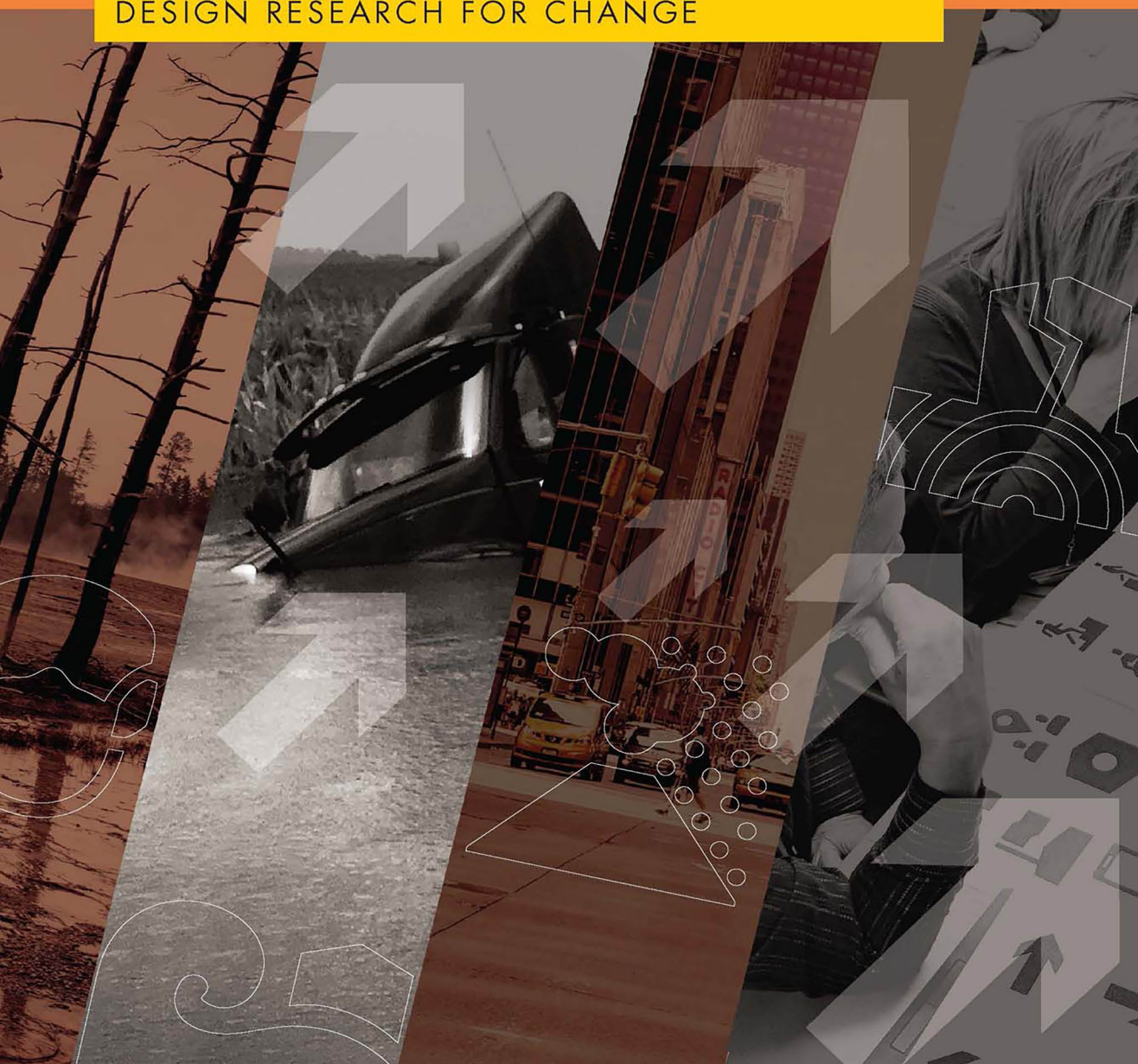
DESIGN FOR EMERGENCY MANAGEMENT

Edited by Saskia M. van Manen, Claudine Jaenichen, Tingyi S. Lin, Klaus Kremer, and Rodrigo Ramírez

DESIGN RESEARCH FOR CHANGE



Design for Emergency Management

Through a combination of theory, practice, and a range of interdisciplinary case studies, this book expands how we define and think about the critical role and relationship between design and emergencies. This role extends far beyond aesthetics: the book highlights the urgency of ensuring that a wide range of stakeholders and a diverse representation of the public come together to work toward preventing disasters.

