

FIGURE 3
NUMBERS OF INSURGENTS GIVEN HIGH INITIAL COMMITMENT



model with current insurgency/counterinsurgency interaction. Some characteristics of the Iraqi insurgency map well to the simulation model. Recall that we assume that insurgents know the terrain better than the counterinsurgents, that insurgents are a small portion of the population, and that commitment is heterogeneous within a particular society. All of these factors are consistent with Iraq today.

Another benefit of exploring the Iraqi case is that each group – Sunnis, Shia, and the Kurds – potentially challenges the US-led counterinsurgency effort while also likely having different preferences and, thus, different distributions of commitment to insurgency. As such, Iraq offers a useful ‘controlled’ comparison wherein numerous factors remain constant allowing us to focus on differences in parameters of interest. The government, the time period, global processes, and many other factors are perfectly controlled when comparing insurgent groups within Iraq.

In some respects, however, the Iraqi case is more complicated than our model. Intervention by foreign powers helped create the motivation for insurgency and insurgents are aided by other states. In addition, some members of the insurgency are not necessarily Iraqi. Although these foreign fighters often perpetrate spectacular events, such as the bombing of the United Nations headquarters or the two bombings of the Shia mosque in Samarra,⁷² they account for a small fraction of the overall number of insurgents.⁷³ The implications then of not modeling the foreign fighter are relatively minor. Iraq also complicates our model as we do not attempt to include multiple insurgent groups in our experiments. Intragroup competition and interaction among groups is avoided in our model and these factors could lead to different strategies or tactics being employed by these insurgent groups.⁷⁴

Although multiple insurgent groups are not directly modeled, we selected Iraq to examine because it provides variation among commitment levels within the case.⁷⁵ In other words, we can compare across the model’s experimental results to examine groups in Iraq with different commitment levels. If we define the poles for commitment in Iraq as the US-led forces and an insurgent alternative, this creates a spectrum to assess whether the model explains the behavior of different groups in the country. Since commitment levels vary across the different groups opposing the new state, we can discuss at least three cases: the counterinsurgents versus the Shia, the counterinsurgents versus the Sunni, and the counterinsurgents versus the Kurds. Each group has a different commitment level and thus a different interaction with the state.⁷⁶

Iraqi Sunnis, a small minority in the country, previously controlled most of the territory of Iraq.⁷⁷ After the US invasion and subsequent dismissal of the government, the Sunnis stood to lose the most from the new democracy which would allow the majority Shia to control the parliament. As such, we expect that the distribution of commitment to insurgency in the Sunni community to be closer to the pole of insurgency than either the middle or US-led position. According to Pentagon assessments, as much as 75 per cent of the Sunni population supports the insurgency and attacks on Americans.⁷⁸ Commitment to armed struggle for the Sunnis can be explained by their loss of power as well as their fear over the new government’s

ability to credibly commit to nonviolence as well.⁷⁹ If our model is accurate, since the Sunnis are highly committed, either strategy will struggle to contain the insurgency. Providing benefits is still a superior solution, but will likely not reduce the insurgents' capabilities to make violence.

Two notable operations against the Sunni city of Fallujah – Operation 'Phantom Fury' and Operation 'Vigilant Resolve' – illustrate the more 'cost-centered' approach to dealing with the Sunnis utilized by the US-led counterinsurgents. Operation 'Vigilant Resolve' in April 2004 attempted to retake Fallujah from insurgents using conventional military tactics. Brigadier General Mark Kimmitt described before the operation that the US military would use an 'overwhelming' response to 'pacify the city'.⁸⁰ During this operation a large portion of the city fled and the bombing campaign destroyed many buildings and mosques. Because of pressure on the counterinsurgent operation internally and externally, a truce was brokered to end the battle after a week.

In November 2004, Operation 'Phantom Fury' began in Fallujah to root out all insurgents from the city. During intense urban combat, a large portion of the residents of Fallujah left the city and by April 2005 fewer than 50 per cent of the 300,000-strong population had returned.⁸¹ These two large operations imposed severe costs on the population of Fallujah and had little to no effect on the overall number of attacks by insurgents.⁸² In fact by August 2005, insurgent attacks reached their highest point at any time during the insurgency.⁸³ Our model suggests that imposing costs on the Sunni population had the effect of moving them closer to the insurgents.

