

2 Related Work

In recent years a diverse body of work has emerged in the research fields of CSCW as well as Human-Computer Interaction (HCI), which focuses on information infrastructures as well as on the interplay between technology and the concept of publics. In the discussion of related work, I will focus on how the field of CSCW arose and the current need for an understanding of information infrastructures (chapter 2.1). Building on the theoretical framing of publics and their different forms and formation processes, I will discuss the interplay between publics and technologies (chapter 2.2). Based on this interplay, I will outline its relation to the discourse of CSCW and introduce the application domain of crisis management (chapter 2.3). I will provide insights into emergent citizen groups as well as their activities as part of the current status of crisis management (chapter 2.4) and present current studies detailing the impact of technology and design on supporting citizen activities during crisis events (chapter 2.5). Based on the placement of the theoretical framing and the presentation of the current state of the art, I will point to the research gap that underpins my outlined research questions and serves as a grounding of this work within the related discourse of CSCW (chapter 2.6).

2.1 CSCW and Information Infrastructures

The field of information systems can be understood as the study of hardware and software systems that people and organizations use to collect, filter, process, create and also distribute data (Laudon & Laudon, 2011; Valacich & Schneider, 2011). In the mid-1960s, information systems mainly existed in form of mainframe systems that execute tasks such as filling seats on airplane flights or printing payroll checks (Grudin, 1994). In the mid-1970s, the technological development of minicomputers “promised to support groups and organizations in more sophisticated, interactive ways” (Grudin, 1994). Those minicomputers were the forerunners of the vision of ‘office automation’, which “tried to extend and integrate single-user applications [...] to support groups and departments” (Grudin, 1994). Raising precise requirements for the design and implementation of an information system that support groups and departments relied on a technology-driven perspective and its development was often based on trial and error, because practitioners with the aim of office automation lack an understanding of “how people [actually] work in groups and organization and how technology affects that” (Grudin, 1994).

In 1984, Irene Greif and Paul Cashman coined the term Computer-Supported Cooperative Work, which encompasses all studies focusing on how to support people in their work arrangements with computers (Greif, 1988). Currently, the field of CSCW is understood as “an endeavor to understand the nature and characteristics of cooperative work with the objective of designing adequate computer-based technologies” (Bannon & Schmidt, 1989) and “emerged more as a bazaar than as a cathedral” (Schmidt & Bannon, 2013). This ‘bazaar’ attracted several researchers such as “psychologists, software engineers, sociologists, anthropologists, and researchers from management information systems, organizational theory, and artificial intelligence, who shared an interest in workgroup collaboration” (Grudin, 1994).

CSCW as an entire field of research “did not emerge as a specialization of an established discipline [such as information systems] or as a joint venture of such disciplines” (Schmidt & Bannon, 2013). It emerged as the key scholars “began to realize that for collaborative computing technologies to advance, it would require a different approach to technology development than the one that had heretofore been the case” (Schmidt & Bannon, 2013), such as supporting articulation work (Schmidt & Bannon, 1992) and taking the actual practice (Greif, 1988) as well as the ‘situated’ character of cooperative work settings into account (Schmidt & Bannon, 2013).

For more than a quarter of a century, CSCW applications have been designed to deal with various specific forms of cooperative work (e.g. group work and team work) (Schmidt & Bannon, 2013). As Monteiro et al. (2013) point out, early CSCW scholars usefully drew the attention to the gap between formalized organizational process representations that are embedded in supplier offerings and “the diverse circumstances of the user organization and its complex, heterogeneous and difficult to formalize practices”. Based on the rapid technological developments, however, Monteiro et al. (2013) argue for a gentle weaning of “CSCW-in-use from its initial and founding preoccupations (the rather restricted, confined and specialized forms of cooperative work witnessed over the last two decades) towards a second wave of analyses that reflect the more open-ended agenda initially set out by Schmidt & Bannon (1992).”

Monteiro et al. (2013) are critical of what they see as a tendency within the field of CSCW to focus narrowly on particular settings as well as timeframes when aiming at analyzing communication as well as cooperation contexts and designing supportive ICT tools. They argue that current approaches fall short

when considering the ways in which information systems have changed over the last decade and taking into account new “kinds of large-scale, integrated and interconnected workplace information technologies”. The technological development, in particular, of Web 2.0 based approaches, ubiquitous and ambient computing as well as the concepts of social computing will have an enormous impact on the analysis and design processes of adequate computer-based technologies for cooperative contexts (Monteiro et al., 2013).

Monteiro et al. (2013) therefore adopt the view of *information infrastructures* (Hanseth et al., 1996), characterized by “openness to number and types of users [...], interconnections of numerous modules/systems (i.e. multiplicity of purposes, agendas, strategies), dynamically evolving portfolios of (an ecosystem of) systems and shaped by an installed base of existing systems and practices” and are “typically stretched across space and time” (Monteiro et al., 2013).

The term infrastructure arose from the Latin *infra* (below) and *structura* (assemblage) and comprises all the basic structural conditions and arrangements needed for the operation of a society. The term originated from the French word ‘infrastructure’ and was mainly used in a military sense. Its primary meaning encompasses “the installations that form the basis for any operation of system” (OED, 2015). Based on the early definitions of the term and referring to List (1841), Jochimsen (1966) defined infrastructure as “the sum of material, institutional and personal facilities and data which are available to the economic agents and which contribute to realizing the equalization of the remuneration of comparable inputs in the case of a suitable allocation of resources, that is complete integration and maximum level of economic activities.”