Design in the context of disasters, such as earthquakes, hurricanes, flooding, and (wild) fires, provides new ways of looking at challenges. It contributes methods to actively engage communities in managing and minimizing disaster risk. Contributors present the latest research on how (collaborative) design and design thinking contribute to the development of processes and solutions to increase disaster literacy and decrease disaster risk for individuals and entire communities. Chapters highlight applied research and implementation of design and design thinking before, during, and after emergencies, resulting in a set of design guidelines derived from best practice.

The book will be of interest to scholars and practitioners in emergency management, product and service design, strategic design, design research, co-design, social design, design for change, and human-centered design.

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To those whose lives have been touched by disaster.


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Introduction

Saskia M. van Manen, Claudine Jaenichen, Klaus Kremer, Tingyi S. Lin and Rodrigo Ramírez

Introduction

Climate change is leading to an alarming rise in weather-related hazards that are expected to become more frequent and increase in severity (IPCC 2022). Simultaneously, population growth means more people living in (urban) areas at risk of weather or geological hazards. This leads to increasing loss of lives, livelihoods and property (e.g. Coronese et al. 2019). A solid understanding of natural hazards used to be considered key to minimize the impacts of disasters. However, in the past few decades it has been recognized that disasters do not occur in a vacuum. Instead, they are based in complex socio-economic and cultural settings (e.g. Kelman 2020). Understanding and interacting within these contexts, and combining insights derived from the physical sciences, is now paramount to comprehensive prevention and mitigation of the devastating effects of natural phenomena. This is often captured in a seemingly simple equation, where disaster risk is the consequence of the interaction between hazard characteristics, exposure to the hazard, and communities' vulnerability and capacity (Table I.1).

Managing disaster risk, the remit of emergency management, is a complex multi-faceted endeavor and therefore a good example of a so-called 'wicked problem' (Rittel and Webber 1973). Wicked problems are open-ended, poorly defined problems that can be symptomatic of another problem and therefore characterized by incomplete, contradictory and changing requirements with complex interdependencies. There are numerous ways to explain and understand a wicked problem, which influences the nature of the problem's resolution and means there are endless potential solutions. Solutions to wicked problems are iterative and characterized by imagination, user empathy and prototyping (Lawson 2006), which are characteristics of design methodology. Solutions are considered neither right nor wrong but rather better or worse, although there is no immediate means of assessing the solution (Rittel and Webber 1973). Throughout the past two decades, 'design thinking' has been heralded as the preferred method to tackle wicked problems. Design thinking is a human-centered and iterative problem-solving approach that involves understanding people's needs, defining problems, generating creative ideas, and testing and refining solutions.

Despite the global interest in design and design thinking, particularly its inclusion in business practices, the importance and role of design in disaster risk reduction and emergency management has been little explored. Design for emergency management is thus an emerging field, the goal of which is to explore academic and practice-based systemic approaches for evidence-based design in the specialized area of emergency planning, risk literacy and disaster risk reduction.

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Table I.1 Commonly used terms and their definitions. Although frequently used interchangeably in the literature, the terms crisis, emergency and disaster each have distinctive as well as overlapping characteristics

Term	*Source*	*Definition*
Capacity	(UNDRR 2017)	The combination of all the strengths, attributes and resources available within an organization, community or society to manage and reduce disaster risks and strengthen resilience. Capacity may include infrastructure, institutions, human knowledge and skills, and collective attributes such as social relationships, leadership and management.
Crisis	(Pauchant and Mitroff 1992)	A crisis is "a disruption that physically affects a system as a whole and threatens its basic assumptions, its subjective sense of self, its existential core".
Disaster	(Al-Dahash et al. 2016)	An event whose impacts overwhelm the capacities of local responders and place demands on resources that are not available locally.
Disaster risk	(UNDRR 2017)	The potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity.
Emergency	(Al-Dahash et al. 2016)	An event that can be responded to using the available resources, with no need for external assistance.
Emergency management	(IAEM 2007)	The managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters.
Exposure	(UNDRR 2017)	The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.
Hazard	(UNDRR 2017)	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation.
Resilience	(UNDRR 2017)	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.
Vulnerability	(UNDRR 2017)	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

Emergency management

Emergency Management is the discipline and profession tasked with reducing losses as the result of hazards and managing disaster risk at the local level (Table I.1). It "seeks to promote safer, less vulnerable communities with the capacity to cope with hazards and disasters" (IAEM 2007, 4).