The Shia and the Kurds provide examples of groups that have medium and low commitment respectively. Kurdish forces have been the most supportive of the US-led endeavors and have supported the establishment of the government contingent upon some form of regional autonomy. Kurdish turnout for the national election in 2005 topped 90 per cent indicating strong support or commitment to the new regime and US-led efforts to consolidate power. Our model suggests that providing benefits to the Kurds will only increase their commitment to Iraqi democracy and the present efforts at counterinsurgency and, as a result, decrease their commitment to the insurgency. In large part, this is the strategy that is used primarily with the Kurds. It is unsurprising, then, that they are the only group that overwhelmingly support democracy and that do not support attacks on US troops. According to a recent poll, only 7 per cent of Kurds support attacks against the US as compared to 94 per cent of Sunnis and 33 per cent of Shiites.⁸⁴

The Shia also support the general political process as their numbers are an advantage in the democratic process. As a group their support for US-led counterinsurgency, however, is more tepid than the Kurds. In the terms of our model, their distribution of commitment to insurgency is between the Kurds and the Sunni. Muqtada al-Sadr, an influential Shia cleric, for example, has repeatedly called for the US to exit the country.⁸⁵ Al-Sadr has also sporadically battled US forces and maintained a sizable militia.⁸⁶ Our model suggests that providing benefits to both of these groups should dissuade would-be insurgents. In fact, only benefits have

accrued to the Kurds, and they are the most supportive group whereas the US-led forces have used a mixed strategy with some Shia such as Al-Sadr. For the most part, this mixed strategy has led to mixed results. Our model suggests benefits such as improving security in Sadr City in Baghdad or providing some other political carrot to al-Sadr and his loyalists may reduce their need to mobilize militia and potential insurgents.

While the discussion of the Iraqi case does not 'prove' our model, it suggests some plausibility for the implications of the model and potential policy choices for the US and its coalition partners. Understanding the commitment of the population that supports an insurgency can help explain why some counterinsurgent campaigns are successful while others may fail.

CONCLUSIONS

Although there has been considerable attention devoted to attrition versus hearts and minds approaches to insurgency, little work has attempted to compare the two theoretically.⁸⁷ Our approach captures key elements of the core logics as well as relative strengths and weaknesses of the approaches from the perspective of counterinsurgents and insurgents who can employ a mix of strategies.

The results of computational experiments, although generated from different theoretical and methodological underpinnings, complement the recent arguments of other scholars and indicate that a hearts and minds approach is likely to be far more successful than an attrition approach.⁸⁸ Because an attrition-based strategy risks driving members of the population towards the insurgency inadvertently, playing to the population's hearts and minds may avoid the negative externalities associated with targeting insurgents. This finding has clear implications for ongoing insurgencies, such as the current one in Iraq. It suggests that the provision of public goods may be paramount in winning popular support, thereby robbing insurgents of a committed base of potential insurgents. The model, however, also predicts that where counterinsurgents face highly committed members of the population, either strategy may be ineffectual. For the Sunnis in Iraq, increasing costs or benefits may have little impact on their support for the insurgents.

Like all models, ours is a simplification of reality, yet it is an important baseline. Further attempts to model insurgency could provide more complexity such as the possibility that counterinsurgents and insurgents employ either costs or benefits based on their beliefs about the strength of the insurgency. For example, when areas are contested (and therefore the strength of the insurgency in an area is much higher), counterinsurgents and insurgents might pursue different strategies than in uncontested areas.⁸⁹

Integrating a transnational component to the model would also make it more realistic. This could be accomplished by exogenously increasing the number of insurgents in the model at different time intervals. With foreign fighters, it is likely that a 'hearts and minds' would not be as successful because any benefits would not directly affect the foreign fighters. Indirectly, however, the increasing satisfaction of

the local population may lead to a decrease in support for foreign fighters over time. It is not clear whether an attrition strategy would necessarily be more successful, however. If the attrition strategy further alienates the population, then foreign fighters might be received even more favorably, thus exacerbating counterinsurgent problems with containing the insurgency.

