CabinetOffice

Emergency Planning College

Understanding Crowd Behaviours:

Supporting Documentation

UNIVERSITY OF LEEDS

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This report has been commissioned by, and prepared for, the Cabinet Office It forms part of the 'Understanding Crowd Behaviour' research report series. The research was sponsored and funded by the Cabinet Office, as part of the canon of civil protection literature and guidance, published on their UK Resilience website:

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The research was carried out, and the report series produced, by Organisational Psychologists at the Centre for Socio-Technical Systems Design (CSTSD) and the Centre for Organisational Strategy, Learning and Change (COSLAC) at Leeds University Business School.

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DISCLAIMER

Please note, the recommendations made in this report regarding good practice for event preparation and crowd management are an interpretation of best practice made on the basis of knowledge and expertise gained from literature and interviews. They are not definitive rules of event preparation and crowd management.

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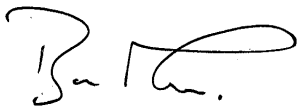
Foreword

Foreword

I am pleased to be able to commend this guidance to you. It was sponsored and funded by the Civil Contingencies Secretariat, project-managed by the Emergency Planning College and written by a team of specialists in organisational psychology from Leeds University Business School. It is the product of a year's research involving a detailed literature review and primary research with practitioners and specialists in the field. It summarises our knowledge, articulates our current understanding of good practice in crowd management and gives planners clear direction, and supporting information, regarding the safe assumptions that may be made about crowd behaviour. As such, this guidance fills what had been a significant gap in our canon of guidance, and contains information that will be of value to a broad cross-section of the public safety and resilience community.



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A Guide for Readers

A Guide for Readers

You should read this report if you are interested in the sources of the literature underpinning the guidance and lessons identified, or if you want to learn more about the different methods used to gather information for the reports.

- This report contains a list of the references cited in the text, detailing the original sources of the literature reviewed and enabling individuals to read those aspects of the literature in which they are most interested.
- This report also describes the research methods undertaken, and the schedules used for the interviews with experts.
- This should be particularly relevant to individuals involved with researching crowd behaviours.
- It should also be of interest to anyone who wishes to learn more about the research process involved with producing these reports.

EXECUTIVE SUMMARY

Executive Summary

- This research was sponsored and funded by the Cabinet Office, as part of the canon of civil protection literature and guidance, and is published on their UK Resilience website (http://www.cabinetoffice.gov.uk/ukresilience.aspx).

- For ease of reading, the research has been divided into a series of four, inter-related reports, namely: -

    - **Understanding Crowd Behaviours: Guidance and Lessons Identified**

    - **Understanding Crowd Behaviours: Supporting Evidence**

    - **Understanding Crowd Behaviours: Simulation Tools**

    - **Understanding Crowd Behaviours: Supporting Documentation**

- This Executive Summary provides an overview of the whole research project (i.e., of all four reports), summarising the Research Aims, Methodology, Key Messages, Good Practice Guidelines, Lessons Identified and Recommendations for Further Research.

- For completeness, this Executive Summary is included at the beginning of each report.

- In addition, a separate guide has been prepared for readers of the reports, which aims to help identify which reports may be of most relevance and use.

    - **Understanding Crowd Behaviours: A Guide for Readers**

- **We recommend that anyone with a professional interest in crowd behaviours should read this Executive Summary.**

Research Aims

- To review – and identify gaps in – existing research, theoretical literatures, and available knowledge on crowds and their behaviour, in both normal and emergency situations.

- To review how the leading simulation software tools accommodate crowd behaviours, and consider how approaches to modelling and simulating crowd behaviours might be enhanced for the future, incorporating both psychological and technical concerns.

- To identify ways forward for the field of crowd management, particularly in relation to planning for very large scale crowd events, which will take place over consecutive days and across multiple locations.

- To produce a set of professional guidelines for emergency planners and responders, specifying reasonable assumptions which can be made with regard to crowd behaviours in normal and emergency situations, against which current assumptions can be tested, and with which future planning can be informed.

Methodology

- A rigorous methodology was undertaken during this research, to gain a wealth of information regarding crowds, their behaviours and methods of simulation, from a wide range of sources (see **Understanding Crowd Behaviours: Supporting Documentation**, 'Research Methodology', pages 43 to 56).

- In-depth literature reviews examining over 550 academic papers, books and official reports were carried out (see **Understanding Crowd Behaviours: Supporting Evidence**, 'Part 3 – Review of the Literature', pages 54 to 242). These specifically concerned: -

    - The key theories of crowd behaviours, with particular focus on the underlying assumptions and rules governing human behaviour, in both normal and emergency situations.

    - Relevant disasters and mishaps involving crowds, with particular emphasis on crowd behaviours, and the often interconnected nature of contributory factors.

    - The key methods used to model and simulate crowd behaviours.