Emerging as a top-down command and control discipline and practice from World War II and Cold War civil defense, emergency management's contemporary focus is on a comprehensive approach to community empowerment and coordination. Emergency management is informed by disaster science, "the multidisciplinary study of the human dimensions of hazards and disasters [… which…] draws from the insights of multiple academic disciplines, especially the social sciences, natural sciences, engineering, and computer science" (Phillips et al. 2022, 176). Modern emergency management includes the duty to increase communities' hazard awareness, understanding and participation throughout the disaster risk management cycle (Figure I.1): from preparedness and risk reduction, to enhancing communities' ability to manage and recover from emergencies (e.g. Haddow et al. 2021; IAEM 2007). It is thus focused on human behavior in the context of an emergency, and increasingly works to reduce the risks rather than only responding when an emergency presents itself.

Disaster risk is central to emergency management: from understanding the context in which risks occur to identifying, analyzing and evaluating risks, addressing risks and monitoring and reviewing interventions with time and changes in circumstances. A local

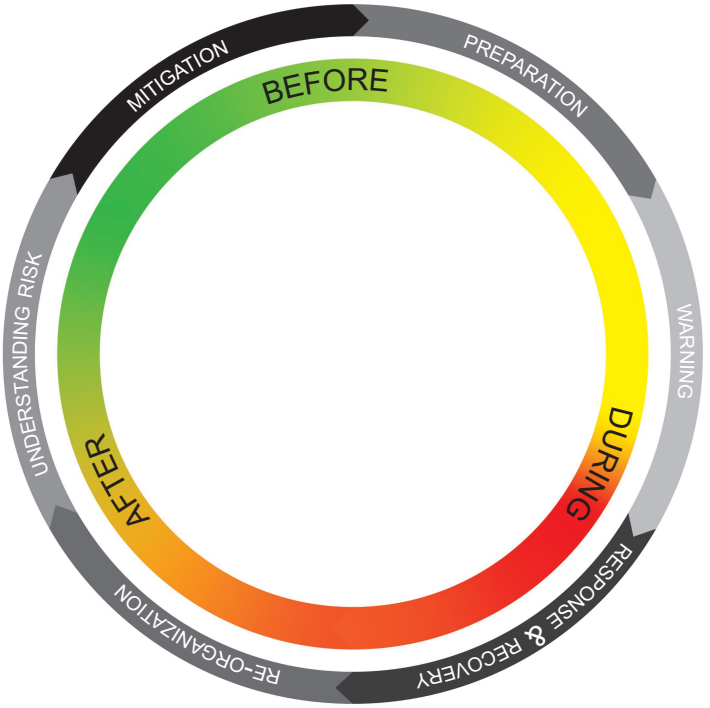

Figure I.1 The disaster risk management (DRM) cycle.

emergency management plan for example is risk-based: it informs the reader about the risks in a certain area, includes a risk analysis, and potential measures for risk reduction, readiness and recovery. Yet the underlying assumption, that education about risks and ways to address these will inspire the public to take the appropriate actions when faced with a potential emergency, has long been discredited (e.g. Paton 2003; Valkengoed and Steg 2019), but it is still the basis for a very large part of the work conducted.

Thus, the majority of the tools and visual representations used in the risk-driven discipline of emergency management are not necessarily appropriate for communicating to, and stimulating dialogue with, the lay public – who in the end comprise the communities that emergency management works to safeguard. The chapters in this volume show that taking a (co-)design-based approach to the communication of risk and appropriate actions to take during an emergency can significantly increase community engagement with emergency management information, before and during a disaster. But what does a design-approach entail? What is design? And how is it complementary to emergency management?

Design

Everything is designed, whether or not it was a conscious act of design. That is, everything man-made is a consequence of a decision someone took, deliberate or not, and most often not even considering it an act of design. Even in its most elementary form, design shapes our actions and interactions with the world around us. This doesn't just apply to what is around us in terms of objects and architecture, but also to the societies we live in, for example the election system, rules, regulations, political climate. It also applies to disasters: there is nothing natural about a disaster (Kelman 2020), rather disasters are consequences of choices that we as humanity have made. Thus, if disasters happen by design, perhaps we can also un-design them. That's where design for emergency management comes in.

