Crisis as opportunity, disruption and exposure: Exploring emergent responses to crisis through digital technology

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A B S T R A C T

We live in a technologically advanced era with a recent and marked dependence on digital technologies while also facing increasingly frequent extreme and global crises. Crises, like the COVID-19 pandemic, are significantly impacting our societies, organizations and individuals and dramatically shifting the use of, and dependence on, digital technology. The way digital technology is used to cope with crises is novel and not well understood theoretically. To explore the varied uses and impact of digital technologies during crises, we propose to view crisis as (1) opportunity, (2) disruption, and (3) exposure. Examining crisis as opportunity reveals how digital technologies enable experimentation and accelerate innovation while raising coordination challenges and risky implementation. Viewing crisis as disruption highlights how digital technologies enable the rapid shifting of organizational and occupational practices to new digital spaces, allowing work continuity, yet potentially distorting work practices and raising challenges of over-dependence. Finally, crisis exposes the societal implications in making visible and exposing digital inequalities and producing moral dilemmas for us all. We use these three perspectives to shed light on the varied uses of digital technologies in the COVID-19 crisis and suggest new avenues for research on crises more broadly.

Introduction

In early 2021, the world is still enduring the Coronavirus disease (COVID-19) pandemic—an unprecedented public health crisis that has perpetuated economic and social crises. Governments, organizations, practitioners and researchers alike, both individually and collaboratively, are striving to stop spread of the pandemic and mitigate its multi-faceted adverse effects. Since the onset of the pandemic, the use of digital technologies has accelerated, expanded and intensified as challenges of the crisis are faced and overcome. Use of digital technologies has ranged from enabling contact-tracing, remote working and education to the use of artificial intelligence and robotics in healthcare. Some even provocatively argued that digital technologies can stop the pandemic. For example, Byung-Chul Han, a well-known German-Korean philosopher and theologian, went as far as to claim that: "'Big Data' is far more effective at fighting the virus than the absurd border closures in Europe.[1]" The way digital technologies were developed and employed in this crisis have led to variable impacts and outcomes globally. For instance, Asian countries, such as China, South Korea and Singapore, used distinct contact tracing technologies compared to Europe and the USA, leading to different adoption and impact (Min, Lifshitz-Assaf, & Levina, 2021).

Concurrent with the acceleration and implementation of digital technology during the pandemic, there has been the caution and

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[1] https://www.dw.com/en/will-germans-trade-privacy-for-coronavirus-protection/a-52943225

growing skepticism of the widespread and excessive appropriation of the technology by organizations, governments and societies. Concerns have been raised, for example, about a digital panopticon and the problematic consequences of digitally enabled transparency (Zuboff, 2018). New questions emerged surrounding the use of digital technology, such as: 'Does less privacy mean more freedom in this new context?' and 'Is the transparency afforded by digital technology socially and organizationally desirable?'.[2] Similarly, digitally-enabled practices that offered much hope at the beginning of the pandemic, such as virtual working, telemedicine and online education activities, have become increasingly contested (Mroz, Papoutsi, Rushforth, & Greenhalgh, 2021).

While crisis has long been an important area of organizational scholarship (Pearson & Clair, 1998), the shifts in digital technology use to cope with the COVID-19 crisis are fast-paced, dramatic and not well understood. In particular, as recent experience with the coronavirus pandemic crisis suggests, organizational and institutional responses to crisis are accomplished *through*, not simply with, digital technology. Collective efforts to try and tame the crisis seem to be "inextricably tied up with many digital configurations entailing various platforms, multiple servers, numerous networks, countless algorithms, and big data" (Barrett & Orlikowski, 2021, p. 16) and become contingent upon the openness, distributedness, recombinability, re-programmability, and accessibility of digital technologies (Kallinikos, Aaltonen, & Marton, 2013; Nambisan, Wright, & Feldman, 2019; Yoo, Henfridsson, & Lyytinen, 2010; Zittrain, 2006). In essence, digital technologies and human agents (individuals, groups, organizational and institutional actors) become deeply entangled "as coevolving forces in emergency responses" (Nan & Lu, 2014, p. 1141).

The aim of this special issue is to bring together some of the latest scholarship of organizational studies (OS) and information systems (IS) to advance constructive and critical debate on the varied and innovative uses of digital technologies in times of crisis. Our main premise in initiating this debate is that crisis creates and exacerbates complexity, which "is not only a feature of the systems we study, [but] it is also a matter of the way in which we organize our thinking about those systems" (Tsoukas & Hatch, 2001, p. 979). One way to explore and navigate crisis-engendered complexity is by viewing and describing the multiple facets of crisis from different vantage points and developing rich narratives of the varied responses to crisis. Therefore, we propose and discuss three interrelated perspectives on crisis in the digital age; opportunity, disruption, and exposure, to explore and develop theoretical insights while paying attention to key practical and policy implications that ensue from digital response to crisis. Then we provide an overview of the articles included in this special issue, highlight their contributions, and spell out how they support or refute the three proposed perspectives. We conclude by suggesting several avenues for future research.

Three perspectives on crisis

Prior literature underscores that crisis is "a low-probability, high-impact event that threatens the viability of the organization" (Pearson & Clair, 1998, p. 60) and institutional orders (Habermas, 1975). In this paper, we seek to complement this understanding of crisis by focusing on how digital technologies, in particular have been used to respond to the COVID-19 crisis, which can be applied to crises more broadly. Moreover, we propose three different perspectives, which generate distinctive and complementary insights into what constitutes crisis. Ours is an attempt to appreciate the complexity of crises as a phenomenon, with the acknowledgement that it will likely not capture the full essence of a crisis.

