Designing with Users: Co-Design for Innovation in Emergency Technologies

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ABSTRACT

In this paper, we motivate the need for collaborative research and design for IT innovation in crisis response and management. We describe the value of such methodology and demonstrate how working alongside users enables creative anticipation of emergent future practices that can inform both more 'appropriate' and more ambitious innovation. We demonstrate how co-design methods are particularly valuable for eliciting ethical, legal, and social issues that would otherwise go unconsidered.

Keywords

Collaborative design, Common information space, ELSI, IT, Interoperability

INTRODUCTION

There are persistent calls for more effective collaborative practices in emergency response (ENISA, 2012). These practices require organizational and technical interoperability, including exchange of situational information, existing knowledge, and translation between diverse organizational and situated practices. SecInCoRe is a European project that aims to support these types of practices through the design of a cross-border and inter-agency Common Information Space (CIS) to facilitate disaster response and management. Innovating in a way that maximizes benefits, discerns risks and unintended consequences, including ethical, legal, and social issues (ELSI), requires awareness of different stakeholder perspectives and expectations in disaster response. But a sufficiently rich understanding of ELSI in technology design is nearly impossible through studies *of* potential users and use contexts alone. Ethical design of disaster IT requires researching and designing *with* users grounded in a more hands-on understanding of current practices while simultaneously envisioning new ways of working. Merging user, researcher, and designer understandings through collaborative design makes it not just possible to incorporate users understandings but also to foresee potential ELSI in a way that enables creative anticipation of emergent future practices that can inform adaptable and resilient innovation, requirements for any emergency technology that has to deal with situation and needs that are in constant flux. It also makes it possible to uncover and address ethical, legal and

social issues (ELSI) that emerge through these socio-technological collaborations.

This paper provides a brief description of the SecInCoRe project against the backdrop of a selective review of co-design methodologies. It then discusses a co-design workshop implemented for SecInCoRe. In doing so, it demonstrates how different aspects of the co-design process elicit ELSI in unique and productive ways. It finishes with a discussion of what addressing the ELSI questions that have been raised means for the larger project.

BACKGROUND

SecInCoRe seeks to enhance information sharing and interoperability through the development of new networked services based on an inventory of data sets and information systems used in past disaster events. The project team aims to create ideas grounded in old and new technologies and existing and emergent practices. This innovation can enhance risk awareness, preparedness, the humanity and efficiency of response, compliance with legal obligations, and, as importantly, encourage greater consciousness of how different groups are affected by, make sense of, or contribute to responses to unfolding crisis situations. It can also engender increased public visibility and accountability for responders, complicate data protection and organizational information politics, and can make it harder to mitigate the spread of rumours or vigilantism (Büscher, Liegl, Rizza & Watson, 2015; Crowther, 2014). Such transformative consequences are unknowable in sufficient detail in advance of actually taking new technologies into use (Mogensen, 1992; Suchman, 2007).

Collaborative design can help make visible these otherwise unknowable consequences. It is a methodology that involves the people who will be affected by new technologies throughout all design phases. It brings into one conversation multiple perspectives, forms of expertise, and contexts, as it explores the interplay between the social, technological, and organizational through hands-on engagement with prototypes. Co-design is a way to study emergent technologically augmented practices *in vivo*, making technology's workings—including breakdowns, frictions, and opportunities--visible as an ongoing practice (Bellotti, Back, Edwards, Grinter, Henderson & Lopes, 2002; Introna, 2007). Co-design also makes it possible to treat 'user needs' and design solutions as co-emergent and dialectical. How a problem is expressed, what elements become part of the solution, and an individual's capability to solve the problem change based on the context of interaction, visions, opportunities, and practices and are impossible to foresee by a designer in advance (Dourish, 2003; Lave, 1988). Participants become a collective resource for design and produce an environment of mutual learning (Törpel, Voss, Hartswood, & Procter, 2009). Co-design thus facilitates *practical* and *discursive* co-realization of socio-technical futures (Hartswood, Procter, Slack, Voß, Büscher, Rouncefield & Rouchy, 2002).

