

This article was downloaded by:[The New School]
On: 10 April 2008
Access Details: [subscription number 789275684]
Publisher: Routledge
Informa Ltd Registered in England and Wales Registered Number: 1072954
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Economy and Society

Publication details, including instructions for authors and subscription information:
<http://www.informaworld.com/smpp/title~content=t713685159>

Enacting catastrophe: preparedness, insurance, budgetary rationalization

Stephen J. Collier

Online Publication Date: 01 May 2008

To cite this Article: Collier, Stephen J. (2008) 'Enacting catastrophe: preparedness, insurance, budgetary rationalization', *Economy and Society*, 37:2, 224 - 250

To link to this article: DOI: 10.1080/03085140801933280

URL: <http://dx.doi.org/10.1080/03085140801933280>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Enacting catastrophe: preparedness, insurance, budgetary rationalization

Stephen J. Collier

Abstract

This article examines ‘enactment’ as a significant new form of knowledge about collective life that differs fundamentally from familiar forms of ‘social’ knowledge. The emergence of enactment is traced through a series of domains where the problem of estimating the likelihood and consequence of potentially catastrophic future events has been made an explicit object of expert reflection: response to a possible nuclear attack in US civil defence planning in the late 1940s; the emergence of natural hazard modelling in the 1960s and 1970s; and the emergence today of terrorism risk assessment and its proposed application to federal budgetary distributions. The article engages with central questions in debates around ‘risk society’ and insurance, holding that new approaches to understanding and assessing risk are not merely idiosyncratic or subjective. Rather, they should be treated as coherent new forms of knowledge and practice whose genealogy and present assemblies must be traced.

Keywords: insurance; risk society; security; terrorism; modelling; natural disasters.

Introduction

In recent years events such as terror attacks, natural disasters and technological accidents have received growing attention from critical social scientists.¹ A central question in this literature is whether such events exceed the mechanism of risk spreading through insurance that was so essential to a certain kind of security over the twentieth century. This problem of insurability has served as

Stephen J. Collier, Graduate Program in International Affairs, The New School, 66 West 12th Street, Room 612, New York, NY 10011, USA. E-mail: CollierS@newschool.edu

a lens for broader issues: do such risks exceed mechanisms of calculated mitigation altogether? How do they transform the apparatuses of collective security that characterized industrial modernity?

The present article addresses these questions by shifting attention away from insurability and calculability *per se* and towards an analysis of alternative mechanisms for knowing and assessing risks. The knowledge form classically associated with insurance – which uses statistics to analyse an ‘archive’ of past events – is only one way through which uncertain threats can be known. In what follows, I contrast this *archival–statistical* knowledge with *enactment–based* knowledge produced by ‘acting out’ uncertain future threats in order to understand their impact.² I will trace the genealogy of enactment through a series of historical moments in the United States: from civil defence preparedness to disaster insurance to budgetary rationalization in contemporary domestic security. In tracing this genealogy, I do not mean to suggest that enactment-based knowledge has superseded archival–statistical knowledge or that enactment is the paradigmatic knowledge form of contemporary collective security. It is, however, a significant new approach to producing knowledge about collective life, one that is increasingly important in the diverse emerging assemblages of risk, rationality, and security.

The article begins by examining the critical social science discussion concerning catastrophe risk and insurance. I focus in particular on a central point of reference in these discussions, Ulrich Beck’s ‘insurability thesis’. Beck’s thesis involves two interlinked claims. First, he argues that contemporary societies increasingly face ‘catastrophe’ risks such as industrial accidents or large-scale terrorism that cannot be covered by private insurance. Second, Beck argues that this insurance ‘limit’ marks the threshold of risk society, whose dominant techno-political dynamics are shaped by uncertain risks that are beyond rational assessment and calculated mitigation.

Beck’s claims have been criticized, both because they are empirically suspect (insurers do cover some catastrophe risk) and because they paint an overly epochal picture of the shift from the manageable risks of industrial modernity to the uncertain and thus unmanageable risks of risk society (Bougen, 2003; Ericson & Doyle, 2004a; O’Malley, 2004; Rose *et al.*, 2006). These critiques are persuasive. Nonetheless, I want to insist that Beck offers crucial insights into contemporary mutations of risk and collective security. Following Beck’s own suggestion in recent work (Beck & Lau, 2005), his epochal story can, with some modification, be turned into a set of useful propositions for inquiry. Beck argues that uncertain risks exceed the limits of calculative and instrumental rationality in general. It would be more precise and analytically productive to say that such risks push the limits of a *specific form of calculative rationality* based on archival–statistical knowledge. This distinction is important, since what we observe today is not the paralysis of frameworks for rational response to uncertain threats. Rather, we see the proliferation of such frameworks in multifarious emerging initiatives whose aim is to generate knowledge about uncertain future events and to link this knowledge to diverse mechanisms of

mitigation. Thus, as O'Malley (2000) suggests, the central question concerns not the theoretical status of calculative rationality (or 'insurability') *per se*, but, rather, how risks judged 'uncertain' from one perspective are already being known and assessed using other approaches.

The remainder of the article examines one approach to assessing 'uncertain' risk that has emerged and become institutionally significant in the last fifty years: enactment. Enactment, it will be shown, is of a fundamentally different character from archival–statistical knowledge (see Table 1). Rather than drawing on an archive of past events, enactment uses as its basic data an *inventory* of elements at risk, information about the *vulnerability* of these elements and a model of the threat itself – an *event* model. And, rather than using statistical analysis, enactment 'acts out' uncertain future threats by juxtaposing these various forms of data. These elements of enactment have been noted in some critical scholarship on insurance (Bougen, 2003; Ericson & Doyle, 2004a). But they have generally been treated as 'idiosyncratic' or non-standard techniques of risk assessment. What is more, since such discussions have been confined to insurance, they have not examined the diversity of domains in which enactment has been deployed.

The analysis that follows traces a genealogical progression through which enactment was articulated and linked to diverse mechanisms of mitigation: first, civil defence preparedness planning in response to the Soviet nuclear threat in the early 1950s; second, new approaches to natural hazard modelling, which linked enactment to insurance from the 1960s to the 1980s; third, and finally, the contemporary emergence of terrorism risk assessment based on enactment, and its proposed application to the rationalization of federal budgetary distributions. These moments in the genealogy of enactment affirm many propositions in Beck's risk society theses. In each, archival–statistical forms of knowledge and assessment encounter a 'limit'. In each, the problem of estimating the likelihood and consequence of uncertain future events is made an explicit object of expert reflection and technocratic response. The genealogy of enactment does not, however, confirm propositions concerning a generalized crisis of rationality in the face of uncertain threats or a 'structural break' (Beck & Lau, 2005, p. 532) in the status of expert knowledge. Rather, we find alternative forms of knowledge and assessment – enactment among them – with coherent genealogies, with bodies of sanctioned expertise that become authoritative in certain contexts (though they remain disputed in others), and

Table 1 Archival–statistical knowledge *versus* assessment through enactment

	<i>Archival–statistical knowledge</i>	<i>Enactment</i>
Data	<i>Archive</i> of past events	Inventory of elements; vulnerability data, event model
Technique of Assessment	<i>Statistical</i> analysis of distribution of risks over a population	<i>Enactment</i> of future events

with their own norms and modes of veridiction.³ In specific sectors and in response to events we see moments of *re-problematization* in which existing forms are critiqued, redeployed and recombined. My analytic strategy is to trace these recombinations and the emerging forms of collective security to which they are giving rise.⁴

Beck's 'insurability' thesis and styles of reasoning about risk

In his now thoroughly debated work, Beck has characterized contemporary society as 'risk society'.⁵ The distinction that Beck marks with this term is between a society faced with threats whose 'risk' can be confidently expressed as a likelihood of future harm and a society faced with threats whose risk is uncertain.⁶ He argues that this distinction is made visible by the limit of a distinctive technology of collective security, namely, insurance and, in particular, private insurance. Given the centrality of these claims to contemporary discussions about risk, it bears rehearsing the outlines of Beck's 'insurability' thesis.

The voluminous critical scholarship on insurance has shown that insurance was applied to problems of collective security in response to a certain class of events – 'pathologies of the social' such as disease, workplace accidents and poverty – in the nineteenth century (Ewald, 1991, 2002; Foucault, 2007; Hacking, 1990, 2003; Rabinow, 1989; Rose, 1999).⁷ Through an emerging practice of applied social science, these pathologies were mapped onto the regularities of collective life through new knowledge forms that were, in turn, linked to the insurential mechanism of risk spreading. The *data* associated with this 'social insurance', that is, insurance deployed as a mechanism of collective security, might be called archival (Collier & Lakoff, 2008a; Fearnley, 2005). It is a 'historical' record of past events – illnesses, crimes, incidents of poverty – in a population. The analytic technique or *technique of assessment* in social insurance is statistics, used to understand the distribution of these events – and, thus, the distribution of risks – over a population. This archival–statistical knowledge about the population, finally, was linked to the insurance form of risk spreading. Actuaries could estimate the risks associated with an individual policy and with a total portfolio, and make decisions about what to insure, whom to insure and what premiums to charge. This ensemble of elements is portrayed in Table 2.