- In addition, three of the leading simulation techniques currently available were reviewed – through utilising accessible literature and conducting interviews with both users and creators of the tools – focusing on their underlying behavioural assumptions and rules (see **Understanding Crowd Behaviours: Simulation Tools**).

- 27 semi-structured interviews were conducted with a wide range of individuals acknowledged to be experts in the field of crowds and crowd behaviours, including leading academics, experienced police officers, and key crowd event and management practitioners (see **Understanding Crowd Behaviours: Supporting Evidence**, 'Part 4 – Expert Interview Findings', pages 243 to 275).

    - The interviewees were specifically chosen for their wealth of experience, ranging from a few to over 30 years. The majority had over ten years' experience in the field.

    - They had a range of roles and responsibilities, including overseeing public order at major events, emergency planning, operational planning and safety management.

    - Experience of major crowd events amongst the interviewees included Notting Hill Carnival, The Matthew Street Festival, Glastonbury, Liverpool Capital of Culture 2008, Hogmanay, New Year's Eve in London, large scale marches in London (such as Stop the City, Stop the War, May Day protests), and events at Wembley Stadium.

- In addition the lead author of this report: -

    - Attended two crowd-related courses held at the Emergency Planning College, on Crowd Dynamics, and on Public Safety at Sports Grounds and Events.

    - Spent a day with police officers at the Metropolitan Police Public Order Training Centre, Gravesend, and a day with Lothian and Borders Police during a visit from the Queen.

- Particular attention has been paid to examining very large scale crowd events, which will take place over multiple days and across multiple sites (see **Understanding Crowd Behaviours: Supporting Evidence**, 'Part 1 – Very Large Scale Crowd Events', pages 10 to 21), focusing on: -

    - The differences between very large scale, multi-day, multi-site events and other, more frequent or one-off events, specifically with regards to preparation and crowd management.

  - The new and additional risks that arise in light of these differences and the findings of this research, which will need careful and rigorous analysis and mitigation by appropriate professionals.

- Analysis has also been undertaken of the problems occurring at the opening of Heathrow Terminal 5 (see **Understanding Crowd Behaviours: Supporting Evidence**, 'Part 2 – A Cautionary Tale: Heathrow Terminal 5', pages 22 to 53), since this provides an excellent recent example of a major infrastructure and operational investment which was badly planned and managed. There are important lessons to identify from this case study.

Key Messages

The key messages to take away from this report are: -

- A great deal is known about crowds and how to plan for and manage crowd events. However, this has not been captured and articulated in a single guidance document until now.

- Key advice for successful crowd management includes: -

  - Thorough planning and preparation, using a wide range of "what if...?" scenarios, including unexpected scenarios.

  - Adoption of a system-wide approach.

  - Coordination between all agencies involved.

  - Utilisation of personnel who have plentiful first-hand knowledge, skills and experience in planning for and managing crowd events.

  - Communication with the whole crowd – both audio and visual – particularly in emergency situations.

  - Leadership and guidance to initiate crowd movement in emergencies.

  - Acknowledgement that seemingly small problems occurring in combination can have a significant impact on event success.

- Nevertheless, there are significant gaps in our understanding of crowd behaviours and in the current capability of crowd simulation tools.

- These gaps are exemplified by the special circumstances of very large scale, multi-day, multi-site crowd events, which will be very different to more frequent, one-off events in a number of ways and, therefore, are likely to involve new or additional risks which will require careful analysis and mitigation.

- In particular, focusing on these very large scale, multi-day, multi-site events, there is a need to consider the potential risks surrounding: -

    - The different types of crowds and their likely behaviours.

    - The behaviours of non-ticket holders who will be attracted to the events, for a range of motives (both legal and illegal).

    - The boundaries – i.e., the scope and scale – of the system we are trying to plan for and manage.

    - The range of “what if...?” scenarios that need to be considered.

    - The knock-on effects of an incident over consecutive days.

    - The importance of coordination between all agencies, across widespread geographical locations.

    - The need to ensure all personnel – from all agencies and in all locations – are consistently and effectively educated, trained and briefed, for both normal and emergency circumstances.

    - The development of new capabilities and facilities for simulation tools, in order to accommodate the above issues.

- There are also some important lessons to identify from the experiences of the Heathrow Terminal 5 opening, in particular that: -

    - Combinations of failures in preparation and management can come together to create major inconvenience to the users of new facilities.

    - These factors include apparently mundane failures such as delays in the completion of the building programme, corner-cutting in training and familiarisation, initial software problems with new computing facilities, a failure to listen to the end users, and so on.

    - These can happen on such a scale as to represent a public relations debacle for the companies and authorities concerned and for the UK more generally.

- Careful preparations need to be made for such everyday contingencies.