In addition, adding a target audience that changes its utility calculations based upon the present number of insurgents might be a way to incorporate the US public into the model. Changes in audience utility calculations could lead to increases or decreases in numbers of counterinsurgents. In the past, when governments could use a heavy hand against insurgents such as the US government's response to the Seminole Indians in the early 1800s or the Bolshevik response to the Antonov Revolt in 1920–21, neutralizing a peasant insurgency with attrition was possible. As the Russian experience in Chechnya has shown, limited attrition constrained by public opinion can have great costs for both sides and may not lead to a resolution of the underlying conflict.

Finally, of crucial importance will be to subject these theoretical expectations to more rigorous empirical testing. One useful way of examining empirically the predictions of our model would be to use a 'most-similar' research design. A study could ensure that the structural characteristics in the agent-based model are similar across all cases empirically, but then examine the effects of different strategies across the cases. Our case illustration of Iraq provides a useful starting point for such an analysis, yet more detailed work could examine the sources and changes of commitment at the individual level as well as the variation in the use of cost and benefit strategies.

Analyzing the model and its implications in light of empirical realities is important because it is unlikely that US conventional military strength will be rivaled in the near future. This makes it all the more likely that insurgency and small wars will be the weapon of choice for groups opposing US, and other major power, interests around the world. Understanding the nature of insurgency as well as how adequately to deal with its presence and emergence is of critical importance in this next era.

NOTES

1. For a review of various metrics to assess the war on terror see Daniel Byman, 'Measuring the Effectiveness of the War on Terrorism: A First Look', presented at the 2003 Annual Meeting of the American Political Science Association, 28–31 Aug. 2003.
2. Donald Rumsfeld, 'Global War on Terror', memo, 16 Oct. 2003 <www.usatoday.com/news/washington/executive/rumsfeld-memo.htm> .
3. For examples of other work, see T. David Mason, 'Insurgency, Counterinsurgency, and the Rational Peasant', *Public Choice* 86 (1996) pp.63–83.
4. James D. Fearon and David Laitin, 'Ethnicity, Insurgency and Civil War', *American Political Science Review* 97/1 (2003) pp.75–90.
5. Insurgency as described by the Central Intelligence Agency is divided into several components. First, it is a protracted political–military action aimed at total or partial control of the state apparatus. Second, this action is pursued through the use of irregular armies and 'illegal' political entities. Third, actions carried out by these groups include warfare, terrorism, and political mobilization aimed at

creating propaganda to delegitimize the current authorities while increasing the legitimacy of the insurgent group. Fourth, the common thread of all insurgent groups is the desire to control a particular area. See Central Intelligence Agency, *Guide to the Analysis of Insurgency* (Washington DC: CIA Publication nd).