Table 2 Social insurance

Data	<i>Archival</i> information about pathologies of the social (disease, accidents)
Technique of analysis	<i>Statistical</i> assessment of risk distribution over a population
Mechanism of mitigation	Insurance-based distribution of risk over a population of rate payers

For Beck – and, it should be noted, for many other critical social scientists – social insurance is paradigmatic of the modern ‘security pact’.⁸ The ‘systematic creation of consequences’ by industrial modernity, Beck argues, found a ‘counter principle’ in a ‘social compact against industrially produced hazards and damages, stitched together out of public and private insurance agreements’ (Beck, 1992b, p. 100). Through the mechanism of insurance ‘the incalculable threats of pre-industrial society (plague, famine, natural catastrophes, wars, but also magic, gods, demons) [were] transformed into calculable risks in the course of the development of instrumental rational control’ (Beck, 1999, p. 76).⁹

In his work on risk society, of course, Beck’s primary concern is with the limits of this security pact. He associates this limit with the emergence of threats such as nuclear war or environmental catastrophes that do not meet the basic criteria of insurability based on archival–statistical knowledge.¹⁰ Such threats are also systematically produced by industrial modernity; indeed, as Beck points out, they are the products of industrial modernity’s very success, a point to which we return. But unlike ‘pathologies of the social’, these threats of risk society exceed industrial modernity’s characteristic mechanism of security. There is no archive of past events whose analysis might provide a guide to future events.¹¹ As a consequence, Beck argues, ‘standards of normality, measuring procedures and therefore the basis for calculating the hazards are abolished. . . . [I]ncomparable entities are compared and calculation turns into obfuscation’ (Beck, 1992b, p. 102). Such risks, in short, exceed mechanisms of calculated, rational assessment.

Beck draws various implications from these observations, among them a core thesis concerning a new politics around the distribution of social ‘bads’. Here I want to focus on a narrower technical dimension of his argument. Beck posits that the ‘limit’ of private insurance marks the threshold of risk society. The market economy’s internal dynamic, he argues, ‘reveals the boundary line of what is tolerable with economic precision, through the refusal of private insurance. Where the logic of private insurance disengages, where the economic risks of insurance appear too large or too unpredictable to insurance concerns, the boundary that separates “predictable” risks from uncontrollable threats has obviously been breached’ (Beck, 1992b, p. 130). The uninsurable risk, for Beck, is the autonomic signalling mechanism of risk society.

Beck’s ‘insurability thesis’ has been subject to deserved critique, first of all on empirical grounds: private insurers do, in some cases, offer coverage for catastrophe risk. This empirical qualification has conceptual implications. It does not seem plausible to maintain that private insurance serves as the boundary marker of risk society (Ericson & Doyle, 2004, p. 137); and we may wonder more broadly whether epoch-marking terms like ‘risk society’ do the analytical work required to trace contemporary shifts in contemporary risk and security. These problems, I hold, can be traced to two conceptual slippages in Beck’s work. First, in his arguments about insurance Beck seems to conflate the limits of a specific *knowledge form* – what I have called the archival–statistical

form of knowledge and assessment – with the limits of the insurential *mechanism* of risk spreading. Second, Beck associates the limit of a *specific style of reasoning about risk* with the limit of rational assessment *in general*.¹² If these slippages can be sorted out, we may be able to proceed with Beck's categories, understanding that they offer provocative orientations for inquiry rather than an epochal diagnosis of the present.

First, the empirical question concerning the insurability of catastrophe risk: discussions of this problem can be traced back to at least the 1960s and 1970s when a combination of new economic formalizations and practical problems – specifically, mounting losses from natural disasters – drew the attention of insurance professionals and policy-makers. Beginning in the 1970s, a specialist literature of economists and insurance experts began to argue that catastrophe risk could be managed by private insurance companies (Anderson, 1976; Jaffee & Russell, 1997). Over time, tools for assessing such risks became increasingly widespread, and have recently been extended to new kinds of catastrophe risks, such as terrorism. This development has been examined in critical studies of insurance that have asked how actuaries and underwriters respond to catastrophe risks (Bougen, 2003; Ericson & Doyle, 2004a; O'Malley, 2003). Ericson and Doyle (2004a), for example, have studied how the insurance industry successfully reconfigured itself to provide terrorism risk insurance following an initial retrenchment after 9/11. Faced with the uncertain risk of terrorism, they show, underwriters do not proceed on the basis of archival–statistical knowledge and assessment. Rather, they draw on alternative forms of risk assessment and mechanisms of risk spreading that are 'assembled in different ways' (Ericson & Doyle, 2004a, p. 139). These include new approaches to risk assessment – about which more below – as well as the introduction of 'secondary' mechanisms for distributing risk such as reinsurance, securitization and government backstops (Bougen, 2003; *Economist*, 2007).

In showing how catastrophe risks are covered by insurers, critical studies of insurance have refuted some elements of Beck's position but seem to confirm others. They refute his claim that the limit of archival–statistical knowledge is also the limit of the insurance mechanism of risk spreading. If we distinguish these, such studies suggest, we see that the insurance mechanism can be extended beyond the limits of archival–statistical knowledge with which it has been associated. But in their discussions of *how* insurance is extended beyond this insurance limit these studies seem to confirm another key Beckian thesis: that the limit of archival–statistical knowledge, at least in insurance, is also the limit of rational knowledge and calculated assessment. Insurers faced with uncertain threats, critical scholars argue, must fall back on 'subjective' or 'non-scientific' approaches to assessing catastrophe risk; they do not have access to tools of rational assessment or quantitative calculation.¹³ For example, Ericson and Doyle argue that '[i]n spite of claims about a "fully probabilistic framework" and an understanding of "the true nature of risk," terrorism loss estimate models are heavily dependent upon the subjective opinions of experts' (2004a, p. 150). 'Scientific data on risk', they note, 'are variously

absent, inadequate, controversial, contradictory, and ignored. Insurers impose meaning on uncertainty through non-scientific forms of knowledge that are intuitive, emotional, aesthetic, moral, and speculative' (Ericson & Doyle, 2004a, p. 138). Bougen (2003), p. 259), meanwhile, refers to the 'highly idiosyncratic methods' that are used to assess uncertain risks. 'The industry in dealing with low probability events', he notes, 'has a particularly fragile connection to statistical technologies. As regards natural catastrophes, reinsurers operate in a calculative space invested by inescapable uncertainty' (Bougen, 2003, p. 258).

No doubt, there is something to this. In situations where existing techniques of assessment are destabilized subjective judgement plays a significant role, as these scholars have shown through extensive interviews. The problem is that oppositions of scientific *versus* non-scientific, objective *versus* subjective or idiosyncratic *versus* standard may obscure more than they reveal. They seem to render unnecessary the conceptualization of alternative approaches to risk assessment or the search for coherent genealogies through which these have evolved and been recombined across multiple domains. As O'Malley puts this point, it is necessary to 'appreciate the value in recognizing the diversity of . . . techniques for governing the future, rather than conflating them into a binary of "risk" and the "incalculable" other of estimation' (O'Malley, 2003).

In this light, I would push the critique of Beck in a different direction, while affirming many of his basic insights. In his arguments about insurance, Beck has associated the crisis of a *specific* approach to knowing and assessing risk – the statistical analysis of past events – with a crisis of economic or calculative rationality *in general*. An alternative approach, following the old Weberian argument, would be to ask not whether a given form of knowledge and assessment is rational, but what form of rationalization is being employed (Weber, 2002).¹⁴ From this perspective, one might argue that the archival-statistical model is only one approach to knowing and assessing uncertain future events. There are, to borrow Hacking's (1992) phrase, other 'styles of reasoning' about risk, and one need not make any general judgement about their rationality to acknowledge their systematicity, specificity and rigour or to acknowledge that they may provide frameworks for quantitative, calculative choice. What is more, as O'Malley points out, these forms 'have long and effective histories' (2003, p. 277). The questions that ought to be asked, in this light, are: what are these histories of alternative approaches to risk assessment? And how are their elements taken up, reworked and redeployed by experts facing diverse risks in heterogeneous domains?

The remainder of this article approaches these questions by examining the 'long and effective history' of one approach to knowing collective life and assessing its risks – enactment. Various starting points for a genealogy of enactment could be chosen: the development of war games and war simulations (Collier & Lakoff, 2008a; Der Derian, 2003); the Dutch development of flood models beginning in the 1920s (Bijker, 2002); the formulation of earthquake loss models for insurance decisions in the 1930s (Freeman, 1932); or, the case discussed presently, civil defence planning after

World War II. Given these various possible starting points, it should be clear that in what follows I do not propose a definitive historical account of enactment. Rather, I examine exemplary moments that illustrate how techniques of enactment have been invented, redeployed and recombined in response to new threats.