Good Practice Guidelines

- A comprehensive set of good practice guidelines has been collated and established for all professionals and practitioners involved in the field of crowds, including crowd events, crowd management, crowd control and emergency services (see **Understanding Crowd Behaviours: Guidance and Lessons Identified**, 'Guidelines for Good Practice', pages 10 to 39). These guidelines focus on: -
  - Good practice for crowd management.
    - For example, concerned with: thorough planning and preparation; minor risks combining to create major problems; multi-agency teamworking; utilisation of experienced personnel; cross-agency coordination; strategies for communicating with the crowd; differentiation of different types of crowd; and awareness of different behaviours from different types of crowd.
  - Good practice for emergency situations and evacuations.
    - For example, concerned with: leadership and guidance during an emergency situation; initiating crowd evacuation as quickly as possible; strategies for communicating with the crowd and providing information; and awareness of how individuals are likely to behave during an emergency.
  - Good practice for crowd simulation techniques.
    - For example, concerned with: trying to model more accurately crowd movements and behaviours; incorporating different types of crowd and crowd member; including family or other small groups within simulation models, rather than just focusing on individuals; and modelling interactions between crowds and other groups, and between crowd members.

Lessons Identified

- A comprehensive set of lessons identified has been produced (see **Understanding Crowd Behaviours: Guidance and Lessons Identified**, 'Lessons Identified', pages 40 to 85), concerning: -
    - Definitions and types of crowd.
    - Assumptions about crowds – including crowd movement and self-organisation, crowd behaviours in normal and emergency situations, crowd disorder, and ways of improving crowd management.
    - Ways in which crowds and their behaviours can be simulated.

Recommendations for Further Research

- Recommendations for future research and practice have been suggested (see **Understanding Crowd Behaviours: Guidance and Lessons Identified**, 'Recommendations for Further Research, pages 94 to 134), with the main priorities concerning further work on: -
    - The development of a rigorous risk assessment tool, which will enable its users to identify the full range of risks associated with different kinds of events and circumstances involving crowds.
    - How new risks associated with the building and subsequent operation of a range of new facilities and sporting events, over an extended period, can be managed and mitigated – i.e., drawing on the lessons that can be identified from an analysis of what is different about very large scale, multi-day, multi-site crowd events, and of the multiple problems which contributed to the problematic opening of Heathrow Terminal 5.
    - Stewarding and its impact on crowd behaviours. At present, there appears to be no research investigating the interactions between crowds and stewards, despite stewards undertaking a crucial role during crowd events and often being the first point of contact for crowd members.
    - Individuals who wish to be part of an event but do not have tickets to attend the event itself – i.e., non-ticketed event crowds – and the impact which their behaviour has on the preparation for, and overall management of, an event.

- The scope of “what if...?” scenarios used during preparations to think about potential problems and to test out the suitability and sufficiency of the plans in place. A wide range of scenarios should be tested, considering not only major risks such as bomb threats, but also less dramatic, but probably more likely, risks such as tripping hazards or software problems, which have the potential to contribute towards more major incidents. Moreover, scenarios should be extended to consider the wider event environment, along with the knock-on effects of incidents occurring in succession or combination.

- The next generation of simulation tools, incorporating issues such as: behaviours of groups within a crowd; different types of crowd and crowd member; interactions between crowds and other groups and between fellow crowd members; emotions; tipping points; unexpected scenarios; different system scopes; multi-purpose behaviours; incomplete information; and theoretical underpinning.

- A definition and comprehensive typology of different kinds of crowds, considering dimensions such as: the purpose and duration of the crowd; level of movement possible within the crowd; the event atmosphere; levels of crowd membership identification and heterogeneity; levels of interaction, both within the crowd and with external groups; the size of groups within the larger crowd; and the amount of luggage or baggage crowd members have.

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Research Methodology

Research Methodology

- A rigorous methodology was undertaken during this research to gain a wealth of information regarding crowds, their behaviours and methods of simulation, from a wide range of sources, namely: -
    - In-depth literature reviews.
    - Semi-structured interviews with a range of crowd experts.
    - Attendance at professional courses.
    - Days out in the field.

Literature Reviews

- In-depth literature reviews were carried out, using a range of techniques, specifically concerning: -
    - The key theories of crowd behaviours, with particular focus on the underlying assumptions and rules governing human behaviour.
    - Relevant disasters involving crowds, with particular emphasis on crowd behaviours, and the often interconnected nature of contributory factors.
    - The key methods used to model and simulate crowd behaviours, in addition to the leading simulation techniques currently available, focusing on their underlying behavioural assumptions.

Initial Discussions

- Initial discussions were held with fellow organisational psychologists, to decide which key social psychological theories, specifically concerned with group behaviour, should be initially reviewed, in order to guide the literature searches.
- These theories were: -
    - Deindividuation theory
    - Social facilitation theory
    - Social loafing theory
    - Emergent norm theory
    - Minimal group paradigm
    - Social identity theory
    - Self-categorisation theory
    - Place scripts theory

- Discussions were also held to decide which crowd disasters – from which important lessons could be learned for crowd events – were likely to be most relevant and well-known (i.e., with sufficient literature available), and should specifically be included in the review.