6. In contrast, Bard O'Neill's definition of insurgency is a 'struggle between a non-ruling group and the ruling authorities in which the non-ruling group consciously uses political resources (e.g., organizational expertise, propaganda, and demonstrations) and violence to destroy, reformulate, or sustain the basis of legitimacy of one or more aspects of politics'. This definition mirrors the key points of the CIA definition while including specific tactics and resources employed in the struggle. O'Neill's extension into tactics later helps decipher types of insurgency which leads to policy implications for dealing with each type. See Bard O'Neill, *Insurgency and Terrorism* (Dulles, VA: Brassey's 1990).
7. Contrary to public perceptions, guerrilla warfare is not a modern creation. It has a long, illustrious history reaching back to Asia as early as the fifteenth century BC. Modern times, however, have seen a proliferation of guerrilla warfare as small wars have blazed across the globe as practitioners have written influential treatises. For examples, see Ernesto (Che) Guevara, *Guerrilla Warfare* (Harmondsworth, UK: Penguin Books 1969); Vo Nguyen Giap, *People's War, People's Army Military Review* (Honolulu: UP of the Pacific 2001); Mao Tse-tung, *On Guerrilla Warfare* (New York: Praeger 1961); Carlos Marighella, *For the Liberation of Brazil* (Harmondsworth, UK: Penguin Books 1971).
8. The US State Dept. defines terrorism as, 'premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience'. Accessed March 2005 at <www.cia.gov/terrorism/faqs.html > .
9. See Nathan Leites and Charles Wolf Jr, *Rebellion and Authority* (Chicago: Markham Publishing/RAND Corp. 1970) pp.3–4. Leites and Wolf claim that the terms insurgents and counterinsurgents are vague and evoke strong feelings. They argue 'rebellion' and 'authority' are 'more accurate' and 'less partisan'.
10. NATO defines counterinsurgency as 'those military, paramilitary, political, economical, psychological and civic actions taken to defeat an insurgency'. US Dept. of Defense 'Counterinsurgency' (2003) <www.answers.com/topic/counterinsurgency > . Military and political means are both important in defining the operations of a counterinsurgent. During the Cold War, counterinsurgency was equated with counter-communism. Focus on ideology rather than commonality in insurgency across regions and across time led to inaccurate solutions to a possibly systemic problem. See D. Michael Shafer, 'The Unlearned Lessons of Counterinsurgency', *Political Science Quarterly* 103/1 (1988) pp.57–80.
11. Daniel Byman, *Trends in Outside Support for Insurgent Movements* (Washington DC: RAND 2001). Also see Paul Staniland, 'Defeating Transnational Insurgencies: The Best Offense is a Good Fence', *Washington Quarterly* 29/1 (2005) pp.21–40.
12. Eric Wendt, 'Strategic Counterinsurgency Modeling', *Special Warfare* 18/2 (2005) pp.2–12.
13. Ibid.
14. Within a particular strategy, tactics that both persuade and punish are used. When we refer to a state following an attrition strategy, we assume that a majority of the tactics employed impose costs while when a hearts and minds strategy is used, most tactics provide benefits to the population. As stated earlier, most counterinsurgency campaigns mix tactics and thus each strategy we outline is an ideal type.
15. Shafer (note 10).
16. Robert M. Cassidy, 'Back to the Streets Without Joy: Counterinsurgency Lessons from Vietnam and Other Small Wars', *Parameters* 34/2 (Summer 2004) pp.73–83; Robert R. Tomes, 'Relearning Counterinsurgency Warfare', *Parameters* 34/1 (Spring 2004) pp.16–28.
17. Julia A. Heath, T. David Mason, William T. Smith, and Joseph P. Weingarten, 'The Calculus of Fear: Revolution, Repression, and the Rational Peasant', *Social Science Quarterly* 81/2 (2000) pp.622–33.
18. Some other notable examples of this approach include Roger Trinquier, *Modern Warfare: A French View of Counterinsurgency* (New York: Praeger 1964) and Susan L. Carruthers, *Winning Hearts and Minds: British Governments, the Media, and Colonial Counter-Insurgency 1944–1960* (London: Leicester UP 1995). Trinquier argues that the French experience in Algeria could directly be related to its inability to win the allegiance of the indigenous people. In a study of the British historical experience with insurgency, Carruthers argues that counterinsurgency should target the hearts and minds of both the target population as well as the population of the aggressor state.