While some researchers follow a techno-centric perspective of infrastructure towards information systems (Dourish, 1999; Tanenbaum, 2002), others outline the social aspects of an infrastructure, referring to the fact that users inevitably reshape a new infrastructure during use, and should always be considered as designers. As such, it is necessary to map all aspects of the artifact and activity chains of the old infrastructure (Hanseth & Lundberg, 2001). Star & Bowker (2002) focused on the socio-technical perspective of an infrastructure. Besides just looking on the physical entities, they also took the role of the actors as well as their relationships into account. Based on their study of distributed information system within a scientific community, they have described eight salient characteristics of an infrastructure (Susan Lee Star & Bowker, 2002; Susan Leigh Star & Ruhleder, 1996):

- embeddedness in other social and technological structures;
- transparency in invisibly supporting tasks;
- spatial and temporal reach or scope;
- the taken-for-grantedness of artifacts and organizational arrangements, learned as part of membership in a community;
- infrastructures shape and are shaped by conventions of practice;
- infrastructures are plugged into other infrastructures and tools in a standardized fashion, though they are also modified by scope and conflicting (local) conventions;
- infrastructures do not grow *de novo* but wrestle with the inertia of the installed base and inherit strengths and limitations from that base;
- normally invisible infrastructures become visible upon breakdown

Modern work environments mainly use information systems as work infrastructures (Pipek & Wulf, 2009) that are shaped and “used across many different locales and endures over long periods” (Monteiro et al., 2013). When considering information systems, Pipek and Wulf (2009), outline their infrastructural aspects such as interconnectedness, complexity, layer approach and standardization, as well as (in-)visibility in use. A work infrastructure does therefore not necessarily cover only technological systems, but also the “entirety of devices, tools, technologies, standards, conventions, and protocols on which the individual worker or the collective rely to carry out the tasks and achieve the goals assigned” (Pipek & Wulf, 2009). Reuter (2014) attaches to this discussion and further argues that the scope of infrastructures is not limited to spatial or temporal dimensions and also those aspects must be considered that focus on social and organizational dimensions.

Star and Bowker (2002) discuss “the interplay between the ‘global’ establishment of available technologies and the development of ‘local’ use practices, and the dependencies between different layers of infrastructures” (Pipek & Wulf, 2009). Pipek and Wulf (2009) focus on the reshaping of a work infrastructure and the practice of “re-conceptualizing one’s own work in the context of existing, potential, or envisioned IT tools” as *infrastructuring* (Figure 1). By introducing the term of infrastructuring as all activities that lead to

discovering and developing the usage of an entire infrastructure and contribute to a successful establishment of usages of information infrastructures, Pipek and Wulf (2009) wanted “to avoid confusion with classic notions of design as design-before-use performed by professional designers”.

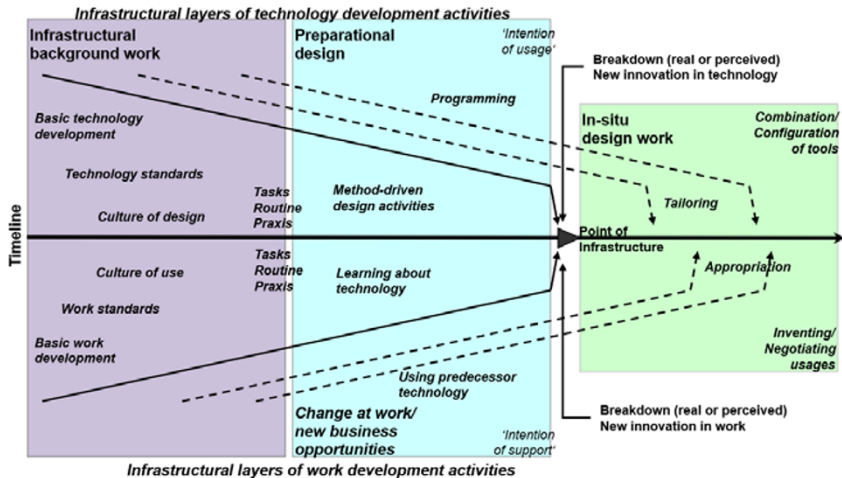


Figure 1: Infrastructural Layers of Technology Development Activities (Pipek & Wulf, 2009)

One of the major characteristics of infrastructuring as a technology development methodology was the ‘Point of Infrastructure’ which is the moment in which a (group of) practitioner(s) understand(s) that the current use of a technological infrastructure needs to be reconsidered (Pipek & Wulf, 2009). They assume that points of infrastructure do not happen arbitrarily during the course of performing a practice. Instead they argue that there are specific factors which are likely to trigger this reconsideration and that there is a dependency between a (work) practice and its supporting (work) infrastructure that has developed previously and which hence becomes largely invisible to the actors who engage the practice in question. This dependency is what causes the reconsideration, based on four motivational forces (Pipek & Wulf, 2009):

- *Actual infrastructure breakdown:* The infrastructure is not able to deliver the service it is expected to provide, often because parts of the technologies have become inoperable (e.g. power failure when trying to stream a video).

- *Perceived infrastructure breakdown*: The infrastructure does provide its service technologically, but not to the level of expectations of its user (e.g. the inability to stream video in a mobile network when there is limited bandwidth available).
- *Extrinsically motivated practice innovation*: The framing conditions or the task and goals associated with a practice have changed in a way that it is impossible to maintain the old practice (e.g. a video streaming platform develops a new pricing/subscription scheme and the customer requires a new device to be accompanied with new process documentation).
- *Intrinsically motivated practice innovation*: The framing conditions, tasks and goals associated with a practice remain unchanged, but practitioners discovered the potential for performing the practice in a new way, possibly because it is more cost efficient, simpler, quicker, or simply more fun (e.g. equipping the home with new sensor and management technology to be able to start streaming a video two minutes after arrival in the living room).

As Pipek and Wulf (2009) argue “each point of infrastructure does not only provoke in-situ design activities and makes visible prior preparatory activities, but it also creates *resonance activities* of observing and communicating aspects of what has become visible within the work environment or to other work environments.” By examining those resonance activities “the social appropriation of certain technology usages can be captured, and the relations between different points of infrastructure become clear” (Pipek & Wulf, 2009).