- These disasters were: -

    - Hillsborough Stadium Disaster (1989)

    - King's Cross Fire (1987)

    - Bradford City Fire Disaster (1985)

    - Hajj Pilgrimage Disaster (2006)

- It was also decided that the disastrous opening of Terminal 5 at Heathrow Airport on 27th March 2008 should be included in the report, as a recent and well-known case study example of how a very large scale, multi-day, multi-site crowd event could turn into a PR disaster if not prepared for, and managed, appropriately.

- Discussions concerning which crowd simulation tools should be reviewed in the report also took place during this initial phase. One of the key factors influencing the final choice was access to, and availability of, information (for reasons of commercial sensitivity and intellectual property, etc).

    - Legion was chosen as it was well-known and was the simulation tool used by the Emergency Planning College and colleagues of the authors at Arup.

    - Myriad II was chosen as it was developed by Professor Keith Still at Crowd Dynamics and, therefore, access was available.

    - Mass Motion was chosen as it was developed by Erin Morrow at Arup, an organisation with which the authors are associated and, therefore, have access.

Literature Searches

- Once an initial start point for the searches had been decided, a variety of search techniques were used to conduct a rigorous search of the available literature.
- Table 1 details the various methods used, and the number of articles, book chapters or official reports reviewed from each.
- Table 2 then details the thorough searches of the academic databases which were carried out.

Table 1. Search methodology

Search Method	Details of Search	Items Reviewed
Textbook searches	Three general social psychology textbooks (Hogg & Tindale, 2001; Hogg & Vaughan, 2002; Myers, 2005) were consulted to gather initial information about the social psychology theories thought to be most relevant to crowd behaviours. Relevant references cited in the textbooks were found and reviewed in detail (see snowball sampling section below).	**3** **62**
Database searches	Thorough database searches were then carried out, using a wide range of search terms (See Table 2 below).	**213**
Key author web page searches	Searches were carried out for articles by key authors in the field of crowd behaviours, namely Stephen Reicher, John Drury and Clifford Stott, using the authors' own web pages. The authors also (having been interviewed) sent copies of articles they felt were relevant to the topic.	**14**
Internet searches for crowd disasters	Information regarding the Hajj Pilgrimage Disaster (2006) was obtained from www.crowddynamics.com Searches were also carried out for the disastrous (in terms of PR) opening of Terminal 5, Heathrow, using internet search engines (Google, Google Scholar).	**1 (website)** **6**

Table 1 cont. Search methodology

Search Method	Details of Search	Items Reviewed
Internet searches for selected simulation tools	Searches were carried out for the chosen simulation tools – Legion, Myriad II and Mass Motion – using internet search engines (Google, Google Scholar). Information about Legion was taken from www.legion.com Information about Myriad II was taken from www.crowddynamics.com	**2 (websites)**
Recommended articles and books	Specific articles or books recommended by expert interviewees were reviewed.	**15**
Known papers	Papers of known relevance concerned with fundamental organisational psychology issues were deliberately sought, e.g., socio-technical systems theory, hierarchical task analysis.	**11**
Official documentation	Guidance documents from official bodies related to the field of crowd events were reviewed, to gain a broad understanding of the topic area. Official reports related to crowd disasters were also reviewed.	**3** **4**
Snowball sampling	Relevant references cited in articles already reviewed, were located and reviewed. Relevant references in these articles were then also followed, located and reviewed, with this process continuing until no further useful articles were identified.	**228**
TOTAL NUMBER OF ITEMS REVIEWED		**562**

- As the table shows, a total of 562 items were reviewed in detail for this report.

Table 2. Database literature searches

Date	Database[1]	Search Term	Number Results	Number Downloaded	Number Duplicates	Number Unique Articles
04/04/08	WoS	crowd	2014	-	-	-
04/04/08	WoS	simulat*	>100000	-	-	-
04/04/08	WoS	model*ing	>100000	-	-	-
04/04/08	WoS	crowd behav*	55	24	0	**24**
04/04/08	WoS	crowd psychology	31	4	1	**3**
04/04/08	WoS	crowd model*	21	9	0	**9**
04/04/08	WoS	crowd simulat*	23	14	5	**9**
04/04/08	WoS	crowd dynamics	21	13	2	**11**
04/04/08	WoS	crowd AND simulat*	142	62	31	**31**
04/04/08	WoS	crowd AND model*ing	69	30	25	**5**
04/04/08	WoS	emergency planning	398	-	-	-
04/04/08	WoS	emergency planning AND crowd	1	0	0	**0**
04/04/08	WoS	emergency planning AND simulat*	22	2	0	**2**
04/04/08	WoS	emergency planning AND model*ing	24	1	1	**0**
04/04/08	WoS	stadium	1431	-	-	-
04/04/08	WoS	stadium AND Crowd	17	4	3	**1**
04/04/08	WoS	stadium AND simulat*	38	1	1	**0**
04/04/08	WoS	stadium AND model*ing	13	1	1	**0**
04/04/08	WoS	egress	1841	-	-	-
04/04/08	WoS	ingress	1986	-	-	-
04/04/08	WoS	evacuat*	10313	-	-	-
04/04/08	WoS	emergency	68451	-	-	-

[1] WoS = Web of Science database: search limits = English language, all years (1900-2008); search field = topic (unless stated otherwise).
PI = PsychInfo database: search limits = all years (1908-2008, unless otherwise stated); search field = keyword (unless otherwise stated).

