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Learning during crisis as a 'war for meaning': The case of the German *Escherichia coli* outbreak in 2011

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Abstract

Previous research has examined learning *from* crises. However, comparatively neglected is the analysis of learning *during* such events. This explorative case study reports findings on how learning took place during the outbreak of *Escherichia coli* in Germany in 2011, which resulted in 53 fatalities. We identify three broad communities: (a) public agencies, (b) research institutions and hospitals and (c) opposition parties and non-governmental organizations. We discuss their conflicting interests in the face of the unfolding crisis, and we explore how their (re)actions and sensemaking affected the way the outbreak progressed. By conceptualizing the crisis as an epistemic object, we show how transepistemic sensemaking both enabled and constrained learning. The crisis, as an epistemic object, is a contested terrain, and each epistemic group's commitments influenced the trajectory of their responses, demanding a processual perspective to capture the constantly realigning ways actors interpret and react upon the crisis. This study demonstrates how learning *during* a crisis may thus be transitory since it is hampered by a 'war for meaning'. This 'war' potentially also prevents significant learning subsequent to a crisis, as institutional and epistemic commitments are quickly reformed and transepistemic engagements are closed.

Keywords

Crisis, epistemic object, learning, outbreak, sensemaking, war for meaning

Introduction

Crises – understood for the purposes of this study as unforeseen incidents that result in severe damage to people, organizations or the environment – represent a pervasive risk in modern society (Beck, 2009). The causes can stem from virtually every area of life, for instance, environmental

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disasters (e.g. Auf der Heide, 1989), terrorist acts (e.g. McLeish and Nightingale, 2007) or corruption scandals (e.g. Misangyi et al., 2008). These events unfold rapidly, involving multiple geographies, societies, organizations and individuals, and their trajectories are difficult to predict and manage. Studies of crises are becoming increasingly important to researchers from many theoretical angles, not least those interested in the relationships between learning and crisis (Boin, 2008; Moynihan, 2008, 2009; Smith and Elliott, 2007), but the field is still immature (Mellahi and Wilkinson, 2010).

Previous research on learning primarily tends to concentrate on learning *from* crises. Moreover, one of the central premises of the different streams of research is that such 'shocks' (Clemens and Cook, 1999) result – most of the time – in substantial changes concerning the way humans or organizations have to pursue their objectives, perhaps due to legal changes. However, our study explores how and why measures taken to manage crisis as the event unfolds do not necessarily lead to significant learning *during* the event. By doing so, we highlight implications for the scale and scope of learning *from* such an event. Our findings are highly relevant since previous research studies show how, despite the impact of crises, individuals, organizations and institutional fields actually seldom appear to learn effectively from such extreme events (Elliott and Smith, 2006; Lampel et al., 2009). Documenting change as new procedures or policies does not necessarily lead to behavioural change, perhaps due to deep-seated cultural and institutional inertia (Boin, 2008). Learning, if it occurs during the event, will depend on how groups of actors work together to manage the crisis, and thus, any learning will evolve while working, or learning-in-working (Kakavelakis and Edwards, 2011). Competing groups of actors are likely to mean that negotiating the appropriate course of action is contested (Roberts, 2006), and this is heightened during crisis periods when actors rely on experience, heuristics or epistemic values in order to judge the appropriateness of actions through constant sensemaking (Knorr-Cetina, 2003; Weick, 1995). In other words, we focus on the specific research question: 'how do crises influence the learning trajectories of organizations?'

We will address this research question by means of an explorative case study analysis of the large-scale, food-borne disease outbreak that involved enterohaemorrhagic *Escherichia coli* (EHEC), as well as the more severe outcome form of it – the haemolytic-uraemic syndrome (HUS) – in Germany in 2011. We will reconstruct how learning unfolded in the course of this crisis. In doing so, we provide contributions to the understanding of learning *during* crisis. First, we highlight how crises create a contested terrain against which competing epistemic values define the sensemaking activity within groups of actors. Second, we recognize that this 'war for meaning' inevitably creates barriers to learning as the political objectives of different groups of actors prevail over consensus. Third, our framework highlights how this conflicted view of the events diminishes the likelihood that learning during the crisis will endure.

In the remainder of this article, we proceed as follows: first, we position our study in the literature on learning in the face of crises, sensemaking and epistemic objects. Second, we introduce our research setting – the field of public health, constantly in danger of yet another unexpected disease outbreak. Third, we delineate how we have collected and analysed the data. Fourth, we report upon the interaction between groups of actors and their sensemaking activity in relation to the *E. coli* outbreak. We conclude by offering a framework, suggesting that our findings might be applicable to related settings and identify areas for future research.

