

John Preston · Jane M Binner
Layla Branicki · Tobias Galla
Nick Jones · James King
Magdalini Kolokitha · Michalis Smyrnakis
Editors

City Evacuations: An Interdisciplinary Approach

 Springer

City Evacuations: An Interdisciplinary Approach

John Preston · Jane M Binner
Layla Branicki · Tobias Galla
Nick Jones · James King
Magdalini Kolokitha · Michalis Smyrnakis
Editors

City Evacuations: An Interdisciplinary Approach

 Springer

Editors

John Preston
Cass School of Education
University of East London
London
UK

Jane M Binner
Sheffield Management School
University of Sheffield
Sheffield
UK

Layla Branicki
Marketing and Strategic Management
Group, Warwick Business School
University of Warwick
Coventry
UK

Tobias Galla
Michalis Smyrnakis
School of Physics and Astronomy
The University of Manchester
Manchester
UK

Nick Jones
James King
Department of Mathematics
Imperial College London
London
UK

Magdalini Kolokitha
Department of Educational Foundations
and Policy Studies
University of London
London
UK

ISBN 978-3-662-43876-3 ISBN 978-3-662-43877-0 (eBook)
DOI 10.1007/978-3-662-43877-0
Springer Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014946190

© Springer-Verlag Berlin Heidelberg 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law. The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

City evacuations and emergency management, are complex problems which require inter-disciplinary methods of working. This book is the result of a large scale, 2 year project that brought together research expertise from both the physical and social sciences, including crisis education, econometrics, physics (agent and network modeling), policy studies and strategy. It looks not only at the dynamics of evacuation, but at issues of social media and emergency management, warning and informing the public, identifying outliers in emergency management data and the co-ordination of emergency response.

The research was informed by policy makers and practitioners at both the national and local level throughout. Representatives from three UK case study cities were consulted at the start of the project about their needs in this area and 2 years later we returned to these groups to present our findings. In addition, we interviewed and consulted experts from UK government, social media agencies, Department of Homeland Security and Federal Emergency Management Agency (FEMA). Aside from international academic conferences the results of the project were also presented to the Cabinet Office, Department of Homeland Security, the Home Office, the National Steering Committee for Warning and Informing the Public (NSCWIP), a range of UK local authorities (Essex, Plymouth and Exeter), to experts from the sampled cities and at two breakfast events held at the Houses of Parliament.

John Preston

Acknowledgments

The authors would like to thank the Engineering and Physical Sciences Research Council (EPSRC) and the Economic and Social Research Council (ESRC) for funding this project under the grant title ‘Game Theory and Adaptive Networks for Smart Evacuations’ (grant reference EP/I005765/1).

The results of this project were very much a team effort and we would also like to acknowledge the contribution of all of the policy makers and practitioners who informed our research and contributed their time to engage with us. We would also like to thank Dr. Maria Ferrario (Co-investigator) and Dr. John Hutchinson of Lancaster University for their invaluable contributions to the project.

Contents

City Evacuations: Their Pedagogy and the Need for an Inter-disciplinary Approach	1
John Preston and Magdalini Kolokitha	
Unpacking the Impacts of Social Media Upon Crisis Communication and City Evacuation	21
Layla J. Branicki and Doreen A. Agyei	
Simulation of Information Spreading Following a Crisis	39
James King and Nick Jones	
Quantitative Decision-Making Rules for the Next Generation of Smarter Evacuations	63
John Fry, Tobias Galla and Jane M Binner	
Decentralized Optimisation of Resource Allocation in Disaster Management	89
Michalis Smyrnakis and Tobias Galla	
A Semi-automated Display for Geotagged Text	107
Vincent A. Schmidt and Jane M Binner	
Conclusion: Evacuations and Transmedia Vulnerability	117
John Preston	

Contributors

Doreen A. Agyei University of Warwick, Warwick, UK

Jane M Binner Sheffield Management School, University of Sheffield, Sheffield, UK; Birmingham Business School, Birmingham, UK

Layla J. Branicki University of Birmingham, Birmingham, UK

John Fry Sheffield University Management School, Sheffield, UK

Tobias Galla Theoretical Physics, School of Physics and Astronomy, University of Manchester, Manchester, UK

Nick Jones Department of Mathematics, Imperial College London, London, UK

James King Department of Mathematics, Imperial College London, London, UK

Magdalini Kolokitha University of East London, London, UK

John Preston University of East London, London, UK

Vincent A. Schmidt Air Force Research Laboratory, Dayton, OH, USA

Michalis Smyrnakis Department of Automatic Control and Systems Engineering, University of Sheffield, Sheffield, UK

City Evacuations: Their Pedagogy and the Need for an Inter-disciplinary Approach

John Preston and Magdalini Kolokitha

Abstract We consider an overview of city evacuation policy with particular reference to the United Kingdom and using a conceptual framework which considers evacuations and invacuations to be pedagogical. Taking an historical perspective, with a focus on the United Kingdom, the chapter considers the reasons for a gradual move from a policy of city evacuation in WWII towards an ‘invacuation’ policy in the Cold War. It then explores more recent policies of ‘flexible response’ to a range of contingencies with mixed invacuation/evacuation policies being proposed. We illustrate this with an examination of websites for evacuation/invacuation preparedness in UK cities. Recent trends in mobility, social media and communication technologies present increasing interdisciplinary problems for evacuation modelling.

