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Risk assessment models and early warning systems

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P 00 – 302

**Risk Assessment Models and
Early Warning Systems**

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Zusammenfassung

Das Papier behandelt Modellierungsfragen und Datenprobleme bezüglich der Zweckmäßigkeit sog. *risk-assessment*-Modelle bzw. zur Klärung von Frühwarnmodellen. Zunächst wird generell die Datenlage überprüft. Dabei läßt sich argumentieren, daß zwei Typen von Daten im Mittelpunkt stehen: einerseits Daten, die zur Erklärung des Auftretens und der Eskalation von gewaltsamen Konflikten herangezogen werden können, andererseits Daten, die sich für die Fundierung von *risk-assessment*-Modellen eignen. Während beim ersten Typus vor allem ein eklatanter Mangel bezüglich innerstaatlicher Konflikte herrscht, sind wir beim zweiten Typ mit dem Problem konfrontiert, daß das Generieren von immer neuen Daten solange ein wirkungsloses Unterfangen bleiben wird, wie es nicht mehr theoretische Klarheit über die Prozeß- und Strukturbedingungen von Gewalt gibt. Anschließend werden noch zentrale Modelle überprüft, die sich mit dem *risk-assessment* und der Frühwarnung befassen. Es wird gezeigt, daß – mit Ausnahme von Korrelationsmodellierungen – noch immer zuwenig Arbeit investiert wird, wenngleich die Alternativen durchaus vielversprechend sind.

Abstract

This paper addresses model design and data-related issues pertaining to the use of risk assessment models in support of conflict early warning systems. The paper first examines the data needed for risk assessment models. It argues that there are actually two types of data that we must collect and use: data to determine the theories that best explain the outbreak or escalation of violent conflict and data corresponding to variables that have been demonstrated to have predictive power and thus are appropriate for use in a risk assessment model. With respect to intrastate conflicts there remains a dearth of data of the first type that is only slowly being corrected. Collecting data of the second type will continue to be an inefficient process until better theories have been formulated and tested with the first type of data. The paper then examines a number of models germane to risk assessment and conflict early warning. It finds that except for one class of models, so-called correlational models, there has been only limited work done even though the alternatives appear to have promise.

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Introduction

The goal of achieving useable risk assessment models and early warning systems for violent conflicts has reemerged in recent years.¹ Growing awareness that early intervention may have prevented or at least mitigated disasters such as Rwanda or Somalia has motivated governments, international organizations, and nongovernmental organizations to improve their ability to get an early warning that a violent conflict, with its attendant humanitarian relief demands, is about to erupt (Chayes and Chayes, 1996). Those organizations with responsibilities for humanitarian relief hope, as a result of early warning, to plan more effective operations to provide food and other necessities to persons displaced by the violence. Other organizations that focus on diplomatic or military initiatives hope to use early warning to preempt an outbreak of violence or its recurrence following a conflict by having more time to implement conflict prevention measures such as preventive diplomacy or preventive peacekeeping (Boutros-Ghali, 1992).

There are two key facets to the conflict prevention problem. The first is acquiring the capability to achieve reliable and useable conflict early warning. The second is effectively making use of that capability, motivating the willingness within and among countries and international organizations to act early and expeditiously. This paper focuses on the capability facet. An exploration of the second, willingness facet can be found in Brecke (2000).

This paper describes the state of the art regarding the two main elements of a conflict early warning capability: the data and the models.

1. Conflict Early Warning Data

At the risk of appearing to be a person who divides the world into pairs, I will make one more binary distinction. Data germane to conflict early warning can be divided into two types. The important distinction is not between quantitative and qualitative data, although that distinction exists. Rather, we need to distinguish between the data that will help us figure out

¹ See, for example, Cahill (1966), Rupesinghe and Kuroda (1992), Andriole and Young (1977), Boutros-Ghali (1992), Laurance (1990) and Snyder, Hermann, and Lasswell (1976).

the best early warning indicators and the data that is gathered to serve as those indicators. This is undoubtedly not a standard distinction, but the following paragraphs will make the case for this position.

The road to a reliable early warning capability is highly unlikely to be a short and direct one, but it can probably be traversed. Raw data is not the answer. Even the relatively well-funded State Failure Project (Esty, et al, 1995 and Esty, et al, 1999), which evaluated 600 variables, could achieve only a two-thirds success rate in classifying whether a state failure would occur or not. That achievement is nontrivial, but it is not sufficient for the desired goal of a reliable early warning system.