Civil defence and the enactment of nuclear attack

The episode with which I begin is situated in the early years of the Cold War, in American civil defence. It is a nice case here because it describes a context in which planners were beginning to think about what Beck identified as a signature risk of 'risk society': nuclear war. Planners saw civil defence as essential for limiting the damage of nuclear attack on American cities. They also thought that civil defence would help ensure that the United States, if attacked, could fight back. Later, this problematic of 'second strike' focused on hardening and multiplying missile launch facilities.¹⁵ But immediately after World War II, the assumption still ran that the continued functioning of cities and industry after an enemy strike would be crucial to successfully prosecuting a war. Civil defence authorities saw that, in the era of total war, the very systems that had been developed to support modern urban life were now sources of vulnerability.¹⁶ Industrial plants, systems of transportation, communication and urban hygiene whose construction had been essential to modern prosperity and security were, thus, understood in a new light – as possible targets. This, too, was a quintessentially Beckian moment. The success of modernization created new vulnerabilities and risks. The question was: how could these vulnerabilities be systematically assessed? And how could they be mitigated?

The answers to these questions were outlined in the technical and policy documents that defined the US approach to civil defence in the early Cold War. These documents laid out a new form of knowledge about collective life and its risks. It was concerned not with the regularly occurring pathologies of the social but with an uncertain future catastrophe: a nuclear attack (Collier & Lakoff, 2008a). The basic technique for producing such knowledge was to 'act out' a nuclear strike on an American city by juxtaposing various kinds of data arranged on maps. The aim was to generate information about an attack's immediate impact, about the consequences for urban systems that would flow from this initial impact and about the capacities that would be required for response. Although the techniques in these documents were rudimentary, the basic components of enactment were already present.

The discussion that follows describes enactment in civil defence planning by examining a 1953 document entitled *Civil Defense Urban Analysis* that Lakoff and I (2008a) have analysed in a more extensive discussion from which this section draws.¹⁷ The purpose of *Civil Defense Urban Analysis* (CDUA) was to instruct local officials on the procedures for conducting 'urban analyses' that

would serve as the basis for civil defence planning. The starting point for such urban analysis was to catalogue forty-seven types of 'urban features' that, the document explained, were significant for assessing the impact of an attack and for planning post-attack response requirements. These features included infrastructures (streets and highways, port facilities, the telephone system, bridges, the water distribution system, the electric power system), spatial characteristics of human settlement (patterns of land use, building density, population distribution), organizations (industrial plants, police stations, hospitals, zoos, penal institutions) and features of the physical environment (underground openings such as caves and mines, topography and prevailing winds) (*CDUA* 66–77). The resulting catalogue of urban elements comprised a distinctive set of data about collective life that can be contrasted to the 'archive' of events used in archival–statistical analysis. The components of the catalogue were not past events (illnesses or accidents) but elements of a city that might be relevant to a potentially catastrophic *future* event.

After cataloguing these urban features, the next step for local civil defence planners was to engage in *assessment through enactment*. In early Cold War civil defence, enactment meant physically juxtaposing maps to produce knowledge about an uncertain future event. Here, I consider just one part of this process – the estimation of initial blast impact – to indicate how this mapping procedure allowed planners to model a nuclear blast and its impact on a specific city. First, planners were to arrange the catalogued urban elements on a map of the city to produce a diagram of the pre-attack event-space. This diagram served as a kind of template over which a variety of attacks could be acted out. Second, planners were to model a given possible attack as it unfolded over this event-space by placing a transparent acetate overlay with regularly spaced concentric circles on top of the event-space diagram. The centre was placed at an 'assumed aiming point' so that each concentric circle radiating out from this point demarcated a zone of common blast intensity, thus mapping the distribution of blast intensity throughout the city.

Once these two elements – the catalogue and the modelled event – were juxtaposed, planners were instructed to introduce data about how a given 'feature' in the catalogue would be affected by a given level of blast intensity. They did so by drawing on information about what later, in other contexts, would be called the feature's *vulnerability* – its susceptibility to damage from a given event. In civil defence planning, this information about vulnerability was drawn from various sources including atomic test data, engineering analyses and studies of prior events, such as the bombings in Nagasaki and Hiroshima. By combining vulnerability data with information about blast intensity at a certain location, planners could estimate damage to specific urban features. Data on vulnerability provided in *CDUA* were drawn from a document called 'The Effects of an Atomic Bomb Explosion on Structures and Personnel' prepared by the Defence Research Board of Ottawa, Canada. These data allowed planners to classify damage to buildings in one of four

categories: (1) collapse or 100 per cent structural damage; (2) partial structural damage; (3) heavy damage to window frames and doors; and moderate plaster damage; and (4) 100 per cent window breakage. An enforced concrete structure half a mile from ground zero, according to these data, would be totally destroyed by a blast eight times the strength of Hiroshima. A bomb the size of the Hiroshima blast, by contrast, would damage only window frames and doors of a concrete structure, but such a blast would totally destroy private homes up to two miles from ground zero.

It is noteworthy that in using such ‘vulnerability’ data planners were drawing on information about past events, but in a distinct way. In the archival–statistical model, a large number of past events are analysed to determine an ‘average’ event or a normal distribution of events over a population. Civil defence planners, by contrast, used data from past events – whether actual bombings or carefully constructed tests – to understand an uncertain future event that would be *heterogeneous* to the original. Nuclear tests or the bombings in Hiroshima and Nagasaki, thus, were not treated as average events. But they provided data about the vulnerability of structures that, when combined through enactment with features of a future event, allowed planners to understand how a similar detonation – or a larger one – would affect an American city.

Civil defence planning contained, in preliminary form, the characteristic elements found in later articulations of enactment: a *hazard model* that indicated the spatial distribution of blast intensity; a catalogue – or what would later be called an *inventory* – of elements at risk; and information about *vulnerability* of these elements. In civil defence, these elements were linked to a specific mechanism of mitigation: preparedness planning. On the basis of information derived from the mapping procedure, civil defence planners could estimate required response capacities and mitigate vulnerabilities (see Table 3).

Developments in civil defence were to have longer-term significance in various domains. For example, preparedness planning based on enactment can be traced from civil defence to domestic emergency preparedness (Collier & Lakoff, 2008a; Lakoff, 2007). The analysis here, however, traces a different line of development. It follows the forms of knowledge and assessment in civil defence as they were redeployed to respond to other problems and linked to other mitigation mechanisms, first of all catastrophe insurance, the problem that is at the centre of the ‘insurability’ debates.

Table 3 Enactment in civil defence

Data	<i>Model</i> of a nuclear blast; <i>catalogue</i> of ‘significant’ urban elements; data about <i>vulnerability</i> of urban elements
Technique of assessment	Enactment through the physical juxtaposition of maps
Mechanism of mitigation	Preparedness planning

Catastrophe insurance and hazard modelling

The development of catastrophe insurance was not related primarily to nuclear war – although, improbable as it may seem, nuclear war insurance was offered by some companies. Rather, it was related to natural hazards, particularly hurricanes, floods and earthquakes. The evolution of insurance coverage for natural hazards is a surprisingly recent development. Despite some early efforts to develop actuarial frameworks for such events, attention to the problem of natural hazards risk assessment was limited well into the post-World War II period. Insurers either did not provide coverage for natural hazard risk or folded it into general property insurance.¹⁸

Attention was turned to natural hazard risk with greater urgency in the 1960s and 1970s. The reasons for this increased attention deserve detailed study, although some initial indications can be given. Insurers were aware that loss from natural hazards had increased markedly over the post-World War II period (Anderson, 1976; United States. Task Force on Federal Flood Control Policy, 1966). This increase was attributed to various factors. Among them was urban and suburban development in areas such as coastal lowlands and floodplains. By the late 1960s some observers were arguing that this increasingly ‘risky’ pattern of development could be traced, at least in part, to ‘successful’ modern mechanisms of security. Generous federal benefits (beginning with the 1950 Federal Relief Act) and flood control works that diminished the frequency of floods, but that did not necessarily prevent more infrequent, catastrophic floods, encouraged development in areas exposed to natural hazard risks (Kunreuther, 1968, 1973; United States. Task Force on Federal Flood Control Policy, 1966). Here, again, was a paradigmatic dynamic of risk society: the risk of catastrophic loss was made more acute by the very success of modern mechanisms of security. Against this background, it can be surmised that the problem of natural hazard risk assessment received greater attention from private insurers in the 1960s and 1970s for at least two reasons: first, because insurers anticipated a growing market for natural hazard insurance as losses grew; second, because many policy analysts argued that private insurance would better ‘price’ natural hazard risks, and federal legislation (particularly the 1968 Federal flood insurance programme) encouraged private insurers to offer natural hazard coverage.¹⁹

In response, various approaches to modelling natural hazards and to assessing catastrophe risk began to emerge. Here, I will examine one exemplary figure in this development, Don M. Friedman.²⁰ Friedman was an employee of Travelers’ Insurance in Hartford, Connecticut, who served as director of that company’s Natural Hazard Research Program. The trajectory of Friedman’s work is notable for the broader genealogy of enactment. In the late 1960s, Friedman had produced a report on computer simulation of the earthquake hazard for the Office of Emergency Preparedness (OEP). OEP was one of a long line of successor agencies to the 1950s Federal Civil Defense Administration. It was also a point of passage for many practices of

emergency management, preparedness and risk assessment as they migrated from civil defence to other areas of domestic preparedness, disaster modelling and vulnerability mitigation (Collier & Lakoff, 2008b; Lakoff, forthcoming).²¹

As we will see, Friedman's approach closely resembled the form of assessment through enactment that had been developed in civil defence. The same basic elements were employed: a hazard model, vulnerability data and an inventory. But Friedman's approach was different in at least two significant ways. First, he linked enactment to a different mechanism of mitigation: insurance rather than preparedness. Second, Friedman was one important figure in applying advances in computer modelling to natural hazard risk assessment, both by drawing on sophisticated, computerized vulnerability assessments and hazard models²² and by 'acting out' uncertain threats using spatially tagged data sets that could be analysed through computers.