The fact that design is far more than making things look good is exemplified by the 'Design Maturity Ladder' (Bringolf 2022; The Danish Design Centre, 2001), which shows that the impact of design can go far beyond aesthetics (Figure I.2). This is because design is an iterative systematic solution building approach that utilizes creative tools in a process called 'design thinking' (Figure I.3). When we apply design thinking to first assess user needs, and then start developing solutions in collaboration with these users, 'participatory design', we arrive at what is termed 'human-centered design' (HCD). At the core of HCD lies empathy: knowing, or being able to imagine, what another person or other people are thinking and/or feeling. In essence, walking in their shoes. This is particularly important when we turn our attention to another concept in design that is also relevant to emergency management: 'inclusive design'.

Design thinking

Design thinking has taken the world by storm the past two decades, especially in the world of business (e.g. Mashhood 2018). The design thinking process can be divided into six core phases: (1) understand: learn about and frame and the challenge to be addressed, (2) define: nail down the problem, (3) ideate: generate and develop potential solutions, (4) prototype: make (rough) mockups and (5) test these extensively before (6) launching. Although these phases are often presented linearly, continuous exploration

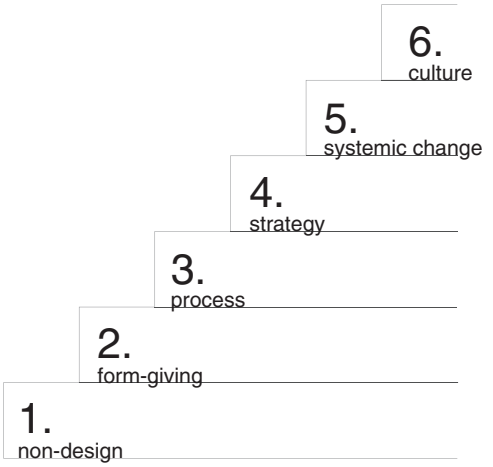

Figure I.2 The extended design maturity ladder.

of and reflection on ideas, concepts and prototypes means that the overall process is highly iterative (Figure I.3). During each of these phases, a range of creative tools can be used to explore, generate and evaluate concepts and designs. These tools include (but are not limited to) literature reviews, participatory workshops, observation, questionnaires, mind mapping, word clouds, sketching, (rapid) prototyping, storyboarding, stakeholder mapping, personas and focus groups.

However, the popularity of design thinking has its downsides, where design is diminished to a mere set of methods and processes, that almost anyone can apply in a simple copy-and-paste standardized mix of methods: consult end-users, create ideas, prototypes, test and implement (Iskander 2018). However, implementing this on different scales or to different types of problems requires perhaps a similar process, but certainly different methods and skills (VanPatter 2018), or 'designerly ways of knowing' (Cross 1982). Furthermore, design thinking as it is currently being championed does not present a research paradigm as it is disconnected from philosophical context and generally fails to acknowledge existing academic literature on the topic (Badke-Schaub et al. 2010; Tonkinwise 2011). Instead 'design thinking' should be regarded as discourse (Rylander 2009b) that alludes to design research, which presents a transdisciplinary approach to problem solving that draws on the natural and social sciences and art. Nor does design thinking necessarily deliver on its premise of being able to solve even the most complex of problems, let alone systematically leading to implementation of successful products or services (Ackermann 2023).

This partial democratization of design meant the discipline of design has found its way to the boardroom, but it is also extremely reductionist in terms of what design is and what it can be. Design may be seen as unable to address the root causes of disasters: vulnerability and capacity, merely providing a stepping stone in terms of the perception and understanding of risk. However, like disasters vulnerability arises from consequences of decisions made, frequently political in nature. Thus, recognizing design as process, even beyond design thinking, rather than product renders it transformative as illustrated by the extended design ladder (Figure I.2).