Learning in the face of crises

Research into learning in the face of crises is expanding (e.g. Lampel et al., 2009; Marucheck et al., 2011). However, work that addresses learning *from* crises dominates the field. Nevertheless,

research on unexpected events, such as food-borne pathogens or disease outbreaks, has lately gained increased attention from management and policy scholars. For example, a recent special issue by Lampel et al. (2009) explored learning from and through rare events, and an article by Moynihan (2008) examined intra-crisis learning following an animal disease outbreak. In line with the objectives of our study, most of the research focuses on the importance of the respective events for influencing trajectories of change, for example, elucidating how disasters serve sensemaking and restructuring (Christianson et al., 2009) and how organizations cope with strategic surprises (Bechky and Okhuysen, 2011), or corruption scandals as triggers of change (Misangyi et al., 2008). Following this stream of research, we concentrate upon events that are unforeseen and have detrimental consequences for organizations involved and/or people affected. Nonetheless, as opposed to prior research, we shed light specifically upon learning *during*, rather than *from*, crises, which tends to remain a largely unchartered territory (e.g. Lampel et al., 2009). We do recognize, however, that the difficulties involved in learning *during* the event may influence potential to learn *from* crisis. Our study is therefore contributing to understanding the challenges of both intra- and inter-crisis learning.

Sensemaking across epistemic groups of actors

A key premise for this article is that actors work in specific overarching professional or institutional arenas, which may influence work and learning practices (Berends et al., 2003). Nevertheless, solutions to problems emerge from discursive interactions through transepistemic relations, and with cognizance of others' institutional commitments (Knorr-Cetina, 1983). Sensemaking is understood as an ongoing social accomplishment related to the ways actors negotiate the meaning of what they interpret (Weick, 1995), both through face-to-face interactions and through instantiated non-present actors within the context of action (Knorr-Cetina, 1983). Weick (1988) suggests that sensemaking will thus differ between such groups of actors and organizations, and between levels. Therefore, sensemaking relates to reflection-in-action (Yanow and Tsoukas, 2009), whereby actors constantly (re)produce their environment as they make sense of unfolding situations. Weick (1995) labels this process as enactment. Hence, sensemaking is not a passive activity; it is an active, social accomplishment that has implications for how actors respond to situations and phenomena, such as crises.

Learning, then, is always part of some social system and reproduced by sensemaking. Practical coping arises from the institutionalized disposition to act and adapt instinctively to existing contingencies (Chia and Holt, 2006). Understanding local actions is thus dependent on understanding the potential influence and norms of the epistemic arenas of action in which the people are participating (Knorr-Cetina, 2003). The notion of epistemic arenas of action is important here as it serves to sensitize us to the peculiarities of how different actors relate to and represent an epistemic object within what Knorr-Cetina and Preda (2001) describe as 'trading zones'. An epistemic object is the locus of enquiry about which actors contest, and potentially exchange, meanings and representations (Knorr-Cetina, 1997). As such, actors continually (re)present and construct the object from within specific frames of reference but with knowledge about others' epistemic commitments. Following Knorr-Cetina (1982, 2003), an epistemic arena of action is therefore a more inclusive term than, for instance, scientific community. For her, epistemic arenas of action comprise the confluence of different people from different disciplines (e.g. scientists, media people, laypersons and public managers) who negotiate the meaning of both technical and non-technical issues. Examples are natural scientists who present their research by means of artefacts and issuing research proposals. They construct their research by refining it in line with the suggestions made

by those public managers who offer feedback, review and issue research grants. Hence, the notion of transepistemic arenas of action differs from the community of practice conception of situated learning (Lave and Wenger, 1991) as the latter approach would include only fellow researchers or alternatively the public managers, in each case treating them as separate phenomena.

These arenas of action revolve around epistemic objects, which actors (re)produce through their interaction with it. Thus, for Knorr-Cetina (1982), epistemic objects produce meaning and are continually unfolding. Epistemic objects (such as a crisis) generate practices, which are thus bounded but lack completeness (Knorr-Cetina and Preda, 2001). The reason for this observation is that such objects, as a locus of enquiry, offer different possibilities on how people can make sense of them and enact them (Knorr-Cetina, 1997; Miettinen and Virkkunen, 2005). Consequently, difficulties of knowledge sharing and learning occur between different arenas of action due to differences in language, the locus of practice and different conceptualizations of the products or activities (Bechky, 2003). Just explicating the knowledge produced in an arena of action does not necessarily overcome these barriers since the epistemic values that diverse arenas use to interpret it are fundamentally different (McGivern and Dopson, 2010). However, it is not just the different values that define the learning trajectories since context fundamentally influences the degree to which people can create and transfer new knowledge, and learn to practice differently (Roberts, 2006). We argue that, in a crisis, it is possible to identify a number of arenas of action whose conceptions, sensemaking and practices will differ significantly, as institutional actors engage in making sense of the situation (Weick, 1995). Moreover, the crisis unfolds both temporally (with its own logics and trajectory), and through the enactment of solutions generated within contested transepistemic arenas of action. The crisis, as an epistemic object, is in essence an open-ended projection around which transepistemic actors orientate their inter-subjective knowledge making and learning activities (Knorr-Cetina, 2003; Miettinen and Virkkunen, 2005).

In such a context, it is likely that ambiguity will amplify the differences as actors struggle to enact a response and decide a course of action. It is not surprising, then, that in times of crisis, this heterogeneity of epistemic groups of actors result in learning that is fragmented, contested and sometimes ignored. We argue that examining how learning unfolds in such an ambiguous, emergent relational and proximal space provides a new and novel contribution, since it potentially highlights an essential element of learning *during* crisis, a previously under-researched field.

