Editorial – Safer societies

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Safe societies are utopian societies; safer societies are not. Safer societies, in turn, are resilient, but not all resilient societies are more safe. Societal safety, as we use the term, relates specifically to the challenges and prospects for better risk assessment and management at the societal level—the toolkit for which includes but most certainly is not limited to resilience strategies and practices.

When it comes to managing those specific risks, "safety" has been used to refer to the risks of unintended events (e.g., storms or industrial accidents), while the term, "security," has been used to refer for instance to the risk of intended events (e.g., terrorism against critical infrastructures). Not surprisingly then, the research fields of safety and security (let alone the fields of “infrastructure protection” or “societal resilience”) have hitherto been treated by and large separately.

These conventional distinctions remain useful as far as they go, but they no longer go far enough in a world where complex is about as simple as it gets. The articles in this Special Issue, each its own way, attest to the reasons why many in the Safety Science community find themselves having to move into domains of theory and practice that build on but move beyond the conventional. We call this newly combined domain for shorthand purposes, “societal safety.”

The call for this Special Issue invited articles on societal safety and critical infrastructure reliability and inter-sectoral governance. The idea for a Special Issue came out of a workshop between American and Norwegian researchers on safety, reliability and disaster risk at the Center for Catastrophic Risk Management (CCRM) at UC Berkeley in 2016. One workshop conclusion was that the interconnectivity among hazards, infrastructures, technologies and economies mandated greater communication and even convergence at points among the disciplines of safety, security, reliability and disaster risk reduction. This conclusion forms the backdrop of the Special Issue. It offers the hypothesis that it is decidedly more problematic now to continue to uphold well-established distinctions between safety, reliability and security, between natural and human-made disasters, between organizational and societal risk management, and between technical, human and organizational approaches to risk.

We received a diverse, very pertinent collection of submissions in response to the call. We describe and connect the individual articles towards the end in of this Introduction, but first we invite the reader to reflect on some key issues, societal developments and theoretical takes on them, that we find particularly important within this expanded field of societal safety.

Our discussion takes as its starting point how changes in the world, particularly the emerging Information and communication technologies (ICTs), necessitate new directions in the field of safety science. This includes but is not limited to: 1) the continuing convergence of the fields of safety and security; 2) a relational and situated understanding of infrastructure, recognizing that the criticality of infrastructures emerges due to their relation to each other and their users, situated as the users and uses are in specific contexts and knowledge bases; 3) changes in the way the public sector is organized and how this influences the need for and ways to work towards coordination in the efforts to uphold societal safety; and 4) a need for "bringing society as society back in" to the studies of societal safety, recognizing that it is necessary to transcend the boundaries separating the public, private sector and citizens, NGOs and volunteers in order to forward our understanding of what makes our societies safe. We conclude with a brief discussion of what the main strands of theory within the field of Safety Science can contribute with to a future field of societal safety studies. First, though, just what do we mean by “societal safety” in the new directions that follow?

Why "societal safety"?

Societal safety (Olsen et al, 2007) is an umbrella term seeking to better integrate issues related to safety, security, reliability and resilience on a societal level. The concept has its origin in Norway, as a direct translation of the Norwegian term "samfunnssikkerhet", as also explained by Høyland (this issue), Nilsen et al. (this issue) and Almklov et al. (this issue). It arose in the post-Cold War realization that civil protection was becoming an issue not only of preparing the society for nuclear or conventional war, but more and more to mitigate the inherent vulnerability (in the technical systems and social arrangements on which modern life depends) from natural hazards but also from failures and accidents within critical systems. More recently, increasing emphasis has been put on terrorist attacks and other forms of intended malicious events. There are strengths and disadvantages of using this concept, and both lie in its "all-inclusiveness", which we discuss in more detail towards the end of the editorial.