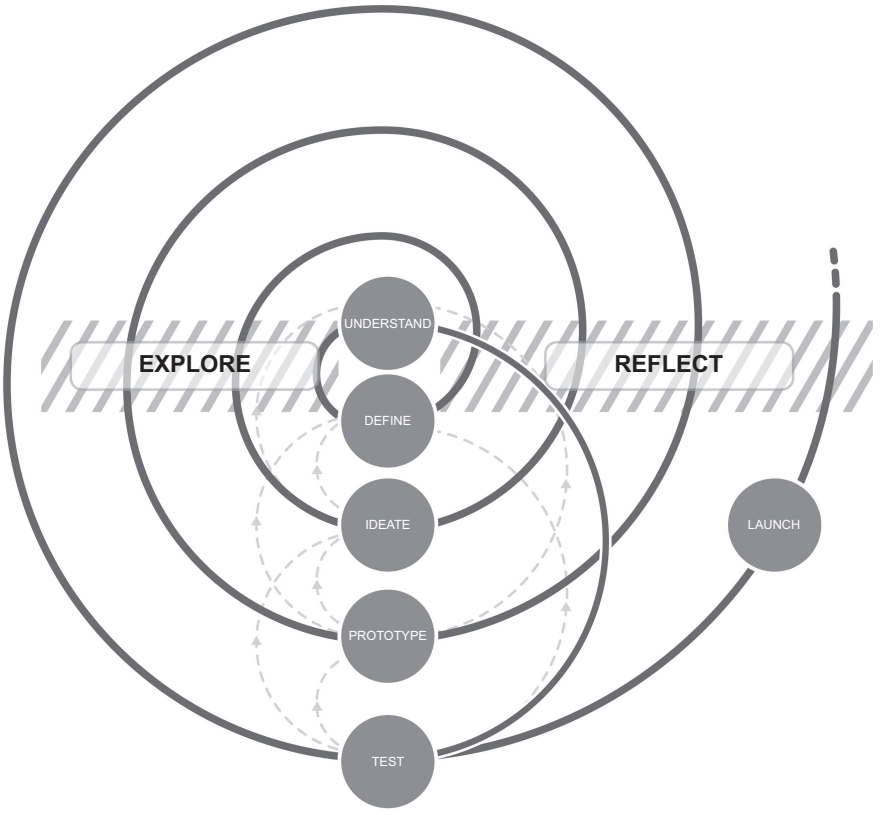

Figure I.3 The design thinking framework.

Human- and life-centered design

HCD is closely intertwined with design thinking as it has repeatedly been shown to lead to commercial success, as exemplified by design-driven companies such as Apple, AirBnB and Netflix. This is because HCD focuses on the needs and aspirations of people. At the start of the century "70% to 80% of new product development [failed] not for lack of advanced technology but because of a failure to understand users' needs" (Hippel 2007, 1). As such, customer perception and experience has become central to the development of new products and services (Verganti 2009). This veers away from traditional design where the focus is predominantly on material or technological properties of artifacts (Giacomin 2014). Neuroscience has shown that products or services that have been designed with perceptual, cognitive and emotional characteristics in mind directly impact neural pathways and functioning in humans (e.g. Utz and DiPaola 2020).

Traditionally audiences are often disaggregated based on demographic profiles such as education, income, gender or ethnicity. Design on the other hand is more interested in the audience's psychographic profile: what are people's dreams, aspirations, motivations and what do they consider barriers to achieving these? As HCD is based around empathy, designers come with an incredible toolkit to understand the intended audience and their needs at a deeper level, including before, during and after an emergency. This often

extends beyond what intended users articulate themselves about their needs and wishes to devise meaning, motivation and purpose. This is illustrated by a quote misattributed to Henry Ford in relation to the development of the Ford Model-T automobile: "If I had asked people what they wanted, they would have said faster horses" (Howard 2019).

HCD thus responds to the fact that people are not rational decision-making machines, but that they act on feelings and their personal understanding of an object or situation instead (Krippendorf 2004). However, the risk-centered approach at the heart of emergency management tends to favor a single universal manner in which humans perceive their world, imposing an emergency manager's perspective. However, as Krippendorf (2004) argues, imposing a creator's perspective on the intended users, and assuming this to be true for everyone can be misleading or at worst dictatorial. It only applies, if at all, to those with the same or sufficient (scientific) training. People always rely on their own experience, knowledge, and culture to assess anything new that enters their world, and this individual perspective then gives rise to a multitude of individual interactions with artifacts, which in turn shapes what they are.

The realizations that you are not designing for yourself and not necessarily merely for the present time or immediate future are key. This brings us to a natural expansion: life-centered design, which is defined as: "an adaptable, regenerative, and globally inclusive framework synching responsible businesses and designers with global goals to design products and services that minimize harm, re-nourish the planet, and foster fair, thriving, and diverse ways of being" (Lutz 2022, 9).