Research context

EHEC infections are reported frequently (about 800 per annum in Germany), but as the EHEC outbreak in Germany during 2011 has shown, a specific form of EHEC can affect a large number of people and result in death. Between May and June 2011, the EHEC (HUS) affected a total of 4321 patients and caused 53 fatalities (Robert Koch-Institute (RKI), 2011b). The unexpected outbreak stirred intense public and media debates within Germany and throughout Europe. Financial damages occurred, highlighting the societal *and* managerial relevance of the outbreak. Given that the outbreak primarily affected people in Northern Germany, we focus our analysis on German institutions and organizations to offer a coherent boundary for our analysis. For the purposes of this study, we benefited from serendipity, as we were able not only to gather data retrospectively, as is more commonly pursued in related research on sensemaking and crises (e.g. Christianson et al., 2009), but we also gathered real-time data. At the outbreak of the EHEC (HUS) crisis in Germany in April 2011, we took advantage of our ongoing engagement with relevant organizations in a research project regarding food pathogens and food safety. Given the engagement with the field in 'real-time', we were able to follow new theory-building leads, while accessing key persons in the

respective organizations and institutions. We could therefore engage in data access and interpretation for the analysis of learning *during* crisis.

Methods

Given that previous research has hardly addressed learning during crises, we make use of an explorative approach (Yin, 2009). An interpretative research methodology (Lincoln and Guba, 1985) is appropriate to answer the phenomenon-driven guiding research question of how crises influence the actors learning trajectories, as it allows us to capture how learning and the complex event unfolded from the respondents' perspective and is similar to other research into such events (Langley, 1999).

Data collection

To heighten the validity of the findings (Yin, 2009: 114–118), we made use of the following data sources: First, independent press and broadcast coverage was analysed in order to track changes in the way actors reinterpret and act upon the crisis from a societal and media perspective. Second, we conducted 33 interviews with key respondents from different organizations (11 research institutions, 7 hospitals, 8 public agencies, 4 food producers, 1 non-governmental organization (NGO), 1 local state agency and 1 trade association). These sources represented different functions affected by, and involved in learning before, during and after the crisis. Others have employed a similar approach when doing analyses in the field of sensemaking in the face of organizational crisis situations (e.g. Christianson et al., 2009), and it serves to account for the subjective experiences and assessments of the persons involved from the German organizations and institutions that dealt with the crisis. Third, we collected data from five organized events in the fields of public and veterinary health (i.e. conferences and workshops like the annual meeting of the German Society for Nephrology) subsequent to the outbreak. We drew upon material from participant observation from these venues, the Internet and public announcements around the respective venues.

Data analysis

With regard to this study, data analysis went roughly through four separate stages that were in reality interlinked but are sketched separately for analytical purposes: in the first stage, we collected and stored all the data we gathered in a case study database to heighten reliability as suggested by Yin (2009). Cyclical rereading and preparing of protocols would subsequently form the basis for gaining a better understanding for the way actors faced the crisis and learned in situ. Towards this end, we also analysed the outbreak activities of the various actors along a temporal dimension to capture the unfolding processes (Langley, 1999). In the second stage, we wrote descriptions of how learning during crisis took place and was enacted. We discussed the resulting detailed descriptions in an interdisciplinary research team and drew several charts to visualize actors and their interpretations to obtain an overview. In the third stage, we condensed the empirical data by conducting a joint analysis for each group of actors, for example, public authorities vis-a-vis NGOs. The emergent data structure surfaced, among others, instances of ad hoc learning that provided opportunities to explore learning-in-work for each group of actors identified in the study. Finally, we then reconstructed these aspects in the form of a narrative version of events, which is included below.

Results: contested sensemaking and learning during crisis

We identified three key groups of actors involved in sensemaking related to the outbreak. The first group consists of hospitals and research institutions, which were primarily responsible for dealing with the affected patients and finding the source of the outbreak. Second, the public agencies – notably the national and federal state ministries – also tried to manage the situation and to demonstrate that the political apparatus of Government was in control of contingencies. The third group of actors, the opposition parties and NGOs, had their own political agenda. These groups focused on criticism of existing systems and preparedness, as well as the negative influence of agribusiness on food security. Such actions increased ambiguity in an already difficult situation. However, all groups contributed their own perspective, and the resulting incoherent picture, set in the context of wider institutional and public concerns, provides a challenging forum for learning. We illustrate this contested terrain and 'war of meaning' through two specific challenges raised during the event: the search for the source of the outbreak and managing overstretched resources.

Searching for the source: claim, counter-claim and recrimination

All organizations involved seemed to recognize that discovering the source of the outbreak was of key importance in order to derive conclusions regarding how to stop further contaminations (Bielaszewska et al., 2011). The research institutions and hospitals involved were trying to solve the crisis and alleviate harm done to patients (I-7). The public agencies were primarily keen on trying to show that they were in at least partial control of events (I-10). Thus, the respective institutions put great effort into attempting to discover the source of the outbreak and to communicate the outcomes to reassure the public. In the course of doing so, public agencies, hospitals and research institutions were constantly refining their interpretations and methods concerning how to respond and how to detect the source of the outbreak.

During this time, there was the introduction of telephone conferences across Germany and throughout Europe. Different constellations of organizations involved gathered to exchange the latest ideas on how to proceed and track down the source of the outbreak. For example, an interviewee commented about the exchanges on a European level:

> there was a telephone conference […] from the European Center for Disease Control [where from] every country someone participated […] these experts confronted us [the German participants] with questions. (I-28)

Thus, the participants used these telephone conferences as opportunities to exchange knowledge, to learn from others and to allow challenges to their approach and understanding of the situation they faced.