A more subtle approach that does not expect (or hope) to almost immediately find “smoking pistol” indicators will probably be required for a successful and reliable system. That approach entails following a cycle in which researchers collect and test data to evaluate different explanations or mechanisms for how violent conflicts erupt and from that develop superior explanations (theories). Those new or refined theories will call for the collection of new data—or at minimum a new combination of existing variables—and the cycle will repeat until explanations (theories) with useable predictive power emerge.

At that point the new theories will point to the information that is most relevant to risk assessment and early warning, and that information will become the second type of data, the early warning indicators collected by governments and other organizations for the practical task of conflict early warning and prevention.

This conclusion is probably not a popular one. Most, if not all, practitioners interested in conflict early warning want to know only the second type of data. Unfortunately, efforts to determine the best early warning indicators will be at best inefficient and at worst ineffective if there is no attempt to operate in the mode that goes back and forth between data and theory in the manner just described.

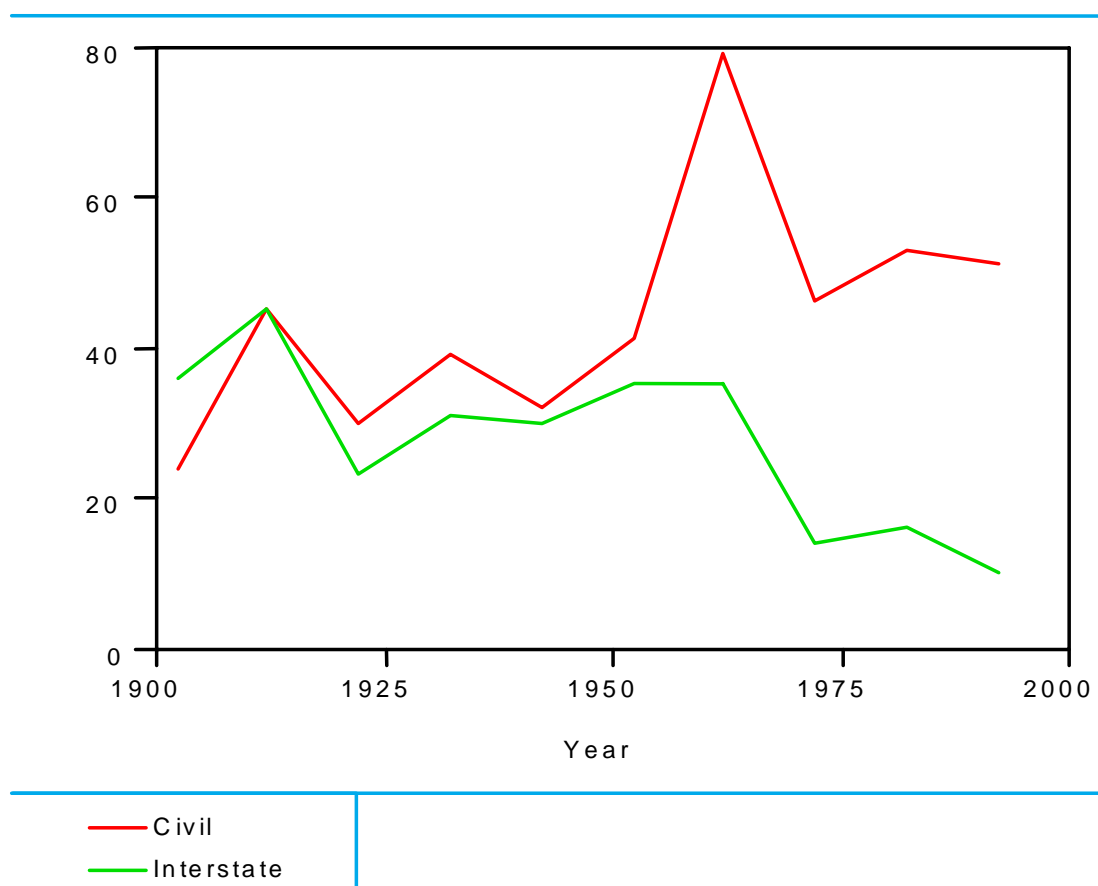
If the reader accepts the argument that we need to first concentrate on the data for evaluation and testing of theories, the next step is to determine what those data are and should be. Dismayingly, even the primary data needed develop better theories are not as useable as we might expect or would like. The best data in terms of comprehensiveness, availability, and appropriateness to address theoretical questions, unfortunately, pertain to interstate conflicts and disputes (Jones, Bremer, and Singer, 1996). I say ‘unfortunately’ not because this family