1 Introduction: The Need for an Interdisciplinary Approach

This book is the result of a large scale interdisciplinary research project entitled ‘Game theory and adaptive networks for smart evacuations’ which brought together UK researchers across the sciences and social sciences to consider issues of city evacuation, invacuation and emergency planning. One of the factors considered in proposing the project was the frequency of mass evacuations affecting a whole city. Were such events so unusual that there was little need to consider such an event? On a global scale, at least, mass evacuations are not uncommon. For example, in August 2008 1.9 million people were evacuated in coastal Louisiana and New Orleans due to Hurricane Gustav with an additional 300,000 people evacuated in Cuba. In March 2011, following the 2011 Japanese nuclear accidents, 200,000 people were evacuated from within 50 miles of the Fukushima nuclear power plant. In August 2011 Hurricane Irene led to an evacuation from North Carolina to New York. Most

J. Preston (✉) · M. Kolokitha
University of East London, London, UK
e-mail: j.j.preston@uel.ac.uk

recently, there has been a wave of evacuations in the wake of Hurricane Sandy. Mass city evacuations (and invacuations where people ‘shelter in place’ in buildings) are not unknown, and even more frequent are situations where parts of a city (a block, or street) or the city site of a ‘mega event’ (a festival, an airport, a sports stadium) need to be evacuated. Evacuations, and invacuations, are not uncommon.

Our project brought together researchers from experimental physics, mathematicians (graph theorists), organisation theorists, economists, educationalists, sociologists, computer scientists and linguists (involved in natural language processing). However, the need for an inter-disciplinary approach to the problem is not self-evident. Indeed, it could be argued that inter-disciplinarity has become a buzz word in research terms, increasingly necessary for grant capture, but not a panacea for large scale social problems. There is always the issue of dialogue between disciplines and the extent to which this is possible. This does not only occur between the sciences and social sciences but also between fields and sub-fields in the same discipline. There are also problems of absence and inclusion/exclusion. Although we considered that we had a good balance of disciplines in the project we identified disciplines where we could have benefited from a firmer grounding. For example, we did not have a psychologist, a transport engineer or a geographer on the project. We were also aware of the benefits of consulting those who define themselves as working in an inter-disciplinary way (in areas such as ‘evacuation science’) whilst also being cogent of the limitations of an approach not grounded in any one disciplinary area.

Despite these drawbacks the features of city evacuations—their complexity, idiographic nature and the necessity of a transversal approach to responding to them—makes an inter-disciplinary approach essential (even if we might argue about the extent or mix of inter-disciplinarity).

Firstly, city evacuations/invacuations are of an extraordinary level of complexity which would meet Oliver’s (2012, p. xxiv) definition of ‘catastrophes’ being events ‘...so large and complex that normal disaster preparedness and response strategies, resources and skills are vastly insufficient’. These are sometimes known as ‘hypercomplex events’. Perry and Quarantelli (2005) considers catastrophic events to involve several ‘overwhelming’ factors such as effecting all of a community’s structure, being beyond the capacity of local preparedness responders, requiring help and aid from nearby regions, being subject to protracted media coverage and needing the intervention of national or international authorities. They can involve (Oliver 2012, p. 263):-

...extraordinary levels of mass casualties, damage or disruption severely affecting the population, infrastructure, environment, economy, national morale and/or government functions.

The partial evacuation/invacuation of New Orleans following Hurricane Katrina is a good illustration of the ‘hypercomplexity’ of contemporary disasters where federal authorities were overwhelmed and local community structures and responders were not able to meet the demands of the disaster. This resulted in massive political and social implications, far beyond the original disaster.

Secondly, the events which lead to evacuation and invacuations are idiographic. No two evacuations or invacuations are identical which means that a standardised approach, even one following a single disciplinary orientation, will never be apt for any particular scenario. The current security landscape means that evacuations and invacuations may become not only more frequent but also increasingly distinct from previous events. Environmental degradation, the unpredictable actions of non-state actors and increasing interdependence result in unexpected outcomes can exacerbate the scale of disasters. For example, following the Japanese Tsunami of 2011 a large scale evacuation/invacuation occurred not as a direct result of a natural disaster but due to an accident in the Fukushima nuclear power station. One can not predict in advance the disciplinary profile that may best fit the evacuation/invacuation event.