Another example of opening up sensemaking frames was when leading medical practitioners and hospital managers changed the way they communicated about the spread of the disease. They started to exchange information regularly via online forums and newsletters from the German Society of Nephrologists (I-19). Although the online forums and newsletter had existed already for lobbying and disseminating information, the forums evolved during the event to become effective ways of interacting with other experts, sharing ideas and engaging in virtual conversations to make sense of the crisis. In addition, medical scientific journals deviated from their ordinary publishing schedules and prioritized publications related to EHEC (I-11). In these publications, authors frequently drew attention to the lack of understanding and demanded further enquiries. Thus, in the first two instances, technology enabled epistemic interactions to be broadened and shared beyond

the boundaries of existing research and medical communities, and the publication strategy highlighted the lack of scientific knowledge available at that time.

While the medical and research communities searched for a source, the public agencies were keen to show that they were still in control of events. One of the ways they did this was to provide information to the public via the media. However, such was their desire to demonstrate competence, they provided information prematurely, before the medical and research community had confirmed the source of the outbreak more substantially and unequivocally. They communicated early results to establish trust and reassure the public, and there were frequent announcements concerning the current state of the outbreak and intermediate successes. However, in effect, they exacerbated the ambiguity and raised tensions because the information released was premature and would change constantly as events unfolded (I-10; I-23). Their action stems from a specific dilemma the respective agencies were facing. On the one hand, they wanted to keep the public up to date and communicate progress; on the other hand, they were not faced with clear and unequivocal findings, and their communication strategy actually exacerbated the uncertainty, certainly in the minds of the public and media outlets, and diverted valuable resources. These premature pronouncements thus created tensions between the public agencies and science communities during the crisis (I-07). For example, the senator from the Office for Health and Consumerism in the federal state of Hamburg announced very early that the science community had identified cucumbers as the source of contaminations, which caused difficulties as the final report of the Federal Institute for Risk Assessment documents:

> When epidemiological examinations suggested a causal connection between the consumption of salad and contraction of the illness, the BfR [Federal Institute for Risk Assessment] and RKI [Robert Koch-Institute] recommended that consumers refrain from eating raw tomatoes, cucumber and green salads. The EHEC pathogens found by the authorities in Hamburg on Spanish cucumbers caused quite a stir all over Europe. (Federal Institute for Risk Assessment, 2012: 13)

It subsequently transpired that the cucumbers were not the source of the infection, and this official received extensive criticism for having aired this warning too early. For instance, the European Commissioner for Health and Consumer Policy, John Dalli, criticized these premature conclusions:

> I stress that the outbreak is limited geographically to the area surrounding the city of Hamburg, so there is no reason to take action on a European level. [EU-wide] measures against any product are disproportionate. (Dalli in Dowling et al., 2011)

Nevertheless, similar statements were observable by other ministers and leading figures, as the overarching aim was both to gain positive media coverage by announcing successes, and to show how well the public agencies were able to deal with the evolving situation (I-11).

While this was occurring, NGOs and opposition parties engaged in the debate about the crisis, making sense of what was happening from within their own political frameworks. The debate created further tensions by presenting the role of the government, agribusiness and factory farming as contributing to the problem, rather than resolving it. Pointing out failures in handling a crisis represents a common feature of everyday politics. Therefore, it is not surprising that the opposition parties were keen to highlight delays in detecting the source of the infection (I-8). However, in this case, the confusion about the source provided opposition the opportunity to challenge the capacity and competence of public agencies to make reasoned judgements about the best course of action. In a similar vein, the NGO foodwatch made several announcements addressing similar shortcomings.

These instances resulted in further calls to (re)allocate resources needed to improve the situation. The call for a switch to increased organic farming was one such suggestion since the NGOs portrayed it as being more sustainable and secure in comparison to industrialized agribusinesses (I-15). However, the relevance of this approach came under scrutiny when, at one point, the public agencies announced that an organic farm was suspected as being a potential source of the pathogen. Such contradictory evidence created further uncertainty about food security, the cause of the outbreak and how to manage long-term food security.

Another issue that the opposition groups raised was installing a central federal agency, capable of dealing with such dangerous outbreaks (I-5; I-11; I-17). Their proposal implied that existing practices and institutions had failed, or were failing, and they presented a challenging view of the government's ability to deal with its institutional responsibilities, to manage the crisis and to identify the source of the outbreak. The increasing pressure placed on the government was not only coming from the opposition parties and NGOs but also from supranational organizations like the World Health Organization or the European Union, which demanded immediate actions. The public agencies in Germany transferred this pressure to the respective research institutions. For instance, the RKI announced,

> Daily updates sent by the RKI via email to a distribution list enabled a rapid and comprehensive circulation of information on the epidemiological situation and new developments. When necessary, special information reports or teleconferences (TCs) took place. The general public was kept informed through press releases, press conferences and interviews by the media with the RKI as well as on the RKI website. (RKI, 2011a)

All groups aired their claim, counter-claim and recrimination publicly as the crisis and policy response continued to evolve.