of conflicts is not important to study. The problem is that at this time interstate conflicts are relatively rare compared to (primarily) intrastate conflicts, as can be seen in Figure 1, which portrays the number of violent conflicts for each decade of the 20th century that are primarily interstate conflicts as opposed to intrastate conflicts.

FIGURE 1

Number of Conflicts in 20th Century

Civil vs Interstate Conflicts



While accumulation and refinement of our understanding of interstate wars and disputes is occurring (Vasquez, 1993; Geller and Singer, 1998), in no small part because of the improving data regarding wars and disputes and causal factors such as alliances and international system structure (Wilkenson, 1996; Wilkenson, 1999; Gibler, 1999), progress with respect to intrastate wars lags precisely because of the relative absence of analogous data.

Possibly the most fundamental shortcoming regarding data relevant to intrastate war is that there is at this time no even remotely comprehensive list of intrastate violent conflicts that is in a form both readily accessible and useable for data analysis, namely, in a computer data file. It is hard to imagine how we can find the causes of intrastate conflicts when we lack even a list of the conflicts for which we would like to find the causes.

This absence of a useable list of conflicts borders on the mind-boggling. Finding the causes of conflicts and the early warning indicators requires working with a significant sample of conflicts. We will not find the causes using sample sizes of one or even a few. Only a large sample will give us the ability to confidently generalize from past cases to future pre-conflict situations.

It must be emphasized that the problem is not the absence of lists of conflicts. Appendix A contains a long list of lists. The problem is two-fold: each one of the lists in the appendix contains only a small subset of the total population of violent conflicts and very few of the lists of intrastate conflicts are in a form suitable for data analysis. The Correlates of War Civil Wars dataset is available and being updated, but it is limited to conflicts in which (essentially) at least 1000 fatalities have occurred, a design constraint that eliminates many conflicts and thus limits the range of conflicts for which causes can be identified. An on-going project to build a Conflict Catalog will resolve this problem of limited, useable intrastate conflict datasets, but that effort is not yet complete (Brecke, 1999).

A second, related shortcoming is that we do not have a sound categorization system for violent conflicts. At this time conflicts are categorized in terms of very general distinctions such as interstate versus civil war (Small and Singer, 1982) or are placed in essentially ad hoc categories such as ethnic conflicts or peasant revolts, terms, that while generally meaningful to most readers, are not precise in terms of the criteria for inclusion and are not clearly distinct from other terms such as ethno-political conflicts or peasant rebellions. Appendix B provides a sample of about 150 of these categories. An empirically-based categorization system is in the works, but its completion of necessity follows completion of the Conflict Catalog (Brecke, 1997). It is worth noting that a categorization of violent conflicts analogous to what is done in other sciences requires a large sample size and a significant number of variables in order to achieve stable categories, that is, categories that do not lose their validity because of a minor change in the data.

This emphasis on categorization is important because if we want to identify early warning indicators that can provide us a 6-12 months “heads-up” of a conflict eruption or escalation, we almost certainly need to think in terms of identifying appropriate indicators for particular types of violent conflict. The likelihood of finding early warning indicators for a specific type of conflict will almost certainly be easier than finding them for a broad range of conflicts. The variety of conditions that lead to ethnic conflict, for example, is almost certainly much wider than the conditions that lead to a conflict in which the major point of contention is control of the state and the primary identifying characteristic of the major protagonists is religion or a conflict in which the major point of contention is creation of a new state and the primary identifying characteristic is language. By narrowing the definitions (and thus instances) we can reduce the number of variables and have a better chance of identifying which possible early warning indicators correspond with—and better yet, precede—the outbreak of the particular type of conflict.

