Civil Engineering: Does a Realist World Influence the Onset of Civil Wars?

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Abstract

Recently, the study of civil wars has attracted more and more attention from scholars of international relations. Using a computer simulation called EARTH (Exploring Alternative Realpolitik THeses) that not only simulates a realist world, but also includes civil wars; the author explores what aspects of a realist world are associated with the onset of civil war. Although features of a realist world are not the dominate factors in accounting for civil wars, the loss of territory that accompanies losing interstate wars does influence the chances of states undergoing civil war.

In his annual report on the work of the United Nations in August 1999, Secretary General Kofi Annan said,

> During the 1990s, we have witnessed major changes in the patterns of global conflict and in the international community's responses to them. Today, more than 90 per cent of armed conflicts take place within, rather than between, States. (Annan, 1999)

Annan's statement reflects the commonly held belief that civil wars (relative to wars between states) have become much more common in recent years.

There is no question that civil wars are increasingly viewed as a significant problem in today's world. There are many challenges associated with civil wars. For scholars of international relations, a major challenge is to understand the role and impact of the international environment on the outbreak of civil war. We face a significant problem: Our most commonly used theoretical framework—realism—does not appear to address civil wars. This paper is an attempt to integrate civil wars into a realist framework. Using a computer simulation of a realist world called EARTH (Exploring Alternative Realpolitik THeses), I will explore what factors in a realist world are associated with the onset of civil war. Let me be clear. This is a *theoretical* exercise. Any relationships that are discovered in this study need to be investigated empirically. However, it seems worthwhile to explore the theoretical connections between the most commonly used framework in international relations and civil wars.

I begin with a comparison of the historical record of civil and interstate wars. This is followed by a brief description of the realist literature. I then assess the relationship in the existing literature between realism and civil wars. The computer simulation EARTH is then outlined, with particular emphasis on EARTH's conceptualization of civil war. The simulation experiments are described, and the results are analyzed. Finally, the conclusions of the study are discussed.

Civil and Interstate Wars: The Historical Record

How accurate is Kofi Annan's statement about recent changes in the pattern of global conflicts? The Correlates of War Project has collected data on interstate wars and civil wars from 1816 through 1997 (Sarkees, 2000). During that period of time, the investigators identify 213 civil wars (referred to as intrastate wars) and only 97 interstate wars; by their estimates civil wars are more than 2½ more common than interstate wars. As alluded to by Annan, the imbalance between interstate wars and civil wars is particularly extreme from 1990 to 1997 (1 interstate war and 24 civil wars). It is important to note that the historical data make clear that civil wars have *always* been more frequent than interstate wars.

Scholars appear to be aware of the importance of learning more about civil war. Research on this topic has become increasingly popular. For example, looking at the presentations at the 2006 and 2007 Annual Meetings of the Peace Science Society (International), research on civil wars has been the most popular topic. Twenty three percent of the presentations were about civil war. To put this in context, the second most popular subject of presentations was international conflict; 19% of the presentations were on this topic (Palmer, 2007).[1] Civil wars are important phenomena, occurring much more frequently than wars between states. And this is particularly true recently. At the same time, there are signs that scholars of international relations have become increasingly interested in trying to understand civil wars. In light of both the relative frequency

of civil wars and the growing interest in the academic study of this topic, it is particularly important to explore the theoretical connections between the most popular approach to understanding international relations—realism—and this form of conflict behavior.

A (Very) Brief Discussion of Realism

Realism is the most widely use framework in international relations. It is not the dominant approach at all times, but it always seems to come back to the forefront. Currently, the variant known as structural realism (Waltz, 1979) or neorealism (Mearsheimer, 2001) holds sway. Through the years, writing on realism[2] has displayed a great deal of diversity about even its most basic features. This makes simply characterizing realism a daunting task. Nevertheless, I will make an attempt to both organize the vast realist literature and to highlight the post–World War II development of realist thought in the United States.

Realism has both a practical (policy-oriented) side and a theoretical side. The practical side is represented by the writings of authors such as Machiavelli (1514/1961) or Kautilya (Modelski, 1964). They wrote explicitly to advise policy makers about how to survive and prosper in a world that operates according to realist principles. The theoretical side is represented by authors such as Gulick (1955) and Claude (1989). They used realism to understand the world. Of course there are also authors such as Kissinger (1994), who tend to include both perspectives in their writing. And what do they write about? Much of this vast literature has been directed at supplying the answers to two questions, one at the state level and the other at the system level:

1. What drives states to behave as they do and how can they survive and prosper?
2. What drives the behavior of the system of states and how is the multistate character of the system preserved? (paraphrased from Cusack & Stoll, 1990, p. 20)

Four Images of Realism

The discussion of realism in the last several paragraphs leaves the impression that there is a great deal of order and coherence in realist writings. Alas, that is not the case. Stoll and Cusack (1990, pp. 21-40) identify 12 different assumptions in the realist literature that are "debated." More precisely, they find 12 areas that are part of the underpinnings of realism over which there are divergent views within realist writings.[3] This, however, does not mean that the collectivity of realist writings is completely chaotic and without structure. Stoll and Cusack (1990, pp. 40-54) argue that there are four images of the final outcome of a realist system that repeatedly occur in realist writings.