Friedman described his approach in a 1984 article entitled 'Natural hazard risk assessment for an insurance program', which reflected work conducted over the past two decades. As Friedman presented the issue in 1984, natural hazards presented multiple challenges to the traditional tools of actuarial risk assessment. The traditional approach was based on an analysis of what Friedman called 'past loss experience' or, in the terms I have been using here, an 'archive' of past events that could be analysed statistically. The question was: what universe of 'past experience' could be analysed to assess probable loss from natural disasters? Here, Friedman reasoned, insurers faced a dilemma. If only recent events were considered, then loss estimates might be skewed by the small size of their sample. 'Loss experience measured over a short period of years,' he noted, 'can be highly biased by occurrence or non-occurrence of a geophysical event during the period' (Friedman, 1984, p. 70). But a longer time series introduced its own problems. Patterns of settlement, techniques of construction and the cost of replacing damaged property would change dramatically over time.²³ Therefore, past loss experience might provide little useful information about future loss experience.²⁴

Natural hazard risk assessment, Friedman noted, posed a further problem not easily managed by the traditional actuarial approach – that of distributing risk. In order to make decisions about premiums for a given policy, actuaries have to estimate the 'expected annual loss' from natural hazards to each insured property. But because natural hazards might affect a large number of insured properties simultaneously, it was also necessary to assess what Friedman called the 'catastrophe producing potential of individual geophysical events', that is, the potential of such events to affect many insured properties simultaneously and, thus, to threaten the solvency of an insurance company. This problem was not new to insurance. Such 'portfolio risks' were long recognized in the area of fire insurance. By the early nineteenth century so-called 'pin maps' were being used to assess insurers' exposure to damage from fires that might damage many spatially

proximate insured properties in a single event.²⁵ But such models had fallen out of use, and they were inadequate, in any case, for the much larger and more complex patterns of damage produced by hurricanes, earthquakes or floods (Mathewson, 2001).

Friedman concluded that these features of natural hazard risks rendered traditional methods of risk assessment inadequate. The 'unique features of infrequent occurrence and the tendency to cause many losses when [catastrophic events] occur', he argued, 'make it desirable to find a supplementary means of estimating present or future risk rather than depending solely upon the traditional method of evaluating the magnitude of a hazard using past loss experience' (Friedman, 1984, p. 66). Friedman's point was not that the experience of past events could tell insurers nothing; data about the frequency and severity of past disasters, he held, could provide a useful guide to future events.²⁶ But given changes in building materials, patterns of settlement, disaster mitigation measures and so on, past experience of physical damage and monetary *loss* could not provide a guide to future loss. The question to be asked of past events, Friedman argued, was not how much damage they caused *when they occurred*. Rather, the question was what the cost of past events *would be if they happened in the present*. 'What is needed,' Friedman explained, 'is not [information about] actual damages that occurred as a result of a past geophysical event, but an estimate of potential damage production to the present distribution of properties from a recurrence of the past event' (Friedman, 1984, p. 64).²⁷

The approach Friedman proposed was a form of enactment that echoed nuclear attack modelling in early Cold War civil defence. Like civil defence modelling, it juxtaposed data from heterogeneous sources to 'act out' a future event. But Friedman drew on new applications of mathematical models and computer databases developed by civil defence planners over the 1950s and 1960s. Using them, he was able to model 'geophysical events, and attendant severity patterns, that interact mathematically with a given array of properties to produce synthetic loss experience' (Friedman, 1984, p. 70).

In 'Natural hazard risk assessment' Friedman outlined four components of natural hazard risk models, which closely paralleled the different dimensions of enactment in civil defence: (1) the geographic pattern of severity; (2) local conditions that might affect the severity of an event at a given location; (3) the 'elements at risk'; and (4) the 'vulnerability' of these elements (Friedman, 1984, p. 72). Here, I shall not consider the formal expression of these various components. Something can be said, however, about how they were assembled from heterogeneous sources of data. The first and second – the geographic pattern of severity and local conditions – comprised the 'hazard model'. The 'geographic pattern of severity' of the event itself referred to the spatial distribution of whatever feature of a hazard caused damage (water depth for floods, shaking for earthquakes, wind and flooding for hurricanes). Local conditions that might influence an event's severity included – in the case of a hurricane – mountains, hills or valleys that would affect wind

speed, the shape of the shoreline, the depth of offshore waters and any 'man-made constraints' such as levees that would affect patterns of flooding (Friedman, 1984, p. 72). By combining severity patterns with local conditions it was possible to model how an event would unfold over a *specific* landscape.

The third component of the model – what Friedman called 'elements at risk' – referred to properties or structures that might be damaged by a natural hazard. These elements at risk were similar to the 'urban features' catalogued in civil defence planning. For an insurer, however, the elements of central concern were those whose damage produced a liability – that is, insured properties. As in civil defence, the task was not only to identify these elements but to arrange them spatially, creating what Friedman called a 'geographic inventory'. This was accomplished by assigning spatial tags to entries for each element in a computer. As Friedman explained, 'the detailed geographical distribution of over two-hundred million persons and fifty million single family dwellings has been put into [a] grid system' (Friedman, 1984, p. 78). The input process 'included the use of United States Census Data, large-scale maps, grid overlays, and an index to 75,000 towns and cities' (Friedman, 1984, p. 78). The result was a computerized database of the spatial pattern of settlement in the United States that could be correlated with the distribution of severity patterns determined by the hazard model.

The fourth and final element to be included in the model was 'vulnerability,' which referred, as noted above, to the susceptibility of a given structure to damage. Friedman's hurricane model employed a simplified statistical approach to damage estimates that examined past events to establish a correlation between the maximum wind speed of a hurricane and the distribution of damage to structures in a certain area (a relationship that was found to be non-linear).²⁸ 'Vulnerability' of elements at risk could then be expressed as a percentage of the insured value of a property that was expected to be lost in an event of a given magnitude.

The final step in the modelling process was the enactment itself. If in civil defence enactment was performed by physically overlaying maps, then Friedman 'acted out' the event by combining the elements noted above in a computer model. 'Each of these areas', Friedman noted, 'is addressed in computer storage so that building characteristics such as number, type, value, usage, degree of exposure, and vulnerability can be stored at each grid address' (Friedman, 1984, p. 78). The interaction of these elements with the event could be simulated, resulting in an estimation of 'loss experience'. Friedman summarized the approach in a diagram reproduced here as Figure 1.

Despite its increasing technical sophistication, Friedman's approach to natural hazard risk assessment did not, of course, render uncertain risks certain – if what is meant by 'certainty' is the predictive power of a robust archival-statistical analysis. But it did offer a basis for calculative decision-making, one that combined complex data about collective life with increasingly sophisticated simulations of natural hazards in an enacted future. The 'loss experience' produced by the model provided insurers with information that could be used

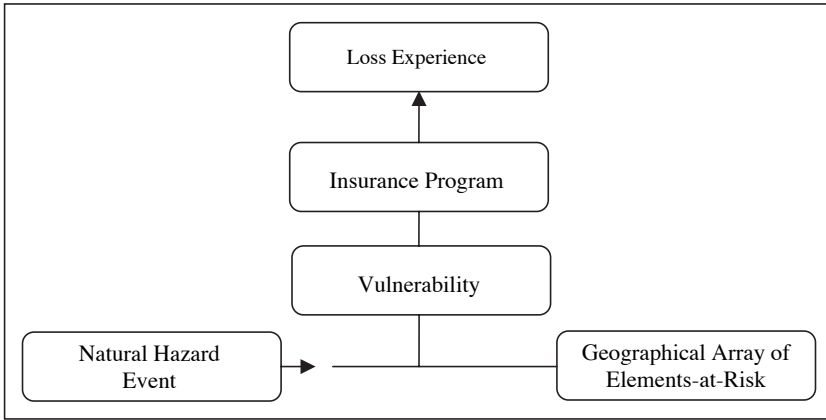


Figure 1 ‘Interaction required in the determination of catastrophe potential’ (Friedman 1984, p. 71)

to make calculative decisions about premiums in different areas and about the management of portfolio risks.²⁹

The problem of natural hazard loss estimates, in sum, constituted a specific site of re-problematization. Experts like Friedman, faced with a new class of events, recognized that existing forms of knowledge and assessment were inadequate. In response, they redeployed forms of knowledge and assessment developed in one domain – that of civil defence – and recombined them with mitigation mechanisms from another domain – that of social insurance. This recombinatorial process is portrayed in Figure 2.