In SecInCoRe, we want to take these advantages of co-design and use them to provide insight into ELSI as they arise in emergent socio-technical futures in disaster response and management. To do so, we are pairing these practical engagements with disclosive ethics investigations, which involve a tracing of 'effects' that technologies-in-use engender for different stakeholders (Introna, 2007), to pair the envisioning of new potentials for innovation with the uncovering wider more 'disruptive' aspects of innovation as they emerge (Chesbrough, 2003). In this way, ELSI become concrete matters of concern, and open up opportunities for innovation during all phases of technology development and use, including conceptualization, production, and implementation (Büscher, Simonsen, Bærenholdt & Scheuer, 2010; Ehn, 2008; Hertzum & Simonsen, 2011). In this way, in this project we hope to address positive and negative unintended consequences throughout the design process instead of after-the-fact.

CO-DESIGNING COMMON INFORMATION SPACES

SecInCoRe recently tested co-design methods to elicit ELSI at a two-day workshop with thirteen emergency response experts from a range of backgrounds and twelve members from the interdisciplinary SecInCoRe team. We employed methods to leverage and combine the knowledge, experience, expertise and vision of professional experts, social science analysts, designers and engineers. The workshop had two main objectives: 1) to develop collaborative design methods that integrate (visions of) new technology with new ways of working; and 2) to learn about past disaster events and current response practices to identify problems in information sharing, variations in practice and interpretations of data

relevance and usefulness, and to explore ethical, legal, social opportunities and challenges. We documented results with video, audio, and hand written notes.

The workshop methods were designed around disaster re-enactments (past and future) in small groups (Figure 1). To ground these re-enactments in concrete experiences, each expert was asked to bring an object that was representative to them of a significant moment regarding interoperability during a disaster. As some of the key moments were re-enacted, focusing on crisis response efforts, particular emphasis was made on demonstrating practices and difficulties in information sharing and making sense of information. Then, after being introduced to our present design ideas and prototypes, we asked them to revisit their re-enacted scenarios and appropriate all of these prototypes. The experts were invited to re-enact the cases as if they already had these technologies and to make three-five minute video prototypes (Mackay & Fayard, 1999) that demonstrated how technology and new ways of working could come together fruitfully. Within and between activities was much time for open discussion. The activities, design results, and aimed for elicited ELSI are listed in Table 1. In the subsections below we explore key ELS themes that materialized.

Figure 1. Re-enacting past disaster events

Collaborative Activity	Design Result	ELSI Aim
Discussion of representative objects in small groups	Describe present practices	Understanding of current situation into which any innovation would be inserted. Understanding of local variations of conceptions of relevance, security, liability, and responsibility.
Re-enactment of disaster scene in small groups	Via the observation of socio-technological practices. Identify present problems, including commonalities and areas of difference between experts. Diagrams of spatial-temporal interactions needed for response success.	Develop a picture of planning and response needs as well as ELSI that exist at present. Grasp how they negotiate tensions and tools they use to translate and align local meaning making or recognize activities as common.
Presentation of our design conception plus large-group discussion	List of questions and debates about the value of the design	Identify how users understand our design and how that understanding diverges from ours to better understand their value structures and practices.
Making prototype videos in small groups	Discussions of what the new technologies can/should do. Videos of how the experts understand what our design does and how that relates to what they already do.	Identify new solutions and new ways of posing problems previously not envisioned. Develop an understanding of what is needed for social cohesion, confidence, and trust. Gather issues of concern and barriers to practice as emerged from these engagements.