Table 2 cont. Database literature searches

Date	Database	Search Term	Number Results	Number Downloaded	Number Duplicates	Number Unique Articles
04/04/08	WoS	stress	>100000	-	-	-
04/04/08	WoS	emotion*	76892	-	-	-
04/04/08	WoS	egress AND crowd	11	10	8	**2**
04/04/08	WoS	ingress AND crowd	1	1	1	**0**
04/04/08	WoS	evacuat* AND crowd	42	35	30	**5**
04/04/08	WoS	emergency AND crowd	27	12	11	**1**
04/04/08	WoS	stress* AND crowd	25	1	1	**0**
04/04/08	WoS	emotion* AND crowd	75	5	1	**4**
04/04/08	WoS	egress AND evacuat*	44	24	9	**15**
04/04/08	WoS	egress AND emergency	48	13	12	**1**
04/04/08	WoS	ingress AND evacuat*	13	0	0	**0**
04/04/08	WoS	ingress AND emergency	9	0	0	**0**
04/04/08	WoS	emergency AND evacuat*	641	-	-	-
04/04/08	WoS	emergency AND evacuat* AND crowd	13	11	11	**0**
04/04/08	WoS	emergency evacuat*	120	23	8	**15**
04/04/08	WoS	emergency (Title) AND evacuat* (Title)	128	36	18	**18**
29/07/08	WoS	mass evacuat*	24	3	1	**2**
29/07/08	WoS	panic	13064	-	-	-
29/07/08	WoS	panic AND crowd	14	12	12	**0**
29/07/08	WoS	panic AND evacuat*	23	14	7	**7**
29/07/08	WoS	disaster	15266	-	-	-
29/07/08	WoS	disaster AND crowd	23	6	6	**0**
29/07/08	WoS	Reicher S (Author)	99	18	3	**15**
29/07/08	WoS	Reicher SD (Author)	15	3	1	**2**

Table 2 cont. Database literature searches

Date	Database	Search Term	Number Results	Number Downloaded	Number Duplicates	Number Unique Articles
29/07/08	WoS	Drury J (Author)	10	7	5	**2**
29/07/08	WoS	Stott C (Author)	10	9	6	**3**
29/07/08	WoS	Sime JD (Author)	10	5	2	**3**
29/07/08	WoS	Hillsborough disaster	21	4	2	**2**
29/07/08	WoS	King's Cross fire	27	4	0	**4**
29/07/08	WoS	Bradford fire	16	1	0	**1**
16/10/08	PI	moderator* of crowd*	1	0	0	**0**
16/10/08	PI	moderator* of group*	8	1	0	**1**
16/10/08	PI	moderator* of social*	18	1	0	**1**
16/10/08	PI	moderator* crowd*	0	0	0	**0**
16/10/08	PI	moderator* group*	3	1	0	**1**
16/10/08	PI	moderator* social*	7	0	0	**0**
16/10/08	PI	individual difference* crowd*	0	0	0	**0**
16/10/08	PI	individual difference* group*	18	0	0	**0**
16/10/08	PI	individual difference* social*	57	0	0	**0**
16/10/08	PI	personality crowd*	2	0	0	**0**
16/10/08	PI	personality group*	180	-	-	**-**
16/10/08	PI	personality social*	1396	-	-	**-**
16/10/08	PI	personality social* (Title)	68	0	0	**0**
16/10/08	PI	emotion* crowd*	1	0	0	**0**
16/10/08	PI	emotion* group*	64	1	0	**1**
16/10/08	PI	emotion* social*	1336	-	-	**-**
16/10/08	PI	emotion* social* (Title)	100	0	0	**0**
16/10/08	PI	affect* crowd*	2	0	0	**0**

Table 2 cont. Database literature searches

Date	Database	Search Term	Number Results	Number Downloaded	Number Duplicates	Number Unique Articles
16/10/08	PI	affect* group*	385	1	0	**1**
16/10/08	PI	affect* social*	824	-	-	**-**
16/10/08	PI	mood crowd*	0	0	0	**0**
16/10/08	PI	mood group*	62	3	0	**3**
16/10/08	PI	minority influence crowd*	0	0	0	**0**
16/10/08	PI	minority influence group*	1	1	0	**1**
16/10/08	PI	minority influence social*	3	0	0	**0**
16/10/08	PI	leader* crowd*	0	0	0	**0**
16/10/08	PI	leader* group	501	-	-	**-**
16/10/08	PI	leader* group* (Title)	112	0	0	**0**
16/10/08	PI	leader* social	129	0	0	**0**
16/10/08	PI	conform* personality	1646	-	-	-
16/10/08	PI	conform* personality (Title)	199	7	0	**7**
16/10/08	PI	conform* individual difference*	4	0	0	**0**
Total			**> 419 375**	**438**	**225**	**213**