2.2 The Public and its Formation

To deal with the diverse and interconnected information infrastructures and (collaborative) infrastructuring activities which exist beyond organizational boundaries and with the inter-connectedness of individuals in heterogeneous contexts, this dissertation is based on the concept of publics. The concept of publics, I suggest, is an appropriate lens to approach information infrastructures, because it acts as a corrective to classic CSCW notations, which usually focus on organizational settings and the specific constellation of people aggregated or teams, groups. Wider, dispersed, emergent, inter-organizational or even global groupings require new conceptual formations. Citizens’ movements such as the Arab Spring or the Euromaidan serve as a good example (although initially not associated with organizations), because they have clearly shown that, whenever affected – whether negatively or positively – by others’ decisions (here: state or

government), citizens make use of information infrastructures (although not entirely comparable to the current socio-technical infrastructures) to deal with shared issues. In 1927, John Dewey defined those groups of people who, when facing a similar issue, recognize it as such and organize themselves to address it, as a *public* (Dewey, 1927). The term ‘public’ originates from the Latin ‘*populus*’ denoting a mass population in association with a matter of common shared interest.

As far back as 1964, the sociologist Philip Converse pointed out the difficulties involved in studying the ways in which belief systems are structured, drawing attention to the relationship between group interests, ideologies and information (Converse, 1964). Using interview data, he was able to show that higher levels of political sophistication correlate with activism. At around the same time, sociologists such as Howard Becker, Anselm Strauss and Herbert Blumer were concerned with notions relating to the construction of the social ‘problem’. It was Becker (1963) who coined the term ‘moral entrepreneurs’ to categorize those who seek to create or enforce social norms. Generally speaking, some individuals are much more likely to concern themselves with ‘issues’ than others.

Both, Habermas and Dewey had a more explicit interest in the political process. In 1984, Habermas argued in terms of a ‘rational discourse’ in the public sphere which encompassed both the instrumental and the normative (Habermas, 1984). Fraser (1990), however, argues that Habermas’ definition rested on specific kinds of social relations, which led both her and, later, Warner (2002), to employ the notion of ‘counterpublics’ to make space for marginalized views and disenfranchised participants (Le Dantec & DiSalvo, 2013). Dewey, in what I feel is a more nuanced view, conceived publics to be: “those indirectly and seriously affected for good or for evil [who] form a group distinctive enough to require recognition and a name. The name selected is The Public” (Dewey, 1927). He defined a pragmatic and situational notion of a public, which is characterized not as a single constituted mass of people, but in contrast as a particular configuration of individuals bound by a common cause in confronting a shared issue (Dewey, 1927).

A public is, in this definition therefore, a sociological subject, which is grounded and situated in a concrete situation of affectedness, consists of multiple individuals and responds to contextual and environmental factors. With his notion of a (issue-) public, Dewey distinguishes between the ‘state’

represented by elected politicians and lawmakers and the often incoherent body of citizens who elect the state and are affected by the laws and decisions made. When laws have been passed or decisions have been made and ordinary citizens are consequentially affected, then a public is called into being. The public tries to abate these externalities by finding an agreeable solution to the disputed issue; or at least by forming a public opinion to be brought into the purview of those whose duty it is to act on the issue through legislation (Dewey, 1927; Pietilä, 2001; Turner & Killian, 1987). Dewey referred with his definitions of a public to a political public and its traditional representation as a counterpart of state. But his terms “matters of concern” or “issue” are so generalizable that all issues could be understood to call a public into being.

The fact that issues and publics are co-constituted is fundamental to Deweyian pragmatism and to the adoption of this stance by other authors (DiSalvo, 2009; Le Dantec, 2012; Marres, 2007; Marres & Weltevrede, 2013). One does not precede the other. The argument is shifting from understanding issues as affecting people to determining a public by how people define their relevance to the issue. As such, the public defines the issue by being made relevant through their engagement with it. In their different ways, the authors above draw attention to the manner in which mass, amorphous pictures of a public do not do any justice to the nature of informed discourse. Warner (2002) makes this explicit in emphasizing a specific meaning of the word ‘public’ by pointing out that „multiple publics exist and one can belong to many different publics simultaneously”.

2.2.1 Differentiation of Publics

Based upon Dewey’s situational and issue-based definition of a public, Grunig (1983) conducted empirical studies and used the situational theory of communication to determine the nature of different environmental publics and their cognitive strategies to resolve shared environmental issues. He revealed eight environmental issues that were used for specifying communication behavior with questions eliciting the problem recognition, level of involvement and constraint recognition of the subjects for each issue. Grunig (1983) discovered that when an issue affects nearly each individual citizen people who normally would not be concerned all at once become “members” of a special environmental public. Based on these findings, he formed the ‘Situational Theory of Publics’ which identifies and classifies a public based on its awareness of an issue or problem and a public’s activity and response to it

(Grunig & Hunt, 1984). Although he focuses on the relations between organizations and the public, the theory examines how publics are formed and how an organization can segment publics accordingly to communicate with them.

Rawlins and Bowen (2005) summarize, Grunig's (1983) position as distinguishing between *non-publics* (who have no problem), *latent publics* (who have a problem), *aware publics* (who recognize that they have a problem), and *active publics* (who recognize a problem and do something about it). Latent publics, aware publics and active publics are each a subset of the construct of a public (Figure 2).

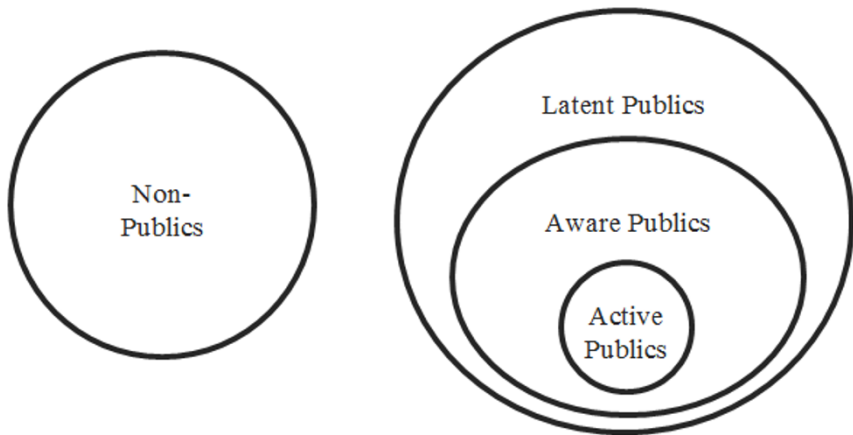


Figure 2: Grunig's Differentiation of Publics

Comparable to the active publics of Grunig (1983) and based on Dewey's situated notion of issue-publics, Blumer (1946) defined a public as a group of people who are confronted by an issue, share their ideas as to how to meet the issue, and who engage in discussion about the issue. When considering publics by time with regard to the relationship to an issue, they can evolve from non-publics to active publics.