Thirdly, evacuations and invacuations are increasingly transversal. They are multi-level emergency events that involve individuals, small groups and formal organisations. An increasing number of governmental and non-government organisations are involved in preparedness and response. As well as these groups, there are many non-governmental organisations and pressure groups that are implicated. This can lead to ‘disaster fatigue’ as different organisations over-commit to intervention. It also produces new and unexpected configurations of response. In the case of Hurricane Sandy (2012), for example, a splinter group of the anti-capitalist ‘Occupy’ movement calling itself ‘Occupy Sandy’ organised disaster relief in New York and other United States towns and cities. The group used similar social networking technologies and techniques, as employed in their protests, to organise disaster relief. This also gave the group an increased presence in pointing out the political implications of disaster relief and recovery. This was an unexpected, and perhaps unpredictable, transversal response to the disaster.

In this book we take an interdisciplinary approach to city evacuations (and related to this invacuations). In this chapter we introduce the idea of city evacuations/invacuations by taking a pedagogical stance, examining them as ‘learning events’. After explaining how evacuations/invacuations may be considered to be pedagogical we examine the history of policy with regard to these events in the United Kingdom. We consider, in particular, the ways in which pedagogically there has been a movement away from didactic to increasingly networked learning although this needs to be considered in a local, rather than a national, context. Next, we move to consider how new technologies have been employed in disaster preparedness through an empirical study of the preparedness websites of three cities. We then outline the structure of the remainder of the book.

2 The Pedagogical Evacuation/Invacuation

In earlier work on ‘disaster education’ it is considered that often what is referred to as ‘disaster education’ is a misnomer (Preston 2012). Disaster education, for some, is mostly concerned with imparting information, public relations, mass communication

theory and the psychology of cognition and behaviour. Although all of these fields are useful in alerting and mobilising the public in a crisis there is nothing necessarily educational about these processes (except tacitly and coincidentally). We prefer to define ‘disaster education’ and related fields such as ‘preparedness’ as being fundamentally pedagogical. That is, they involve theories and concepts which have their foundations in the science of teaching and learning. This positioning of ‘disaster education’ makes it properly educational and distinguishes it from related fields such as ‘public information’ or ‘crisis communication’. In earlier work (see Preston 2012) we consider various different forms of disaster education in terms of their basis in pedagogical theory distinguishing between types that rely on didactic pedagogies (where information is imparted with little or no engagement in learning required), affective pedagogies (which aim to induce learning through affecting an emotional state), family and community pedagogies (which use methods of group learning), construction kit pedagogies (where learning occurs through engagement with an activity) and performance pedagogies (where learning occurs through participation in a dramatisation). This method of distinguishing between different pedagogical forms of disaster education helps us to move away from considering a particular medium or message to be indicative of a particular form of learning (and hence cognition or behaviour). For example, imparting information on the internet or on a smart-phone may appear to be more engaging than giving out information on a leaflet. If, though, these forms are equally pedagogically thin in terms of the didactic transmission of information then individual learning will proceed in a similar way. Equally, seemingly more active forms of learning (such as participation in an emergency drill in school or in the workplace) may not reinforce emergency preparedness unless it is grounded pedagogically (for example, through community learning or using performance pedagogies to rehearse a particular incident).

Although pedagogy may refer to techniques of learning in an evacuation/invacuation it can also be used to consider the ways in which societies take a particular stance on emergency issues. Public pedagogy (see Preston 2012 for an application to emergencies) has been used to consider the ways in which pedagogies penetrate the most informal, or popular cultural, elements of our lives. The fictional recreation of disasters as an area where individual agency and preparedness is required (rather than passive reliance on state resources) has been a common trope in popular culture in both film and fiction. It is even possible to consider the state itself as engaged in pedagogisation of various areas of social life. The conception of the pedagogical state in which governance occurs through pedagogical mechanisms is being advanced in sociology and has connections with other conceptions of state control, such as governmentality. As different pedagogical strategies and stances have implications for who might experience the worst effects of a disaster, and how they might cope with a crisis, this has implications for social justice. Pedagogies are never ‘neutral’ and presuppose a particular type of learner and mode of instruction. Whilst we might consider didactic pedagogies to be a ‘cold’ way of conveying information, the effectiveness of more active pedagogies might be more concen-

trated amongst those who are already presupposed to 'learn to learn' in a developing situation.