The search for a unified theory of war, so to speak, one or a few indicators that point near-unerringly to a future conflict of any type, is way too premature. Our existing theory is nowhere near advanced enough to give us that capability. Even particle physicists, whose theory is advanced enough to give exquisitely precise predictions that can be tested to a level of detail several digits to the right of the decimal point, do not yet have a unified theory. Their theoretical endeavors over the last century has focused on making (theoretical) explanations for the different components of the physical world, such as leptons or the strong force, and then working their way towards a broader theory that combine the explanations for the components, such as the one that linked electro-magnetism and the weak force.

This may be the problem of the State Failure project. State failure, as important as it is, may, like war, be too broad a phenomenon to explain and reliably predict at this time. The three variables identified as being closely associated with state failure: Infant mortality, trade openness, and level of democracy, will probably be components of some future theory that fully explains state failure, but the heterogeneity of the 127 (Phase II) cases, especially in terms of the types of conflicts they experienced, makes the three variables lowest common denominators that are not sufficient to explain specific instances of state failure. To support this contention, it is worth noting that the State Failure Task Force identified additional important indicators for specific types of conflict. Especially, ethnic conflict was (is) more

likely when a single ethnic group dominates the ruling elite as well as when there was a “youth bulge” in the population (Esty, et al, 1999, p. 51).

If the reader accepts the argument that we should, at least for now, concentrate on explanations for different components of the social world, in this case, different types of violent conflict, then the emphasis should be on projects that focus on sets of seemingly similar conflicts. The following efforts to differing degrees adhere to that admonition and merit mention in addition to the State Failure Project noted earlier.

For example, for his model of communal or ethnopolitical conflict, Gurr (1994) proposes 15 indicators grouped into background conditions, intervening conditions, response conditions, and an example list containing 9 accelerators.

For genocides/politicides, Harff (1994) distinguishes between background conditions, intervening conditions, and accelerators (also called precipitating events). Background conditions are further broken down into international and internal background conditions. She offers a list of 19 indicators.

Fein (1994) for the most part agrees with Harff, but she has her own set of indicators pointing towards genocide/politicide. Her 18 indicators break down into three categories: Conditions from the past, recent background conditions, and precipitating events.

For the much broader class of conflicts that cause humanitarian relief operations and refugee flows, Schmid and Jongman of the PIOOM program at Leiden University in the Netherlands have developed a list of 70 background conditions indicators and 118 situational circumstances indicators (Schmid, 1998).

These are serious efforts. The problem is that there is no strong evidence that any of the indicators they propose are truly conflict early warning indicators. The first data task described above has been essentially bypassed in the quest for the second type of data.

The essential argument is that we need to be patient and build a strong foundation to find the best early warning indicators. To accomplish that we need to tread the line between single case studies that fail to give us generalizability and (so-called) large-N quantitative studies that mix disparate phenomena (different types of violent conflict) together in order to get sufficient sample sizes for statistical power. The Conflict Catalog and the subsequent conflict categorization projects seek to give us the data such that we have sizeable samples with specific types of conflict, but that, again, is in the future. We need to start from basic

information and build our theories from there. The benefit of taking such a path is that it will enable us to much more effectively leverage the other data, such as that for the State Failure Project, that has already been collected.

2. Conflict Early Warning Models

The reader may accept the plausibility of the need to first collect data to resolve between different theoretical explanations for the outbreak of violent conflicts as opposed to rather blindly collecting early warning indicators, but that does not answer the question of what data (beyond very basic data) should be collected for the first step. The answer to that question forces us to examine the models being used to determine the most appropriate theories.

To reduce ambiguity, in this paper a *theory* is an explanation of a phenomenon (or set of phenomena) whereby the explanation describes a process or mechanism through which the phenomenon occurs or changes. For our purposes an appropriate theory describes a process by which a violent conflict erupts or an already conflictual situation transitions to a higher level of violence. It describes how the appearance of or change of some thing or things causes a conflict to erupt or escalate. A *model* is a representation of the phenomenon that articulates or brings together in a relatively concise and comprehensible way the components of a theory. A theory can be represented by a number of models, each typically providing a particular perspective on the phenomenon. Confusingly, a model can, in turn, represent a number of theories. There is not necessarily a one-to-one relationship. In this instance, the usual and preferred action is to apply data against the model to see which theories embodied in the model best fit or correspond to the data.

This multiplicity in the ways that phenomena, theories, and models interact makes it difficult to establish a coherent schema for organizing models. While we might wish for simplicity's sake that models corresponded on a one-to-one basis with theories, the fact that they do not forces us to use different organizing principles. Two such organizing principles are:

- To categorize models by the phenomena they represent
- To categorize models by the methodologies employed to apply data to the model

For this paper we will focus mainly on models germane to intrastate conflict.