2.2.2 Publics and Communities

Complementing the term public, 'community', Latin *communitas* (from *communis*, things held in common) is defined as "a group of people living in the same place or having a particular characteristic in common" (Oxford English

Dictionary, 2016). Tönnies (1887) distinguishes between ‘Gemeinschaft’ (German word, translated as community) and ‘Gesellschaft’ (German word, translated as society) to categorize differences in the degree and type of social ties and social networks. Community refers to groupings based on togetherness due to personal social interactions, while society is described as “belonging to indirect interactions and formal values”. McMillan & Chavis (1986) describe the sense of a community as “a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together.”

As Stickers (2010) argues, a public is not only distinct from a state, but is also distinct from a community: “Communities contain private and public aspects, and while some publics include communities and some publics evolve into communities, not all publics are communities: publics may be mechanistic associations, aiming to solve their problems solely “from external circumstances, pressure from without’ and lacking consciousness and feeling of a common inner life, shared meanings, and mutual interests. To become communities, publics must express their problems symbolically and aspirations as shared and thereby engender a felt sense of a ‘general will’”. He substantiates this differentiation by the example of the wish for better schools: “My problem and your problem initially merely happen to coincide – e.g. we each, independently and individually, want better schools for our children – and we each seek to solve that problem for ourselves individually and only incidentally in collaboration. But as a result of our working alongside one another, as a public, we come to experience the merging of my problem and your problem so that they become our problem, and my victory and your victory become our victory” (Stickers, 2010).

Referring to the concept of evolving publics (Grunig, 1983), aware publics and active publics who are aware of an issue could evolve into a community that built upon the engagement with that issue. As Dewey (1916) already stated: “Men live in a community in virtue of the things which they have in common; and communication is the way in which they come to possess things in common. What they must have in common in order to form a community or society, are aims, beliefs, aspirations, knowledge – a common understanding – like-mindedness as the sociologists say.” But as he further described “Such things cannot be passed physically from one to another, like bricks; they cannot be shared as persons would share a pie by dividing it into physical pieces. The

communication which insures participation in a common understanding is one which secures similar emotional and intellectual dispositions – like ways of responding to expectations and requirements.” Dewey refers to communication as “a process of sharing experience till it becomes a common possession” (Dewey, 1916).

2.2.3 Publics and Technology

Drawing on existing literature, publics can be characterized as possessing three significant attributes: (1) they arise from, and respond to, emergent issues that are qualified by the context; (2) there is a multiplicity of publics with permeable borders; and (3) in addition to the situatedness and multiplicity of the Deweyan public, it is not exclusive to a particular class or social milieu (DiSalvo, 2009). Dewey formulated his theory of publics in 1927. This era, referred to the ‘Roaring Twenties’ in the US, was characterized as a period of sustained economic prosperity with widespread use of automobiles, telephones and electricity, coupled with industrial growth on an unprecedented scale. During this time, the nationwide mass media and movie industry evolved and political content for the masses was abandoned in favor of focusing on celebrities, sports and movies. Dewey (1927) argued that modern technologies such as “the movie, cheap reading matter and [the] motor car as drawing people’s attention away from politics”, because, as he stated, for ordinary people these are more entertaining topics of discussion than political news. He stated that the institutions of the industrial society and its mass media of communication were destroying the communal basis of individual and group life.

However, as Dewey (1927) argued, without communication the public will “remain shadowy and formless”; it is only by improving communication that the public will find itself and become a cohesive group (converting a ‘Great Society’ into a ‘Great Community’). Stickers (2010) further argues that without a proper access to, and appropriation of ICT tools “publics remain fractured, disorganized, and mere aggregates of self-interested individuals, i.e. they remain merely associations (Gesellschaft) and not yet communities (Gemeinschaft)”.

Technologies in the context of a public are therefore a blessing and a curse at the same time. On the one hand, communication technology can be used to improve communication. This encourages engagement with issues and the formation of a ‘public will’. On the other hand, as Stickers (2010) stated, “a main present barrier to the transformation of publics into communities is that

publics have become ‘eclipsed’ by [...] the vast, sophisticated communication technologies of our time”. Modern ICT – especially mainstream mass consumer technologies – and their design are situated within this area of tension. Despite the fact that publics have always existed, the emergence and evolution of modern information infrastructures have changed the way in which issues can be communicated and discussed, as presented in various contexts such as in political uprisings (Wulf, Aal, et al., 2013; Wulf, Misaki, et al., 2013).

2.3 Application Domain of Crisis Management

Dewey’s pragmatist view characterizes a public not as a single constituted mass of people, but rather as a configuration of individuals bound by a common cause in confronting a shared issue in a given situation. It is apparent that taking into account the current relationship between affected citizens and information infrastructures, the technological support of group and formation processes of individuals as well as cooperative activities has evolved. To research these processes as well as technological support in practice, I will rely on the domain of crisis management and especially on emergent citizen groups. because in and around disaster events, individuals are seriously affected and bound by a common cause in confronting shared issues and get together to form emergent and temporary groupings as well as to conduct (often improvised) relief and rescue activities.