Accordingly, our analysis is not meant to be exhaustive but rather a starting point. We develop multiple distinct perspectives on crisis that are based on the common narratives in the literature and popular press and our lived experiences. We use these perspectives to shed light on the underlying common themes across the special issue papers and believe that they can be used fruitfully to guide researchers, practitioners, and policymakers in developing a more nuanced understanding of crises.

Crisis as opportunity

Since the COVID-19 pandemic crisis erupted, Winston Churchill's famous quote "Never let a good crisis go to waste," has been cited frequently and incites the perception of resultant positive change. Exploring how crisis becomes a positive, tailwind-like, force through pushing things forward is a common narrative in the media and by various stakeholders. This is particularly when depicting the crisis as an opportunity for positive change, for accelerating processes that were stalling, for questioning social and institutional norms, forms and processes and for experimenting with new ones. Perhaps one of the most influential scholars to view crisis as opportunity was Thomas Kuhn, who in his notable book "The structure of scientific revolutions" (1962, see esp. chapters 7&8), specifically stressed the important role of crises for experimentation with, and the creation of, new ground-breaking paradigms and scientific theories. In his words: "So long as the tools a paradigm supplies continue to prove capable of solving the problems it defines, science moves fastest and penetrates most deeply through confident employment of those tools [...] The significance of crises is the indication they provide that an occasion for retooling has arrived" (p. 76). For Kuhn, a major crisis is "a necessary precondition for the emergence of novel theories" (p. 77) because it "loosens the rules of normal puzzle-solving in ways that ultimately permit a new paradigm to emerge" (p. 80).

More broadly than scientific paradigms, in times of crisis, expectations to conform to dominant social conventions and norms are lowered, thus creating the conditions for the fermentation of new social and organizational paradigms. As Orlikowski and Scott (this issue) note, "when spiraling uncertainty disrupts and suspends established practices, existing ways of doing things are called into question". Organizations and individuals may also experience some form of liberation, understood as "emancipation from any sort of determination" (Boltanski & Chiapello, 2005, p. 433), which hitherto governed social interactions. New ways of organizing and self-

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[2] https://www.nytimes.com/2020/03/28/us/coronavirus-data-privacy.html?smid=url-share

organizing can flourish in such times as there is a loosening of the centralized and formal ways of doing so (Nan & Lu, 2014).

Acceleration of innovation processes is one of the outcomes of this questioning in the COVID-19 crisis. In regular times, across different organizations and industries, innovation processes take significant periods of time, from months to years (Garud, Gehman, & Kumaraswamy, 2011; Van De Ven, Polley, Garud, & Venkataraman, 1999). The COVID-19 crisis, however, created temporal conditions and constraints that forced organizations to accelerate digital innovation processes to weeks or months. At the early stages of the COVID-19 pandemic crisis, organizations were using a wide variety of technologies to accelerate innovation in the areas of personal protection equipment (PPE), contact tracing technologies, medical devices and predictive analytics. In particular, as *de-novo* drug discovery had been perceived as almost impossible, there was an increase in development of AI for drug repurposing (Zhou, Wang, Tang, Nussinov, & Cheng, 2020). Acceleration of innovation processes has been increasing in the last few years before the crisis, as new and faster research and development (R&D) tools have been developed (Lifshitz-Assaf, Randazzo, & Jung, 2021). However, the crisis has made the temporal dimension of innovation a salient one for organizations. The unprecedented speed of the vaccine development, in particular, paved the way to review and revise current R&D processes and tools supplied by the dominant scientific paradigm.

A second organizational response to the COVID-19 crisis was leveraging digital technologies to experiment with new types of knowledge boundary work (Langley et al., 2019) aimed at collaboratively producing new knowledge to cope with this crisis. Prior to the COVID-19 crisis, many organizations and professional communities had initiated distributed innovation processes to transcend their traditional knowledge boundaries (Lakhani, Lifshitz-Assaf, & Tushman, 2013). They often confronted significant organizational and professional challenges to adopt such open processes (Beck et al., 2020; Fayard, Gkeredakis, & Levina, 2016; Lifshitz-Assaf, 2018). The crisis, however, created a strong motivation to dismantle professional and organizational boundaries (Lifshitz-Assaf, 2018) and collaborate in knowledge creation for the sake of fighting the pandemic (Dahlander & Wallin, 2020). Majchrzak and Shepherd (2021) propose how a crowd-based digital innovation framework could help with compassion venturing in times of crises. Organizations have been experimenting with new ways of producing knowledge across boundaries, from creating coopetition agreements on data sharing across highly competitive pharma corporations,[3] to prestigious medical journals moving to open access,[4] launching new networking platforms for scientists to connect (LifeBit, Benchling, Crowdhelix and others), to initiating open innovation challenges for rapid medical device production (Lifshitz-Assaf et al., 2021).