Participatory design

An increasingly important and prevalent concept within emergency management is community participation. Here too, design as a discipline has knowledge and experience to contribute: participatory design has been around for around 50 years at the time of writing. It originated in Scandinavia in the early 1970s (Ehn 1993) and nowadays also forms the basis of 'design thinking', which from a practice perspective is similar to participatory design (Björgvinsson et al. 2012). Common concepts in participatory design and design thinking include early user involvement; balancing people, technology and economics; multidisciplinary teamwork; and iterations of research, design, prototyping and evaluation to reach a solution (Rylander 2009a; Lawson 2006).

Involving end users in the development of ideas and the implementation of solutions in the realm of emergency management gives communities at risk or affected (co-) ownership of the results (Hussain et al. 2012). This brings about greater levels of satisfaction and suitability of the outcome(s) for the intended purposes and context of the design (e.g. Scariot et al. 2012). Furthermore, design often takes an action-based research approach, meaning that it diagnoses and addresses a real-world problem (Lewin 1946). Combining this with a participatory design component means communities, emergency managers and others are involved in the development of solutions that integrate knowledge, practice and specific insight to problems that are relevant to those most at risk.

Participative design has been successful in areas such as education, technology and health care while the need for and benefits of direct stakeholder involvement are increasingly called for in disaster risk reduction (e.g. Cronin et al. 2004; van Manen et al. 2015). Participatory design is frequently facilitated through workshops that bring together designers, users and other stakeholders to assess user needs, problems with existing products or systems and co-create new solutions. Important to note is that there are various

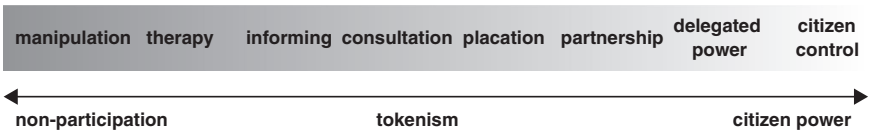

Figure I.4 Arnstein's citizen participation ladder (1969). Rather than discrete rungs on a ladder it can also be seen as a continuum, where depending on the context and nature of a project, the level of participation can vary dynamically throughout different phases of the design process.

levels of participation (Arnstein 1969): these range from non-participation to citizen control (Figure I.4). Although the term citizen was common at the time Arnstein's ladder was first published, it is now to be read as 'people', to include those without formal status, organization, representation or influence (Slotterback and Lauria 2019).

Inclusive design

Emergency managers often address the 'general public', but who are they? HCD is a great start for effective emergency management, but we have to acknowledge that humans are an immensely diverse group with widely varying abilities, languages, responsibilities and resources. People may have impairments in vision, hearing, physical, cognitive or psychological capability, which can be visible or invisible. Having said that, "people are disabled not by medical conditions but by environments, attitudes, and systems that create barriers" (Ladau 2021, 80). Intersectionality is also important in this context, as impairments can intersect with any and all other identities, meaning that when multiple marginalized identities overlap the vulnerability of people can increase.

Emergency management is there for everyone, irrespective of gender, background, educational level, status or other factors. However, although hazards don't discriminate, disasters do: people in developing countries are often disproportionately affected, as are minorities, women and children (Dorkenoo et al. 2022; Kousky 2016; Rahiem et al. 2021). If the goal is the same opportunity to thrive and adapt in the face of natural or man-made hazards (accessibility), we have to focus on equitable disaster risk management. This means ensuring that products or services support each and every individual user's needs and preferences. Important to note is that this does not mean that certain groups are given special treatment. Or said in another way, rather than addressing everyone in the same manner (equality), we may need to tailor approaches and messages, and investigate the broader systems in which we operate to remove barriers to understanding and participation.

This leads us to consider the principles of 'universal' and 'inclusive design' (Figure I.5). Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. In other words, this is likely to be a one-size-fits-most approach: a single artifact or intervention that reaches as many people as possible within the target audience, but it doesn't have to be appropriate for everyone. Instead, the focus is on reducing the level of ability required to interact with the design, for example by providing a ramp instead of stairs in order to access a building. On the other hand, inclusive design considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference. This often means developing a range of designs, for example an app