One attempt to organize models relevant to conflict early warning was done by Gurr and Harff (1994). They categorized models into the three following types:

- Correlational Models
- Sequential Models
- Conjunctural Models

This breakdown corresponds quite closely to different methodologies.

2.1 Correlational Models

The Correlational Model approach has seen wide application in determining the causes of war, particularly interstate wars, and progress has been made (Geller and Singer, 1998). The approach is based on the assumption that certain indicators or measures of the political, economic, and social situation in a country covary with a measure of the level of violence in that country.² One tries to find out how much they covary by putting them in a multiple regression (or a logit analysis) equation. On the right-hand-side of the equation exists a (sometimes very large) number of factors (indicators) believed to contribute to the likelihood of whether a situation will become a violent conflict or not in the not-too-distant future. On the left-hand-side is the outcome indicator with values such as conflict or no conflict or close to a conflict or possibly some more precise measure of the level of violence. The goal is to find the influence or weight that each factor has on the outcome. Those factors that turn out to “weigh heavily” on the outcome become key components of a correlational model of the outbreak of violent conflict.

Inspection of the correlational model approach reveals that it possesses two distinct facets. The first is to develop and validate a correlational model that corresponds to a particular theory (Gurr and Moore, 1997). This involves using data from the past to find the

² One can go further and argue on theoretical grounds that the variables represented by those indicators of the situation cause the level of violence, but that is not strictly necessary for obtaining conflict alerts.

relationship between each factor and the outcome.³ The second facet entails assuming that the correlational model is reasonably correct and robust and then supplying current values to each of the factors of the regression equation (Gurr, 1998). (In effect the equation(s) describing the model changes its (their) nature from stochastic to deterministic.) If the values of those factors (the terms on the right-hand-side of the equation) reach values such that the calculated value of the outcome (the left-hand-side of the equation) corresponds to a violent conflict, there then exists a reasonable basis for a conflict alert.

These two facets of the correlational model illustrate and parallel the distinction made earlier between the data needed to determine the appropriate early warning indicators and the data needed for early warning activities in an organization. Onishi (1998) describes the use of both facets of a correlational model approach to achieve an early warning of displaced persons.

2.2 Sequential Models

The Sequential Model approach is a very different method for achieving conflict alerts. Rather than describing a causal structure that involves some number of independent variables pointing to a dependent variable such as the likelihood that a conflict will erupt, as is done with a correlational model, a sequential model consists of a “mechanism” that describes how changes in an environment bring about a specific event (or events) or a change in some specified variable. For example, whereas a(n extremely simplistic) correlational model might represent the theoretical argument that the level of violence in a society is a function of the degree of wealth inequality and the unemployment rate, a similarly simplistic sequential model might be expressed as: If the unemployment rate in a society is rising, the level of discontent among the workers will rise. If the level of discontent is at a high level and the government drastically raises the price of bread, then violence is likely to erupt.

The element of time is much more integral, much more explicit in the “explanation” of how a conflict comes about.

Events fit more easily within a sequential model than they do in a correlational model. Events typically trigger changes in a sequential model. They can cause relationships between

³ Typically the concern is the weight or strength of the relationship, but the nature or the functional form of the relationship can be ascertained as well.

different elements of the model to become either active or inactive. Alternatively, they can cause a change in the tempo or dynamic of a relationship. For example, two groups in a society may coexist with some tension but essentially peaceably. If members of one of the groups begin to verbally attack the other group, accusing them of being the cause of increased crime, for example, that event or series of events is likely to increase the tensions between the groups, probably inciting increased verbal and written exchanges of both a provocative and conciliatory nature by different individuals in the groups. At another level, if there is an incident in which members of one of the groups attack and kill members of the other group, this event is likely to provoke retaliation by the second group, which establishes a relationship of violent exchanges that did not exist before.

Harff (1994) describes a sequential model that incorporates this general concept with respect to genocide and politicide: one looks for *accelerators*, events that, when they occur, tend to lead to a cascade of events resulting in a genocide/politicide (with politicide defined by Harff as situations in which groups are victimized primarily because of their political opposition to the ruling regime instead of their communal characteristics such as ethnicity or religion).