19. Gavin Bulloch, 'Military Doctrine and Counterinsurgency: A British Perspective', *Parameters* 26/2 Summer (1996) pp.4–16.
20. Austin Long, *On Other War: Lessons from Five Decades of Rand Counterinsurgency Research* (Santa Monica, CA: RAND Corp. 2006).
21. Leites and Wolf (note 9), 1970.
22. *Ibid.* pp.20–1.
23. David Galula, *Counter-insurgency Warfare: Theory and Practice* (New York: Praeger 1964) p.70.
24. Rarely is only one of these strategies employed in isolation, but usually one is more prominent than the other. In general, our claims refer to campaigns that greatly privilege one approach above the other.
25. Fearon and Laitin (note 4), 2003.
26. Mason (note 3); T. David Mason, *Caught in the Crossfire: Revolutions, Repression, and the Rational Peasant* (Lanham, MD: Rowman & Littlefield 2004).
27. Norma J. Kriger, *Zimbabwe's Guerrilla War: Peasant Voices* (Cambridge, UK: CUP 1992).
28. Leites and Wolf (note 9).
29. Inputs for their model included people, food, material, information and other similar items needed to sustain a rebellion. Outputs are the activities of the guerrillas aimed at destabilizing the regime. Inputs must be converted and combined to make the outputs. According to this perspective, the supply chain can be broken at this point (*Ibid.* p.35).
30. Richard Shultz, 'Breaking the Will of the Enemy during the Vietnam War: The Operationalization of the Cost-Benefit Model of Counterinsurgency Warfare', *Journal of Peace Research* 15/2 (1978) pp.109–29.
31. Ian F. Beckett, *Encyclopedia of Guerrilla Warfare* (New York: Checkmark Books 2001).
32. This approach, of course, is morally repugnant and most likely infeasible in today's world of 24-hour news coverage and especially for modern democracies. (See Edward N. Luttwak, 'Dead End: Counterinsurgency Warfare as Military Malpractice', *Harper's* 314 (2007) pp.33–42.) Limited attrition is a more likely strategy.
33. Mao Tse-tung (note 7) p.93.
34. To reiterate, these are not mutually exclusive options, but often one is privileged over the other.
35. Galula (note 23) p.70 suggests classifying areas according to their degree of insurgent control. Red areas are insurgent strongholds, pink areas contested, and white areas are controlled by the government. For Galula, counterinsurgents should then attempt to make red areas pink and pink areas white.
36. Scott Peterson, 'Friend and foe blurred on urban streets', *Christian Science Monitor*, 15 Nov. 2004, <www.csmonitor.com/2004/1115/p01s01-woiq.html> .
37. O'Neill (note 6), 1990; T. David Mason and Dale A. Krane, 'The Political Economy of Death Squads: Towards a Theory of the Impact of State-Sanctioned Terror', *International Studies Quarterly* 33/2 pp.175–198; Heath *et al.* (note 17) pp.622–33.
38. This is consistent with what Wendt (note 12) calls the 'Area-of-Influence Model' of counterinsurgency.
39. Timothy P. Wickham-Crowley, *Guerrillas and Revolution in Latin America: A Comparative Study of Insurgents and Regimes Since 1956* (Princeton UP 1992).
40. Ronald J. Deibert and Janice G. Stein, 'Hacking Networks of Terror', *Dialogue* 10 1/1 (2002) pp.1–14
41. This contact has traditionally been physical, but as we mention above, contact may also be virtual.
42. Mason and Krane (note 37), 1989; Bulloch (note 19); Andrew Krepinevich, 'The War in Iraq: The Nature of Insurgency Warfare', 2 June 2004, <www.csbaonline.org/cgi-local/pubfind.cgi?PubCategory=Homeland+Security&no_top> .
43. Stathis Kalyvas, 'The Logic of Massacres in Algeria', *Rationality and Society* 11/3 (1999) pp.243–85.
44. Timur Kuran, 'Now Out of Never: The Element of Surprise in the East European Revolution of 1989', *World Politics* 44 (Oct. 1991) pp.7–48; Ravi Bhavnani and David Backer, 'Localized Ethnic Conflict and Genocide: Accounting for Differences in Rwanda and Burundi', *Journal of Conflict Resolution* 44/3 (2000) pp.283–306; Lars-Erik Cederman, 'Articulating the Geo-Cultural Logic of Nationalist Insurgency', 'Origins and Patterns of Political Violence I: Violence in Civil Wars' Workshop, Santa Fe Institute, NM, 16–18 Jan. 2004). For a discussion of the strengths and weaknesses of agent-based models, see Lars-Erik Cederman, *Emergent Actors in World Politics: How States and Nations*

Develop and Dissolve (Princeton UP 1997) pp.49–69. Our model, although not comprehensive nor free of shortcomings, provides a useful perspective on insurgency and counterinsurgency.