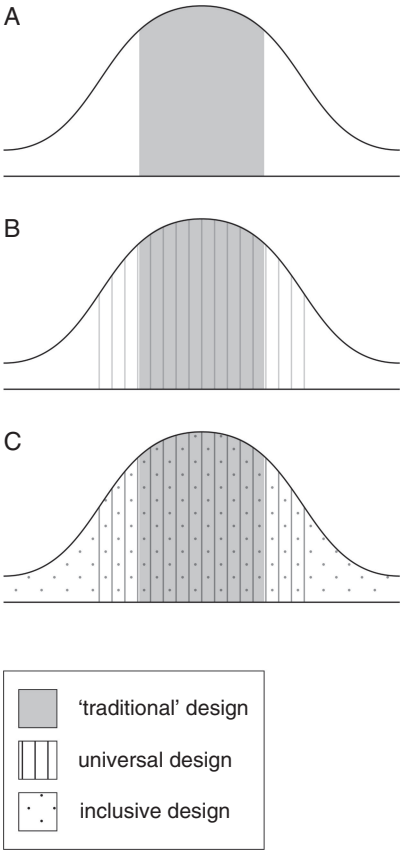

Figure I.5 (A) Traditional design, (B) universal design and (C) inclusive design.

that has a choice of languages, where each item in the range has a distinct user population (e.g. deaf people, blind people, etc.).

Design for emergency management: an emerging discipline

The brief introduction to emergency management and design in the past two sections has highlighted their overlap: both provide a pragmatist approach aimed at intervening in a situation, rely on integration of multiple types of information from a variety of sources, and work in a research-informed manner, albeit the research base drawn upon diverges significantly. Where emergency management is risk-driven and largely based on quantitative data, design is motivated by empathy, focused on an individual's experience and underpinned by qualitative data. Bringing these two together, and bridging the conceptual divide to give rise to the nascent discipline of design for emergency management brings to the fore a number of challenges.

From designers' perspectives, there may be a lack of understanding of the complexity and multi-layeredness of emergency management, and the importance of systems thinking in this regard. After all, public-facing outreach is merely the top of the emergency

management iceberg: the parts that cannot be seen are the underlying planning, and coordination of stakeholders for example. Nor might designers necessarily be aware of the need for, and value of, their skill set within the area of emergency management.

Conversely, from an emergency manager's perspective the value of collaborating with a trained designer might not be self-evident, especially in a world where everyone has access to free or open-source resources to make posters, websites, and social media posts. Another challenge might arise from this: the ability to justify the financial resources required to invest in these types of collaborations.

The entry point for design for emergency management, the bringing together of these distinct disciplines, then is the common desire to make a positive contribution, even save lives. As emergency management starts to veer from a sole risk-based emphasis to incorporate resilience and interdisciplinarity, communities are shifted to the core of the discipline. That is, communities and the plurality of their experiences.

We propose that the discipline of design has complementary capabilities to offer emergency management. However, as emergency management is such a broad integrative discipline we also argue that rather than merely incorporating basic design skills into the profession, emergency managers and designers should work collaboratively to address the crises humanity is facing. At this point in time, one of the main advantages for emergency managers of working with designers is that it can present quick wins and large socially relevant gains. It also asks both professions to take the time to reflect and to be able to accept the inevitability of change arising from new insights resulting from reframing through a designers' skill set.

In this book, we showcase a number of case studies that highlight the added value of design when applied to emergency management, and the synergies that occur when these disciplines align along a mutual goal. The first part of the book, Chapters 1–5, offers an underpinning philosophy and guidelines derived from practice. The second part, Chapters 6–14, showcases a number of case studies with research on, or application of, design and design thinking before, during and after emergencies. These case studies illustrate how design can be implemented in emergency management. The conclusion then consolidates the learnings from each chapter. Also included is a reader's guide, this is intended to support reflection on the content of the book. Refer to it as desired before diving into the chapters or go chapter by chapter. We don't recommend saving it until the end, as reflection forms a core component of design for emergency management (Figure I.3) yet it is often overlooked as we race from one crisis to another. However, the only way to generate change is to stop and look both ways: from the present to the past, then to the future and back to the present.

We hope that this book inspires you to reach out and make a connection across discipline boundaries, whether from the field of emergency management to the realm of design, or vice versa. After all, it is high time to 'un-design' disasters and to consciously revise the unsustainable course that humanity is on.

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Conclusions and recommendations

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References

The topics touched upon in this book are wide-ranging, both in scope and complexity. For more in-depth reading, we refer you to the resources below. Please note these are just a selection, there are many more out there. We also recommend that you consult the references at the end of each chapter for more specific reading.