Finally, the COVID-19 crisis has removed multiple barriers to experimentation and acceleration of innovation in the health-tech sphere. Prior to the crisis, investors were often reluctant to invest in health-tech due to the heavy regulatory environment and the slow pace of new technology adoption by patients and clinicians. Both of these factors have changed as a result of the crisis. Oborn, Pilosof, Hinings, and Zimlichman (2021) describe how healthcare professionals increased their experimentation with new digitally enabled treatment procedures, such as telemedicine for inpatient care in hospitals. This has led both public and private institutions to fuel the experimentation and acceleration of health-tech innovation by increased investments. For instance, recently, the UK government unveiled a £140 m fund to accelerate the testing and evaluation of the most promising AI technologies for healthcare.[5]

Emerging tensions

Accelerating and experimenting with innovation processes, however, may have problematic consequences that are yet to be fully realized. Working in an accelerated manner, for example, presents a myriad of coordination challenges (Kellogg, Manning, & Ghersin, 2020). From a knowledge perspective, the multiplicity of efforts without coordination is good for experimentation but impedes the ability to create a cumulative innovation base (Murray & O'Mahony, 2007). For instance, a report on an open-source hardware movement during the COVID-19 crisis highlighted the need for better coordination between different communities and the public efforts (Bowser, Long, Novak, Parker, & Weinberg, 2021). A recent study shows how accelerating innovation processes by simply compressing existing processes often leads to frustration, coordination challenges and failure to produce new products in the limited time frame and instead identifies the need to create new time frames (Lifshitz-Assaf et al., in press). However, it is hard to create and lead new coordination processes when adding the challenges of virtual work (Bailey, Leonardi, & Barley, 2012; Kanawattanachai & Yoo, 2007; Massey, Montoya-Weiss, & Hung, 2003). In addition, working at a high pace for a prolonged crisis, may lead to burn out and exhaustion of employees (Beckman & Mazmanian, 2020) as many are dealing simultaneously with personal challenges due to the crisis.

Moreover, while digital technologies enabled new ways of knowledge creation across organizational and professional boundaries, the saliency of national boundaries has emerged during the COVID-19 crisis. The lack of knowledge sharing across nations delayed the worldwide implementation of best practices and solutions to the pandemic. As Bill and Melinda Gates stress "There is no such thing as a national solution to a global crisis. All countries must work together to end the pandemic and begin rebuilding economies."[6] Scientists have issued several calls to open COVID-19 genome data[7] and increase open access research and explore models to accelerate the dissemination of cumulative knowledge surrounding the pandemic (Aspesi & Brand, 2020). The digital technology is there to enable fast and smooth knowledge sharing, however, significant national or international policy changes have yet to be implemented to instigate the knowledge flow.

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[3] https://www.oecd.org/competition/Co-operation-between-competitors-in-the-time-of-COVID-19.pdf
[4] https://www.the-scientist.com/news-opinion/journals-open-access-to-coronavirus-resources–67105
[5] https://www.ft.com/content/f305671f-75d6-4d4c-867e-09bdb3d3e02e
[6] https://www.gatesfoundation.org
[7] https://www.nature.com/articles/d41586-021-00305-7

In addition, the acceleration which led to a "gold rush" of AI tools for COVID-19 is now raising a number of concerns. The development and evaluation of AI tools in healthcare is still an evolving process that suffers from multiple challenges, ranging from the procedural to the moral. Who bears the responsibility and accountability for AI decisions? How can experts work with opaque AI for critical decision making? For instance, in many hospitals around the world, AI was quickly adopted to augment or even replace experts' judgment regarding COVID-19 patients, as illustrated by the Oborn et al. study (2021). Using AI tools in medicine, especially when the underlying knowledge is uncertain as during the COVID-19 pandemic, is high risk. The use of AI during the COVID-19 crisis used systematic evaluation where experts' decision-making processes are compared *vis a vis* to the AI decisions and were circumvented, or suppressed (Lebovitz, Levina, & Lifshitz-Assaf, 2021). Furthermore, as noted by Faraj, Renno, and Bharadwaj (2021), AI applications are brittle in times of crisis and rely on human expertise to reconfigure algorithms. More broadly, innovation processes take time as they involve high levels of technological uncertainty, inducing tensions and debates when making decisions on the development process (Benner & Tushman, 2002; Seidel & O'Mahony, 2014; Smith & Tushman, 2005). Reducing the amount of time dedicated to sailing through these tensions and debates might create a boomerang effect post the crisis.

Finally, while acceleration of digitized innovation led to increased funding in health-tech, it also seemed to create a "COVID bubble" around potentially socially contentious businesses that have flourished due to quarantines. For instance, Uber acquired Drizly, an alcohol e-commerce platform in a $1.1 billion deal.[8] Is this the kind of innovation that we want to accelerate as a society in times of crisis?

Crisis as disruption

Crisis is a disruptive event that threatens the regularity and continuity of organizational and occupational practices (Seidl & Whittington, 2021), intercepts existing communication practices and puts existing governance arrangements to test (Billings, Milburn, & Schaalman, 1980; Hermann, 1963; Marcus & Goodman, 1991). At a broader societal level, crisis may initiate a "cultural collapse" (Turner, 1976) and "a breakdown in shared meaning, legitimization, and institutionalization of socially constructed relationships" (Pearson & Clair, 1998, p. 63), as well as throw occupations and entire professions off balance. For example, in times of prolonged and global crises, such as the COVID-19 pandemic, many healthcare organizations suspended non-urgent operations, professionals adapted their protocols and consultation practices to comply with new social-distancing rules and accommodated the treatment needs of a massive influx of coronavirus patients (Oborn et al., 2021).

The emergent efforts to deal with crisis as a disruptive force and adapt to new material and social conditions are far from smooth, but involve action, reflections and negotiation of meaning (Weick, 1988). One type of effort by which organizations in particular responded to the COVID-19 crisis through digital technology was to rapidly shift organizational practices to novel and digitally configured spaces, with the aim to create continuity. Such spaces were not purely digital, but included physical arrangements (e.g., home offices, desks, cameras, delivery vehicles, etc.), social structures (e.g., roles structures) and an array of digital capabilities, becoming 'safe zones' within which abruptly disrupted organizational activities could resume. For example, the COVID-19 pandemic suddenly required teams in knowledge-based organizations to swiftly adapt and accomplish their interactions in an entirely digitally mediated way (Whillans, Perlow, & Turek, 2021). Easily reconfigurable and accessible digital infrastructures (Constantinides, Henfridsson, & Parker, 2018) and digital platform ecosystems enabled a myriad of organizations to rapidly shift to digital spaces. Platforms, such as Zoom Video and Microsoft Teams, enabled educational organizations around the world to relocate educational activities online when in-person teaching was disrupted in early 2020. Relatedly, digital platforms, such as Shopify, enabled small businesses that previously operated exclusively offline, to quickly develop an online presence, e-commerce routines and reach out to existing and new customers, preventing (at least temporarily) total collapse of economic activity.