- *The invisible hand*: States pursue their self-interest by all possible means. As a consequence, from time to time a state or states will pursue dominance. The self-interest of other states will lead them to act against those states seeking dominance. The result is that the multistate nature of the system is preserved. Claude (1989) calls those who fall into this image "relaxed realists." Rousseau (1970) is one example. This image is also where the current variant of realism—defensive and offensive neorealism—belongs (Mearsheimer, 2001).
- *Conscious balancing:* A second image consists of writers who believe that the self-interest of states can be a significant force, but that it will not be sufficient to preserve the system. Something extra is needed to preserve the system. Within this image three different "extras" are commonly cited. One is the presence of a balancer. A balancer is a state that holds itself above the pushing and hauling that is an integral part of a realist world. The balancer does intervene (to restore the balance) if it looks like a state (or group of states) is seeking dominance. Crowe (1928) provides an eloquent statement of the importance of a balancer.[4] A second school of thought asserts that the "something extra" is the presence of one or more statesmen who understand the importance of keeping the system in balance. Guicciardini (1561/1969) argues that the leading statesmen kept the Italian city-state system going, and Kissinger (1957) makes the same claim about the importance of key states-men to the stability of the European state system after the fall of Napoleon. Finally, some advocates of conscious balancing assert that there needs to be a norm of not eliminating an essential national actor (Kaplan, 1957). With the additional balancing mechanism, scholars who fall into this image believe that the multistate system will be preserved.
- *System collapse*: Writers who are part of this image believe that while a system of states that operates according to realist principles can survive for a period of time, it will ultimately collapse into an empire. While this certainly seems to be a logical possibility it is one that is typically ignored or down-played by political scientists. It is explicitly discussed by Carneiro (1970a, 1970b, 1978), who studied pre-Columbian America. He notes that in the state systems he studied there is a long-term trend toward the development of a single dominant state.
- *Cycles of empire and multistate system:* The final image includes writers who believe that one state can dominate the system, but that this empire cannot persist. Ultimately empires collapse and a multistate system will return. This image is in the works of the historians Toynbee (1954) and Kennedy (1987). Among political scientists it is present in the writing of Modelski (1987) and Thompson (1988).

This scheme is not perfect and does not successfully categorize all of the writing in the realist tradition. I believe it is useful and does a reasonable job of bringing order to this body of literature. At the very least, it demonstrates that there is a great deal of

diversity in realist writings,[5] and that this diversity of views even extends to the ultimate fate of a system of realist states. These are not minor differences. In the next section I take a different cut at the realist literature: a modest review of some of the key American post–World War II realist writings.

Highlights of Post–World War II American Writings on Realism

The above summary is one way to organize the realist literature. In this section I will take another approach. I will briefly compare three significant American realist scholars: Morgenthau (Morgenthau & Thompson, 1948/1985), Waltz (1979), and Mearsheimer (2001). Morgenthau is the first well-known American realist of the post–World War II era. Waltz's 1979 book introduced neorealism. Mearsheimer popularized the distinction between defensive and offensive realism. I will compare these three scholars on the following dimensions:

1. Whether the author believes (like most classical realists) that politics is rooted in human nature.
2. The unit of analysis favored by the author (state or system level).
3. Whether the author assumes that decision making is rational.
4. The goals of states in a realist world.
5. Whether the system can retain its multistate character or whether war can threaten or destroy the system.

Morgenthau. In the words of Dougherty and Pfaltzgraff (2001), "[n]o twentieth-century writer has had a greater impact on the development of realist theory than Hans J. Morgenthau" (p. 75). He is clearly the pre-eminent realist of the post–World War II era, and his works are enormously influential. In line with most of the classical work on realism, he believes that politics is rooted in human nature (Morgenthau & Thompson, 1985, p. 4). His work ranges back and forth between the system and state levels. He assumes decision makers are rational (p. 5). When states strive to balance the power of others, the uncertainty of power calculations means that states must act to maximize their power. This means that "[p]reventive war, however abhorred in diplomatic language and abhorrent to democratic public opinion, is in fact a natural outgrowth of the balance of power" (p. 229). Thus the balance of power is inherently unstable.

Waltz. Waltz's 1979 work refocused attention on realism; interest in the approach had waned in the aftermath of the 1973 oil embargo. Unlike Morgenthau, Waltz does not assume that politics is rooted in human nature. Although he makes assumptions at the state level, Waltz's theory is at the system level. As for the assumption of rationality, Waltz wanders back and forth on this issue. In his 1979 book, he states, "Notice that the theory requires no assumptions of rationality or of consistency of will on the part of all the actors. The theory says simply that if some do relatively well, others will

emulate them or fall by the wayside" (p. 118). However, later, in responding to a critic who argued that he did assume rationality, Waltz (1986) says,

> Contrary to his [Keohane's] statement, I do not differ with him over rationality, except semantically. I prefer to state the rationality assumption differently. Since making foreign policy is such a complicated business, one cannot expect of political leaders the nicely calculated decisions that the word "rationality" suggests. More significantly, my preference is based on the importance I accord, and Keohane denies, to the process of selection that takes place in competitive systems. (p. 330)

As for the survival of the system, Waltz asserts (1979) that "balances of power recurrently form" (p. 124) and that a "[b]reakdown [of the system] due to war is unlikely" (p. 199).

Mearsheimer. Mearsheimer's contribution to neorealism is to emphasize the distinction between defensive realism and offensive realism. Defensive realist states seek to maintain their power and maintain the balance of power, and they have survival as their goal. Offensive realist states maximize their power and have hegemony as their goal. Mearsheimer argues that states in Waltz's structural realism are defensive realists, but Mearsheimer believes that most states are offensive realists. He calls classical realism "human nature realism" and explicitly does not use this assumption (Mearsheimer, 2001, p. 18). Like Morgenthau, his work moves back and forth between the system level and the state level. He explicitly assumes that great powers are rational actors (p. 31). And while Mearsheimer asserts that "…the world is condemned to perpetual great power competition" (p. 2), he believes that the system will survive.

This brief review shows that even when greatly narrowing our focus on the realist literature to prominent American scholars in the post–World War II era, there is still significant variation on key elements of realism. While it would not be accurate to say it varies randomly from scholar to scholar, it would be equally inaccurate to say that there is a logical progression to the literature. In the words of Mearsheimer (2001), "Realism is a rich tradition with a long history, and disputes over fundamental issues have long been commonplace among realists" (p. 13). Even if one does not agree with Vasquez's (1997) assertion that the realist paradigm is a degenerative research program, there is no question that realism is a hydra. This variability makes it difficult to get a clear grasp on its essence. And it complicates any attempt to systematically evaluate realism.

Realism and Civil Wars: Is the Glass Empty, Half Full, or Sort of Full?