In these terms we can consider the process (and not just the initial information dissemination) components of an invacuation/evacuation to be pedagogical. Before the crisis event takes place the state (and/or local emergency planners) will have a particular orientation towards the pedagogisation of emergency preparedness. Comparatively, some state actors might consider a less pedagogised approach (relying on didactic, public information with little concern for modes of learning) whilst others might consider a more pedagogised approach (where there has been some consideration for the ways in which citizens learn). Various pedagogical methods may be used to pre-prepare the population. In many conceptions of 'disaster education' the preparedness stage is the end of the process with later stages relying on public information or mass communications. However, learning evidently takes place during an evacuation or invacuation. On a very basic level this occurs as people respond to new situations and environments. New technologies and community organisation, through, have increasingly pedagogised this part of the evacuation/invacuation. Social media, smartphones and GPS have revolutionised the way in which people can learn about a rapidly developing evacuation/invacuation environment. New forms of community organisation (which have often arisen in conjunction with social networking technologies) have resulted in different forms of community learning. Even after a crisis learning can be applied to the recovery stage (Chamlee-Wright 2010).

In outlining the pedagogisation of evacuations/invacuations we must be careful not to be deterministic. It is easy to consider that pedagogies have become more complex and richer over time whereas in many cases the converse has been true. For example, United States preparedness for nuclear attack in the 1950s and 1960s made use of many diverse pedagogical forms such as public education ('Duck and Cover' drills in schools), community and family education and active learning. By the early 1980s although nuclear tensions between the United States and Soviet Union were high, formal engagement with preparedness pedagogies was not overt (although one could argue that public pedagogies, through popular culture, were explicit). However, there is no doubt that increasingly complex technological societies have the potential to make use of potentially more sophisticated pedagogical tools (or at least some members of those societies do).

In order to illustrate this we consider two periods of planning for evacuations/evacuations in the United Kingdom—from the First World War (1914–1918) to the end of the Cold War (1987) and from 1987 to the present day—to consider the differences and complexities of pedagogies. We then consider more recent developments (2010–2012) in how city evacuations/invacuations have been pedagogised through the use of the web and social media using a case study of UK cities. Through a single disciplinary approach (pedagogy) we consider how increasing pedagogical complexity and the ways in which the local/national interact make an interdisciplinary approach necessary.

3 Evacuation and Invacuation: From the First World War to the End of the Cold War

There's no civil defence here. We just have to sit.

(New Jersey woman quoted on disaster preparedness in the Cuban Missile Crisis, 1962 quoted in Wuthnow 2010, pp. 39–40)

In the era of 'Homeland Security' and 'Civil Contingencies' the idea that populations were largely left to their own devices in a crisis seems strange. However, a reluctance to engage populations in the specifics of disaster education and preparedness was common at the beginning of the twentieth century (at least in the United Kingdom) and this reluctance continued up until the end of the century. For reasons of morale, national security, strategic advantage and social control, populations were largely kept away from the specifics of civil defence in a crisis. Only in times of mass civic mobilisation and the militarisation of societies (such as during WW2) was emergency preparedness an overt national priority. To understand evacuation and invacuation policy it is helpful to consider its historical antecedents as these set the scene for later policy initiatives.

During the First World War (WWI), in which the United Kingdom was under aerial attack for the first time, there was initially reluctance by the state to develop either evacuation or invacuation procedures. Even a system for warning and informing the general public was considered to be superfluous. According to Grayzel (2012, p. 46):-

Initially there was not even a consensus that public warnings should be issued at the approach of enemy aircraft, instead public announcements after early raids suggested that 'to avoid the creation of panic...it is most unlikely that any warning will be given by the authorities.

It was not until late in 1915 that basic procedures to inform the public about sheltering at home and security measures were considered (Grayzel 2012, p. 47) and only in July 1917 that public warnings were introduced (Grayzel 2012, p. 78, although not at a national level). It was only in the inter-war period (1918–1939) that arrangements for the evacuation of major cities such as London was discussed (Grayzel 2012, p. 46) with evacuations being studied by the 'Anderson Committee' in 1938 (Welshman 2010, p. 191). The fear of emergency planners was of that spontaneous evacuation would lead to a loss of morale and reduce industrial production (Grayzel 2012, p. 137) and that a planned dispersion would be more effective. The purpose of evacuation was considered with this in mind being '...to effect and control the movement of refugee populations, before they left of their own accord' (Report to the Fabian Society 1936).

The inter-war plans for city evacuation involved a zonal approach with London being divided into an 'inner zone' (where evacuation was mandatory), a 'middle zone' (where it was optional) and an 'outer zone' (where discouraged) (Grayzel 2012, pp. 142–143). In actuality, a much more limited city evacuation was conducted which divided the country into 'evacuation zones', 'reception areas' and 'neutral zones' (Welshman 2010, p. 20). Guidance for the general public on invacuation was published in 1938 in a pamphlet entitled 'The protection of your home