45. Parameters are varied *one at a time* to control for all other factors.
46. A summary of notation used in the model appears in Table 1.
47. Galula (note 23) pp.75–6.
48. Our model assumes that ‘nature’ provides a small number of insurgents initially. In other words, our model does not attempt to explain the onset of insurgency or the reasons individuals initially choose to mobilize an insurgency. Recall that we suggested earlier that factors such as ideology or identity might serve as underlying sources of commitment to an insurgent movement, but such concerns are beyond the scope of this paper.
49. Mark I. Lichbach, *The Rebel’s Dilemma* (Ann Arbor: Univ. of Michigan Press 1995).
50. T.E. Lawrence, or Lawrence of Arabia, similarly observed, ‘rebellion can be made by two per cent active in a striking force, and 98 per cent passively sympathetic’. Cited in Andrew Krepinevich Jr, *The Army and Vietnam* (Baltimore, MD: Johns Hopkins UP 1986) p.9.
51. Mancur Olson, *The Logic of Collective Action* (Cambridge, MA: Harvard UP 1965).
52. Gordon Tullock, ‘The Paradox of Revolution’, *Public Choice* 11 (1971) pp.89–99.
53. Krepinevich (note 42).
54. Lichbach (note 49).
55. Where $U[\cdot]$ represents a uniform distribution and $N[\cdot]$ represents a normal distribution. For χ_i^p , $\mu = 0.5$ and $\sigma = 0.16$ to ensure that at 3 standard deviations out on either side, 99 + per cent of $\chi_i^p \in [0, 1]$. Any $\chi_i^p < 0$ or > 1 are rounded to zero and one respectively. These are rare.
56. This can also be conceptualized as having a commitment to an opposite ideology, different goals, or alternative leadership.
57. These distributional choices are justifiable on both modeling and empirical grounds. Whether the insurgents or counterinsurgents are distributed uniformly or normally is going to matter little, because the distribution is in such a small range (0–0.2). For the population, empirically there is reason to argue that the vast majority of the people are (and remain) in the middle and support the side they expect will win (Krepinevich [note 42]). Thus assuming a normal distribution is well-justified.
58. Others also allow vision to vary across agent types (e.g., Joshua Epstein, ‘Modeling Civil Violence: An Agent-based Computational Approach’, *Proceedings of the National Academy of Science* 99/3 pp.7243–50). For tractability, we assume that members of the population do not have any vision. They move randomly in all cases.
59. Its new level of commitment is based on the initial distribution of commitment in each experimental condition.
60. Changing groups might similarly be thought of as ‘tag-flipping’ (Joshua Epstein and Robert Axtell, *Growing Artificial Societies: Social Science From the Bottom Up* [Washington DC: The Brookings Institute Press 1996]).
61. For tractability in the model, we do not allow the population to provide benefits or costs to either insurgents or counterinsurgents. In reality, members of the population perform this role, but because they do so for both insurgents and counterinsurgents, we assume that the provision of benefits and costs ‘washes out’. Accordingly, members of the population always move randomly. Finally, and also for tractability, intragroup interaction is prohibited.
62. This is also justifiable, because members of the population are *not* likely to demonstrate large fluctuations in their commitment in the short run. Over time, agents could certainly fluctuate widely, and our model captures that. We conducted ‘sensitivity analysis’ wherein agents’ responsiveness is distributed higher: $R \in U[0, 0.66]$ and $R \in U[0, 1]$. We explicitly vary this range to gauge its effect on the key parameters and note the effect in the experimental results section.
63. Mason (note 26) p.169.
64. This is consistent with Kalyvas (note 43).
65. Mason (note 26), p.159.
66. Christopher Ford, ‘Speak No Evil: Targeting a Population’s Neutrality to Defeat an Insurgency’, *Parameters* 35/2 (2005) pp.51–66.
67. In addition to theoretical reasons for allowing insurgents to neutralize the population, this mechanism creates more symmetry between the effects of counterinsurgent *and* insurgent cost strategies, by allowing insurgents to swing support for the counterinsurgency back in favor of the insurgency, just as counterinsurgents are able to neutralize insurgents.
68. Note that we conduct sensitivity analysis altering the vision of counterinsurgents and insurgents, the responsiveness of population members, the threshold for joining the insurgency, and the algorithm for

searching in one's neighborhood. We find that, in all cases, changes in the number of insurgents occur, but these changes are confined to increases or decreases that are comparable. In other words, although absolute numbers change, the comparative dynamics are stable across sensitivity analysis, thereby allowing us to make robust conclusions about how the costs and benefits strategies relate to each other. For example, higher responsiveness leads to proportionally greater insurgents, but the comparative relationship between the costs and benefits strategies remains similar.