Societal characteristics challenging existing approaches to societal safety and security

The convergence between safety and security

Societal safety and societal security are converging – notwithstanding “safety" has commonly referred to the risks of unintended events, with "security" referring to the risk of intended events. Traditionally the research fields of safety and security have been separate, if only because their risks were seen to be different as are many of the tools and measures for preventing intended versus unintended incidents. This conventional distinction between safety and security is, however, more and more difficult to uphold.

The increased fear (and incidents) of terrorism in Europe and the US have been one driver in pressures to converge. Protecting citizens from malevolent acts has traditionally been part of the security domain. The monitoring, surveillance and interventions are carried out by specialized professionals

and the activities usually subjected to a certain level of secrecy. The reliable functioning of critical infrastructures, on the other hand, has been maintained within the reliability domain, by control operators, engineers and technical risk analysts. This is to say, comprehensive risk assessment and protection of critical infrastructures requires input, efforts and communication from both conventional domains of safety and security.[1] The latter, in turn, requires a common platform with regard to language, methods and the flow of information, which, to take one important case in point, challenges traditional protocols to secrecy and need-to-know.

Another driver behind the convergence between safety and security is enhanced digitalization of societies in general, and critical infrastructures in particular. The reliable and safe functioning of critical infrastructures depends on ICT as the "infrastructure of infrastructures", meaning that ICT failure can have grave consequences for critical service provision by, e.g., energy, telecommunications and transportation infrastructures. But ICT failure can be sparked by *both* intentional and unintentional causes and, as such, requires joint efforts from both ICT security experts (how can ICT systems fail?) and reliability experts within each infrastructure (how can ICT failure influence the infrastructure?).

In doing so, issues related to system integrity, information protection, privacy, safety and reliability need to be balanced if not reconciled, again requiring collaboration among professionals, especially those concerned with reliable performance, within the safety and security fields. Moving beyond the well-established silos of safety and security constitutes an important research challenge for the scientific, engineering and risk management communities. It also represents a massive competence challenge for all infrastructure owners and operators. As more threats and hazards interconnect, the protection of society challenges all of us to produce a correspondingly more integrated approach.

Emergent infrastructuring processes

While some critical infrastructures, such as railway and power grid systems, were built as planned developments or series of developments, ICTs tend to become infrastructural in a more emergent manner, via a mutual reinforcing process with user behavior and commercial interests. This process is a form of *emergent infrastructuring* as compared to planned infrastructure development. Studying infrastructures, including their emergent properties, implies a relational perspective geared to revealing how people, organizations and associated technical systems come to relate to each other though the processes of infrastructuring.

Our notion of infrastructuring is inspired by theory on information infrastructures within Science and Technology Studies (STS) and Social Informatics (see Star & Ruhleder, 1996; Bowker & Star, 2000; Monteiro et al, 2013; Almklov et al, 2014). In a discussion of information infrastructures, Star & Ruhleder (1996:112) ask “When is infrastructure?” rather than *what* is infrastructure. The crux is that infrastructure is relational to practice. The “when?” encourages us to study the emergence, reproduction and modification of a wide range of practices, where a system is infrastructural when practices are organized around the social and context-dependent expectations that the systems work. A critical infrastructure is a system upon whose reliability, and by implication safety, the functioning of society depends.

Addressing infrastructure as a relational phenomenon, that of emergent dependency being produced as “successful technologies,” provides us with a better toolbox for understanding the infrastructural role taken on by a wide range of ICTs currently. Also, it highlights how vulnerability is the flipside of

[1] As argued by Zoli et al (this issue) the CIs are often coopted by terrorists in their attacks, thus necessitating the convergence of infrastructure safety and security professionals cooperating in the protection of these lifelines of society.

success for technologies. Perhaps the best current example is that of the Global Positioning System. GPS has rapidly proliferated into new domains, both for location services and due to the accurate time signal provided by the GPS satellites, which are used to synchronize data networks, among other things. But knowing exactly which technologies, functions and services depend on GPS is an immense task, something probably exposed only during a break down (caused by jamming as seen in some recent cases, or maybe solar storms). The success of GPS has led to adaptation in several public and private functions, in an often-unplanned manner. Or a different example: No one a few years ago would have considered a break-down of social media such as Facebook as a problem for societal functioning; yet its success, precisely in attaining an infrastructural function, has produced a dependency leading to new and sometimes more visible vulnerability in need of further investigation and research.