The medical practitioners had been continuously searching for information from patients to track down the source of the outbreak. In doing so, they attempted to refine their working methods. The introduction of a recipe-based restaurant cohort study is a good example. The method culminated in identifying bamboo shoots offered by a restaurant in the northern German city of Luebeck (Federal Institute for Risk Assessment et al., 2011). It is particularly noteworthy as the method originated from criminology. The medical practitioners and representatives of research institutions like the RKI adapted the method when they met by chance with colleagues from the police departments while coordinating other issues. Subsequently, it was revised on a trial-and-error basis and refined according to the needs and circumstances of the present outbreak:

> In order to be less dependent on raw vegetable consumption memory of patients and control subjects during the analysis, the RKI pursued the following approach with the help of a 'recipe-based restaurant cohort study' […] The group participants were asked which meal they had ordered (photographs were used as a reminder) [and] the chef of the restaurant was interviewed in detail concerning quantities of each ingredient went into which meals and how each meal was prepared. (RKI, 2011a: 20–21)

Using the cohort study method, the RKI eventually traced the source of the outbreak, but by the time they achieved this, the crisis had effectively ended. However, research institutes such as the Institute for Hygiene/National Consulting Laboratory for HUS, University of Muenster, were quick to highlight that unknown latent dangers are still present and likely to recur:

> All experts agreed upon one point – after the outbreak is as before the outbreak! There is no all-comprehensive protection against zoonotic infection diseases, but by means of intensive research the

probabilities of future epidemics can be reduced and in the case of an outbreak immediate counteraction can be launched. (Benninger, 2011)

Therefore, while the medical and science community found the source of the epidemic, the argument from scientific researchers seems to be that there is limited effective change to prevent a recurrence. It should be noted, of course, that the research institutes involved had an interest in highlighting the latent dangers in the system, and their sensemaking supports their own agenda (I-10). Their claim about the future is made in relation to gaining resources from other key actors involved, the public agencies.

Coping with capacity: suspending and reorganizing structures

At the beginning of the outbreak, medical doctors were required to notify EHEC infections to the local and state health agencies by fax within 24 hours. However, in effect, it could take up to 2 weeks before the data reached the federal level. The delay in information processing meant that it took considerably longer to understand the scale and scope of the outbreak. The local health agencies in the federal states had until the third working day of the following week to report the infection. It is at this point that the federal agencies processed the data and subsequently forwarded it to national agencies, which was the RKI. Public holidays and agencies using the post extended the reporting lag. As a result, the agency for health and consumer protection in Hamburg first invited the RKI to assist them on 19 May, 18 days after the official start of the epidemic (I-23). The delay impeded timely access to information for the RKI to monitor the spread of the outbreak. Subsequently, the Federal Ministry for Health issued a directive to require reporting direct to the RKI within 24 hours. Thus, the change in reporting systems is an example of how institutions worked across boundaries to repair failings in notification practices. Engagement across boundaries led to the institutionalization of new routines during and after the crisis that affected a number of practice domains. At the time of writing, the Federal Minister for Health announced the introduction of legislative changes to the Infection Protection Act in order to deal with notification protocols resulting from learning during the epidemic. Thus, the interactions within the transepistemic arena of action resulted in ministers adjusting policy to cope with the learning that occurred across disciplines.

Hospitals and public agencies found the existing structures to be inadequate to respond to the challenges faced by their organizations when dealing with the outbreak. As the crisis evolved, hospitals and public agencies implemented changes and improvised roles in order to cope. Doctors and hospital administrators ignored formal protocols for establishing patient's health insurance, since the existing procedures could delay treatment. The head of a leading nephrology unit in the city of Hamburg reported that he was simply not waiting for any approvals before introducing novel medications for the patients since the patients ran the risk of dying (I-19). Thus, while still being confused about the source of the outbreak, medics were experimenting with treatments to find out what might work best. The head of the hospital supported the medics who were taking such an approach and in effect gave them the scope to proceed quickly and in the best interests of the patients.

Informal deviations from existing routines occurred when large hospitals started collaborating with smaller hospitals. Usually, as the leader of a nephrology unit in a large northern hospital reported, 'there are severe animosities between large and smaller hospitals, but that didn't count during the crisis' (I-28). They exchanged qualified staff and patients across hospitals, regardless of the size. The medical directors of the three hospitals primarily involved confirmed that rotating staff and patients on this scale was unprecedented and proved to be successful (I-25; I-28).

In the course of the outbreak, the hospitals and research institutions realized that they were not capable of handling the crisis on their own. In the hospitals, they used public awareness and media attention as a window of opportunity in order to obtain further resources. For instance, the vice president of the Hannover Medical School on behalf of the hospitals involved in treating people affected by EHEC or HUS announced the following:

> We as hospitals with the maximum capacity of care cannot carry the full societal risk of epidemics and plagues […] Three quarters of an intensive care unit are blocked due to EHEC. (Spiegel Online, 2011)

Apart from struggling to identify the specific EHEC strain and suffering from overstretch in terms of human resources and patient capacities, they were also unable to deal with the large number of institutions involved in a coherent fashion. The different institutions included national research institutes (e.g. RKI), local hospitals, the federal state ministries and their 16 federal state counterparts, which created confusion over responsibilities and competences and resulted in a change to coordinating structures, discussed later.