- As Table 2 shows, over 400 000 hits were returned using these specific search terms. Of these, 438 items were deemed particularly relevant to the area of investigation and were, therefore, downloaded. After taking into account any duplicate items, a total of 213 unique articles were retrieved and reviewed in detail.

Expert Interviews

Recruitment of the Expert Interviewees

- Following discussions with The Emergency Planning College, a number of expert individuals prominent in the field of crowd behaviours and crowd events were identified.
- These included leading academics, experienced police officers, key crowd event and management practitioners, and key individuals involved with tools designed to simulate crowd behaviours.
- Three different interview schedules were constructed by the report authors to be used as a guide for the interviews conducted with academics, with practitioners, and with those concerned with crowd simulation tools (see 'Interview Schedules', pages 57 to 67).
- The selected individuals were then contacted via email, outlining the aims and objectives of the research, and providing an indication of the topics which would be covered during the interview.
- Those individuals who did not believe they were the most appropriate person to be interviewed – i.e., who felt they did not have sufficient expertise in the area – recommended other individuals who they felt would be able to provide a better insight into crowd behaviours.
- Interviews, at a time and date convenient to the experts, were then arranged for those individuals willing to participate.

The Interviews

- 27 semi-structured interviews were conducted in total. They ranged in length from approximately 40 minutes to 3 hours, with the majority being over an hour.
- All interviews were recorded, with the interviewees' permission.

The Expert Interviewees

- A wide range of individuals considered to be experts in the field of crowds and crowd behaviours were interviewed.

- The interviewees were specifically chosen for their wealth of experience in the field of crowds, ranging from a few years to over 30 years. The majority had over ten years' experience in the field.

- They had a range of roles and responsibilities, including overseeing public order at major events, emergency planning, operational planning and safety management.

- Their experience of major crowd events included Notting Hill Carnival, The Matthew Street Festival, Glastonbury, Hogmanay, New Year's Eve in London, large scale marches in London (such as Stop the City, Stop the War, May Day protests), and events at Wembley Stadium.

- Experienced police officers interviewed: -

    - Deputy Assistant Commissioner Chris Allison – Metropolitan Police
    - Superintendent Roger Gomm – Metropolitan Police
    - Superintendent Roger Evans – Metropolitan Police
    - Sergeant Kerry O'Connor – Metropolitan Police
    - Superintendent Phil O'Kane – Lothian and Borders Police
    - Chief Inspector Peter McGrath – Lothian and Borders Police
    - Chief Inspector Peter Mills – Sussex Police

- Key practitioners interviewed: -

    - Simon Ancliffe – Founder of Movement Strategies
    - Professor Keith Still – Founder of Crowd Dynamics
    - Sue Storey – Emergency Planning Manager, Nottinghamshire County Council
    - Ian Rowe – Arup
    - Andrew Jenkins – Arup
    - Clara Yeung – Arup
    - Erin Morrow – Arup
    - John Parry – Emergency Planning Officer, Liverpool City Council
    - Susan Lees – Senior Events Manager, Liverpool Culture Company, Liverpool City Council
    - Susan McAdam – Senior Events Manager, Liverpool Culture Company, Liverpool City Council
    - Alastair Scott – Senior Events Manager, Liverpool Culture Company, Liverpool City Council
    - Andrew McNicholl – Senior Events Manager, Liverpool Culture Company, Liverpool City Council

  - Gerrard Gibbons – Acting Chief Executive, Liverpool City Central Improvement District
  - Edward Grant – Senior Lecturer in Events Management, University of Derby
  - Mike Richmond – Managing Director of Richmond Event Management Ltd; Managing Director of The Event Safety Shop Ltd

- Leading academics interviewed: -

  - Professor Edward Borodzicz – University of Portsmouth
  - Professor Stephen Reicher – University of St Andrews
  - Dr John Drury – University of Sussex
  - Krisen Moodley – University of Leeds
  - Glyn Lawson – Human Factors Research Group, University of Nottingham

Interview Analysis

- Detailed notes of each interview were made from the recordings and sent to the relevant interviewee for confirmation that the overall content was accurate.

- Each interview was then content analysed, looking for key themes specifically concerned with crowds, their behaviours and the most appropriate ways of preparing for, and managing, crowd events. Common themes across the interviews were also identified.