The term ‘crisis’ originates from the Greek *krisis* (decision) and is understood as a “crucial point or situation in the course of anything; a turning point; an unstable condition in which an abrupt or decisive change is imminent” (Institute for Crisis Disaster and Risk Management, 2009). Crisis is neither a positive nor a negative term, but it is often connoted rather negatively in everyday use and expected to lead to an unstable situation affecting an individual, group, community, or whole society. When crisis situations develop negatively, an emergency, disaster or catastrophe can arise.

Most researchers are interested in doing empirical studies rather than clarifying conceptual distinctions (Perry & Quarantelli, 2005), such that the different terms crisis, emergency, disaster or catastrophe and their distinctions are often not fully obvious. Within this thesis, the terms are characterized by their scope, such that “‘disasters’ are qualitatively different from everyday community emergencies, so are ‘catastrophes’ a qualitative jump over ‘disasters’” (Quarantelli, 2006).

An emergency can be defined as a “hazard impact causing adverse physical, social, psychological, economic or political effects that challenges the ability to rapidly and effectively respond” (Institute for Crisis Disaster and Risk Management, 2009). It requires a stepped-up capacity and capability to meet the expected outcome and it commonly requires change from routine management methods to an incident command process to achieve the expected outcome. If the outcome is worse than expected, an emergency develops into a disaster. As Quarantelli (1985) has outlined, a disaster is a crisis situation that far exceeds the capabilities.

A major disaster can lead to a catastrophe, which the Federal Emergency Management Agency (FEMA) defined as an event in which a society incurs, or is threatened to incur, such losses to persons and/or property that the entire society is affected and extraordinary resources and skills are required, some of which must come from other nations. Quarantelli (2006) as well as later Perry (2007) clarified the differences between disasters and catastrophes and argued that “the distinction we draw between catastrophes and disasters is not just an academic exercise [...] What is crucial is that catastrophes require some different kinds of planning and managing than do even major disasters” (Quarantelli, 2006). Both highlighted the differences on organizational, community and societal levels.

The difficult differentiation of the terms crisis, emergency, disaster as well as catastrophe also applies to terms that describe the management of those situations. As Hiltz et al. (2011) stated the terms, “disaster, crisis, catastrophe, and emergency management are sometimes used synonymously and sometimes with slight differences, by scholars and practitioners”.

Crisis Management can be understood as “the coordination of efforts to control a crisis event consistent with strategic goals of an organization. Although generally associated with response, recovery and resumption operations during and following a crisis event, crisis management responsibilities extend to pre-event awareness, prevention and preparedness and post event restoration and transition” (Shaw & Harrauld, 2004). Crisis management, therefore, goes beyond the response phase and encompasses all activities and strategies which aim to prevent a crisis event. Based on the FEMA suggestion and focusing on the response and mitigation phase, emergency management is defined as the “organized analysis, planning, decision making, and assignment of available resources to mitigate (lessen the effect of or prevent) prepare for, respond to,

and recover from the effects of all hazards. The goal of emergency management is to save lives, prevent injuries, and protect property and the environment if an emergency occurs” (Institute for Crisis Disaster and Risk Management, 2009), whereas disaster management is understood as emergency management with a higher magnitude.

The overall and long-term goal of crisis management is moving society as a whole towards disaster resilience. Resilience from the Latin *resiliō* („to spring back”) is defined as “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to 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” (UNISDR, 2009). Based on the term, resilience, ‘disaster resilience’ can be understood as the “ability of countries, communities and households to manage change, by maintaining or transforming living standards in the face of shocks or stress – such as earthquakes, drought or violent conflict – without compromising their long-term prospects” (Department for International Development, 2011). However, in practice its implementation is often understood in diverse ways (Aldunce et al., 2014). Disaster resilience was outlined as one of the main goals of the Hyogo Framework (United Nations, 2005) and fostering it at all levels is currently one of the main efforts of the Sendai Framework (United Nations, 2015). Goldstein (2011) introduces the concept of ‘collaborative resilience’, which encompasses the goal of establishing disaster resilience by strong cooperation between all the involved stakeholders, including public administration (i.e. decision makers in politics and government), the emergency services (police and fire fighters), aid agencies, (e.g. the red cross) and industrial companies, but also affected citizens as well as spontaneous volunteers.

2.4 Emergent Citizen Groups in Crisis Management

In case of an emergency, a disaster or catastrophe, most (especially Western) nations split into three different groups of people. These groups encompass (1) the professional public authorities with security responsibilities, emergency services and private aid organizations with a ‘we care’ attitude and a high level of responsibility for most of the task during the response and recovery work, (2) the volunteer-based emergency services and aid organizations that are quite similar to and often perceived in the same way as fully and paid ‘professionals’, and (3) the citizens engaged in various ways during a crisis with an attitude usually towards ‘the crowd to be managed’ and often with less engagement in

prevention or response strategies. But – as I will show – attitudes have shifted in recent years and the sharp distinction of these three different groups with regard to their engagement in disaster events is no longer clear and the boundaries of their activities are blurring.

2.4.1 Official and Volunteer-based Crisis Management

When dealing with emergencies and disaster situations, a variety of official organizations is involved. They consist of the public authorities with security responsibilities, such as emergency services (e.g. police, firefighters) or the public administration as well as different private, national and international aid organizations, and operators of critical infrastructures. These organizations often rely on volunteer-based emergency services and aid organizations, which are less trained as well as often unpaid, but are nevertheless as important for civil protection and crisis management as the professional and official staff. In Germany, for instance, the public authorities with security responsibilities cooperate with 1.8 million volunteer-based emergency service staff during their civil protection tasks (Bundesamt für Bevölkerungsschutz und Katastrophenschutz, 2015).