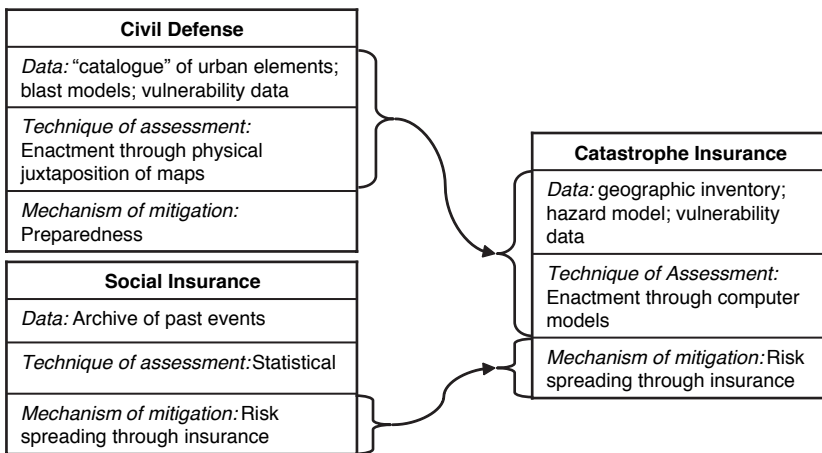


Figure 2 Recombinations I – catastrophe insurance

From catastrophe insurance to risk-based budgeting

Despite substantial technical development in natural hazard risk modelling from the 1960s through the 1980s, it was not until the late 1980s and early 1990s that broad interest in this new assessment tool grew among insurers (Grossi & Kunreuther, 2005; Grossi *et al.*, 2005; Mathewson, 2001). The field was catalysed by a series of major disasters in the US, including Hurricane Hugo (1989), the Loma Prieta Earthquake (1989) and Hurricane Andrew (1992). These events were major shocks to the insurance industry. Andrew left nine insurance companies insolvent and raised again old questions about exposure concentrations and portfolio risks. These disasters increased demand for reinsurance services (Kozlowski & Mathewson, 1995, 84);³⁰ they also catalysed interest in new forms of risk assessment on the part of insurers and reinsurers who realized that ‘in order to remain in business . . . they needed to estimate and manage their natural hazard risk more precisely’ (Grossi *et al.*, 2005, p. 25) see also Bougen (2003)). The growing demand for natural hazard risk assessment was initially met by three firms, all of which had been founded in the late 1980s and early 1990s: AIR Worldwide (founded in 1987); Risk Management Solutions (1988); and EQECAT (1994). Over the 1990s, these modelling companies grew and catastrophe models ‘increased in number, availability, and capability’ (Grossi *et al.*, 2005, p. 25).

By the 2000s, the practices of catastrophe modelling were being systematized. A 2005 volume entitled *Catastrophe Modeling: A New Approach to Managing Risk*, edited by Patricia Grossi and Howard Kunreuther and developed in collaboration with the major commercial modelling firms, sought to reflect increasingly stabilized practice in this area.³¹ The approach outlined in the volume echoed the forms of assessment through enactment as they had developed from civil defence to natural disaster modelling in catastrophe insurance. Grossi and Kunreuther noted ‘four basic components of a catastrophe model’ that are by now familiar: hazard, inventory, vulnerability and loss (Grossi *et al.*, 2005, 26).

The most important users of catastrophe models in the first decade of the twenty-first century, the authors noted, were insurers and reinsurers. Capital markets were also ‘eager users of this technology’ which they employed to price catastrophe bonds (Kunreuther *et al.*, 2005, p. 27; see also Bougen, 2003). But in formalizing and generalizing the methodology of catastrophe modelling, Kunreuther and Grossi addressed a broader range of possible users and applications. Government agencies in particular, they noted, were showing renewed interest in catastrophe modelling, initially (during the 1990s) in the area of natural hazard modelling and increasingly, after 2001, in the area of terrorism risk assessment.³² These new users – and new applications – have shaped new redeployments and recombinations of enactment that are more or less contemporary.

Here I examine one specific example of these contemporary developments: a proposal for government use of terrorism risk models adapted from natural

hazard models of the type just discussed. This example concerns a problem that has been hotly contested in US domestic security discussions: the rationalization of Homeland Security grants to US states (Lakoff *et al.*, 2007). In particular, I examine one proposal for such rationalization, formulated by the Center for Terrorism Risk Management Policy (CTRMP), a unit of the RAND Corporation founded specifically to study terrorism risk insurance. The proposal, laid out in a 2005 report entitled 'Terrorism Risk Assessment' focuses on risk assessment in one specific federal programme, the Urban Areas Security Initiative (UASI). This initiative, note the authors of the CTRMP report, is intended to 'enhance security and overall preparedness to prevent, respond to, and recover from acts of terrorism' by providing 'financial assistance to address unique planning, equipment, training, and exercise needs of large urban areas' (Willis *et al.*, 2005, p. vii). There is agreement among various stakeholders, they continue, that the distribution of this financial assistance should reflect 'the magnitude of risks to which different areas are exposed' (*ibid.*, p. vii). Therefore, a funding formula should be used that would weight distributions according to the risk faced by each state. The suggestion that federal budgetary distribution should be based on a formula is unexceptional. There is a substantial tradition of technocratic thought and practice in the area of so-called 'formula-based financing' that concerns precisely the problem of rationalizing the distribution of funds based on some definition of 'need' (Collier, 2007). When federal grants are in areas such as health care, housing, education or poverty alleviation, 'need' can be defined on the basis of archival–statistical data about collective life – rates of poverty, local levels of economic activity, numbers of school-age children or their performance on aptitude tests. From such measures of 'need' a coefficient can be derived that determines what portion of financing for a particular programme should be allocated to a given sub-national government (Collier, 2005).

In the Urban Areas Security Initiative the relevant definition of 'need' is the exposure of a given state to terror risks. The problem, as the authors of the CTRMP report noted, is that there is no consensus about how the magnitude of risk might be assessed (Willis *et al.*, 2005, p. vii). Again, archival–statistical knowledge proved inadequate to a new class of threat. The CTRMP report proposed two possible approaches to assessing the risk in a given state and, thus, the proportion of total funds it should be awarded. The first would employ density-weighted population as a proxy for terrorism risk, based on the assumption that attacks were more likely in densely settled urban areas. The second, recommended, option was what the authors referred to as an 'event-based approach' to risk assessment that would draw on 'models of specific threat scenarios, calculations of economic and human life consequences of each scenario, and assessments of the relative probability of different types of attacks on different targets' (*ibid.*, p. 25). The specific event-based approach that the report's authors proposed to employ was adapted from a terrorism risk model developed for insurance purposes by Risk Management Solutions (RMS), one

of the catastrophe modelling firms founded in the early 1990s (Ericson & Doyle, 2004a). A double redeployment was under way: first, natural hazard risk models had been applied to terrorism risk modelling for insurance purposes; second, CTRMP proposed to use these loss models for budgetary rationalization (see Figure 3). It is worth saying a few words about these steps in turn.

The entry of the major catastrophe modelling firms into terrorism risk assessment began in earnest after 9/11. As with natural hazard modelling in the 1960s and 1970s, this development had to do both with the needs of private insurance companies and with public regulation. Prior to 9/11, terrorism insurance seems to have been handled in much the same way that natural hazard insurance was approached in the 1960s. Insurance companies either did not provide terrorism coverage in their policies or included it in blanket property insurance (Kunreuther *et al.*, 2005, p. 210). In the initial aftermath of 9/11, insurance companies withdrew from the provision of terrorism insurance, taking a precautionary approach in the face of what they considered to be excessive uncertainty (Ericson & Doyle, 2004a; Grossi *et al.*, 2005). But the hand of insurance companies was forced by the passage of the 2002 Terrorism Risk Insurance Act (updated by the 2005 TRIEA), which required insurers to offer terrorism insurance (Kunreuther *et al.*, 2005, pp. 216–17).