Reforms and changes in critical infrastructure organizations

The legacy from New Public Management

The shift in the way public organizations have been managed in western societies since the 1980s and onwards has often been subsumed under the heading of "New Public Management", or NPM for short (Hood, 1991; Christensen and Lægreid, 2002). Critical infrastructure organizations (e.g. public and private organizations within telecommunications, water and energy supply) have been restructured under adjunct processes variously described as deregulation, privatization and liberalization. The following changes are particularly relevant: 1) the disaggregation of integrated public infrastructures into networks of more functionally specific companies supplying parts of the service, often partially or wholly privatized; and 2) the introduction on principles of management from the private sector into public organizations, e.g. internal pricing and management by objectives. While NPM is no longer as fashionable a research topic and practical recipe as it was during the 80's and 90's, its presence and adjunct results are still fresh and very much felt in public sector and private sector organizations, including those responsible for critical infrastructures.

Previous studies of critical infrastructures (Almklov and Antonsen, 2010; 2014) have described these developments as "modularization" (of organizations) and "commoditization" of operational work. While the reliability challenges are interconnected, the organizations dealing with them are increasingly fragmented and more reliant on coordination through market-based arrangements. Simply put, there are changes in those who are responsible for the critical functions, and in the ways the organizations managing them operate, singly and jointly. Organizational interfaces are important in ways not seen before, while recognizing that there are tight couplings within these systems and in the ways these systems are embedded in our societies pose challenges to managing the infrastructures reliably and safely (De Bruijne and van Eeten, 2007).

The neoliberal forms of governance, of which NPM reforms have long been part, continue to be motivated by goals and pressures to reduce public expenditure through increased efficiencies (or outright cost cutting) with operational work being outsourced, while the public sector takes on the role of a buyer of services. This means that the state must rely on the eyes and ears of private organizations to monitor risk, and that the state administration has to implement measures in the form of regulatory demands and detailed service-level agreements for operational services. For dealing with disturbances and disruption, many of the operative resources that need to be mobilized are now found in private companies or volunteer NGOs. In Europe, by way of example, the civil protection capabilities

from the Cold War has been trimmed dramatically, and societal safety needs to rely heavily on resources outside the public sector.[2]

Intersectoral collaboration and coordination

Moving beyond sectorial "silos" requires concerted actions from several branches of the public sector at different levels as well as scales of administration. This means a focus on the sources of risk and the Perrowian "couplings" or pathways of cascading effects cross sectorial boundaries within in the public sector (Perrow, 1984)[3], and also between the public and private sector (for a cautionary note on "infrastructure cascades," see Roe and Schulman, this issue). Building and upholding societal safety involve issues that are ill-matched to the sectorial structures of governance, since many risks concern several sectors and are transboundary.[4] This leads to classic coordination problems, not least of which being whose responsibilities and budgets are involved in preventing such disturbances and failures.

It is difficult to identify, let alone agree upon, which problems and mitigations fall within or outside the current organizational frames for societal safety. Societal safety as it is today fits poorly with the boxes and arrows in the organizational charts of the organizations. More, success in upholding societal safety is rarely visible or measurable product or service in itself. The coordination challenges posed by societal safety, and the problems they pose for the public agencies working with societal safety, have been and remain an important part of the literature on societal safety.