A sequential model represents a theory. Both describe a process to explain how a change in some thing leads to a change in the object of interest, in our case violent conflicts. This is another way in which sequential models differ from correlational models. A sequential model has a one-to-one correspondence with a theory. To make a sequential model, one must have a theory in mind. In fact, the act of making the model forces an explicit articulation of a theory. Correlational models, in contrast, typically have a one-to-many relationship with theories. One model can, in principle, support a number of different theories. The data that are applied to a correlational model determine which particular theory it supports.

If one considers a sequential model in terms of what it is doing, it is clear that an appropriate methodological or analytical approach is to implement it in a computer simulation. A computer simulation model almost by definition represents a process that unfolds through a sequence of steps, usually over time. As such, a computer simulation directly corresponds to a sequential model. The unique feature of computer simulations is that they step through the sequence of steps in an accelerated manner inside the computer. The result is that in a simulation, one year in the “real world” transpires in something much less, perhaps one minute or a few seconds. It is through this accelerated movement through time

that a sequential model implemented in a computer can provide an early warning of violent conflicts. As the model simulates the situation between or within countries, the model can, in effect, get to the future before the “real world” gets there.

Thus, a sequential model implemented in a computer simulation could be used to provide conflict alerts in the following way: As in any formalized conflict alert system, information from current news feeds and new publications is processed and entered into a database subsystem, probably on a daily if not continuous basis. The Kansas Event Data System (KEDS) and the new Integrated Data For Events Analysis (IDEA) system provide the core capability for this task (Gerner and Schrodt, 1996; Taylor, Jenkins, and Bond, 1999). From the database the conflict early warning system extracts or calculates the indicators which serve as inputs for the simulation. These inputs become the initial values for the variables within the model, and as such serve as starting points for the simulation model’s calculations. The model is then run in order to simulate the country or countries it represents. If the simulation run, given new input data that arrived since the last run (perhaps on the previous day), results in a conflict that did not occur in previous simulations, it is providing a conflict alert.

Unfortunately, to this writer’s knowledge there are no computer simulations that represent sequential models of the outbreak of violent conflict. A partial exception to this assertion is various strategy-oriented computer games such as *Civilization*, *Imperialism*, and *Age of Empires*. In these games a player can end up involved in wars, but the reason these simulations are not really useful for the purpose of conflict early warning is that the sequential models implicitly built into the games are simply the game designers’ personal mental models of how wars come about. Those models may be very good, but they lack the solid theoretical and empirical foundation that is essential for a credible conflict early warning system. The problem remains, as before, an absence of good theories explaining the processes by which different types of violent conflict erupt.

An alternative approach to sequential models can be found in the PARISinLA project (Adibi, Alker, Malita, and Vest, 1997). This project emphasizes analysis of the history of discussion or debate between actors as well as their actions, and it employs sophisticated software to analyze those histories as they are embodied in textual descriptions. The PARISinLA project also makes use of data sets that contain the histories of cases involving

conflict management, most notably CASCON and SHERFACS, and thus are well-suited to this type of historical and textual analysis. This is work in progress.

2.3 Conjunctural Models

The Conjunctural Model approach focuses on combinations of conditions and events that lead to violent conflicts. The underlying premise is that different combinations of a country's circumstances lead to different outcomes. For instance, some situations lead to violence in the form of a guerrilla war against the government, while others lead to an inter-ethnic group conflict, while yet others do not lead to violence at all. Schock (1996) presents a weak form of a conjunctural model that explores whether political context moderates the influence of economic inequality on political conflict. Stronger forms of a conjunctural model are possible that allow for the exploration of a large variety of combinations or conjunctures that lead to violent conflict.

Conjunctural models may possess an advantage over correlational models with respect to both finding causes for violent conflicts and in an operational conflict early warning role. The problem for correlational models may be the assumptions behind them. One of the assumptions with correlational models is that they start from the premise that the explanatory variables covary with the output or dependent variable. In addition, correlational models typically assume that the explanatory variables do not covary with each other as they covary with the dependent variable. The explanatory variables are supposed to be independent from each other. If the explanatory variables covary with each other quite closely, a problem of multicollinearity emerges, and as any introductory statistics text explains, multicollinearity makes it effectively impossible to ascertain the precise relationship between the explanatory and dependent variables (Wonnacott and Wonnacott, 1977).