Professional Courses and Days in the Field

- The lead author of this report attended two crowd-related courses held at the Emergency Planning College, Easingwold: -
    - Crowd Dynamics
    - Public Safety at Sports Grounds and Events

- The lead author also experienced days out in the field with the police: -
    - A day with police officers at the Metropolitan Police Public Order Training Centre, Gravesend.
    - A day out on duty with Lothian and Borders Police during a visit from the Queen.

Interview Schedules

Interview Schedule – Practitioners

Devised by Challenger, Clegg and Robinson (2008)

Current position

- What is your current role?
- How long have you been in that role?
- How long have you worked in the field of crowd management/control?
- What are your main duties and responsibilities?
- What is your professional or disciplinary background?

Training

- Have you had any training in crowd events/management/dynamics?
- What type of training have you had?
    - Was this training formal (e.g. a course) or on the job?

Experience of crowd events

- Can you give some specific examples of crowd events you have been involved with?
    - What size are these crowds?
    - What is the composition of these crowds?
    - What type of crowds are they?

  (Want specific information about the types/characteristics of crowds they typically deal with)

- Have you been involved with any emergency situations?
    - What were they?
    - Why/how did they arise?
    - How were they handled?
    - What was the outcome?

  (Want specific examples of what was said and/or done)

- Are there any lessons identified from these emergency situations?

- Have you had experience of any crowd disasters?
  - What went wrong?
  - Why/how did it occur?
  - How was it handled?
  - What was the outcome?

- Are there any lessons identified from these disasters?

Preparation for a crowd event

- How do you typically prepare for a crowd event?
  - How long does it take?
  - What are the main priorities?
  - What are the key issues to consider?

- What are your main responsibilities in the preparation for an event?

- Do you use “what if…?” scenarios?
  - How do you find them helpful?
  - Examples

- Do you use simulation tools?
  - Which tools do you use?
  - In what ways are they useful?
  - Examples

- Does your preparation change depending on the type of crowd event?
  - In what ways?

- What is involved in a risk analysis?
  - Do you consider the likelihood of the risk occurring? If so, how?
  - Do you consider the severity of the risk? If so, how?

Build-up to a crowd event

- Can you describe the typical build-up to a large crowd event?

- Can you describe the preceding few hours?

- How do the crowd dynamics change during the build-up?

- What are the key issues to consider?

- Are there tell-tale signs of potential problems to look out for?

- What are your main responsibilities in the build-up to an event?

During a crowd event

- What types of management/control are typically involved?
- What are your main duties and responsibilities?
- Are there key signs to look out for, indicating potential problems?
- What types of monitoring do you use?
    - Does this vary considerably depending on the type of event?
- What types of information systems do you use?
    - Does this vary considerably depending on the type of event?

Crowd behaviours

- Are you aware of different types of crowds?
    - What types?
    - How are they different?
    - Does it depend on the type of event?
    - Does your preparation/action differ depending on the type of crowd?
    - What is your experience of different crowd types?
- Are you aware of different types of crowd member?
    - What types?
    - How are they different?
    - Does your preparation/action differ depending on the type of crowd member present?
    - e.g., able-bodied v disabled, children, luggage, elderly
- What is the rationale underpinning your categorisation of crowd types and crowd members?
    - Do you draw on any theories or literature?
    - Do you use any research evidence?
    - Are they based on previous experience?
    - Other?
- Do you make any assumptions about crowd behaviours?
    - What assumptions do you make?
    - Why are these assumptions made?
    - What are they based on?
    - Is there any theory underpinning these assumptions?

- Do you follow any rules about underlying crowd behaviours?
    - e.g., “IF…THEN” rules – “if the crowd is large, then use more exits”
    - What?
    - What are they based on?
    - Is there any theory underpinning these assumptions?
    - Do these rules vary depending on the type of crowd?

- What is the rationale underpinning your assumptions and rules of crowd behaviours?
    - Do you draw on any theories or literature?
    - Do you use any research evidence?
    - Are they based on previous experience?
    - Other?

After a crowd event

- Do you have a debrief session after each event?
    - What is involved in this?

- Do you have a review of successes and failures?

- What actions are typically taken from this review?

- Do you have “lessons identified” after an event?

- Have there ever been any surprises?

Recommendations for event planners

- What do you feel are the key factors involved in crowd events?

- What do you feel are the key risks at crowd events?

- What best practice advice would you give?

- What do you feel are the key lessons involved with successfully planning and managing crowd events?

Interview Schedule – Academics

Devised by Challenger, Clegg and Robinson (2008)

Current position

- What is your current role?
- How long have you been in that role?
- How long have you worked in the field of crowd management/control?
- What is your professional or disciplinary background?

Current research interests

- Can you tell me about your research in the field of crowd behaviours/dynamics?
- Can you give me some specific examples of research you have done concerning crowd behaviours?
    - e.g., size, scale, type of crowd, etc
- What do you think are the key issues involved in crowd events?
- What do you think are the key signs of potential problems at crowd events?
- What would you say are they key lessons to be identified about crowd behaviours from your research?
- Why did you decide to go into this particular area?