As Kunreuther *et al.* (2005) point out, terrorism risk models have the same structure as other catastrophe models. They include a ‘hazard model’, an inventory of elements at risk, an assessment of the vulnerability of these elements and a loss estimate. Here I will focus in particular on how two elements of these risk models – the hazard model and the vulnerability assessment – are adapted to terrorism risk modelling of the type developed by RMS and taken up in the CTRMP proposal.

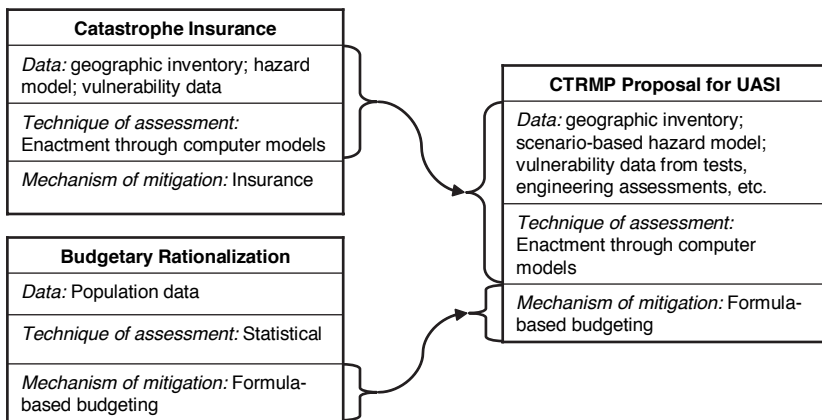


Figure 3 Recombinations II – terrorism risk assessment

'The greatest source of uncertainty' in a terrorism risk model, the CTRMP report notes, 'derives from estimates of threat, which concern terrorists' goals, motives, and capabilities' (Willis *et al.*, 2005, p. 14). Terrorism risk amplifies the assessment problems presented by natural hazard risk: even less is known about the likely characteristics of events, and even less information from past events is available (Kunreuther *et al.*, 2005). Therefore, terrorism risk models like that produced by RMS depend on a distinct method for generating a hazard model, namely the use of imaginative scenarios. The initial selection of attack scenarios and the determination of frequency estimates are based on 'elicitation' of expert understanding. As Ericson and Doyle (2004a, p. 150) point out, this technique of 'elicitation' is 'subjective' in the sense that it draws on expert opinion, not on statistical or quantitative measures. But the methodology of such expert 'elicitation' is systematized, and has a long history that can be traced to approaches such as the Delphi Method, developed by RAND in the early years of the Cold War (Kunreuther *et al.*, 2005).

If the hazard module of terrorism risk assessments is based on methods that are formalized but 'subjective' then the 'vulnerability' module in terrorism risk modelling is 'subject to lower levels of uncertainty'.³³ The authors of 'Estimating Terrorism Risk' note that estimating vulnerability often takes the form of 'straightforward engineering and statistical problems' that can be approached through existing and well-established methodologies. Terrorism vulnerability assessments can draw on models of natural disasters 'that are directly applicable, or nearly so' (Willis *et al.*, 2005, 15). They can also use 'methods of engineering risk analysis that have been used successfully in estimating risks of space flight and operating nuclear reactors', as well as on military damage assessments: '[T]he military and other government agencies', the authors note, 'have long studied the effects of weapons on people and structures and this, too, is useful for estimating consequences' (Willis *et al.*, 2005, p. 15).³⁴

It is in the final 'output' – the loss estimate – that a model of risk assessment for government budgetary decisions differs most fundamentally from an insurance loss estimation model. For government decision-makers, the question does not concern the dollar value of *insured* loss and, thus, the appropriate premiums and risk exposures. Rather, it concerns the *total* loss inflicted by an event – in life and dollars. CTRMP, in this light, proposed as a metric 'average annual loss' in a given state as a guide to government decision-makers. Average annual loss, was, of course, a basic metric in insurance loss models, used to determine premiums and to manage catastrophic loss exposures. In the CTRMP proposal, by contrast, average annual loss would be used to derive a coefficient that expressed the *proportion* of total annual loss expected in the US that was accounted for by a given state. This coefficient, finally, could be plugged into a formula for the 'risk-based' distribution of homeland security funds. Enactment, in this way, would be linked to budgetary rationalization.

Conclusion: enactment, security and the politics of truth

Surveying the broad field of these developments, we clearly cannot conclude that enactment has stabilized in apparatuses of security. The CTRMP proposal has not been adopted in US domestic security funding, which continues to be a highly politicized and disputed problem (Lakoff *et al.*, 2007). Terrorism risk modelling, for its part, remains in the early stages of development, and existing methodologies are not widely trusted by insurers (Kunreuther *et al.*, 2005). Natural disaster risk assessment techniques based on enactment are increasingly accepted, and in other areas, such as emergency preparedness, enactment is accepted and well institutionalized. But even there we find various knowledge forms and assessment techniques vying for legitimacy and institutional force; enactment is only one among these.³⁵

Where does this leave us in relationship to risk society and Beck's insurability thesis? As noted above, Beck has been criticized for his epochal claim that we have moved from a period of industrial modernity and governable risks to a risk society characterized by ungovernable risks. Acknowledging Beck's recent efforts to qualify and clarify his position, at least two analytical problems with the overdrawing of the distinction between industrial modernity and risk society are particularly relevant in light of the preceding discussion. The first is that it tends to obscure processes of transformation that take the shape of partial mutations, sectoral redeployments and recombinations of existing elements. For example, the recombination of the insurance risk spreading mechanism with the enactment mode of knowledge and assessment seems difficult to analyse in relation to risk society. Is it an example of risk society? An exception to it? The second problem is that, as O'Malley has pointed out, an insistence on the 'ungovernability' of the risks that characterize risk society can divert attention from new forms of knowledge and assessment.³⁶ As I suggest above, it is crucial to draw a distinction between the limit of archival–statistical knowledge and the limit of rational assessment in general, and to examine alternative forms of knowledge and assessment with their own specificity, systematicity and institutional legitimacy.

All that said, this article has suggested that one may nonetheless find in Beck's core concepts an essential guide to contemporary re-problematizations of risk, rationality and security, one that helps us think through the genealogy of enactment. Across multiple sectors, and over many decades, enactment was invented and then redeployed in response to problematic situations in which the archival–statistical model proved inadequate to new problems. One can identify common features of these problems – and common responses across multiple domains – without suggesting that they are local manifestations of the broader logic of risk society.

Part of the challenge, in this light, is to weigh the significance of enactment as something more than an idiosyncratic and subjective response to situations in which rational forms of assessment cannot be employed and something less than the sign of a structural shift. In part, this is a question of tracing the

trajectory of its technical application and institutional acceptance – a task that I have tried to begin here. But there is another question to be asked, one that concerns the quintessentially political question of collective security: how might enactment relate to contemporary transformations of the security pact?

Here, it is helpful to keep in view the development of social insurance. Techniques of risk spreading taken from other domains – in particular from long-distance shipping and institutions of mutual aid – were first applied to pathologies of the social in specific sectors, and in response to specific problems such as physical incapacity or old age. Over time, these became more general in their application, covering more domains and a greater share of national populations. In this process, these knowledge forms emerged as crucial elements in the modern security pact: technical concepts of social risk became essential to the definition of political citizenship; the state's side of the modern social contract was fulfilled, in part, through insurance (Ewald, 2002). For enactment, we can see the beginning if not the end of a parallel development. Enactment is also a form of knowledge about collective life – about the vulnerabilities and risks of individuals and groups. But it differs fundamentally from the archival–statistical knowledge of social insurance. It comes to 'know' collective life not through the regular processes of population or society, but through the uncertain interaction of potential catastrophes with the existing elements of collective life. I have shown how, over the last decades, enactment has emerged in multiple domains as a technical means to relate the present to uncertain future events when the archival–statistical form has encountered a certain limit. A crucial problem now is how enactment may shape the processes through which collective life is reflected in political arrangements, a question concerning less rationality *per se* and more what Foucault (2007) called the politics of truth.

Acknowledgements

I acknowledge the comments and suggestions of Carlo Caduff, Lyle Fearnley, Andrew Lakoff, Turo–Kimmo Lehtonen, Paul Rabinow, Antti Silvast, Grahame Thompson and two anonymous reviewers.

Notes

1 This article is part of a broader collaborative project with Andrew Lakoff on vital systems security and it draws many concepts and questions from our work together.

2 My choice of both terms – 'archival–statistical' and 'enactment' – is deliberate. I refer to 'archival–statistical' rather than, for example, 'probabilistic' or 'risk-based' knowledge because both of the latter may refer to various forms of knowledge and assessment – they are not confined to archival–statistical forms. Indeed, both 'probabilistic' and 'risk' are important concepts in discussions of enactment-based knowledge. I refer to 'enactment' rather than some obvious alternatives – such as

modelling or simulation – for three reasons: first, because experts often refer to ‘models’ (hazard models, for example) as sub-components of an enactment; second, because enactment may take forms such as exercises that do not seem adequately described as simulations or models; third, because these terms (especially simulation) already carry substantial associations in critical social science discussions, whereas enactment does not.