It may be the case that neither of these two assumptions holds true with respect to violent conflicts and especially the conflict early warning task, making the correlational model approach unsuitable. The key feature of the relationship between early warning indicators and violent conflict may not be how they covary; it may be the occurrence of a particular combination or configuration of them at some point in time before the conflict erupts. Moreover, the notion of independence of the explanatory variables (early warning

indicators) may be inappropriate because it may be their interaction that is important. For these reasons, conjunctural models deserve greater attention.

The conjunctural approach can be quite easily understood if the reader envisions it as a pattern recognition task. This results in an analytical approach that emulates what a typical international affairs or country expert appears to do. To illustrate, consider the following. When such an expert focuses her or his attention upon a country to decide whether it is likely to experience political violence and then makes a determination, that individual has in all likelihood used pattern recognition. More specifically, the individual examines the country's situation, which includes both its history and its current condition, in terms of both events and variables describing underlying processes. The individual (consciously or not) compares the situation with other countries' situations, both current and in the past, to find analogues. The individual can find an analogue through two paths. First, the other case (or cases) can be empirically almost identical, a parallel case. In international affairs so much variation in country descriptions exists that such an outcome is unlikely. The second path is that the other case (or cases) can be sufficiently similar such that given the analyst's theoretical (mental) model of how the "world" works, the analyst judges the cases to be analogous. Deviations—even significant deviations—in the cases are possible, but if those aspects of the situation as determined by the theoretical or mental model to be important to the countries' dynamics are the same, then the cases are believed to be analogues. If the analogous case or cases subsequently evolved to violent conflicts, then the analyst is likely to believe that the particular country of interest is also likely to suffer a conflict.

Brecke (1998) describes how to transform situations within or between countries into patterns that can be analyzed in a manner analogous to that described in the previous paragraph. The situation at a particular place at a particular point in time is summarized as one grid pattern. The history of a particular place is summarized in a sequence of grid patterns. Each grid pattern is conjunctural in that it depicts the combination of characteristics (or variables) that describe the situation.

The key to this approach is to use pattern recognition techniques to identify particular grid patterns, configurations of conditions that consistently precede the outbreak of violent conflicts and that also do not occur in places that do not experience violent conflict. There are a number of possible pattern recognition techniques that can be used. Schrodtt has explored the use of factor analysis, discriminant analysis, cluster analysis, genetic algorithms, neural

networks, and most recently, hidden Markov models to identify early warning indicators with modest success (Schrodt and Gerner, 1996; Schrodt and Gerner, 1997; Schrodt and Gerner, 1998; Schrodt, 1991; and Schrodt, forthcoming). The State Failure Project has applied neural network analysis to the data they have collected, and the United Nations Humanitarian Early Warning System project (HEWS) tried using neural network analysis to their own data as well (Esby, et. Al. 1999; Ahmed and Kassinis, 1998). What has not yet been done is to apply any of these techniques to a conjunctural model. It is an approach that remains essentially untested.

3. Conclusion

Progress in terms of data and models in support of risk assessment models for conflict early warning and prevention is occurring, but progress is slow. A significant amount of even basic data about conflicts remains to be collected and analyzed. However, those data may enable us to make better use of the considerable data already collected and assembled. More effort should be placed on collecting data about conflicts as opposed to data about the countries that have experienced or are experiencing violent conflict.

Modeling work that may provide guidance regarding what other data to collect and, ultimately more importantly, provide reliable risk assessment models is also making only limited progress. Part of the problem is that most model developers are hamstrung by limited resources relative to the magnitude of the problem. A bigger problem, as outlined above, is the lack of theory—supported by data—that can guide the design of a reliable risk assessment model. Rather than going directly for an operational risk assessment model, more effort should be placed on modeling and data work to support the development of better theory to explain the outbreak of different types of violent conflict.

Appendix A

Compilations of Violent Conflicts

Dictionaries or Encyclopedias of Wars and Battles

Brownstone, David F. and Irene Franck. Timelines of War: A Chronology of Warfare from 100,000 B.C to the Present. New York: Little, Brown & Company. 1996.

Bruce, George. Collins Dictionary of Wars. Glasgow: Harper Collins. 1995.
(this was formerly Harbottle's Dictionary of Battles, 1966, 1971, 1981 and The Paladin Dictionary of Battles, 1986.)