The section heading is a brief summary of the ways in which we can associate realism with civil wars. As I noted above, realism means different things to different people, so it should not be too surprising that its relationship to civil war can be characterized

in a number of different ways. These range from no relationship to (at least potentially) a realist world that has a great deal of impact on the tendency for states to experience civil war.

The Empty Glass

The easiest position to take is that realism has nothing to say about civil wars. Realists assume that the state is a single entity and often assume (although not always) that the state is a rational actor. Under these circumstances there is simply no theoretical room for realism to speak to civil wars. Additional support for this point of view comes from examining the book-length studies of realism by Morgenthau, Waltz, and Mearsheimer. None of these scholars has anything significant to say about civil war.[6]

The Glass Half Full

There is a small body of scholarship that attempts to link realism with civil wars. More properly, this literature can be characterized as borrowing (or advocating the borrowing of) *parts* of realist (or neorealist) thought to help understand civil wars. One example is Mack (2002). He argues that the realists' assumption of anarchy does not normally apply to what happens within states (realists typically contrast the anarchy of the international system with the hierarchical order of a domestic system). However, when states fail, the relations between groups within the state may resemble the anar- chy associated with realism: "In this case, realist theory *may* help explain escalation dynamics in any subsequent civil war that breaks out" (Mack 2002, p. 516). He does not deal explicitly with how anarchy can be incorporated into a theory of civil war. David (1997) makes an argument similar to Mack. He too believes that the realists' concept of anarchy may be applicable to the study of civil war. Like Mack, he does not really present his own theory of civil war using realism (he does discuss the work of Posen; see below).[7]

Posen (1993) takes the next step of directly incorporating realist thought. He applies Jervis' (1978) concept of the security dilemma to the study of ethnic conflict.[8] The general situation he considers is one in which there is a significant collapse of the central authority of a state. In this circumstance, ethnic groups that have had a past history of conflict may view each other with great suspicion and concern. This leads each group to protect itself by arming. In turn, as each group arms, this increases the suspicion and concern of the other groups. Ethnic conflict becomes more likely. Work by Rose (2000), Saideman (2002), and Vinci (2006) follows along in this tradition. All these scholars apply realist concepts to the interaction between civil war participants.

None of these efforts presents a full-blown realist theory of civil war. Of course this was not the intent of any of the authors. All agree that realism has potential to be part of a theory that explains one or more aspects of civil war. And each offers some

suggestions about how this can be achieved. However, all also agree that realism cannot provide a complete explanation for civil war.

A Full Glass?

Is there a full glass, that is, a way to fully incorporate realism into a theory or explanation of civil war? That is too big a task for a single paper, but I believe we can make some progress toward this end. It is possible to develop a framework that is based on the principles of realism and also includes civil war. This framework can then be used to give theoretical insight into the links between realism and civil war. The computer simulation EARTH models a state system that functions according to a realist frame- work, but also allows for the possibility of civil wars. This tool allows me to explore linkages between realism and civil war.

I will not give an extensive explication of the value of computer simulation. As the joining together of realism and civil war is so uncommon it is important to say a few things about why simulation can be an important and valuable tool. A computer simulation is a working model. It is analogous in some ways a formal model. For example, by running a simulation, one can observe the consequences that follow from the model that is programmed. This is similar—but not identical—to the deductions that are made when using a formal model. It is also possible to create a program that is far more complicated than a formal model. So we can simulate the important components of a realist world and also include a mechanism for the outbreak of civil war and observe the consequences.

However, these advantages come at a price. First of all, while it may be useful to have a large number of components to a simulation, it may become very difficult to trace through the exact sequence of steps that occurred. So it may not be possible to determine exactly why a particular outcome occurred. Second, in a simulation such as EARTH, a number of random elements are included. For example, to assign the initial power to the states in the system, the user specifies the mean and standard deviation of the power distribution. Each state is given a random draw from this distribution. While the use of this approach simplifies building the simulation, it leads to a need to conduct a large number of runs in order to vary the initial configuration of power in the system. Consequently, the conclusions that can be drawn from running such a simulation have to be in terms of average or general tendency. This is not nearly as precise as what can be done using a formal model. Simulation is not a magical tool that reveals all, but it can be very useful to understand the consequences of a model that contains a series of interconnected elements.

Exploring Alternative Realpolitik Theses: The EARTH Simulation

The EARTH simulation has been in use for more than 20 years. It is based on an earlier simulation developed by Bremer and Mihalka (1977), although it

has additional features that were not part of that effort. These include the ability to simulate civil war, which is obviously critical to this research. The most complete description of the simulation is Cusack and Stoll (1990, pp. 63-94). Because there are numerous descriptions of the simulation that are readily accessible, I will only give an abbreviated account. I will spend some time discussing the civil war component of the simulation since there is only a single published work that makes use of it (Stoll, 2005).

There are six phases to the EARTH simulation:

1. *Initialization:* A total of 29 input parameters are used to establish the starting configuration for the run (for example, the "world" of EARTH typically begins with 98 hexagonally-shaped states arranged in 7 rows and 14 columns; see Figure 1). This includes the initial power assigned to each state, the ability of each state to estimate power, the relationship between the power ratio of two sides in a war and the chances of the more powerful side winning the war, as well as a number of other parameters. An online appendix[9] provides a description of all of the parameters used in a simulation run. The initialization phase occurs only at the beginning of a run. Each iteration of the simulation cycles through phases 2 through 6.

2. *Civil war and disintegration:*[10] Every state that consists of more than one territory (hexagon) can experience civil war. A more detailed description of this phase is provided below. Briefly, if a state is selected to experience a civil war, this can involve only a small portion of its territories or a large portion of them. All territories lose power as a cost of fighting a war. The outcome of the war is a stochastic function of the power balance between the two sides. If the "loyalist" side wins, that is the end of the civil war for that state. If the rebels win, then the state disintegrates into two or more states.

3. *Dispute onset:* In the next phase of the simulation a potential dispute initiating state is selected. A state's chances of being selected are equal to its proportion of the total power in the system. The selected state calculates the power balance with each of its neighbors.[11] If it calculates it is more powerful than a neighbor, it initiates a dispute against it. If it finds no such neighboring state, there is no conflict and the simulation moves to the power adjustment phase.