Overstretch, evident in the crisis, was also used by the opposition and NGOs to argue that the public agencies had not done enough to prepare for such an event and that they were lagging in preparedness behind other comparable countries. Through the media, politicians from the opposition parties frequently aired criticism of the crisis response; for instance, the leading public health expert of the social democrats said during a discussion on the subject,

> educating [the doctors], right, we've got to invest in it, and recognize that also concerning the DRG [diagnostic related groups] that's obvious and I don't want to point out here that it is actually you [pointing at the Federal Minister of Health in an ironic manner] who is in position to do so. (Deutsche Gesellschaft für Nephrologie, 2011)

One issue that they raised was the need to install a central federal agency, capable of dealing with such dangerous outbreaks (I-5; I-11; I-17). The implication was that existing practices and institutions had failed, and the government should change existing institutional responsibilities and agencies. In other words, the opposition and NGOs used the uncertainty surrounding the outbreak to leverage change. For instance, Reinhard Brunkhorst, chairman of the German Society for Nephrology argued,

> for exceptional cases like the current epidemic a single command structure is needed […] at the Robert Koch-Institute […]. In the USA there is, for instance, the 'Center For Disease Control'. We also need something similar at the European Level. (Brunkhorst in Beneker, 2011)

In order to cope with the escalating situation, the federal government eventually summarily installed an 'EHEC Task Force' in order to co-ordinate and concentrate resources across federal and state agencies while collaborating with research institutions and scientists. Although it remains an empirical question whether the respective task force was, or is, operating effectively, we can clearly identify it as being a result of the EHEC outbreak. After the crisis, the government did establish the task force as a permanent inter-organizational constellation (after they closed it down for a short period on 5 July 2011). Its role is to support the public agencies, in particular the Federal Ministry of Health and the Federal Ministry of Food, Agriculture and Consumer Protection in the face of future crises (Federal Government, 2011). What is more, the EHEC Task Force and its institutionalization epitomizes an instance of learning both *during* and *from* the crisis.

Another less tangible outcome was the interpersonal connections established during the out-break (I- 23). These connections created a network 'to be relied upon in the case of another outbreak' (I-28). In other words, the practice of managing the outbreak created relationships that may provide a latent capacity to manage future outbreaks or similar incidents. The potential latent capacity can be seen not only in the earlier discussion about searching for the source of the outbreak but also in the liminal suspension of existing structures evident in the attempts to man-age overstretch in the system. The task force is the formal and institutionalized response to capture learning from the crisis. However, many of the key transepistemic interactions occurred through informal networks, virtual communications and discussions rather than through formal protocols and policies (I-23; I-25). Capturing the transient, emergent and ephemeral knowledge generated in these interactions is much more challenging and has significant implications for learning from crisis.

Discussion – learning during crisis as contested terrain

We organized the case explanations by integrating different responses to events within this tran-sepistemic arena of action. In doing so, we showed how actors interpret the outbreak differently and how the crisis, as an epistemic object, continually unfolds. Such a conceptualization has impli-cations for sensemaking, and we demonstrated how organizational actors responded to the situa-tion differently. Sensemaking and epistemic commitments thus led to competing and fragmented views of events. As such, the learning-in-working is largely negotiated, transient and ambiguous. There are specific occurrences useful for understanding future ways of dealing with such events. However, the level of ambiguity and the number of actors involved suggest that the alternative conceptions of events influence the opportunities for, and the scale of, learning that is possible. Our findings thus provide insight into why learning during crisis is contested, political and transient, which in turn has implications for the durability of any learning achieved.

More precisely, the organizations affected by the outbreak employ different ways to deal with the outbreak, which affects the way they pursue and achieve learning during and after the crisis. Although our research setting is unusual to some extent, we suggest that our findings from the case of a food-borne disease outbreak contribute to the literature, as we can generalize them to other settings where learning in uncertain situations is commonplace. Examples similar to our case include, inter alia, public agencies responding to other forms of disease outbreaks (Moynihan, 2008), political crisis situations (e.g. Allison and Zelikow, 1999) or natural disasters in general (Auf der Heide, 1989).

Generalizing from our empirical case, we contribute to the literature as follows: first, we offer a framework that highlights the role of crises (here: the disease outbreak) as epistemic objects (Knorr-Cetina, 1982) that are open and continually unfolding (Knorr-Cetina, 1997; Knorr-Cetina and Preda, 2001). While the event has its own trajectory and direction, the institutions that engage with it are within a transepistemic arena of action (Knorr-Cetina, 2003) shaped by their own epis-temic commitments, while being cognizant of others with whom they are interacting, across boundaries (Knorr-Cetina, 1982). In that sense, creating knowledge and learning is a competitive struggle, which we see between the constellations as they attempt to make sense of, and represent, what is happening. Numerous actors (here: research institutions and hospitals, public agencies in charge and NGOs and opposition parties) are involved in dealing with the crisis, in effect trying to achieve, among others, learning through the 'war for meaning'. The different groups of actors constantly engage in sensemaking (Weick, 1995) as they try to cope with the unfolding nature of the event by (re)producing their own frames of reference. Sensemaking in this connection can be

understood as a cycle between interpreting the crisis and (re)acting upon the crisis. In doing so, the sensemaking and enactment in response to the crises involves instantiating others into those sensemaking frames, which (partially at least) may influence the learning trajectories and possibilities.