Most of the authorities have developed well-established responsibilities and work practices, which are prescribed by laws and regulations. During emergencies and disasters, a significant degree of collaboration between the involved stakeholders is often required. Although organizations have developed systematic approaches to deal with these uncertainties and to allow for planned, coordinated activities during crises (Ley et al., 2012), the scale of disasters such as Hurricane Kyrill 2007, the Love-Parade in Duisburg 2010, the earthquake and tsunami in Japan 2011, Hurricane Sandy in the USA 2012, or the European Floods 2013 can be so extensive that the relevant organizations can be overwhelmed simply by the number of tasks to be performed. Especially in the aftermath of long-term and wide-spread disasters, the capability of the professional disaster management and civil protection can reach its limits. Beside the severity of an event, the unexpected problems, dynamic changes of situations or environmental and knowledge limitations, which often accompany along disasters, lead to the need for improvisation (Ley et al., 2012; Stein, 2011).

2.4.2 Citizen-based Crisis Management and Emergent Citizen Groups

The recent disasters have shown that in addition to official crisis management through emergency services, citizen-based crisis management, often characterized by situated altruism, is a common behavior (Dynes, 1994). Individual getting together to form temporary groups for improvised relief and rescue activities is hardly a new phenomenon (Stallings & Quarantelli, 1985; Wachtendorf & Kendra, 2006).

As summarized by Dunn (2015), early work of Prince (1920) or Deacon (1918) has already examined collective behaviors during disasters and have revealed that disaster are events where there is extensive mixed collective behavior in that much of what occurs is new and different from everyday behavior (Perry & Quarantelli, 2005). Deacon (1918) observed that “immediately and spontaneously neighbors and fellow-townsmen spring to the work of rescue and first aid”. Taking into account different field studies on collective behavior with regard to public officials (e.g. Drabek, 1968; Yutzy, 1964), Dynes (1970) produced a fourfold typology of organized behavior in disasters (Figure 3). This typology classifies organizational behavior based on the two dimensions ‘structure’ as well as ‘tasks’ and encompasses organized behavior as established (regular tasks, old structures), expanding (regular tasks, new structures), extending (non-regular tasks, old structures), and emergent (non-regular tasks, new structures).

| | | STRUCTURE | |
|-----------------------|-----|-----------------------|----------------------|
| | | OLD | NEW |
| T A S K S | Old | Type I Established | Type II Extending |
| | New | Type III Expanding | Type IV Emergent |

Figure 3: Organizations in Disasters (Dynes, 1970)

Early studies mainly focused on the first three types of organizational behavior during disasters and as Quarantelli (1995) argued, only few studies have researched emergent behavior in a systematic way. These few studies, however, focused mainly on “later stage conditions associated with crystallization and institutionalization, rather than on the characteristics of emergent groups, and the early stages of emergence” (Quarantelli, 1984). Emergent behavior is characterized as the “behavior in which people jointly create new norms, new structures, or... a new social order ...collective behavior is extra-institutional – not unrelated to previously existing structures and norms, but transcending, opposing or modifying them and in so doing generating new forms” (Killian, 1994 in Quarantelli, 1995).

Stallings & Quarantelli (1985) describe the early and often spontaneous forms of citizen-based crisis management, with new structures as well as new tasks, as „emergent citizen groups” which are characterized as “emergent groups (e.g. unaffiliated volunteers) [which] undertake activities that were previously foreign to them and develop a social structure that lacks formalization, tradition and endurance” (Stallings & Quarantelli, 1985).

These emergent groups are therefore characterized by a new (social) structure with new goals and tasks in their response to an emergent situation. Only if both requirements (a new structural arrangement and the undertaking of tasks which were new to the group) are fulfilled, are the arising collective citizens’ initiatives properly referred to as emergent groups (Stallings & Quarantelli, 1985). Emergent groups arise in different forms associated with different types of activity which arise. These groups range “from ephemeral teams of neighbors attempting search and rescue, to community residents organizing themselves to force removal of potentially hazardous waste sites or nuclear plants, to disaster victims getting together to pressure officials to take preparedness and mitigation measures for probable reoccurrences of the floods and landslides they have just experienced” (Stallings & Quarantelli, 1985). Kleinebrahn (2014) defined those groups as ‘unbound volunteers’, meaning “independent persons who are not officially invited to become involved in disaster response or recovery, and are often not part of a recognized voluntary agency.”

Stallings & Quarantelli (1985) characterize emergent citizen groups based on their main activities into three types, which consist of (1) damage assessment groups („provide public officials with their first information about the actual extent”), (2) operations groups („collect and distribute food and clothing to

disaster victims, or those that undertake street and debris clearance right after impact, or that transmit messages through ham or citizen band radio networks”) as well as (3) coordinating groups („less to do with immediate assessment or operational activities and more with setting direction, resolving domain disputes, and assuming responsibility for certain communitywide problems”).

Emergent citizen groups are usually small groups that often involve only a handful of people at any given time with a core of continuing members and with other individuals that participate only irregularly (Stallings & Quarantelli, 1985). Comparable to communities (cp. chapter 2.2.2), emergent citizen groups share a sense of ‘we-ness’ and work together as a group, even if “the entity usually does not acquire a name” (Stallings & Quarantelli, 1985). An individual’s involvement is partially affected by situational factors as well as prior experience or skill.

It should be noted that much emergence takes place within and among different already established organizations rather than just among private citizens. Emergent citizen groups are “only part of the full range of emergent phenomena to be expected before, during, and after disaster threats and impacts” (Stallings & Quarantelli, 1985) and often private citizens initiate new groups based on their already established work roles. On the other hand, organizations often arise from emergent groups. The institutionalization of the Red Cross can serve as an excellent example.