4. *Dispute escalation:* In this phase, there can be up to three rounds of alliance formation. The first and the third (if there is a third) are by the target of the dispute. The second is by the initiator of the dispute. In a round, the state calculates the current power balance between its side (i.e., itself and any current allies) and the opponent's side. If it calculates that it is weaker, it seeks allies; otherwise the round ends. The state seeks to build a minimal winning coalition, with all allies being adjacent to the opponent. Each state that is asked to ally makes its own calculation; if it determines that by joining it will be on the more powerful side, it joins. If it determines that it will

not be on the powerful side, it does not join. If the initiator cannot build a minimal winning coalition in the second round, it backs down and the simulation moves to the power adjustment phase. If the initiator does not back down, a war occurs.
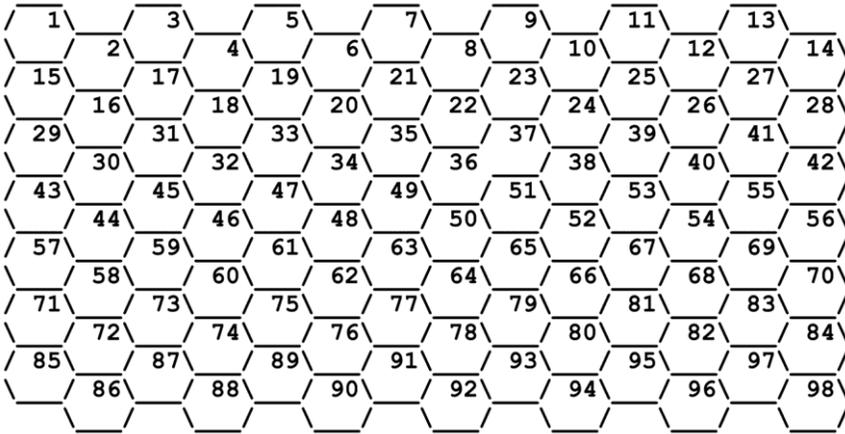
5. *War:* The outcome of the war is a stochastic function of the actual power balance of the two sides. All participants pay a cost to fight the war. The losers must pay an additional cost in power.[12] This power is distributed to the members of the winning side in proportion to their contribution to power of their coalition. Finally, the leader of the losing side (the dispute initiator or the initial target) must also give up territory. Territory is awarded to the winning side in rough proportion to the power contributions of its members.[13] If a state loses all its territory, it is eliminated.

6. *Power adjustment:* Each territory (hexagon) has a growth rate assigned in the initialization of the simulation run. In this phase the growth rate is applied. In the initialization phase each state is also assigned a maintenance parameter. This is the amount of power that the state must pay to prevent the outbreak of a civil war. In the power adjustment phase, states decide how much power to allocate for maintenance. The simulation continues until the user-specified iteration limit is reached; for the runs analyzed in this article the iteration limit was 1000.

The Civil War Phase in More Depth

Because civil wars are the focus of this article, I will provide more detail about the civil war phase. One of the initialization parameters for EARTH is the probability that at least one civil war can occur in an iteration. For the runs analyzed in this article, the parameter was set to 1.0 so that civil wars are possible in each iteration. If civil war is possible, every state containing more than one hexagon is examined.

When the system is initialized, each hexagon is assigned a minimum cost (amount of power) that it must pay in each iteration to prevent the outbreak of civil war. This is only relevant if a state contains more than one hex. A multi-hex state allocates an amount of power for this in the growth phase of the iteration. The amount is variable because states are assigned an ability to estimate the amount of power needed to prevent civil war. Consequently, in a given iteration a state may allocate more power than is required to prevent civil war or less power than is required. If a multi-hex state allocates an amount of power equal to or greater than its actual minimum cost,[14] it does not experience a civil war.

If the state has allocated less than the minimum cost, it may experience civil war. The chance that the state experiences civil war is related to the degree to which the state has underpaid to prevent civil war. This involves calculating the ratio formed by subtracting the actual cost paid by the state from the minimum cost, and dividing this by the minimum cost. This is multiplied by a system level parameter that is a

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Figure 1. Map of the system at the start of a run

probability weight for civil war and compared with a probability generated through a random draw. If the random draw is smaller, a civil war occurs.

The next step is to determine the scope of the revolt. This is a two-step process. In the first step, the number of hexes in the state that revolt is determined. This is calculated by drawing a probability from a uniform distribution and multiplying this by the number of hexes in the state. This figure (rounded) is the number of hexes that revolt. In the second step the specific hexes that revolt are determined. Hexes are ranked in terms of the costs of maintaining them in the state; given this ranking, territories are removed one at a time from the most to least costly until the total of revolting hexes is reached. The index that is used to rank territories includes three factors:

1. *Power:* The more powerful the territory, the more likely it is to revolt.
2. *Incorporation:* The shorter the time the territory has been a part of the state, the more likely it is to revolt.
3. *Distance:* The further away the territory is from the core hex (the original hex of the state), the more likely it is to revolt.

The remaining hexes remain loyal and fight against the rebels. The outcome of the war is determined in the same way as a war between states. It is a function of the power ratio of the two sides. Regardless of the outcome of the war, all participants pay a cost to fight it. If the rebels lose, they remain in the state.

If the rebels win, they secede from the state and one or more new states are formed. The territories (hexagons) of a new state must be contiguous to one another. If not all rebel territories are adjacent, more than one new state is created. Once the secession

process is complete, the next multi-hex state is examined to determine if a civil war occurs; if so, the process described above is repeated. Once all multi-hex states are examined, the simulation passes on to the next phase.

EARTH's Model of Civil War

It is useful to reflect on the model of civil war that is embedded in EARTH. It is a very abstract conception of what makes civil wars likely to occur and, if they do occur, how they develop. The key to avoiding civil war is for the state to pay enough maintenance. If the state devotes enough resources—if it allocates an amount equal to or greater than the minimum it needs—civil war cannot occur. As the amount of resources that the state devotes to maintenance falls further and further below the minimum, the likelihood of civil war increases.