Chandler, David. Dictionary of Battles: the world's key battles from 405 BC to today. New York: Random House. 1991.

Clodfelter, Micheal. Warfare and Armed Conflicts: A Statistical Reference to Casualty and Other Figures, 1618-1991. Vols. 1 and 2. Jefferson, North Carolina: McFarland & Company, Inc. 1992.

Davis, Paul K. Encyclopedia of Invasions and Conquests: from Ancient Times to the Present. Santa Barbara, CA: ABC-Clio. 1996.

Dupuy, Trevor N., and R. Ernest Dupuy. The Harper Encyclopedia of Military History from 3500 B.C. to the present. 4th edition. New York: Harper & Row. 1993.

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Appendix B

Types of Armed Conflicts

<u>Inter-state conflict</u>	<u>Conflict between State and external non-state actor</u>
international war	extra-systemic war
global war world war general war systemic war major coalition war	imperial war colonial war
major powers war	war of liberation war of independence revolutionary war decolonization conflict armed rebellion colonial liberation war
war of rivalry - hegemonic war - power transition war - status war - colonial war (between colonial occupiers)	state-building war (expanding into “unoccupied” territory)
territorial conflict - border war (between countries) - border skirmish - navigation war - territorial dispute - frontier conflict	colonial expansion war
state-sponsored terrorism (in other countries)	war of resistance war of occupation
subversion	drug war
irredentist conflict	
counter-revolutionary war	
armed attack - invasion - missile attack - bombing attack - bombing campaign - bombardment	
intervention	
occupation of territory	
expansionist war	
collaborationist conflict	
neo-colonial conflict	

<p><u>Intra-state conflict</u></p> <p>civil war</p> <p>revolution</p> <ul style="list-style-type: none"> - political revolution - social revolution - urban revolution - peasant revolution - palace revolution - millenarian revolution - anarchistic revolution <p>state-building war</p> <p>state formation conflict</p> <p>insurgency</p> <ul style="list-style-type: none"> - armed insurgency <p>rebellion</p> <ul style="list-style-type: none"> - armed rebellion <p>revolt</p> <ul style="list-style-type: none"> - peasant revolt - armed revolt <p>peasant war</p> <p>peasant rebellion</p> <p>jacquerie</p> <p>coup d'etat/putsch</p> <ul style="list-style-type: none"> - palace coup - reform coup - revolutionary coup - conspiratorial coup d'etat <p>purge</p> <p>pronunciamento</p> <p>dynastic war</p> <p>war of succession</p> <p>terrorism</p> <ul style="list-style-type: none"> - attacks to cripple economy - attacks to shake faith in government 	<p>ethnic conflict</p> <ul style="list-style-type: none"> - ethno-political conflict - race conflict - race war <p>expulsion</p> <p>group identity conflict</p> <p>war of self-determination</p> <p>war of secession</p> <p>separatist conflict</p> <p>insurrection</p> <ul style="list-style-type: none"> - sessionist armed insurrection - armed insurrection - militarized mass insurrection <p>uprising</p> <ul style="list-style-type: none"> - armed uprising - peasant uprising <p>conflict to achieve limited self-rule</p> <p>genocide</p> <p>politicide</p> <p>democide</p> <p>massacre</p> <p>government repression of social groups</p> <p>state terrorism</p> <p>government oppression</p> <p>pogrom</p> <p>counter-terrorism campaign</p> <p>warlord battles for control of collapsed state</p> <p>clan warfare</p> <p>factional warfare</p> <p>internecine warfare</p> <p>class conflict</p> <ul style="list-style-type: none"> - class warfare <p>state resistance conflict</p> <p>riot</p> <p>land seizure</p>
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<u>Abstract properties</u>	<u>Either Inter-state or Intra-state</u>
simple conflict complex conflict recurring conflict	ideological war political war post-colonial war
low intensity conflict guerilla war trench warfare weapons of mass destruction war proxy war	religious conflict - religious war environmental conflict - scarcity conflict - resource conflict - pollution/emissions conflict
local war regional war - regional internal war	<u>Borderline Violent Conflict</u>
relative deprivation conflict cultural conflict distributive dispute ideological conflict	incident clash - armed clash agitation unrest disturbance disorder dispute mutiny piracy
personnel war authority war structural war	

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