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Foreword

When Lewis Fry Richardson published his paper on the 'Mathematical Psychology of War' in 1935, he started out with an apology for the application of mathematics and statistics to the study of violent conflict. Since then, however, these methods have firmly established themselves in conflict research, and are by now fully adopted by a large and growing community of scholars. Like Richardson himself, this community focused primarily on the study of interstate conflict, researching the conditions leading states to go to war with each other. Recently, however, more and more attention is being devoted to civil wars, and in particular, their micro-level dynamics: Where and when does violence erupt? Why does it spread to some localities, but not others?

The focus on the micro-level is mainly due to two reasons. First, research has shown that micro-level determinants account for much of the outcomes we see at the macro-level. For example, the severity of violence and its distribution across space can often be explained by local-level actors and conditions. Second, we currently witness a huge increase in the availability of fine-grained data on intrastate conflicts. The introduction of electronic data collection techniques, and the availability of fast and global communication networks, has made it possible to study episodes of armed conflict at unprecedented levels of detail. Conflict research, it seems, has finally arrived in the information age.

Thus, there are both theoretical and practical reasons that have led to a surge of interest in micro-level conflict research. This is a welcome and exciting trend, but at the same time brings with it new challenges for the research community. As our empirical databases for studying violence become larger and more complex, we necessarily have to expand our methodological toolkit for analyzing patterns contained in these data. These methods need to be able to take into account the messy reality at the local level. This is where this book makes a key contribution. It brings in advanced techniques from computational statistics that model dependencies in patterns of violence across time and space. The application of these tools is illustrated with a detailed study of the conflict in Afghanistan. Thus, the book is timely in two ways: by drawing our attention to an episode of ongoing violence that continues to appear in the news every day, but also by demonstrating how recent advances in other fields can successfully be brought to bear in the study of conflict.

A multidisciplinary approach to the study of political violence is a necessary and important development. As somebody with a dual background in both computer science and political science, I welcome the attention from the sciences devoted to the study of conflict. By providing novel, and oftentimes complementary, perspectives on an issue of global importance, this will considerably enrich the scientific community, and ultimately move the field forward. This book is one step to do so.

Konstanz, June 2013 Nils B. Weidmann

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Chapter 1
Conflict Data Sets and Point Patterns

Since the end of the Cold War in 1989, the world has seen more than 137 armed conflicts (Themnér and Wallensteen 2012), and, with continuing conflicts in Afghanistan, Iraq or Mexico and new ones igniting across Northern Africa and the Middle East, there is no sign of an abating trend. In addition to great human loss, the social, economic and environmental impacts of armed conflict are enormous (e.g. Ghobarah et al. 2004; United Nations Environment Programme 2006). To limit the severity of the repercussions, international organizations, governments, humanitarian agencies, non-governmental organizations (NGOs) as well as insurance companies are interested in assessing the conflict, predicting its progression and, frequently, preventing escalation.

Recent efforts to fulfill these aims increasingly employ quantitative methods that had found broad applicability in many branches of social sciences such as economics and human geography. The surge in the employment of these data-driven methods is not due to novel methodologies in statistics or data analysis but to the radical change in the availability of conflict data, both in detail and quantity. For example, the collection of media reports in the 'Armed Conflict Location and Event Dataset' (ACLED) contains over 4,000 events for Central and West Africa alone between 1960 and 2004 (Raleigh et al. 2010), while the Global Terrorism Database (GTD)[1] contains accounts of over 100,000 terrorist attacks with worldwide coverage. Several other data sets have also grown in size since the acquisition of news sources by data services such as Lexis-Nexis in the 1990s. Yet this increased data availability, spanning over two decades, has only recently begun to be exploited (Schrodt 2012).

Such is the scale of available data today that it has become customary for social scientists to carry out studies at the *event level* (individual incidents and battles) irrespective of the severity or the number of casualties involved (Raleigh et al. 2010; Sundberg et al. 2010). So-called *disaggregated data sets* (where events retain their individuality as opposed to being aggregated by some criteria) are now being generated in enormous quantities and with real-time updates, using machine-coding tools

[1] National Consortium for the Study of Terrorism and Responses to Terrorism (2011). Retrieved from http://www.start.umd.edu/gtd.

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