Resources in EARTH are a very abstract concept. The resources devoted to maintenance could represent the provision of beneficial goods and services to the territories. Resources could also represent the wherewithal to repress the territories. And of course, they could represent a combination of the two. The best characterization of resources is that they are the amount of tangible attention devoted by the state to the prevention of civil war.

If a civil war does occur, the scope (the number of hexes that revolt) is random. Different portions of the state's territory have higher (or lower) chances of joining the revolt. A brief consideration of each factor that has an impact on a territory joining the revolt is a useful exercise.

One factor is the amount of power possessed by the territory. Territories that have more power are more likely to revolt. These territories have a better chance of successfully revolting because the outcome of a civil war is dependent on the power ratio between the rebels and the loyalists. This is consistent with the assertion that potential rebels are (at least somewhat) rational in their decision making about whether to revolt.

Territories that have recently joined the state are more likely to revolt. The only way that territories join a state is if that state wins a war and gains territory from the losing side. EARTH does not explicitly contain the concepts of nationality or ethnicity, but it is reasonable to assume that territories that have recently been acquired have not been fully assimilated into the new state. This makes such territories more likely to revolt if an opportunity to do so arises.

Territories that are distant from the core territory of the state are more likely to revolt. Distance makes control by the state more difficult. Let us consider two examples of this, one theoretical and the other empirical. The theoretical example is the loss of strength gradient, an idea developed by Boulding (1962). He argued that a state's power declines as the distance from the state increases. While he was thinking about states projecting power some distance overseas, the argument also makes sense within a state that is trying to control distant sectors of its own territory. The empirical

Table 1. Parameter Values for Control and Civil War Experimental Parameters

Variable	Parameter Values
Control parameters	
Standard deviation of power estimation [2]	10, 30
Share of power defeated states pay as reparations [5]	0.1, 3
Sigma: relation of power ratio to war outcome [6]	1, 5
Share of power all participant states pay to fight a war [7]	0.05, 0.2
Civil war experimental parameters	
Civil war occurrence interval [12]	1
General imperial policy control parameter mean [13]	0
General imperial policy control distribution parameter [14]	0.2, 0.8
Universal civil war probability weighting parameter [16]	1
Civil war cost maximum [17]	0.2, 1.0

Note: the number in brackets is the parameter number, as listed in the online appendix. The appendix provides a more complete description of the meaning of each parameter. This is the same as table 3 in Stoll (2005).

example is the well-documented finding that contiguity between states is a powerful predictor of conflict between them.[15]

The civil war module of EARTH is simple and straightforward. States can reduce the chances of a revolt by devoting resources to preventing it. Within the territory of a state, some areas (hexes) are more susceptible to revolt than others. This is determined by a set of three factors. The relationships between these factors and the tendency of a territory to revolt are plausible. While not a perfect model of civil war, it is a reasonable place to start to explore the theoretical linkage between realism and civil war.

The Civil War Experiments

The runs for this article were done for another piece of research (Stoll, 2005). That effort also was a study of civil wars; in fact it is the complement of this article. The focus of that article was the impact of civil wars on a state's subsequent interstate war experience.

In all studies using EARTH a standard set of parameters are used as control variables. There are also a series of parameters that define the civil war process; for example, I noted above that the civil war occurrence parameter was set to 1 for all the runs. Table 1 displays the values for all these parameters. A number of additional parameters are also varied.[16] In addition because there are so many random elements in EARTH, it is necessary to vary the starting value for the random number generator. Three different values of the starting seed are used for each set of parameters.

Ideally, all combinations of these sets of parameters would be used. This would be a total of 790 runs. There are 98 states at the beginning of a simulation run and an iteration limit of 1000. This could result in a dataset of 77,420,000 observations.[17] That is too large a dataset to be analyzed effectively. To reduce the dataset to a manageable size, I generated

all the sets of parameters and randomly selected 79 runs to be conducted. These runs produce a dataset that contains about 1.3 million observations. Given that the runs were randomly selected, this process produces a dataset that is an accurate reflection of the total number of runs that could have been conducted.

Analysis: Civil Wars While Living in a Realist World

Does a realist environment have an impact on the chances of a state experiencing a civil war—at least in the world of EARTH? As noted above, running a computer simulation is a theoretical exercise, but the vast amount of information that is generated does not allow for a simple or straightforward interpretation. Consequently, to observe the results of the simulation the data generated by the runs have to be analyzed statistically.

The dependent variable is straightforward. It is a dummy variable coded 1 if the state experiences a civil war in that iteration. To account for the onset of civil war, I will use four sets of predictor variables. These variables represent major features of the interstate and domestic environment of a state in the world of EARTH. The first set of variables measures recent war outcomes for the state (both interstate and civil). War is the most important behavior in EARTH and I want to ascertain to what extent this behavior has an effect on the current chances a state will experience a civil war. The second set of variables measures recent changes in the state's territory and power. Territory provides power and depth as well as points of contact with other states. Power provides the resources states use to make their way in EARTH. The third set of variables measures the current condition of several critical aspects of the state: the extent to which it is currently underpaying maintenance (to prevent civil war), the size (number of territories) of the state, and its current level of power. Note that the second set of variables represents the dynamics of territory and power, while this set represents the current status of these variables. The fourth set of variables consists of four control variables that are always present in studies using EARTH.