69. Recall that low, normal, and high commitment simply refer to a distribution (1) skewed such that most of the population has a low level, (2) not skewed such that the population is in the middle, and (3) skewed such that most of the population has a high level of commitment *ex ante*.
70. The results of Experiments 3 and 4 also relate to Proposition 3 in that we explore the effects of increasing the level of commitment to moderate levels.
71. Cited in Richard Stubbs, *Hearts and Minds in Guerrilla Warfare: The Malayan Emergency, 1948–1960* (Oxford: OUP 1991) p.259.
72. Ellen Knickmeyer, 'Bombing Shatters Mosque in Iraq', *Washington Post*, 26 Feb. 2006, < www.washingtonpost.com/wp-dyn/content/article/2006/02/22/AR2006022200454.html > .
73. Peter Eisler and Tom Squitieri, 'Foreign Detainees are few in Iraq', *USA Today*, 6 July 2004, < www.usatoday.com/news/world/iraq/2004-07-05-detainees-usat_x.htm > .
74. Bloom, for example, argues that the presence of multiple groups leads to 'outbidding' or an increase in violent actions by groups to attract supporters away from rival insurgent groups. See Mia Bloom, *Dying to Kill: The Allure of Suicide Terror* (New York: Columbia UP 2005).
75. We conceive of a case as a particular 'phenomenon for which we report and interpret only a single measure on any pertinent variable' (Harry Eckstein, 'Case Study and Theory in Political Science', in Fred I. Greenstein and Nelson W. Polsby [eds.], *Handbook of Political Science V. 1: Scope and Theory* [Reading, MA: Addison Wesley 1975] p.85).
76. We could increase the number of observations by disaggregating these three groups as well. For parsimony, we only discuss these three cases.
77. An even smaller portion of Sunnis from Tikrit, Saddam Hussein's hometown, enjoyed a disproportionate share of government power and wealth.
78. John Karl, 'Insurgency Gains Alarming Support Among Iraq's Sunni Muslims', ABC News, 19 June < <http://abcnews.go.com/WNT/stoty?id=2470183> > .
79. James D. Fearon, 'Commitment Problems and the Spread of Ethnic Conflict', in David Lake and Donald Rothchild (eds.), *The International Spread of Ethnic Conflict: Fear, Diffusion, and Escalation* (Princeton UP 1998).
80. Rory McCarthy, 'Uneasy Truce in the City of the Ghosts', *The Guardian*, < www.guardian.co.uk/international/story/0,,1202143,00.html > .
81. Jim Miklaszewski, 'Still Locked Down, Fallujah Slow to Rebuild', MSNBC, 14 April 2005, < <http://msnbc.msn.com/id/7503610> > .
82. Based on reports by the US Defense Dept. on the average number of attacks by insurgents per month.
83. Lisa Burgess and Jeff Schogol, 'Pentagon Report: Insurgent attacks Hit Postwar High', *Stars and Stripes* (2006), < <http://stripes.com/article.asp?section=104&article=34434&archive=true> > .
84. *USA Today*/ABC news poll, 4 March 2007. The margin of error is 2.5 per cent.
85. 'Al Sadr back with call for US forces to leave', *The Herald*, 18 Oct. 2007, Web issue 2968, Glasgow, UK < <http://www.theherald.co.uk/news/foreign/display.var.1428567.0.0.php> > .
86. Jill Carroll, 'Sadr's Militia's New Muscle in South', *Christian Science Monitor*, 21 Sept. 2005, < www.csmonitor.com/2005/0921/p01s03-woiq.htm > .
87. A notable exception is the work of Mason (note 3), although he uses decision-theoretic models focused on the population member's decision to join or not. Thus, there is not explicit modeling of the insurgent or counterinsurgent choices.
88. Shafer (note 10); Mason (note 26).
89. Kalyvas (note 43).