Our practice-oriented relational perspective on societal safety helps to highlight several themes in this intricately complicated issue of inter-organizational coordination. First and most obviously, the formal division of tasks and responsibilities between and among different agencies and organizations means inter-organizational dependencies need to be dynamically managed, now and across time and scale. Since the management of such relationships is the definition of coordination[5], coordination quite understandably surfaces as a challenging problem when faced with a multisectorial issue such as societal safety. From our perspective, however, it is useful to distinguish between coordination as a structural process and coordinative work processes. The former refers to the alignment of plans, procedures, rules and regulation, whereas the latter, inspired by ethnographic workplace-studies (Suchman, 1995 Orr, 1996 Barley & Kunda, 2001, Strauss, 1985), refers to the "situated coordinative work" (Almklov and Antonsen, 2014) conducted by practitioners and professionals when undertaking in real time specific activities, often together or in relation to each other. The latter coordination perspective on societal safety gives a great deal of attention to what we have found over the last decade to be the under-researched area of situated coordinative work across sectors and organizations that occurs in real time whether the tasks are routine or nonroutine (see in addition, Roe 2013 and Roe & Shulman, this issue). This form of work, most in the Safety Science community will recognize, is a key resource for resilience.

[2] See also Auerswald et al (2006) for a discussion of the relationship between the state and private entities in crisis management in a US context. For a perspective on how deregulation is linked with internal control, private and public audits and thus society's practical potential for risk handling, see for example Størkersen (forthcoming).

[3] See also Le Coze (2015) for an updated and scaled-up discussion of Perrow's arguments.

[4] Christensen et al (2015), among others, refer to such mis-matches between structures and policy issues as "Wicked Problems" (see Rittel and Webber, 1973).

[5] Malone & Crowstone (1994:3) defines coordination as "managing dependencies between activities."

Situated coordinative work involving more than one organization or sector is managed dynamically and is highly dependent on the specific contexts of the workers and their work, then and there. This contrasts with not only the structural or static features of the organizations involved but with the notion that coordination and collaboration itself being primarily structural processes involving plans, protocols and procedures. Any understanding of resilience, the dynamics that produce safety, on a societal level needs to be based on study of work practices that cross organizational boundaries.

These are instances where concerned professionals and administrators collaborate successfully across sectorial boundaries, and involve private organizations in risk management, the implementation of preventive measures and (particularly) in emergency preparedness and recovery after incidents. While grand administrative reforms addressing the coordination challenges that face work with societal safety might be called for[6], at this stage much can be gained from understanding and improving the ways by which collaborative work is conducted across sectors today. Some of the articles in this issue address this boundary work in different ways: Roe and Schulman (this issue) show how the dynamic management of infrastructure reliability depends on extensive interaction across organizational/sectorial boundaries. Hayes and McDermott (this issue) discuss concrete measures to manage risks in the interstices between different organizations. Almklov et al (this issue) discuss how cultural differentiation between practitioners may be an obstacle to be handled when collaborating and propose some ways to work around it.

The discussions of cross-sectorial coordination and collaboration now also need to account for the proliferation of data and information, also across the borders among public sectors and between the public and private sector. The models we have of bureaucracies and public administration largely stem from a time when information was a scarce resource. This is hardly the case today. This means that, though responsibilities and resources may be constrained to single silos, there are new means for "reliability professionals" (Roe & Schulman, 2008; de Brujine & van Eeten, 2007) to interact also with systems and personnel outside their own organizations. This changes the opportunities for situated coordinative work, and hence resilience. Further identification of the conditions under which this coordinative work and interactions occur is a key area of for ongoing research in the Safety Science community.

In organizational safety research, Rasmussen's (1997:185) model of the different layers of governance has attained much prominence as an early effort to bridge the gaps between organizational safety and the surrounding governance structures. What he describes, however, is one silo, one hierarchical system. However, as we have argued, societal safety requires work in the interstices between and among silos. More specifically, the operational professionals and mid-level managers often collaborate across sectors in ways that are more opportunistic and situation-specific than laid out on organizational charts. In this way, the most important challenge for societal safety lies in understanding what is broadly labelled as "environmental stressors" in the Rasmussen framework. While there has been a good deal of research describing this challenge, how to manage the resulting policy and management messes has not received the same level of attention (Roe, 2013). We argue—indeed, it's been our own experience—that one important step to progress beyond the descriptive accounts of "wicked problems" of societal safety is to distinguish between the different types of situations where coordination and collaboration needs to be achieved, and the levels of administration where it occurs. This clarification is all the more overdue since we already know that a crisis may well require different coordination mechanisms than coordination in the preventive phase of risk management. So too,

[6] Those will, we must assume, produce new challenges. There are no perfect structural solutions to societal safety.

coordination on a local, municipal level involves different challenges and different management strategies than coordination at the central, state level of administration.