Moreover, rapidly shifting existing organizational practices to new digital spaces required developing new organizational skills and negotiating new scripts of digitally constituted interaction on an ongoing basis. For example, Whillans et al. (2021) show that workers negotiated new routines to balance the quality and quantity of their interactions at a professional services firm, such as daily check-ins and setting aside time for building and sustaining relationships. The shift to digital spaces entailed the mobilization of new resources for digital coordination to be achieved (Claggett & Karahanna, 2018; Gkeredakis, 2014; Gkeredakis & Constantinides, 2019), such as, digital nudging and algorithmic processes (Kellogg, Valentine, & Christin, 2020; Möhlmann, Zalmanson, Henfridsson, & Gregory, 2021). For instance, new digital acts were incorporated in the emergent educational practices during the COVID-19 crisis, such as raising virtual hands to participate, throwing online quizzes on students' screens and instantaneously bringing individuals back to the main virtual classroom from breakout rooms. In essence, the forced shift to digital spaces involved ongoing adjustments and engendered new shared understandings, which were coupled with the workings of multiple digital technologies.

Furthermore, responding to COVID-19 crisis through digital technologies involved ongoing reflections on organizational practices (Schatzki, 2001; Schatzki, 2006) and 'on the fly' deliberation on the "possibilities and potentialities" for adapting practices to the new material conditions (Sandberg & Tsoukas, 2011, p. 349). This was particularly visible in the context of professionals and occupational groups, who strove to make the shift to digital spaces compatible with professional expectations and occupational values. For instance, Oborn et al. (2021) found that healthcare professionals embraced telemedicine to maintain the ethos of their professional practices. Specifically, they note that, "in response to COVID-19, the hitherto resistance to using audio-visual technologies in accessing meaningful knowledge about patient care needs, was overruled by the fear of contamination," which would severely jeopardize the performances of healthcare practices. Mobile audio-visual technology enabled doctors to perform their professional duties with no risk of

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[8] https://www.nytimes.com/2021/02/02/business/uber-buys-drizly.html?smid=url-share

COVID-19 and avoiding the limitations of consultations in full PPE, such as difficulty in hearing patients (see also Sergeeva, Faraj, & Huysman, 2021). Thus, the rapid shift to digital spaces prompted knowledgeable practitioners to reshuffle elements of existing professional practices and recalibrate occupational meanings (Dittrich, Guérard, & Seidl, 2016; Edmondson, Bohmer, & Pisano, 2001; Schön, 1983; Yanow & Tsoukas, 2009), for example what it means to examine a patient, perform diagnosis, monitor patients' progress, etc.

Emerging tensions

With a growing stream of organizational and social activities shifting to digital spaces during the COVID-19 crisis, new dependencies have been arising. In particular, by drawing on and heavily latching onto the 'boundary resources' (Henfridsson & Bygstad, 2013) of a few digital platforms, organizations and individuals have been exposed to new forms of risk. For example, as a growing number of organizations became users of a few videoconferencing systems during COVID-19 crisis, such as Zoom, new security issues emerged. Incidents, such as "Zoom-bombing"—the act of uninvited participants disrupting private meetings—and various software glitches, illustrate the perils the arise from the growing dependence on major videoconferencing platforms.[9] Relatedly, while social media platforms, such as Facebook and Twitter, are enablers of much needed, spontaneous responses to crisis (see also, Majchrzak, Jarvenpaa, & Hollingshead, 2007; Nan & Lu, 2014), they also provide the means for the spread of misinformation (e.g., Oh, Agrawal, & Rao, 2013). As such, these social media platforms have intensified loss in cultural meaning (e.g., trust in science) and the transition to a post-truth society (Knight & Tsoukas, 2019).

In addition, the digital reconfiguration of organizational practices to cope with disruption during the COVID-19 crisis inadvertently created "unproductive disconnect" among the different constitutive elements of a practice, such as know-hows, rules, norms, etc. that previously were "artfully" articulated (see also, Pine & Mazmanian, 2017). Adapting practices to new conditions, in many cases, distorted the organization of practices (Schatzki, 2006) and produced undesirable outcomes. For instance, in the midst of 2020, and with many school exams being cancelled due to the COVID-19 crisis, in the United Kingdom, The Office of Qualifications and Examinations Regulation (Ofqual) implemented an algorithm "which was meant to stop grade inflation by standardizing teachers' assessed grades".[10] Yet, in practice the system inadvertently "downgraded 40 per cent of A-level results from teachers' predictions, sparking mass anger. Worse still, results appeared to disadvantage children from poorer backgrounds and were seen to penalize outliers who had outperformed their schools' historic performance."