The first set of variables taps the recent war experience of the state. Before discussing the specific measures to be used, I present descriptive statistics on the war involvements of states in the set of simulation runs; they are displayed in Table 2. There are a total of 15,758 states across all the runs. Each run begins with 98 states, but states are created and destroyed during a run. While each run lasts for 1000 iterations, the average lifespan of a state is just below 85 iterations.[18] The total figures for wars do not take into account the lifespan of a state. The final two rows of the table do this by showing war frequencies per iteration. However, because it is not clear how to equate an iteration in EARTH to time in the real world, even these figures are not too useful. A better way to compare the interstate and civil environment in EARTH to the real world is to compare the ratio of the two types of wars. In the EARTH runs, the ratio of civil wars to interstate wars is about .14 (see Table 2). Using the Correlates of War Project interstate and intrastate war data (Sarkees, 2000), the equivalent ratio is about 2.70.[19]

Table 2. Descriptive Statistics for State War Involvements in Simulation Runs

Variable	Mean	SD	Minimum	Maximum
Lifespan	84.62	107.69	0	1,000
Total number of civil wars	0.65	2.18	0	45
Total number of interstate wars	4.67	8.17	0	124
Civil wars/iteration	0.008	0.036	0	1
Interstate wars/iteration	0.056	0.082	0	1

Note: $N = 15,758$.

In assessing the impact of wars (both civil and interstate), the relative infrequency of these events must be taken into account. For example, looking at a state's war experience in a single iteration would not be very useful, since most states in the system would not have experienced a war in that iteration. My strategy is to create a series of dummy variables, each of which represents one aspect of the outcomes of a state's recent wars. Winning or losing alters the state's power (and possibly its territory). War outcomes can also alter the local environment around the state by increasing or decreasing the power and/or territory of its neighbors. I create four dummies to account for recent war outcomes:

- State has won one or more civil wars over the last 5 iterations.
- State has lost one or more civil wars over the last 5 iterations.
- State has won one or more interstate wars over the last 5 iterations.
- State has lost one or more interstate wars over the last 5 iterations.

The second set of variables tracks recent changes in the state's territory and power. Changes in a state's territory only occur as the result of wars. As with the war outcomes variables, because wars are relatively rare, I use two dummy variables to track changes in territory:

- State has lost territory in the past 5 iterations.
- State has gained territory in the past 5 iterations.

Changes in territory have several impacts. First, these changes alter the amount of power possessed by the state. Second, these changes also have impacts on neighboring states. Third, the more territory in a state, the more it must pay in maintenance to reduce the chances of a civil war. Finally, note that newly acquired territory is more susceptible to revolt if a civil war occurs. So there are competing tendencies with regards to the relationship between changes in territory and the onset of civil war. The third variable in this group is the change in the state's power over the past 5 iterations. Wars change a state's power, but power also changes due to internal growth. Power is a valuable resource. It can be allocated for maintenance (which reduces the chances of a civil war). Power also helps the state to be successful in wars both because power leads to victory and because powerful states are more likely to gain allies. Finally, the

more powerful a state, the more likely it is to have an opportunity to initiate an interstate conflict.

The third set of variables tracks the current status of the state. The first variable in this group is a dummy variable coded 1 if the state is underpaying maintenance. Underpaying maintenance increases the chances the state will experience a civil war. The second variable is the size (number of hexagons) of the state. The third variable is the current power of the state. The potential impacts of these two variables on civil war were discussed above when dealing with recent changes in both variables. The fourth set of variables is used in EARTH studies as controls. The four variables (the values assigned to these variables are given in Table 1) are

- the standard deviation of state's ability to estimate power
- the share of power defeated states pay to winners of wars
- the relation of power ratio to victory (does a high probability of victory require a narrow or large margin of superiority in power?)
- the share of power all states pay to participate in war

With the exception of the control variables, all independent variables are lagged 1 iteration prior to the dependent variable, outbreak of civil war. That is, when predicting the outbreak of civil war at time t, the dummy for winning interstate wars over the last 5 iterations is measured from $t - 6$ to $t - 1$.

Results

The results of predicting the onset of civil war are displayed in Table 3. Let me begin by discussing the impact of the variables in each group. I will then discuss the features of a realist world that have an impact on the onset of civil war.

War Outcomes

At first glance, the two civil war occurrence variables seem to have strange impacts. Winning civil wars increases the chance of a future civil war, while losing civil wars reduces the chances. This is not really that surprising. When a state loses a civil war, it gives up the hexes that revolted.[20] This reduces the amount of maintenance a state must pay to avoid civil war. Conversely, if a state wins a civil war, it retains those territories that are most likely to revolt. The minimum maintenance needed to prevent civil wars remains significant, but the state has lost power due to fighting civil war. This makes the prevention of future civil war more difficult.

States that win interstate wars gain power (and perhaps territory) from their opponents, but they also lose power by the act of waging war. Winning wars may not gain a lot of power for the state (in fact sometimes winning a war creates a net loss of power for states). Consequently the rather small positive impact of winning is not surprising. However, in losing interstate wars a state's power decreases both by the act of waging war and the necessity of giving up power and perhaps territory to the winning side in

Table 3. Logit Predicting Civil War Onset

Variable	Coefficient	Standard Error	Z	$p > |z|$
Civil war(s) won past 5 iterations*	0.872	0.033	26.08	.000
Civil war(s) lost past 5 iterations*	−1.690	0.057	−29.61	.000
Interstate war(s) won past 5 iterations*	0.192	0.031	6.19	.000
Interstate war(s) lost past 5 iterations*	−1.762	0.038	−46.46	.000
Territory lost past 5 iterations*	3.264	0.031	104.57	.000
Territory gained past 5 iterations*	0.219	0.040	5.47	.000
Change in power past 5 iterations	0.00002	0.0000009	2.03	.043
Underpay maintenance*	3.304	0.041	80.02	.000
Size	0.001	.0005	2.47	.014
Power	−0.000008	−0.000002	−4.52	.000
Standard deviation of power estimation	0.113	0.044	2.57	.010
Share of power defeated states pay	0.276	0.112	2.46	.014
Sigma: relation of power ratio to war outcome	−0.034	0.006	−5.75	.000
Share of power states pay to fight a war	−0.817	0.148	−5.53	.000
Constant	−7.272	0.051	−143.88	.000
Observations	1,251,704			
Log likelihood	−40741.744			
Pseudo R^2	.271			

Note: Four failures and zero successes completely determined; these cases were dropped from analysis. Variables marked with an asterisk are dummy variables.

the war. The key here is the loss of territory. This reduces the amount of maintenance that must be paid to prevent civil war, and this in turn reduces the chances of additional civil war.[21]

Change in Territory and Power

Both gains and losses of territory are associated with a greater chance of civil war. Gaining territory can increase the power of the state, but as noted above, the costs paid to fight the war may mean that in the short term, a state has less power.[22] As well, adding territory requires higher levels of maintenance to prevent the outbreak of civil war. Consequently, in the short run adding territory has mixed effects on the chances of civil war, so the small positive impact makes sense. Losing territory reduces the maintenance cost a state must pay, but losses of territory also results in a loss of power for the state; this in turn means that the state has fewer resources to allocate for maintenance. The logit results indicate that the power loss associated with the loss of territory completely swamps the impact of lowered maintenance costs (the z score for the coefficient is more than 100). Recent losses of territory greatly increase the chances the state will have a civil war.