Prompted by the cruelty and helplessness of the nearly 23,000 wounded soldiers at the Battle of Solferino in 1859, Henry Dunant¹ spontaneously initiated medical care of the injured (Hart, 1953). He mobilized local people (mostly women and girls) to provide emergent assistance and medical care to the wounded – regardless of the flag under which they went into battle (slogan: *Tutti Fratelli*: ‘All are brothers’). They lacked sufficient tools, materials and supplies to provide medical care to all wounded, and Dunant himself organized the purchase of needed materials and helped by establishing makeshift medical care (Hart, 1953). Shocked by the battle itself as well as its chaotic circumstances afterwards, he formulated his experiences in the 1862 published work ‘*Un Souvenir de Solferino*’ (English: *A Memory of Solferino*). Here, he envisioned the central idea of initiating neutral and voluntary relief

¹ Henry Dunant (* 8. May 1828 in Geneva; † 30. October 1910 in Heiden) was born as Jean-Henri Dunant and was a business man from Switzerland and a humanist with Christian character.

organizations in all countries with the aim of taking care of all wounded in the case of a battle. This central idea led to the first Geneva Convention “for the Amelioration of the Condition of the Wounded in Armies in the Field“, and in 1863, it was manifested in the founding of the International Committee for Relief to the Wounded, which is better-known as the International Committee of the Red Cross since 1876. So, the Battle of Solferino in 1859 – on the basis of civil, self-organized activities – laid the foundations for the Red Cross. Another example is the establishment of professional firefighters and fire departments, which emerged from the citizen-based night watchman as an important part of medieval city infrastructures, partially volunteers from crafting guilds.

The example of the Red Cross’ institutionalization clearly reveals why emergent citizen groups come into being. Stallings & Quarantelli (1985) outlined that one necessary condition for the emergence of citizen groups *during* a disaster is a perceived need or demand which requires immediate action. Emergent phenomena occur when those needs and demands are not met by existing organizations (Auf der Heide, 1989). And especially during disasters, the public authorities with security responsibilities can “experience such a rapid and unexpected increase in demands that they lack capabilities to deal with them” (Parr, 1970). Here, inter-organizational coordination and the confrontation with disaster produces demands far in excess of the organization’s routine capabilities, and as a results poses several problems (Ley et al., 2012; Stallings & Quarantelli, 1985).

Not only during disasters, but also *prior to* and *following* a disaster, emergent citizen groups “are stimulated by the perception that a problem or issue is not recognized or acknowledged by others” (Stallings & Quarantelli, 1985). As Stallings & Quarantelli (1985) show, in non-emergency times, the public authorities with security responsibilities have come to incorporate several hazards, such as nuclear energy or flood plains, all of which involve contradictory social values, and are almost always controversial.

2.4.3 *Official Crisis Management and Emergent Citizen Groups*

Emergent citizen groups are not inherently in opposition to the public authorities with security responsibilities and most of the groups start out with “the notion that public officials will be on their side once their attention is called to the issue” (Stallings & Quarantelli, 1985). Nevertheless, when considering the perception of emergent citizen groups by official crisis management, it is

obvious that emergency services “often do not take them into account in community emergency management planning and misunderstand both the reasons behind their emergence and the roles they play in disaster-related community problems (Stallings & Quarantelli, 1985). Although emergency services have recognized the relevance and importance of citizen-initiated physical and digital activities, emergent citizen groups are often perceived negatively by emergency services, because they have not planned for the emergent behavior and therefore cannot ‘control’ as well as manage the groups during disaster events (Stallings & Quarantelli, 1985). How to identify, integrate and manage emergent on-site as well as online activities into the official work practices in time-critical and uncertain situations is challenging. There is often neither a clearly designated leader, nor a formally assigned liaison or boundary person for dealing with official emergency services, which hampers cooperation from the official’s perspective (Stallings & Quarantelli, 1985). As Stallings & Quarantelli (1985) argue, those characteristics make it difficult for others outside of the emergent citizen groups to develop relationships with them.

On the other hand “almost all issues raised by ECGS [emergent citizen groups] in initial approaches to outsiders are perceived as being ignored or rebuffed, or as resulting in reactions not addressing their issues” (Quarantelli, 1984). Not only their issues, but also the activities they undertake can be perceived as irrelevant or are being ignored. As Wenger (1992) argued “volunteers rescued the majority of victims following the Loma Prieta earthquake, including those at complex, difficult rescue sites, such as the Nimitz freeway collapse. At the collapsed freeway approximately 80 people were rescued from the structure. Volunteers rescued about 75 of them. The professional rescue units extracted only about four or five. However, the volunteer efforts were not extensively coordinated with those of formal, established organizations. In fact, they were ignored.” As Stallings & Quarantelli (1985) argued, “Perception – whether justified or not – should not be dismissed carelessly, for in the words of a famous social psychological principle [formulated by W. I. Thomas in 1923], ‘if people define a situation as real, then it is real insofar as consequences are concerned’”. Based on those conflicts, “it is true that in the later stages of development of such groups [emergent citizen groups], especially those in pre- and post-impact time periods, there often is conflict and a mutual *we-they* attitude on the part of community officials and group members” (Stallings & Quarantelli, 1985).

2.5 IT Support for Citizens during Crisis Management

Although emergent citizen groups as well as citizen-initiated activities have always existed during emergencies (Tierney et al., 2006), the sheer pervasiveness of modern information infrastructures has extended the possible types of mobilization and communication available to all stakeholders and individuals prior to, during and following a disaster. As summarized by Imran et al. (2015) “the use of Internet technologies to gather and disperse information in disaster situations, as well as to communicate among stakeholders, dates back to the late 1990s”.

Online newsgroups and email clients were already used to coordinate protests in Indonesia in 1998 (Poole et al., 2005) and websites were set up in response to crises in 2003 (Palen & Liu, 2007). But the emergence of social media especially, and the ubiquity of mobile devices have arguably changed the type of citizen involvement and engagement we now see. In 2004 an electronic bulletin board was set up and moderated for 10 days, which could be seen as the first year in which a user-generated content website was used in response to a crisis (Imran et al., 2015). Since then, social media have created opportunities for crisis communication and information propagation that would not exist otherwise and current studies show their prevalence during disasters (Birkbak, 2012; H. Gao et al., 2011; Ludwig, Siebigtheroth, et al., 2015; Vieweg et al., 2008; J. I. White et al., 2014).