Furthermore, the rapid shift to digital spaces during the COVID-19 crisis has arguably instigated organizational forgetting (de Holan, Phillips, & Lawrence, 2004; Easterby-Smith & Lyles, 2011), rather than learning (Lee, Lampel, & Shapira, 2020). For organizational memory to persist, it is necessary that certain shared understandings and "mutually intelligible performances" continue to be available in practice through the ongoing accomplishment of interactions that are usually less formalized (Schatzki, 2006, p. 1868). Yet, this continued availability is now threatened, since certain forms of actions and informal communications have become impractical in new digital spaces. For example, receiving mentorship and developmental feedback is integral to work practices in professional services firms (Whellan et al., this issue). Yet, in the virtual environment, such activities are not easily adjusted, thus undermining professional interactions. Beyond organizations, the sudden shift to digital spaces is likely to alter the fabric of occupations, since the informal processes, "by which an occupational community socializes its members into a particular set of shared cultural values, norms, and worldviews" (Anteby, Chan, & DiBenigno, 2016, p. 189–190), cannot be easily accommodated. In sum, crisis as disruption elicits responses through digital technologies that may gradually result in knowledge loss (see also, Cattani, Dunbar, & Shapira, 2013) and/or discontinuities in the accumulation of tacit organizational and occupational knowledge (Hadjimichael & Tsoukas, 2019).

Crisis as exposure

Crisis exposes and highlights the significance, actions and issues of people, social groups, systems, organizations, and infrastructure that have previously gone largely unnoticed (Bowker & Star, 1999; Star & Ruhleder, 1996). Such increased visibility, of workers and communities for example, can be enlightening, making invisible work more visible (Suchman, 1995). Crisis therefore lays bare how so-called 'essential' workers and scientists matter, people whose roles were previously unacknowledged for societal importance (Rouleau, Hällgren, & de Rond, 2021). In recognition of their significance, during the COVID-19 crisis in the UK, the media, government and public have frequently praised the efforts of "keyworkers", beyond frontline medical staff, including hospital cleaners, porters, and kitchen staff as well as dustmen and supermarket check-out staff. Further, responses to the current crisis have magnified the importance of local communities and foregrounded the potential for crowd based digital innovation to strengthen and empower communities (Majchrzak and Shepherd, 2021).

In addition to the roles of people and communities, crisis events significantly illuminate how objects, material arrangements and digital infrastructures matter (Nicolini, Mengis, & Swan, 2012). The COVID-19 crisis and the shift to remote work, for instance, has revealed how Internet infrastructure matters; how space matters (e.g., having an extra room to convert into a home office); how road networks and physical borders matter (e.g., to impose travel restrictions, etc.). Similarly, as crisis events are often unchartered territory, Leonardi, Woo, and Barley (2021) bring attention to how simulations and models matter and become performative (Callon, 2007).

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[9] https://www.ft.com/content/34055e16-a70a-11ea-92e2-cbd9b7e28ee6
[10] https://www.ft.com/content/16f4ded0-e86b-4f77-8b05-67d555838941

Finally, an organization's response organization's response to crisis also relies on face-to-face interaction with the other (O'Leary, 2016) to facilitate social accountability (Awio, Northcott, & Lawrence, 2011; Baker, 2014; Jayasinghe & Wickramasinghe, 2011; O'Dwyer & Unerman, 2008; O'Dwyer & Unerman, 2010; O'Leary, 2016; Taylor, Tharapos, & Sidaway, 2014). Despite increased access and pervasiveness of digital technologies, face-to-face engagement is critical in encouraging participation and inclusion of less powerful groups, and those people immediately affected, in crisis decision-making (O'Dwyer & Unerman, 2010; O'Leary, 2016). Studies have shown that social accountability in times of crisis requires participation of beneficiaries of aid programs (O'Leary, 2016) or victims of natural disasters (Baker, 2014; Taylor et al., 2014). Related studies have emphasized that crisis exposes inequalities, produces moral responsibility, and may lead to an ethical burden stimulating crisis response (Frey-Heger & Barrett, 2021).

The extent to which moral responsibility stimulates crisis response has been debated. For example, studies of the Syrian refugee crisis (Chouliaraki & Stolic, 2017) have challenged the extent to which news images of the faces of refugees as the "far-away un-fortunate" (Boltanski, 1999: 13) actually established a sense of responsibility for refugees. In cases such as these, organizational response to crisis may only allow for limited illusory connections with the other and a moral weightlessness insufficient to establish moral responsibility (Chouliaraki & Stolic, 2017; Silverstone, 2002). In contrast, awareness of social responsibility may spur action and crisis response. In the UK, during the COVID-19 crisis, unprecedented numbers of people set up food hubs in their communities, with people donating food that people in need can take for free. Further, victims as on-the-spot-entrepreneurs can use their local knowledge and crowd based digital technologies to mobilize their communities in creating compassionate ventures (Majchrzak and Shepherd, 2021).

Emerging tensions

The COVID-19 pandemic has exposed fractures and heightened emerging tensions in the social fabric of societies and magnified high levels of inequality. The crisis has increased the visibility of inequality in healthcare across ethnic minority groups in several Western countries. In the USA, Black Americans are 3.5 times more likely to develop COVID-19 and have a poor outcome from the infection than white Americans, while Latino Americans are over six times more likely. In the UK, the COVID-19 crisis has exposed significant risk for vulnerable groups in society, including elderly residents in nursing homes or those over 70, who are shielding for several months at a time. Recent reports shockingly illuminate the disproportionate risk of disabled people in contracting the coro-navirus during the pandemic. Disabled people comprised half of the COVID-19 deaths in the first 6 months of the pandemic in the UK (March-Nov 2020) and are 2.5 times more likely to die from the virus than a non-disabled person. This disparity of mortality during the pandemic has illuminated and magnified existing structural inequalities such as class and ethnicity. Furthermore, these disparities intersect with the division between digital workers carrying out remote online work and keyworkers who are exposed to higher risk through their physical face to face work (Zheng and Walsham, 2021).