Bearing the aforementioned in mind, we tentatively suggest that transepistemic arenas represent a generalizable concept that can be a useful analytical framework for management learning in contested contexts. Generalizing from our specific observations, we argue that contested or ambiguous events are an unfolding transepistemic object (Knorr-Cetina, 2003) against which groups of actors are continually updating their interpretations and actions (Knorr-Cetina, 1997; Knorr-Cetina and Preda, 2001). Where multiple agencies are involved, actors' judgments and responses depend on sensemaking activities that they negotiate against, or with, other epistemic communities' interpretations of the unfolding event. As a result, over the contested site (the transepistemic object), a 'war for meaning' unfolds and constantly evolves as different communities struggle to make sense of ambiguity. An example here would be the changes in measures taken by the governmental authorities following adverse NGO-, public- and media-related attention. This perspective also implies that scholars ought to pay attention to the way the transepistemic object changes over time, which demands processual analyses (Langley, 1999). Such an approach has to be sensitive to the temporal flow and the way actors engage in sensemaking while continuously (re)interpreting and (re)acting upon an unexpected event.

To illustrate our argument further, the transepistemic negotiation was happening when hospitals deviated from their usual routines to engage in learning by searching for solutions from others within the scientific and medical networks (i.e. reacting upon the crisis), and when they were confused by the scale and then unknown EHEC strain, and decided that they should test as yet unapproved drugs (i.e. interpreting the crisis). As sensemaking is processual in nature and not a static phenomenon, actors constantly (re)produce knowledge as they interpret, (re)act and (re)interpret the evolving crisis. This observation has another important implication. As different groups of actors are engaged in sensemaking – each with a different perspective upon the epistemic object – learning becomes an inherently political issue that is constantly subject to competing interpretations and enactments (Weick, 1995) by the differing groups of actors. Not surprisingly, perhaps, with regard to the governmental authorities and opposition parties that have differing perspectives almost 'by nature', what they learn during the crisis, and if they learn from the crisis, will be influenced by the depth of the institutionalized epistemic commitments and their interpretation and reaction to the evolving epistemic object. In the case of NGOs, for example, the spectre of organic farming being the cause of the outbreak, potentially challenged their sensemaking frames but did not subsequently lead to change in their opposition to industrialized farming.

Second and closely related, our study directs attention towards how learning unfolds *during* a crisis. Instead of rather linear assumptions about how to learn *from* crises, our findings suggest that actors are employing different measures that may, or may not support learning. The actual measures are manifest in the constant reproduction of activities pursued in time-space. We observed these constant reproductions for most activities. Crisis measures are employed intending to demonstrate legitimacy and competence of the established institutions (Brown, 2000; Moynihan, 2009). However, the most effective learning (the development of the cohort study and resource sharing) involved the ability to engage in learn-in-working (Kakavelakis and Edwards, 2011) through reflection and improvisation (Yanow and Tsoukas, 2009). That means that the durability of the practical ways of dealing with the crisis (here: the liminal suspension of structures and the development of real and virtual networks) is likely to be limited since structural and institutional barriers are quickly re-established (Elliott, 2009; Elliott and Smith, 2006). Institutional and epistemic commitments create inherent tensions in learning both *during* and *from* such incidents

(Turner and Gray, 2009). Herein, our results differ from previous conceptions of intra- and inter-crisis learning. The studies by Moynihan (2008, 2009), for example, have advanced our understanding about how particular inter-organizational constellations respond to crises. However, a key difference in our case is that the organizations were not expected to collaborate beforehand as in the cases reported by Moynihan (2008, 2009) where actors were able, among others, to adopt standard operating procedures. Instead, in our case, ad hoc learning across previously unrelated organizations took place, albeit the learning may not endure post crisis.

Third, we find that since an epistemic object is contested terrain, change, where accomplished, was only limited. As pointed out beforehand, the competing interests of the three constellations of actors identified result in 'fragmente[d] confetti knowledge' (I-8) and through a cacophony of voices that hardly represents the basis for substantial institutional change. The alternative conceptions of the evolving event reduces hopes that learning during the crisis is always capable of introducing genuine learning and change within, never mind across, the context of groups of actors revolving around an epistemic object. The reason is that the diverse groups of actors have enduring values that influence the participants' action frames (McGivern and Dopson, 2010). Making sense of the crisis is thus in some sense a 'war for meaning', in this case played out publicly in the media while several groups of actors make sense of the evolving epistemic object at stake. Hence, competing institutional environments limit the ability for reinterpretations of events and thus create a restricted repertoire of how to respond. Others' actions do not necessarily make sense from within an alternative epistemic world (Knorr-Cetina, 2003), and this means that the shared understanding necessary for collective learning is difficult to establish when the situation is ambiguous (Maitlis and Sonenshein, 2010). These differences in sensemaking thus continue after the event as institutions seek to legitimate their actions and positions through enquiry reports or post-event analysis that reconfirm existing institutional authority (Brown, 2000). As such, post-event learning is partial due to the lack of collective sensemaking that occurs both *during* and *after* the event – and such limited change informs the scale of learning possible before the next outbreak.