Early ‘top-down’ communications initiated by official public authorities with security responsibilities have been extended by citizens who post situation-sensitive information on social media related to what they experience or witness from other sources (Hughes & Palen, 2009). Nowadays, citizens therefore use social media not only to receive information from authorities, but also to communicate during disaster situations as well as to coordinate relief activities with each other. Here, the search for information constitutes a kind of peer-to-peer collective behavior (Starbird et al., 2012) where citizens use both official and unofficial sources to obtain an up-to-date overview of the situation they are concerned with (Qu et al., 2009). Social media have become immensely valuable as sources of information as a result of its public availability. Whether intentional or not, information can be communicated to a large population of friends, volunteers or authorities (Reuter, Ludwig, Kaufhold, et al., 2015). It therefore constitutes a ready-made knowledge base, albeit one which lacks any formal organization (Ludwig, Reuter, Siebigtheroth, et al., 2015). Locally

affected citizens are a valuable source of information for the emergency services because they provide unique and up-to-date contextual information (Reuter, Ludwig, Friberg, et al., 2015; Reuter et al., 2016; Vieweg et al., 2010). Moreover, they possess knowledge of local geographic or cultural features (Ludwig, Kotthaus, et al., 2015) which are relevant to official crisis response but which otherwise might go unrecognized (Starbird et al., 2012).

2.6 Research Gap

After introducing the research field of CSCW, information infrastructures and infrastructuring, the concept of publics as well as the domain of crisis management, I will now present the conjunction of these areas and the gap in research as it stands. Here, I will position my overall research goals and outline why relying on the concept of publics and the domain of crisis management could be appropriate for researching the characteristics of ICT tools that support the analysis of large-scale, integrated and interconnected information infrastructures, its users, and the evolving portfolio of systems as well as practices (Monteiro et al., 2013).

The scope of the infrastructure reaches beyond a single event or one-site practice (Reuter, 2014; Star & Ruhleder, 1996). Information infrastructures are increasingly found across organizations and “typically stretched across space and time” (Monteiro et al., 2013). The rather restricted, confined and specialized forms of cooperative work witnessed over the last two decades, have changed (Monteiro et al., 2013) and the advances of ubiquitous computing have made information always accessible and therefore expands the infrastructure (Weiser, 1994). Cooperation is therefore not necessarily limited to specific situations or technologies and when researching the new kinds of interconnected information infrastructures that go beyond organizational boundaries or designing appropriate technologies, it is no longer sufficient to rely on formalized representations of (organizational) processes or particular settings and timeframes (Monteiro et al., 2013). That is why new CSCW approaches are needed (Monteiro et al., 2013).

When aiming at the design of appropriate tools for cooperative activities, designers must try to anticipate the complexity of integrated and interconnected information infrastructures, the diversity of its users, the emergent and often spontaneous evolving portfolio of systems as well as changing practices and appropriation techniques. Following Pipek and Wulf (2009), the concept of

infrastructuring aims to support those kinds of usage of an information infrastructure that have not been intended by the designer. Anticipating all those factors and designing an information infrastructure in its entirety is therefore not easy and requires tools to research (evolving) infrastructuring activities of users.

Considering emergent cooperation practices and related information infrastructures to design ICT artifacts is not a self-evident matter (Monteiro et al., 2013). There is an evident need for methods that help in examining actual and emerging practices around the use and appropriation of information infrastructures to support the design of supportive tools within cooperative contexts. When considering decisions like that designing a tool for cooperative contexts across organizational boundaries, the diversity of users, its relationships as well as its practices in relation to information infrastructures must be considered. The concept of publics, I argue, provides the necessary theoretical framing.

Following Dewey's pragmatist view, whenever affected – whether negatively or positively – by government decisions, citizens deal with shared issues (Dewey, 1927). When taking into account the relationship of the different ways in which citizens might be affected and the advent of new technologies, it is the case that specific technological support needs to reflect group formation processes and evolving cooperative activities. Communications as well as cooperation today are not necessarily bounded in space and time as it was in 1927; information infrastructures have been improved, as required by Dewey, and now offer new opportunities for individuals to engage with issues. By definition, technologies, when used by individual citizens, are part of their information infrastructure. Whether intended or not, individuals select some of the ICT to be used while engaging with issues and thus while forming a public.

Technological development has meant new opportunities for citizens to collaborate, self-organize and engage with issues have arisen. The role of complex information infrastructures – and maybe also group as well as formation processes – is still not well understood. The concept of publics can therefore be an appropriate analytical lens for examining information infrastructures and the inter-connectedness of individuals as well as systems. Individuals of aware or active publics neither have to meet in person to recognize their common understanding, nor do they have to articulate their affiliation in person, as long as it is supported within the information space: “Computer systems meant to support cooperative work in real world settings

must support cooperation through the joint construction of a common information space in such settings” (Schmidt & Bannon, 1992).

To examine information infrastructures with regard to cooperative contexts in a practical way, the domain of crisis management offers enormous potential. During disasters, the public authorities with security responsibilities can “experience such a rapid and unexpected increase in demands that they lack capabilities to deal with them” (Parr, 1970). If that happens in combination with “a perceived need or demand which requires immediate action” (Stallings & Quarantelli, 1985), emergent citizen groups will be likely to develop in response to situations they actually encounter (Wenger, 1992). Emergent citizen groups are therefore stimulated “by the perception that a problem or issue is not recognized or acknowledged by others” (Stallings & Quarantelli, 1985). The subjective perception of the issue or problem should not be dismissed out of hand. As Stallings & Quarantelli (1985) outlined, “in the case of both emergency and non-emergency times, there will always be discrepancies between what some citizens see as what is and what they think should be. Such perceptual discrepancies almost assure the presence of one of the necessary conditions for group emergence”.

During disasters emergent citizen groups must accomplish new tasks of undeniable immediacy to exist and function as a viable entity (Parr, 1970). Those new tasks coupled with new (group) behavior and structures (Stallings & Quarantelli, 1985) often imply new ways of appropriating socio-technical infrastructures and lead to infrastructuring activities, that cannot anticipated in advance (Pipek & Wulf, 2009). Researching those activities with regard to information infrastructures and the diverse interplay between users, technologies and practices is still challenging (Monteiro et al., 2013).

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