During the COVID-19 pandemic, different risk framings have been adopted and used by stakeholders in tackling the health crisis. Tensions have emerged which expose the contested and consequential practices over time and place (Barrett & Orlikowski, 2021). Furthermore, these emerging tensions were exacerbated by the subsequent economic and societal impacts which cascaded from the health crisis (Howard-Grenville, 2021). Risk framing in responding to crisis involves simulation modeling practices with important implications for decision-making and policy development. The model predictions of risk in this crisis have an important and moral impact on human life, with variably short- or long-term consequences to our everyday lives (Leonardi et al., 2021).

In the UK, the initial decision by politicians to follow a 'Herd Immunity' approach led to a public outcry as many believed that it would expose and put the country's vulnerable population at the greatest risk. It was quickly replaced by a governmental rhetorical strategy of being 'science-led' and relying on simulation and data modeling practices as the remedy of all things in managing the crisis (see also Zilber and Goodman, 2021). At the heart of these approaches are different framings of handling risk and uncertainty which were attempts by the government to regain public confidence after what was generally perceived by some as avoidable mistakes. The use of rhetorical framing practices remained particularly important in achieving legitimacy for practices (Suddaby & Greenwood, 2005) with the use of language to persuade constituencies of the desirability and appropriateness of advice. Over the course of the pandemic, risk framing practices by government and scientific advisors were influenced by their ideological deep structures (Barrett, Heracleous, & Walsham, 2013). This led to competing rhetorical strategies (Green Jr, 2004; Green Jr, Li, & Nohria, 2009) which had important implications for decision-making and policy.

Specifically, scientific and health advisers adapted and used simulation and data modeling technologies to make predictions in managing the health crisis, whale politicians did not always accept their model results and scientific advice. Further, the government's handling of the crisis required trading-off human health with the emerging economic crisis, while balancing public confidence and keeping votes. These expressions of power relations highlight what has been termed a risk spatiality (Appadurai, 1990), as scientific advisors compete with government in how to best present alternative advice on risk to influence and determine decision-making. The emerging tensions became visible (on TV) as open contestations between politicians and their 'trusted' science and public health officials. For some time during these periods of contestation, scientific advisers were not present in what had previously been joint presentations with the government at daily briefings on managing the crisis.

The contested and consequential practices of data analytics and modeling in managing the crisis increased over time and in different places (Barrett & Orlikowski, 2021) as economic and social impacts cascaded from the health crisis (Howard-Grenville, 2021). In the USA, a key issue related to whether reopening (business led) strategies were taking precedent over human health in the decision making and crisis response. In Florida, the governor was challenged publicly by his chief data scientist as to whether public health data was being manipulated to meet policy goals for the economy through reopening the economy (Barrett & Orlikowski, 2021). The data scientist who was subsequently fired, set up an alternative data portal and continued to challenge the official data analysis

before being eventually arrested. The cascading of crises exposes how power relations and domination may be reproduced as different groups prioritize different risk framings, influenced in part by their ideologies and profession, with consequences for the scaling of the global pandemic (Barrett & Orlikowski, 2021).

The articles in this special issue

In this section, we introduce the articles that contributed to this special issue and relate them to the three perspectives presented above. These articles went through an accelerated peer-reviewed process in less than a year in order to build knowledge and understanding in a timely and relevant fashion. The articles adopt a variety of research approaches, span various levels of analysis and contexts to draw practice and policy implications and speak differently to each perspective (Table 1).

Oborn, Pilosof, Hinings, and Zimlichman argue that institutions are not only a source of inertia, but also an enabling force for digital innovation, especially in times of crisis. Through an empirical study at an Israeli hospital, the authors developed new insight into how technology affordances and institutional logics work together to shape technology adoption and use during a crisis. The study highlights divergent, unanticipated uses of a particular technology—telemedicine—in response to crisis. Different organizational actors draw upon multiple logics to direct their attention and carve up diverse action possibilities through digital technology. The study also shows how organizations and professionals recalibrate practices by connecting macro-level institutional logics with the micro-dynamics of technology in order to the avoid disruption of rapid change in practices.

Orlikowski and Scott develop the idea of liminal innovation by drawing on a practice approach to understand the reconfiguring of digital work in response to a crisis. Liminal innovation leverages the tensions that arise as openings from disruptions in established ways of working. It is a process of iterative experimentation and implementation that explores novel or alternative materializations of established work practices. They highlight three distinct tensions that arise in conditions of crisis, namely, pragmatic, tactical, and existential. The authors then show how these distinct tensions may be leveraged in a generative manner to reconfigure digital work and produce liminal innovations in practice.

Majchrzak and Shepherd propose a theoretical framework for merging compassion venturing and crowd-based digital innovation literatures. With the acknowledgement that adverse events and crises are likely to only increase in prevalence and magnitude, the authors highlight that researching how digital innovations can help organizations cope with this adversity is vital. Compassion venturing theory is discussed in relation to digital innovation inclusion, so as to implement a broad scale and scope response to a crisis site and alleviate suffering. For crowd-based digital innovations, the authors call for consideration in how it can be applied to solve problems in the aftermath of an adverse event, like a crisis.

Whillans, Perlow and Turek document the transition of workers to virtual environments, tracking teamwork, knowledge and workers' experiences. Based on the shift to remote working during the COVID-19 crisis, the study uncovered activity cornerstones teamwork requires (task, process, and relationship interactions), and how the change in conditions both facilitated and undermined the performance of team activities. Furthermore, the study revealed that employees were prompted to adapt and reflect on their use of digital technology to perform these activities. Overall, the shift to virtual work presented a unique learning opportunity.