However, it is not our intention to paint an entirely bleak picture here. Two issues merit attention that appear to be only minor improvements but that do have the potential for improving the situation partially the next time a large-scale outbreak occurs. First, the Federal Government changed the EHEC task force from an improvised solution as a temporary organization (i.e. project) into a permanent organizational body (Müller-Seitz and Sydow, 2011). This represents evidence of the transition of intra-crisis learning (here: realizing the need for ad hoc collaboration across actors) to inter-crises learning (here: making the EHEC task force a permanent body; cf. also Moynihan, 2009). To put it differently, in effect, the task force represents the institutionalization of learning that occurred during the event and acknowledges, formally, that it was a useful way of managing the situation. The recognition of its usefulness occurred through interactions in the midst of action, learning-in-working (Kakavelakis and Edwards, 2011), between hospitals, research institutions and public agencies. The crisis, as an epistemic object, provided a focus where transepistemic work was able to influence a particular learning trajectory. However, which relations and which interactions were the most influential is difficult to know and, therefore, to repeat in the face of yet another crisis (Knorr-Cetina, 1983), and 'after the outbreak is as before the outbreak' (Benninger, 2011).

The second instance relates to the ties established across public agencies and research institutions that had not been collaborating beforehand. The liminal suspension of existing structures, previously identified by Powley (2009) in his analysis of crisis recovery following shootings within an American University, was also evident in this case. Medical directors and scientists quickly circumvented prior organizational structures to allow new social interaction spaces in order to help to

manage the crisis. It is during these interactions that a solution was found, and they created new meanings through collective sensemaking (Weick, 1995). The interpersonal and inter-organizational connections ensuing from collaboration during the crisis resulted in actors being sensitive to each others' competences, which helped to define the trajectory of learning. The most effective and crucial learning practices involved the ability to engage in research, innovation and improvisation in order to suspend existing beliefs and expectations as the event unfolded (Barton and Sutcliffe, 2009). In other words, the outbreak and the response to it by the hospitals and research institutes created a temporary new group of actors or transepistemic arena (Knorr-Cetina, 1997). It was in the temporary relational network where learning occurred, and was most evident, during the crisis. However, the transience of the relations and activities to cope with the crisis may also be a significant factor in creating difficulties for the institutionalization of learning after the crisis.

Concluding remarks

Informed by a perspective on how a crisis represents an epistemic object that is continually unfolding, we illustrate how the recent EHEC outbreak in Germany in 2011 represented contested terrain where different actors were vying to win a 'war for meaning'. By focusing on the way learning is difficult in the midst of a crisis, but not impossible, we demonstrate the uncertain nature of learning during crisis. The event becomes an epistemic object that different stakeholders react to from their own specific epistemic commitments. Consequently, particular groups of actors translate their experiences into organizational and institutional responses that make sense from within their own paradigms of politics, law or science, each with their own implications for learning. Sensemaking occurs in a transepistemic arena where learning outcomes are often contested, ambiguous and transient. Herein, a parallel can be drawn to the discourse on field-configuring events (Lampel and Meyer, 2008) that targets organized events such as product demonstrations, conferences or award ceremonies (e.g. Anand and Jones, 2008; Hardy and Maguire, 2010). However, in our case, the outbreak represents an unintended 'event' – vis-a-vis intended field-configuring events as defined by Lampel and Meyer (2008) – and also has ramifications for the field level as discussed throughout this text for the case of the EHEC outbreak. Field-configuring events include, potentially at least, actors from separate epistemic domains. Therefore, how they are interpreted, and how they inform future change trajectories within the field, may also be understood as 'contested terrains'. Nevertheless, there are times when this transepistemic work creates learning across domains, although holding on to that learning is complicated by the political and temporary nature of the epistemic object. In sum, the evolving crisis, competing sensemaking and the transient epistemic interactions make the translation of learning *during* crisis to learning *from* crisis particularly challenging, but not impossible.

Although we perceive our findings as generalizable to some extent, for example, to other ambiguous events involving multiple agencies and competing perspectives or to field-configuring events, our study's contribution is limited due to our methodological approach and the choice of the empirical setting. As is common for case studies, an ethnographic approach might have been more fruitful. Such an approach might have resulted in gaining finer grained data, although setting up such a research agenda is difficult given the inability to predict an outbreak and the number of institutional actors involved. Nevertheless, data gathered from participants during the outbreak partially override difficulties of retrospective research on unexpected events, which is often an inevitable shortcoming of other research in this area (Lampel et al., 2009).

Given this limitation, we suggest that our study offers opportunities for future research. For instance, although our study offers explorative evidence of how actors might make sense of crises

and the effect of competing sensemaking on learning, further theorizing might revolve around the role of time as a critical factor. For example, a useful avenue to explore would be how time pressure influences sensemaking within transepistemic arenas. Research might provide insight into how learning from practice during crisis is inevitably transitory, since the arenas of action in which crises take place are only temporary, as is suggested by the temporary networks evident in this case. We discussed these issues briefly in this analysis. However, they merit further attention if we want to comprehend how learning during crisis unfolds and to assess its relevance for contemporary organizational and policy practice in the face of crisis.

Acknowledgements

Funding

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