Bringing society back in

Societal safety is sometimes treated as synonymous to the state's efforts to protect its citizens from non-military threats to their safety, security and well-being. At the same time, lessons from major disasters show that the citizen's themselves constitute a source of broad resilience, by taking steps to protect and provide aid to fellow citizens (Kruke, 2015, see also Bergström, this issue; Marana, this issue).

While the actions of individuals are often important parts of crisis response, more hybrid forms of community involvement in emergency response, where the public collaborate with professional rescue workers, also must be considered front and center when the focus is on societal safety. During the devastating fire in the village of Lærdal, Norway the municipal emergency professionals and a part-time fire and rescue services operated in tight collaboration with local farmers and other volunteers based simultaneously on dedicated roles and on their social networks in the community. Social relations crisscrossed the boundaries among official roles and social ones in interesting ways. The fire fighter acted as a neighbor and the neighbor as fire fighter (see Andresen, 2017). Similarly, discussing the role of the "Cajun Navy", volunteer boat owners, in the responses to hurricanes Katrina and Harvey, Wachtendorf (2017 our emphasis) highlights that the Coast Guard was able to employ this resource effectively: It “demonstrated remarkable skill in *working with* the ad hoc flotilla of boats contributing to rescue operations”, in the case of Katrina in clear contrast to other agencies whose collaboration with the general public was generally poor.

In sum these cases illustrate that we as a community need to move beyond understanding that the general public has a role in emergency preparedness to understanding and better identifying specific relationships between the general public and the authorities involved not only in emergency management but also crisis prevention and under what conditions the relationship change in real time and across time.

The need for a comprehensive approach

To reiterate, a comprehensive umbrella concept like societal safety as we are proposing has both advantages and disadvantages. From our perspective, the distinct disadvantage is that it lumps together fields of research and practice that differ considerably in objects of analysis, methods, level of analysis and with regard to the professions dominating each field. Thus, it is not surprising that scaling up current more specific research findings on safety is no small matter when the unit and level of analysis becomes societal safety, when many of the current insights and approaches to “system safety” are based in or on levels and units of analysis below society as the system in question.

Most often safety research has not only drawn from separate disciplines, where “the system” (beyond the conventional “slips, trips and lapses” focus) differ unsurprisingly for the engineer, economist, and other safety specialists. Equally, much of the existing research is based explicitly on or regarding differences in individual organizations (e.g., differences in regulatory agencies for safety matters), individual infrastructures (e.g., safety in nuclear reactors as distinct from other power plants), and even specific physical assets (e.g. safety issues associated with transmission lines as distinct from distribution lines in an energy infrastructure). By way of example, the literatures for Normal Accident Theory, High Reliability Organizations (La Porte & Consolini, 1991; Weick & Sutcliffe, 2011) and Resilience Engineering (Hollnagel et al, 2006) provide perspectives for dealing with socio-technical complexity and improving the safety of the critical systems on which society relies. Importantly though,

they cannot be scaled up automatically to the society level, where networks of organizations operate multiple critical infrastructures and functions. We are at a different scale and unit of analysis, where management and policy relevance require much further research when it comes to “scaling up.”