The coefficient for change in power is positive. The impact is very small and just barely reaches the .05 level of statistical significance. In fact, this variable has the

smallest z score of any variable in the logit equation. Given the very large number of observations, I conclude that while changes in territory (in particular losses) have an important impact on civil war, the change in power has virtually no impact on the chances of a state experiencing a civil war.

Current Status of the State

The previous set of variables focused on the recent changes in the state's power and territory. The three variables in this group focus on the current status of the state. The variables measure the degree to which the state is allocating adequate resources to maintenance, the size of the state, and its power.

The probability of civil war is a function of the degree to which the state under allocates maintenance. The underallocation variable has a very powerful positive impact on the chances of civil war (the z score for the coefficient is 80). It is not surprising that underpaying maintenance should have an impact on the chances of civil war. Nevertheless, the strength of the relationship is impressive.

While a state that has many hexes will have a lot of power, size has negative consequences as well. The greater the amount of territory controlled by the state, the more it must pay for maintenance to prevent civil war. The empirical results indicate that (given the number of observations) size has little impact on the chances of civil war; that is, the opposing impacts of size basically cancel each other out. Finally, the power of a state has negative impact on the chances of civil war. High levels of power may be associated with large amounts of territory and the need to pay large amounts of maintenance to prevent civil war. At the same time high levels of power give the state the resources to allocate more to maintenance. The results indicate that while high levels of power depress the chances of civil war, the impact is fairly minor.

Control Variables

The four control variables are a stable of studies involving EARTH. Given space restrictions, I will not offer a discussion of these variables. I simply note that all four have moderate impacts on the chances of civil war.

Discussion

The discussion of the results has to be qualified by consideration of the degree to which EARTH provides a reasonable representation of civil war. As noted above, the relative frequency of civil and interstate wars across the set of runs analyzed here is very different from the real world; the ratio of civil wars to interstate wars is much lower in EARTH. Because there is no way to equate an iteration in EARTH with a specific length of time, it is not possible to know if the lack of correspondence is because the frequency of civil war is too low or the frequency of interstate war is too high. Given that EARTH is designed to simulate the basic features of a realist world, and that a realist world is

expected to have a great deal of interstate conflict, it is certainly plausible that the latter is the case. With few restraints to prevent the outbreak of interstate conflict, EARTH may contain more of this type of conflict than the real world. An additional concern is that the rather sparse internal structure of states in EARTH may be inadequate to fully specify all the ways in which civil wars can break out.

The mechanism for the onset of civil war (the state underallocates resources to prevent civil war) does have echoes in empirical research on civil war onset. Fearon and Laitin (2003) find that low levels of per capita income are associated with the outbreak civil war. Hegre and Sambanis (2006) also find that weak states (low income levels, low rates of economic growth) are susceptible to civil war. These findings indicate that states with low levels of resources are more likely to experience civil war. However there is less empirical work to highlight concerning the territories within a state that are more likely to revolt. Taken all together there are some similarities between EARTH and what we know about civil wars, but there are differences as well. So conclusions about the links between realism and civil war must be tentative.

Do aspects of a realist world influence the onset of civil wars in EARTH? In considering this question, I concentrate on those variables in Table 3 with z scores greater than 20. Three of these variables (underpay maintenance, civil wars lost past 5 iterations, and civil wars won past 5 iterations) are part of the civil war environment and are not part of the realist world. One of the variables (interstate wars lost past 5 iterations) is clearly part of the realist world. The final variable—which has the most significant impact—(territory lost past 5 iterations) is part of both the realist and civil war environments.

To discuss the relative effects of the realist environment and the civil war environment on the onset of civil war, a bit of additional analysis is useful. I ran a logit predicting the dummy for lost territory from the 4 War Outcome variables (all of these variables were lagged). An examination of the results (along with calculation of the marginal effects of each variable) shows that the impact of interstate wars on losing territory is about the same as the impact of civil wars.

Taken together, the results indicate that within the world of EARTH both the realist environment and the civil war environment influence the chances of a civil war. The statistical analysis indicates that the civil war environment has more of an impact than the realist environment, but nevertheless aspects of the realist world have an impact on the onset of civil war. The outcome of interstate war influences the chances of civil war; if interstate war involvement results in the loss of territory, this decreases the chances of civil war because it reduces the need to pay maintenance.

Conclusion

Civil wars have been more frequent than interstate wars at least since the demise of Napoleon. In the recent era, the imbalance between these two types of war has shifted even more toward civil war. At the same time, there has been increasing interest among

the academic community in civil war. Scholars of international relations who are interested in civil wars are faced with a problem: The most commonly used theoretical framework in international relations (realism) does not appear to have a lot to say about civil wars. One response to this is to note that using realism as a theoretical framework is fraught with problems; it is a weak foundation on which to build because it is not a single coherent approach. Another possible response is to argue that realism simply has nothing to say about civil wars; it deals exclusively with the external environment of the state. Given the centrality of realism to international relations and the prevalence of civil wars, it is worthwhile, perhaps even important, to attempt to relate realism to civil war.