Leonardi, Woo, and Barley illustrate how digital models that simulate the dynamics of a system are increasingly used to make predictions about the future and explore the public's perception of them. The COVID-19 pandemic has highlighted the importance of models to millions of people worldwide, however, many perceive models to be faultless visions into the future, rather than educated guesses based on data. Over a 10-year period, Leonardi et al. explored digital modeling across several industries and have learned more about the perception of models. The authors also discuss how best to respond to COVID-19 models predictions and those of other stochastic processes.

Faraj, Renno, and Bharadwaj propose the COVID-19 crisis to be seen as a natural breaching experiment, challenging the shiny promise of digitalization. The pandemic has stress-tested and upheaved organizational and societal processes in unexpected ways, and in the process exposed and amplified four key challenges of digitalization. First, the crisis has exposed the uneven distribution of digital access, risking the widening of the digital divide. Second, expectations of fully digitalized work processes have been breached, revealing the need to connect with and account for analog realities. Third, the crisis has disclosed the brittleness of highly digitalized processes dependent on AI, and the need for human expertise in reconfiguring algorithms in work processes. Finally, the crisis has revealed deep concerns about privacy and the acceptable limits to panoptical surveillance by the state as well as corporations.

Zilber and Goodman draw upon the conceptual toolkit of institutional theory to problematize the deployment of not only advanced digital technologies, but also traditional 'low-tech', in response to the COVID-19 crisis. In their critical essay, they question the rationales offered to justify governmental and organizational uses of technology during the pandemic. They argue that the technologies used to handle the coronavirus crisis have not necessarily been the most efficient or rational, but rather the most legitimate and readily available. They bring attention to the socially constructed nature of technological interventions that were mobilized. Thus, rather than treating the pandemic and the technologies used for intervening in it as given and value-free, it is important to explore the complex and contested institutional dynamics involved.

Zheng and Walsham propose an "intersectional" perspective to understand the digital inequality that has been exposed and magnified under the COVID-19 crisis. Adopting this critical perspective, the authors highlight that digital technologies are not just 'solutions' and 'innovations' but intersect with and (re)produce structural stratifications such as gender, race and class. They challenge the adequacy of earlier notions of the 'digital divide' and put forward an alternative view in which digital technology is implicated in complex and intersectional systems of power. As such, the authors highlight the important implications for the subjectivity of individuals who are socially positioned within social orders.

Taken together, the eight articles included in this special issue shed new light on the complexities and tensions that are inherent in

Table 1
Summary of Special Issue Articles and how they relate to the three perspectives on crisis.

	Crisis as Opportunity	Crisis as Disruption	Crisis as Exposure	Level of analysis	Key policy and practice implications
(Oborn, Pilosof, Hinings, & Zimlichman)	Crisis situations are open to rapid innovation, with established ways of working replaced by alternative practices guided by institutional logics.	Professionals and organizational stakeholders improvise multiple uses of telemedicine technology to create safe spaces and interact with professional colleagues and patients from a distance.		Organizational Occupational Societal	Decision makers need to develop greater awareness and openness to the multiple logics and technology affordances that are important for shaping and influencing the success of their organization.
(Orlikowski & Scott)	Crisis creates liminal conditions of iterative experimentation and implementation. This is a continuous process of leveraging tensions and creating opportunities.	Crises generate tensions that can be *pragmatic* (existing practices are strained), *tactical* (practices are interrupted), and *existential* (practices are discontinued). Different tensions may be leveraged to produce digital innovations.		Organizational Practices	Practitioners may be sensitized to reframe mindsets and reposition actions, identifying and leveraging tensions generatively through (ongoing) digital work in developing liminal innovations in practice.
(Majchrzak & Shepherd)	Crowd based innovations mobilize resources, build community and facilitate learning in creating compassionate ventures.		Crises reveal the vulnerability of victims and the value of local communities, which can provide important resources.	Individuals Community Organizational	Agencies responsible for responding to adverse events should not focus exclusively on how emergency-response organizations coordinate with each other. Instead, focus some of their attention and resources on helping victims and local communities to create new ventures to help the victims directly.
(Whillans, Perlow, & Turek)	As they shift to remote working, knowledge workers experiment with which team activities to perform and how.	Crises prompt previously collocated knowledge workers to adapt and reflect on their use of digital technology to perform teamwork activities.		Groups Organizational	Teams and managers need to track core teamwork activities and pay attention to the activities that "go missing," encouraging continued experimentation.
(Leonardi, Woo, & Barley)		Models are not crystal balls yet become useful through processes in which various actors engage in heterogeneous construction of their uncertain future.	The role simulation models play in decision-making and policy development becomes particularly visible during crisis.	Organizational Occupational Societal	Policy makers and managers need to remain vigilant to the dangers of interpreting model outputs without critical attention to their underlying complexity and the ways in which the choices made in building these models.
(Faraj, Renno, & Bharadwaj)		There are nuances when radically framing taken-for-granted ways of working and shifting toward the digital realm.	Previously hidden weaknesses and limits in the way organizations engage with digitalization become visible.	Organizational Societal	Policy makers should provide access to populations and organizations that are excluded from digitalization. Organizations need to build flexibility, safety and resilience of increasingly interconnected supply chains within and across political jurisdictions.
(Zilber & Goodman)		Responses to crisis through digital technologies include complex and contested institutional dynamics. Multiple institutional actors shape how technologies are used and how technological responses are being localized.	Crises reveal possible misconceptions in regard to the use of technologies as a remedy of all things.	Societal Organizational	Governments need to broaden the types of knowledge and the diverse experiences upon which they build in times of crisis. They need to become culturally sensitive and include social scientists, who can critically assess the ways of thinking, and habitual, taken for granted, responses to a crisis.
(Zheng & Walsham)			In times of crisis, the existing digital divide is magnified. Digital inequality intersects and exacerbates existing structural inequalities.	Societal Organizational	Policy makers should focus not only on technologies and skill training, but associative interventions and supportive networks that address some of the underlying vulnerabilities of disadvantaged groups.

emergent organizational and societal responses to crises in the digital age. Collectively, these studies raise a number of issues and generate a series of questions that require the attention of both organizational and IS scholars.