Similar difficulties and challenges regarding scaling up also confront both the current risk-oriented strands of safety research, such as quantitative risk analyses, and many current “safety culture” approaches. A working group in the Society of Risk Analysis (2015) observes that "[t]oday risk analysis is well established in situations with considerable data and clear defined boundaries", but warns that this is not the case when facing matters of "increasing complexity of coupled networks our society depends on, as well as those [arising in preparing for climate change and emerging diseases" (SRA, 2015:12). Also in our view, the assessment and management of risk on a societal level, including risks of intentional attacks and unintended cascades between different infrastructures, calls for new methods and extensive work at the boundaries between QRA professionals, other researchers and stakeholders. As for safety culture, which importantly has shown that there is more to safety than structure, the primary emphasis is on intra-organizational issues. In our view, also argued in Almklov et al (this issue; Antonsen, forthcoming), an approach to safety culture that further emphasizes cultural boundaries is needed to understand both successes and failures of inter-organizational collaboration both in the preventive and responsive stages of societal safety.

Our perspective on societal safety, in contrast, seeks to foster cross-sectoral approaches dealing with the complexities of modern societies at the scale of society, not at the scale of a sociotechnical system, organization or even single sector. In like fashion, our advocacy of societal safety as its own field signals that this issue of societal safety invites the Safety Science community (with a set of traditions, theory and approaches, mainly from industrial settings) to approach the wider societal issues concerning safety now writ large. There are equally relevant approaches from the security side, also now writ large, such as those concerned with hacking and prevention of terror, with which we have to engage in dialogue. In case it needs saying, propelling us even further at the societal level are those widespread floods, heatwaves and fires, highlighting the continuing and increasing need to protect societies against natural hazards.

To conclude, from the perspective of societal safety as its own field, the research challenges for existing frameworks within safety science are twofold: First, they face the challenge of scaling up, in the sense of addressing larger interorganizational systems. Second, there is a need for cross-fertilization across the boundaries separating different disciplines and research traditions, to be able to deal with the increasing complexity of the threats and hazards to the functioning of societies. If we are right, safety science will need to further develop and augment its toolbox of practice and theory in order to understand and manage the risks of emerging infrastructuring processes taking place in a context of institutional change, where citizens are not only the recipients of services but also active sources of safety and resilience.

To be clear, we are not calling for other researchers to abandon the established concepts that already address similar issues. We are calling for efforts to connect the dots between fields of research and practice that are less integrated than the problems they aim to understand and solve. Though the term societal safety may have a specific history, we believe it to be a useful rallying point for safety researchers to engage with the societal level of analysis.

The articles in this Special Issue

While the concerns and future research challenges noted above represent the views and expertise of the editorial team, the articles in this issue individually and jointly contribute, we believe, to filling out key parts of the overall picture.

This Special Issue bridges via the societal safety construct, issues of safety, security and reliability of critical infrastructures. Høyland (this issue) provides some of the groundwork in analyzing how societal safety and security has been defined and used in literature. Le Coze's essay (this issue) in developing the global dimensions of societal safety also delivers an overview of the last decades' developments on risk, arguing that it has moved from primarily socio-technical to often systemic now to even existential foci, and how this movement connects to the steps in globalization. Le Coze underlines the overwhelming scale and transnational nature of risk, and that safety researchers must investigate further the dynamic of interactions that are the heart of societal safety. Bergström (this issue) describes, from a Foucauldian vantage point, how societal resilience has become an object of knowledge in and for society through academic credibility, political needs and events that point to that need. He discusses challenges – especially in the interaction among organizations – posed by inter-related fragmentation and commodification of societal functions. In times of deregulation and the parsing of ever more processes under societal safety, Bergström argues that governments are using the term "resilience" as a way to tell citizens to take more and more responsibility for our own safety.

Intra-organizational cooperation is also the case in two articles touching on resilience writ large. Marana et al. (this issue) presents a framework for public-private-people partnerships in the city resilience-building process. Cedergren et al. (this issue) studies how organizational fragmentation of infrastructure organizations, in their case railway operations, and differences in goals and incentives among organizations influences the organizational ability to respond to and better manage in the face of emergencies. They show how organizations in focusing on their organization's own goals for resilience and recovery, open up for problems on the inter-system levels, i.e., the rationality of one organization does not necessarily lead to recovery of the system as a whole. As emphasized in several articles in this Special Issue (Hayes & McDermott; Nilsen et al; and Almklov et al., this issue), what is best for one organization can contradict what is collectively best.