Crowd behaviours

- Are you aware of different types of crowds?
    - What types?
    - How are they different?
    - Does it depend on the type of event?
    - Does your preparation/action differ depending on the type of crowd?
    - What is your experience of different crowd types?

- Are you aware of different types of crowd member?
  - What types?
  - How are they different?
  - Does your preparation/action differ depending on the type of crowd member present?
  - e.g., able-bodied v disabled, children, luggage, elderly

- What is the rationale underpinning your categorisation of crowd types and crowd members?
  - Do you draw on any theories or literature?
  - Do you use any research evidence?
  - Are they based on previous experience?
  - Other?

- Do you make any assumptions about crowd behaviours?
  - What assumptions do you make?
  - Why are these assumptions made?
  - What are they based on?
  - Is there any theory underpinning these assumptions?

- Do you follow any rules about underlying crowd behaviours?
  - e.g., “IF…THEN” rules – “if the crowd is large, then use more exits”
  - What?
  - What are they based on?
  - Is there any theory underpinning these assumptions?
  - Do these rules vary depending on the type of crowd?

- What is the rationale underpinning your assumptions and rules of crowd behaviours?
  - Do you draw on any theories or literature?
  - Do you use any research evidence?
  - Are they based on previous experience?
  - Other?

Recommendations for event planners

- What do you feel are the key factors involved in crowd events?

- What do you feel are the key risks at crowd events?

- What best practice advice would you give?

- What do you feel are the key lessons involved with successfully planning and managing crowd events?

Publications

- Do you have any key publications in this area?
- What do you feel are the key publications/researchers in the area of crowd behaviours as a whole?

Interview Schedule – Simulation Tools

Devised by Challenger, Clegg and Robinson (2008)

Company

- What is the name of your company?
- What does you company do?
- What is the simulation tool you use?
- Why was the simulation tool designed?
- Who comprises the management team for your company?
- Who are the partners involved with your company?

Background to simulation tool

- Can you tell me about the development history for your simulation tool?
- How many versions are there of your simulation tool?
- Who developed the original version of the tool?
- Can you tell me about the composition of the development team (i.e. about their professional and disciplinary backgrounds)?

Current version

- Can you tell me about the composition of the development team for the current version of your simulation tool?
    - i.e., their professional and disciplinary backgrounds?
- Which market sectors do you target?
    - e.g., rail, sports, retail, air
- Can you describe some case studies of instances in which your simulation tool has been involved?
- What are the main uses and benefits of your simulation tool?
    - e.g., planning, design, safety

- Are there any publications which have arisen from your simulation work?

- How has your simulation tool been validated?
    - Do you have any information or data suggesting that your simulation tool accurately represents reality?

- What publicity has your simulation tool received?

- Has your tool been in the news recently?

Current software

- Do you have different types of crowd in your software?
    - How many types do you have?
    - What are they?
    - What characteristics do they have?
    - How did you decide on these types?
    - What is the rationale underpinning your choice of crowd types?
        - e.g., use of theories and literature, research evidence, previous experience of crowd events, etc
    - How often do you update your crowd types?

- To which types of crowd is your software applicable?
    - All types of crowd?
    - What made you decide to design your software to be applicable to all types of crowd?
    - Only some types of crowd? Which ones?
    - What made you decide to design your software to be applicable to only these types of crowd?

- Are there different versions of your software for different types of crowd?
    - What are the differences?
    - How did you decide on these?

- Do you have different types of crowd member in your software?
    - How many types do you have?
    - What are they?
    - What characteristics do they have?
    - How did you decide on these types?
    - What is the rationale underpinning your choice of crowd member types?
        - e.g., use of theories and literature, research evidence, previous experience of crowd events, etc

- How does your software accommodate different types of crowd member?
    - Does your software account for able-bodied v disabled, children, elderly, people with luggage, etc?

- How often do you update your crowd member types?

- Are there different versions of your software for different types of crowd member?
    - What are the differences?
    - How did you decide on these?

- Does your software have rules of crowd behaviours?
    - e.g., “IF…THEN” rules – “if the crowd is large, then use more exits”
    - What rules does it have? Specific examples…
    - How many rules are there?
    - How specific are these rules?
    - Is there any flexibility in these rules?
    - Do you use “What if...?” scenarios?
    - Are there different rules for different types of crowd?
    - Are there different rules for different types of crowd member?
    - What are the differences?
    - How did you decide on these rules?
    - What is the rationale underpinning these rules?
        - e.g., use of theories and literature, research evidence, previous experience of crowd events, etc
    - How often do you update your rules?

- What type of modelling techniques does your software use?
    - How is your model designed?
    - What are the basic principles behind your model?
    - Do you use simulation agents?
    - Do you use autonomous agents?
    - Do your agents make independent decisions?

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