Avenues for future research

Investigating the use of digital technologies in times of crisis raises fascinating and novel avenues for future research. We propose a few directions for future work that stem from our analysis. One direction that emerges from the acceleration of innovation and experimentation is further work on the relationship between temporality and technologies related to work and innovation processes (Feldman, Reid, & Mazmanian, 2020; Reinecke, Suddaby, Langley, & Tsoukas, 2020; Oborn & Barrett, 2021). The sociology literature has theorized how digital technologies are creating a "high speed society" (Rosa, 2013), yet we lack a deeper understanding of the temporal dynamics and implications of acceleration. To improve our understanding requires exploration of the temporal work (Kaplan & Orlikowski, 2013)involved in accelerating innovation in and across organizations in general and the "golden rush" to AI in particular. Furthermore, while we began discussing the response to crisis through digital technologies, our focus was on the short-term. It is crucial that future research examines the long-term consequences of crises at the level of work, occupations and organizations.

A second direction for future research is around the various uses and development of digital technologies beyond enabling work continuity through the temporary set-up of digital "safe zones". For instance, we can imagine virtual and augmented reality technologies being recurrently used to enrich social interactions, co-create knowledge and enculturate new members to organizations. We may also witness organizations proactively designing modularizable work processes to make them fit for virtual environments (George, Lakhani, & Puranam, 2020). Furthermore, there is a need to further investigate the disconnect across practices that has been created due to the shift to the digital spaces. For example, as organizations shifted toward virtual environments and heavily relied on their employees 'working from home' during the COVID-19 crisis, the associated HR and legal codes were not updated in response to this crisis and still largely reflected "the nine-to-five office culture".[11] More broadly, as the temporary transition to remote virtual work gets prolonged, it surfaces myriad questions on the digitally based practices and processes enabling or impeding organizational identification, team cohesiveness and coordination that used to heavily rely on in-person interaction. Further, with the pandemic there is a rise of surveillance through increased deployment of corporate 'tattleware' to watch over employees working from home (Faraj et al., 2021). Future research could usefully examine whether this unprecedented encroachment of corporate surveillance continues to be tolerated by society or whether a recalibration of HR practices ensues with worker resistance to algorithmic oversight through practices of 'algoactivism' (Faraj et al., 2021).

A third direction that warrants future research is the role of online communities (Faraj, Jarvenpaa, & Majchrzak, 2011) in times of crisis. Specifically, prior research has illustrated the ability of online peer-production communities to create informal structures and processes that are stable over time (Arazy, Daxenberger, Lifshitz-Assaf, Nov, & Gurevych, 2016). The COVID-19 crisis raised many questions around the stability of such communities, such as Linux and Wikipedia.[12] This invites researchers to explore variations in the ways online communities perform resilience as well as to examine whether and how the fluidity of membership that characterizes online communities affects positively or negatively resilience (Faraj et al., 2011). Another aspect for further exploration concerns the formation of new kinds of relationships between online communities and organizations. Communities and crowd based digital innovation play an increasingly crucial role in times of crisis (Majchrzak and Shepherd, 2021). As organizations recognize the importance of online communities in times of crisis, do they intensify their engagement with them and how? More broadly, the evolving relationship between different types of online communities and organizations in times of crisis warrants further study.

Finally, future research needs to better map the different kinds of problematic dependencies on digital technologies and platforms that are exacerbated during crisis. While digital technologies enable organizations to respond to crisis, growing reliance on digital technology entails new forms of risks. For example, prior research highlights that growing dependence of financial markets on electronic trading platforms may contribute to major inefficiencies and new crises (Barrett & Scott, 2004; Orlikowski & Scott, 2021). More research is needed to examine the diverse consequences of, and perils, engendered by the increased dependence on digital technology. As we have seen with the COVID crisis, there are increasing interdependencies between crises (e.g. health, economic, environmental) and future work could usefully examine how overdependence on digital technologies may lead to systemic risk, and how this is accentuated by the cascading of crises over time. Such work would attend to the riskscapes emerging with the scaling of digital innovation (Barrett, 2020; Oborn, Barrett, Orlikowski, & Kim, 2019).

To conclude, we believe that the COVID-19 crisis has opened a host of new research questions for organizational and IS scholars to explore. We are inspired by Kuhn, who "recognize[d] crisis [as] an appropriate prelude to the emergence of new theories" (Kuhn, 1962, p. 85). We are also reflective of the emerging digital inequalities and whether we are indeed making a better world with digital technologies (Walsham, 2001, 2012). We hope that this special issue will stimulate and accelerate the development of new theoretical insight into the ways digital technologies are used in organizations, communities and occupations during crises and beyond.

Acknowledgments

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[11] https://www.ft.com/content/840f5c9b-9189-4653-84ba-d27dbf2dae3d
[12] https://www.linuxfoundation.org/en/blog/how-open-source-development-provides-a-roadmap-for-digital-trust-security-safety-and-virtual-work/

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