3 For a discussion of modes of veridiction, see Rabinow and Bennett (2007).

4 This emphasis on ‘recombinations’ can be found in certain readings of Foucault, in particular Rabinow’s (2003). This aspect of Foucault’s approach is particularly clear in the newly published *Security, Territory, Population* (Foucault, 2007). Beck, too, has recently suggested a strategy of tracing recombinations: ‘That which has existed up until now is not simply replaced or dissolved and does not simply appear as a mere residual leftover; instead, it combines with new elements in different forms’ (Beck & Lau, 2005, p. 541).

5 Beck’s general theses have appeared in innumerable publications. For a review of sub-themes that are particularly relevant to the present argument see Beck (1992a).

6 Ericson (2005) points out that the definition of ‘risk’ sometimes slips in this literature. Here I use ‘risk’ in the most generic sense, as an expression of the likelihood and consequence of a future event, whether or not it is derived using archival–statistical techniques (see also O’Malley, 2004).

7 It should be clear that in this discussion ‘social insurance’ does not mean only insurance provided by the state but insurance associated with particular forms of knowledge about collective life and concerned with events that are ‘pathologies of the social’.

8 There are legitimate questions to be asked about the extent to which this model faithfully describes insurance as it has been practised over the last hundred years. Much has been written about variations in the institutional set-up of insurance in different countries and about the role of ‘estimation’ as opposed to archival–statistical calculation in the history of insurance (O’Malley, 2000; Pfeffer, 1974). Questions might also be raised about whether social insurance should be taken as the paradigm for the modern security pact. Other apparatuses of social modernity such as welfare (O’Malley, 2004) and infrastructure development (Collier, 2006) work on different forms of knowledge, assessment and intervention.

9 O’Malley (2003) has noted that it is not clear what Beck means by ‘control’ in this discussion, since insurance serves only to mitigate financial harm, not to ‘control’ the event.

10 When Beck was first articulating his work on risk society, his examples of these ‘uninsurable risks’ focused on environmental or technological catastrophes, or genetic modification of organisms (Beck, 1992b, p. 101). He has more recently applied his argument to natural disasters and catastrophic terrorism (Beck, 2002).

11 Other criteria of ‘insurability’ are not met by catastrophic risks. See Jaffee and Russell (1997).

12 As noted above (see note 4), Beck’s more recent formulations qualify these claims in important ways, although the basic argument concerning the erosion of the boundary marker of legitimate expertise still seems crucial to his work (Beck & Lau, 2005). My argument here is that this is best investigated as an empirical question rather than a structural logic that can be ‘demonstrated’ in domain after domain.

13 Ericson and Doyle also make the interesting point that insurers initially took a precautionary approach to coverage after 9/11 in the face of great uncertainty (see also Baker 2002). As recent critics of the precautionary principle argue, however, precaution does not necessarily relieve the need to estimate the risk of future events whose likelihood or consequence is uncertain. One has, in other words, to estimate the risks (or the costs) of precaution (Baker, 2002; Wiener, 2002).

14 It is not hard to understand why, from a Weberian perspective, insurance might be exemplary. Because one had a large archive of information about past events, and because these events could be measured in quantitative terms, very precise information could be generated about the costs and benefits of a given course of action (Weber, 1978).

15 For a discussion of second strike and its relationship to new knowledge forms, see Amadae (2003).

16 The link between total war and 'vulnerability' assessment is discussed in Collier and Lakoff (2008b).

17 United States. Federal Civil Defense Administration (2002). Hereafter cited in the text as *CDUA*.

18 Kozlowski and Mathewson (1995, p. 83) note that in the decades after World War II 'the U.S. was experiencing a period of low frequency and severity of natural catastrophic events. Damaging hurricanes were scarce, especially in Florida, and a major earthquake had not occurred since 1906. Modern fire fighting and construction practices had minimized the threat of conflagration. As a result, the insurance industry largely lost the discipline of measuring and managing exposures susceptible to catastrophic loss.' As a result, as Walker points out, 'a blanket approach tended to be adopted based on the perceived risk of occurrence of the hazard regionally or nationally without respect for individual mitigating or extenuating circumstances' (1999, p. 12).

19 The 1968 programme called for the federal government to set up an actuarial framework, thus spurring the development of hazard models.

20 In a recent essay on the development of catastrophe risk modelling Michael Lewis (2007) has traced the practice to Karen Clark. In fact, the history extends much farther back than Lewis suggests, though Clark was a major figure. Among other things, Clark articulated a critique of Friedman's assumption that time-series data could be used to estimate the frequency and severity of natural hazards. Clark (1986) argued that deterministic hazard models had to be replaced with stochastic models that did not rely on time-series data.

21 The history of OEP is the topic of a collaborative project that I am undertaking with Andrew Lakoff, Brian Lindseth and Onur Ozgode.

22 The history of natural hazard models deserves more detailed study (but see Kunreuther 1978). In pointing to the improvement and increasing acceptance of these models, I do not mean to suggest that they did not continue to be beset with profound uncertainties and disputes over their design. In this respect see Ericson and Doyle (2004b).

23 As Friedman put the point, 'Property characteristics do not remain constant. Number, type and geographical distribution [of insured properties] change rapidly with time. Their susceptibility to damage also changes, because of time related modifications in building design, materials and methods of construction, building codes, and insurance coverages' (Friedman, 1984, p. 70).

24 Friedman summed up the dilemma: 'If the length of the sample period of past loss experience is increased, the effect of changing property characteristics is amplified. On the other hand, if the length of the sample period is decreased there is less chance of getting a non-biased estimate of frequency and magnitude of the natural hazard' (Friedman, 1984, p. 70).

25 Pin mapping was unlike the forms of enactment described here in that it did not model events or assess the 'vulnerability' of insured structures. It sought only to understand the spatial concentration of exposure, so that individual companies could limit their liabilities to any given event (Mathewson, 2001).

26 Some contemporaries disagreed with Friedman on this point (see note 20).

27 'For example,' he offered in illustration, 'emphasis should not be placed on what the 1906 San Francisco earthquake originally cost, but what it would cost if a

comparable earthquake occurred today and affected the present type, number, vulnerability and value of current properties' (Friedman, 1984, p. 64).

28 Other more sophisticated approaches to vulnerability that drew on computerized simulations were being developed in materials engineering. According to Walker (1999), Friedman played an important role in incorporating these approaches into risk models.

29 First, it could offer an estimate of the average annual loss expected of a specific insured property and, thus, a basis upon which premiums for that property could be determined. Second the model could estimate the 'catastrophe producing potential' of an event – that is, the potential for an event to produce concentrated claims that could bankrupt an insurer.

30 'World-wide, there was a sudden shortage of reinsurance capacity to meet the new perception of PMLs [Probable Maximum Losses] making it more difficult to obtain reinsurance and leading to big increases in reinsurance rates' (Kozłowski and Mathewson 1995, p. 84; see also Walker 1999, p. 16).

31 One of the volume's co-authors, Howard Kunreuther, was an important figure in the history of thinking about insurance and natural hazard modelling. Beginning in the late 1960s, Kunreuther had written assessments of Federal disaster aid and of the new Federal Flood Insurance programme (Kunreuther, 1968, 1973, 1974).

32 The Federal Emergency Management Agency (FEMA) initiated a project in the early 1990s to create a standard loss estimation methodology for earthquakes, which resulted in the open-source HAZUS model.

33 As the CTRMP group notes, 'Because vulnerability concerns the likelihood that an attack of a specific type and magnitude will be successful against a target, it concerns matters that can, in principle, be carefully studied and for which rough estimates may be reasonably good' (Willis *et al.*, 2005, p. 14).

34 For a similar analysis that emphasizes the assemblage of elements linked together in these terrorism risk models, see Ericson and Doyle (2004a).

35 Howard Kunreuther recently made a similar point concerning the relative acceptance of catastrophe modelling for natural disasters (relatively high) and terrorism (low) at a conference at the New School University in New York (2 November 2007). That said, disputes persist in the field of natural disaster risk assessment. He noted that the major firms have responded very differently to recent catastrophes, some adjusting their likelihood estimates using scenario-based projections of much more intense future natural disasters and others adhering to an archival–statistical approach.

36 'It is . . . curious', O'Malley writes, 'that Beck takes no interest in the innovative forms that such risk spreading (or other governing technologies) might take and how they come to "work". . . . Perhaps this is because his own thesis relies upon the image of catastrophes as ungovernable' (2003, p. 276).