In this article I used the EARTH computer simulation. EARTH models realist worlds, but also allows for the possibility of civil wars. This tool makes it possible to explore the theoretical connections between realism and civil war. Unfortunately, the nature of EARTH requires that a large number of runs be conducted and that the results have to be viewed in terms of average or typical behavior. As well, the civil war component of EARTH does not fully reflect the process of civil war onset in the real world. Definitive conclusions on the impact of a realist world on the onset of civil war are not possible.

What has been learned from this exercise? In the world of EARTH, the primary determinants of a state's civil war involvements are related to the civil war process. There are linkages between the realist world and civil wars. States that lose interstate wars are less susceptible to civil wars if these war losses are accompanied by losses of territory. This reduces the need to pay maintenance to prevent the occurrence of future civil wars.

Civil wars are a significant problem in today's world. Scholars have a role to play in understanding why they occur. In order to shed light on the reasons for civil wars we must provide theoretically based explanations. In this paper I have taken a first step at understanding why civil wars start in a world that functions according to principles of political realism. The results of this set of theoretical experiments suggest that it would be useful to expend further effort pondering the connections between realism and civil wars.

Declaration of Conflicting Interests

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Notes

1. While presentations about civil war have been very popular in the last two Peace Science Society (International) meetings, Palmer (2007) notes that over the last 4 years (2003-2007) only 6% of the articles published in the Society's journal, *Conflict Management and*

Peace Science, have been about civil war. The large number of presentations on civil war appears to be a "leading indicator" of where the field is going.

2. I use the phrases "writing on realism" and "realist writers" to refer to both supporters and critics of realist thought.

3. In the previous sentence, the word debate was deliberately placed in quotes. This is because many writers simply assert their position on one or more assumptions and do not confront or acknowledge that there are other possible points of view.

4. Note that Crowe was an official in the British Foreign Office and he was in effect asserting that Great Britain played the role of the balancer.

5. In earlier work (Stoll, 2005, p. 20), I noted another example of the diversity of writing on realism. It is a table in the introduction to the edited volume on realism by Wayman and Diehl (1994). This table summarizes "common realist propositions" used by the authors in the volume. There are 15 propositions in the table. That seems like a large number for a single coherent framework. More striking, only one proposition is used by all of the authors in the volume and only two additional propositions are used in over half the chapters of the book.

6. There are references to the American Civil War in Morgenthau and Thompson (1948/1985). However, none relates the American Civil War to international relations. As well, Morgenthau makes no general comments about the impact of civil war in a realist system or on a realist state. Waltz (1979) comments that we often think that the threat of violence is what distinguishes international relations from domestic politics, but this is not completely true. "We easily lose sight of the fact that struggles to achieve and maintain power, to establish order, and to contrive a kind of justice within states, may be bloodier than wars among them" (p. 103). Mearsheimer (2001) mentions the U.S. Civil War, but only to illustrate the primacy of land power (pp. 116, 118) and to comment that the United States did nothing about French troops in Mexico during the Civil War because they did not have the ability to deal with this at that time (pp. 143, 249). None of these scholars integrates civil war into the realist framework.

7. To be fair, David's (1997) piece is a review of two edited books on civil wars and Mack's (2002) piece is a discussion of the value of academic research to the policy maker. It would be unusual to expect that such pieces would also include a theory of civil war.

8. As Wagner (2007, pp. 24-27) reminds us, it was Herz (1950) who first introduced the concept of the security dilemma.

9. The appendix is available at www.ruf.rice.edu/~stoll/

10. This phase is optional and can be turned off during a run. Obviously, it was turned on for all the runs analyzed in this article.

11. A state can make errors estimating its own power and also the power of other states.

12. The proportion of power a losing state must pay as reparations is a parameter set by the user.

13. States on the winning side are ordered from most powerful to least powerful. Territory is given out in that order. Consequently not all states may end up with additional territory. For example, if the loser only gives up a single hexagon, it will go to the most powerful state on the winning side and no other member of the winning side will get territory.

14. The actual minimum cost a state must pay is equal to the sum of the minimum cost for each hex the state has gained during a run (i.e., all hexes except the original—"core"—hex of the state).

15. This seems strange given recent American war involvements, but we need to remember that these long distance conflicts are very much the exception, not the rule. Most wars are fought between neighbors.

16. In the discussion of the initialization phase of EARTH, I noted that 29 parameters are needed to establish the starting configuration for a simulation run.

17. The actual number of cases could be lower or higher than the figure given. The estimate assumes that all states survive for all 1000 iterations, but this is not the case. On the other hand, states are also created during a run (primarily through the civil war process). Regardless of the exact number of cases that would occur if all the runs were done, the resulting dataset would be extremely large and unwieldy (or impossible) to analyze.

18. In the early iterations of a simulation run, most interstate wars will involve states that have only a single hexagon of territory. If a one-hex state loses a war, the requirement that the leader of the losing side must give up at least one hex means that the state is eliminated.

19. Clearly, the civil war behavior in EARTH is very different from that in the real world. Other EARTH studies that focus on disputes (Stoll, 1998, 2008) have shown a reasonable amount of correspondence to the real world (at least the real world as operationalized in terms of interstate conflict data from the Correlates of War Project). What accounts for the difference? I will defer consideration of this question to the discussion section that follows the presentation of the results.

20. In an additional analysis (not shown) I added two interactions. The first is the interaction between civil war loss and change in territory (the second interaction is discussed in the next footnote). When this interaction is added, the interaction term is very negative and the dummy for losing civil wars is positive. The negative interaction term is much larger, so losing territory in civil war makes additional civil war less likely. This supports the interpretation in the text.

21. The second interaction term (see Note 20) is the loss of interstate wars interacted with the loss of territory. The sign for this interaction term is negative. With this interaction term in the equation, the dummy for interstate war loss is positive, but the absolute value is much smaller than the interaction term. This clarifies that the key impact of losing an interstate war on future civil war is the loss of territory. If territory is reduced due to losing interstate wars, this decreases the chances of civil war. This is consistent with the interpretation in the text.

22. In the long run, adding territory will increase the power of a state due to the internal growth generated by the new territory.

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