In one of the articles assessing the Norwegian July 22 terror attacks, Nilsen et al. (this issue) underscore that even though official investigations emphasized cultural and informal weaknesses, the actually-implemented measures mainly address structural issues. In addition, it still matters that each sector has resources and goals only to enhance their own tasks, which remains a stumbling block for even necessity-based cooperation between and among sectors.

Several articles take a practice-oriented perspective of the inter-organizational issues that need to be managed to obtain societal safety. In an empirical work, Hayes and McDermott (this issue) deploy the notion of "boundary objects" (Star & Griesemer, 1987) to discuss and analyze the management of interaction between gas pipeline utility services and construction companies and others that might harm the infrastructure or cause accidents while digging in the "crowded underground". Similar issues, but at a different scale, are discussed by Roe & Schulman (this issue), who summarize key observations and empirical findings from their 15-year research project on how control room operators manage energy, water and other infrastructures, and their interfaces with systems and organizations. The authors show how the reliability and safety of these large socio-technical systems depend on professionals with competence and ability to dynamically manage both their own system and the interconnections to other systems in light of their at times competing reliability mandates.

Inter-organizational issues are also the core of Almklov et al's article (this issue). Based on a project investigating the changes in Norway after the terror attacks in Norway July 22 2011, they discuss cultural boundary processes between organizations and groups that need to collaborate in upholding societal safety. The article both argues for a relational approach to organizational culture and suggests (in line with Roe & Schulman's article) that more attention must be placed on improving collaboration among practitioners with different perspectives rather than trying to "solve" the coordination challenges in societal safety by structural reforms.

On a similar note, Frykmer et al (this issue) present a scoping study, discussing the role of improvisation when crises are transboundary and critical infrastructures interconnected. The authors argue that the concept of improvisation is primarily linked to positive outcomes (one might suspect that the term "mistake" or "violation" would be attributed to the same action, had it resulted in a negative outcome). Given a positive bias, there is a risk that (collective) improvisation may become a "folk" model – a taken-for-grantedness that lacks formal definition and empirical grounding in changing circumstances.

Several of the articles employ new perspectives on CI reliability, representing responses to some of the challenges outlined earlier. Mikellidou et al (this issue) analyze existing published research about energy critical infrastructures on extreme weather events and conclude there is need to establish an integrative approach to studies of climate change and energy critical infrastructures. Zoli et al (this issue) discuss the notion of critical infrastructure in the context of terrorist organizations, how terrorist organizations may coopt, if not actually colonize, the state's existing CI's for their own purposes, expand them, or develop their own enabling infrastructures and in some cases build their own. This article presents interesting ideas on how to understand terrorist organizations and their vulnerabilities through the notion of critical infrastructure, but also how attacks on societal infrastructures are a key strategy for terrorist organizations. Pescaroli et al (this issue) argue that terrorism, human-made and so-called natural disasters can have similar cascading damage. Cybersecurity issues and solar storms can both result as described through the authors' massive disruption scenarios. They show how vulnerabilities in critical infrastructures can pose indirect threats leading to loss of life because of the interconnectivity of the systems. Rakas et al (this issue) describe failures of critical systems at airports and develop a method for measuring the impacts of unscheduled communication, navigation and surveillance systems outages on airport operational performance and safety. As so many studies in this issue, they find how personnel work to balance reliability, safety and throughput in critical infrastructure systems in our society.

Jointly and individually, these articles represent steps taken in the directions outlined in this editorial. Much remains, but we hope this Special Issue serves as some of the building blocks for further work on Societal Safety. We would like to thank the authors for taking a great part in this. The authors and other interested are invited to contribute to upcoming workshops where we analyze the current theoretical basis and take the societal safety concept even further.

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