References

- Amadae, S. M. (2003). *Rationalizing capitalist democracy: The Cold War origins of rational choice liberalism*. Chicago, IL: University of Chicago Press.
- Anderson, D. R. (1976). All risks rating within a catastrophe insurance system. *The Journal of Risk and Insurance*, 43(4), 629–51.
- Baker, T. (2002). *Liability and insurance after September 11: Embracing risk meets the precautionary principle*. University of Connecticut Law School.
- Beck, U. (1992a). *Risk Society: Towards a new modernity*. London: Sage.
- Beck, U. (1992b). From industrial society to the risk society: Questions of survival, social structure and ecological enlightenment. *Theory, Culture and Society*, 9, 97–123.
- Beck, U. (1999). *World risk society*. Cambridge: Polity Press.

- Beck, U.** (2002). The terrorist threat: World risk society revisited. *Theory, Culture & Society*, 19(4), 39–55.
- Beck, U. & Lau, C.** (2005). Second modernity as a research agenda: Theoretical and empirical explorations in the meta-change of modern society. *The British Journal of Sociology*, 56, 525–57.
- Bijker, W. E.** (2002). The Oosterschelde storm surge barrier: A test case for Dutch water technology, management, and politics. *Technology and Culture*, 43(3), 569–84.
- Bougen, P.** (2003). Catastrophe risk. *Economy and Society*, 32, 253–74.
- Clark, K.** (1986). A formal approach to catastrophe risk assessment and management. *Casualty Actuarial Society*, 73. *Part*, 2(140), 69–92.
- Collier, S. J.** (2005). Budgets and biopolitics. In S. J. Collier & A. Ong (Eds), *Global assemblages: Technology, politics, and ethics as anthropological problems*. Malden, MA: Blackwell.
- Collier, S. J.** (2006). Infrastructure and reflexive modernization. Paper presented at Helsinki University.
- Collier, S. J.** (2007). *Neoliberal reform and public value: The travels of Buchanan's fiscal contractarianism*. Paper presented at meeting of the American Association of Geographers, San Francisco.
- Collier, S. J. & Lakoff, A.** (2008a). Distributed preparedness: Space, security and citizenship in the United States. *Environment and Planning D: Society and Space*, 26(1).
- Collier, S. J. & Lakoff, A.** (2008b). How infrastructure became a security problem. In M. Dunn & K. S. Kristensen (Eds), *Securing 'the homeland': Critical infrastructure, risk and (in)security*. London: Routledge.
- Der Derian, J.** (2003). War as game. *Brown Journal of World Affairs*, 10(1), 37–48.
- The Economist.* (2007). Come rain or shine: Hedge funds find a new way to profit by taking on the weather gods. 8 February.
- Ericson, R.** (2005). Governing through risk and uncertainty. *Economy and Society*, 34, 659–72.
- Ericson, R. & Doyle, A.** (2004a). Catastrophe risk, insurance and terrorism. *Economy and Society*, 33, 135–73.
- Ericson, R. & Doyle, A.** (2004b). *Uncertain business: Risk, insurance and the limits of knowledge*. Toronto: University of Toronto Press.
- Ewald, F.** (1991). Insurance and risk. In G. Burchell, C. Gordon & P. Miller (Eds), *The Foucault effect: Studies in governmentality*. London: Harvester Wheatsheaf.
- Ewald, F.** (2002). The return of Descartes' malicious demon: An outline of a philosophy of precaution. In T. Baker (Ed.), *Embracing risk: The changing culture of insurance and responsibility*. Chicago, IL: University of Chicago Press.
- Fearnley, L.** (2005). 'From chaos to controlled disorder': Syndromic surveillance, bioweapons, and the pathological future (Working paper). Anthropology of the Contemporary Research Collaboratory.
- Foucault, M.** (2007). *Security, territory, population: Lectures at the Collège de France, 1977–78*. New York: Palgrave Macmillan.
- Freeman, J. R.** (1932). *Earthquake damage and earthquake insurance: Studies of a rational basis for earthquake insurance, also studies of engineering data for earthquake-resisting construction*. New York: McGraw-Hill.
- Friedman, D. G.** (1984). Natural hazard assessment for an insurance program. *The Geneva Papers on Risk and Insurance*, 9(30), 57–128.
- Grossi, P. & Kunreuther, H.** (2005). *Catastrophe modeling: A new approach to managing risk*. New York: Springer.
- Grossi, P., Kunreuther, H., & Winkler, D.** (2005). An introduction to catastrophe models and insurance. In P. Grossi & H. Kunreuther (Eds), *Catastrophe modeling: A new approach to managing risk*. New York: Springer.
- Hacking, I.** (1990). *The taming of chance*. Cambridge: Cambridge University Press.
- Hacking, I.** (1992). 'Style' for historians and philosophers. *Studies in History and Philosophy*, 23(1), 1–20.
- Hacking, I.** (2003). Risk and dirt. In R. V. Ericson & A. Doyle (Eds), *Risk and*

- morality. Toronto: University of Toronto Press.
- Jaffee, D. M. & Russell, T. (1997). Catastrophe insurance, capital markets, and uninsurable risks. *The Journal of Risk and Insurance*, 64(2), 205–30.
- Kozlowski, R. T. & Mathewson, S. B. (1995). *Measuring and managing catastrophe risk*. Arlington, VA: Casualty Actuarial Society.
- Kunreuther, H. (1968). The case for comprehensive disaster insurance. *Journal of Law and Economics*, April.
- Kunreuther, H. (1973). *Recovery from natural disasters: Insurance or federal aid?*. Washington, DC: American Enterprise Institute for Public Policy Research.
- Kunreuther, H. (1974). Disaster insurance: A tool for hazard mitigation. *The Journal of Risk and Insurance*, 41(2), 287–303.
- Kunreuther, H. (1978). *Disaster insurance protection: Public policy lessons*. New York: Wiley.
- Kunreuther, H., Michel-Kerjan, E., & Porter, B. (2005). Extending catastrophe modeling to terrorism. In *Catastrophe modeling: A new approach to managing risk*. New York: Springer.
- Lakoff, A. (2007). Preparing for the next emergency. *Public Culture*, 19(2).
- Lakoff, A. (forthcoming). The generic biothreat. *Cultural Anthropology*.
- Lakoff, A., Klinenberg, E., & Treskon, M. (2007). *Of risk and pork: Urban security and the politics of rationality*. Unpublished manuscript, New York.
- Lewis, M. (2007). In nature's casino. *The New York Times*, 26 August.
- Mathewson, S. (2001). From pin maps to the world wide web. *Insurance Journal*, 5 March.
- O'Malley, P. (2000). Introduction: Configurations of risk. *Economy and Society*, 29, 457–9.
- O'Malley, P. (2003). Governable catastrophes: A comment on Bougen. *Economy and Society*, 32, 275–9.
- O'Malley, P. (2004). *Risk, uncertainty and government*. London: GlassHouse.
- Pfeffer, I. (1974). Residual risks in Europe. *The Journal of Risk and Insurance*, 41(1), 41–56.
- Rabinow, P. (1989). *French modern: Norms and forms of the social environment*. Cambridge, MA: MIT Press.
- Rabinow, P. (2003). *Anthropos today: Reflections on modern equipment*. Princeton, NJ: Princeton University Press.
- Rabinow, P. & Bennett, G. (2007). *A diagnostic of equipmental platforms*. Berkeley, CA: Anthropology of the Contemporary Research Collaboratory.
- Rose, N. S. (1999). *Powers of freedom: Reframing political thought*. Cambridge: Cambridge University Press.
- Rose, N., O'Malley, P., & Valverde, M. (2006). Governmentality. *Annual Review of Law and Society*, 2, 83–104.
- United States. Task Force on Federal Flood Control Policy. (1966). *A unified national program for managing flood losses: Communication from the President of the United States transmitting a report*. Washington, DC: US Government Printing Office.
- Walker, G. (1999). *Current developments in catastrophe modeling*. Paper given at 1999 General Insurance Convention.
- Weber, M. (1978). *Economy and society: An outline of interpretive sociology*. Berkeley, CA: University of California Press.
- Weber, M. (2002). *The Protestant ethic and the 'spirit' of capitalism and other writings*. New York: Penguin.
- Wiener, J. B. (2002). Precaution in a multi-risk world. In D. J. Paustenbach (Ed.), *Human and ecological risk assessment: Theory and practice* (pp. 1509–31). New York: Wiley.
- Willis, H. H., Morral, A. K., Kelly, T. K., & Medby, J. J. (2005). *Estimating terrorism risk*. Santa Monica, CA: Center for Terrorism Risk Management Policy.

Stephen J. Collier received his PhD in anthropology at the University of California, Berkeley. He has taught at Berkeley, at Columbia University and,

currently, at the New School, where he is an Assistant Professor in International Affairs. He is the editor with Aihwa Ong of *Global Assemblages* (Blackwell, 2005) and with Andrew Lakoff he is editing *Biosecurity Interventions: Global Health and Security in Practice* (Columbia, 2008). He is completing a book entitled *Post-Soviet Social: Neoliberalism and Biopolitics in the Russian Mirror*. His current research concerns security, emergency and system vulnerability.