Table 1. Methodology Schema

Designing for Transparency and Translation

Transparency and translation surfaced as crucial issues in the re-enactments. Transparency can mean two seemingly diametrically opposed things: on the one hand it requires that the inner workings of a technology are visible and clear to users, on the other it means that the user does not need to worry about the complexity of technology's inner workings because the technology so intuitive it becomes 'invisible' (Weiser, 1991) and can be used unproblematically. Both these forms of transparency were highlighted at once when, during the making of prototyping videos, one of the experts said:

"What is the CIS? Is that the network or the cloud?"

The experts' task was to think about how to support more information sharing in a network enabled common information space. In doing the task, more than one expert quickly raised questions: 'What do we mean by a common information space? How would it be used?' The emergency response experts had heard all the technical terms before – inventory, common information space, network, infrastructure, cloud – but still struggled to make sense of what these could be used for in practice. While the SecInCoRe team discussed previously about what these terms mean (even if themselves are far from settled on definitions), how the users tried to implement these basic categories of design in their re-enactments shed light on productive paths forward.

Another repeated request from the users was to "make IT simple". The question and discussion above shows that what this means this not self-evident or transparent and in fact needs translating between experts. In the course of the prototyping and discussions, simple meant transparent (both types), familiar, easy, routine, minimal steps.

Our mutual struggles for clear meaning throughout the workshop highlighted the need for translation and diversity in design. Instead of focusing on a catch-all functionality for information sharing, we needed a system that could support multiple demands: translation, local variation, disclosure and withholding, and negotiation of tensions. In other words, it became clear that a CIS needs to enable the management of different ways of knowing. While before this workshop it was clear that we needed a taxonomy-based system, through the workshop it became clearer that such a system has to support translation in order avoid bias and to maintain autonomy within collaborative interactions. Moreover, joint responsibility can only really exist in a framework that maintains autonomy.

Designing Useful Technology

"*Are you fighting on the scenario or are you fighting on the technology?*"

When reliving times of failure in disaster information sharing, the experts did not agree on fault: the user, technology, or context. This made it difficult to decide how technological potential comes to be useful. Examining the assemblages of technologies, practices of use, and situations of action opened up some of the ELSI at stake in the debate around usefulness.

One expert brought a printout of a map with superimposed photographs taken from an army helicopter during floods with continued heavy rain, capturing significant infrastructure breakdown (Figure 2). He brought the map, because it had been pivotal for decisions about food distribution and emergency bridge

Figure 2. Pivotal information captured in photographs taken from army helicopter.

construction, but it had also been difficult to share and make sense of during the response, because the infrastructure for sharing high-resolution images was not directly available and it was not commonly known how to work around this. The fault, and thus what would be a useful solution, was not readily assignable. By collaboratively enacting these gray areas, many ELSI were elicited that would not have otherwise been noticed. For instance, not being able to identify clear cause-effect relationships during failure demonstrated that usefulness is built upon flexibility and reversibility to encourage new solutions from improvised decision-making practices that remain traceable. Moreover, to be useful the system itself has to build interactions with data that balance the right to the data with the most relevant data needed, something that changes depending on the situation.

In another case, otherwise unseen ELSI were made visible in a moment of improvisation within the workshops itself. One of the participants offered to demonstrate a new online mapping service created as part of the UK's Resillience Direct initiative that visualizes information from different sources for disaster response and management. The service offered a different potential than our design, so we decided to include it as an ingredient in the prototyping (Figure 3). In doing so, the conversation from one of understanding each component to discussing overall problems and politics. By adding it to the mixture, it became clear that, as one expert put it, "increasingly we refer to capabilities rather than equipment or resources" (Figure 4). By imagining with this new ingredient the questions shifted from "what can your CIS do" do more practice-based questions like: If you take data from one group or system, do you have to share back? Or, will new generations rely on technology more strongly or will they have more reservations regarding technology operation? Or even, how do you draw on the past while still remaining open to new socio-technical practices that come with each new generations of emergency responders? Bringing in new technologies for information sharing does not automatically mean bringing in more people. Bringing in new technologies places new and old actors in awkward positions of negotiation, where inclusiveness of people, technology, and resources compete with each other in a range of ways.

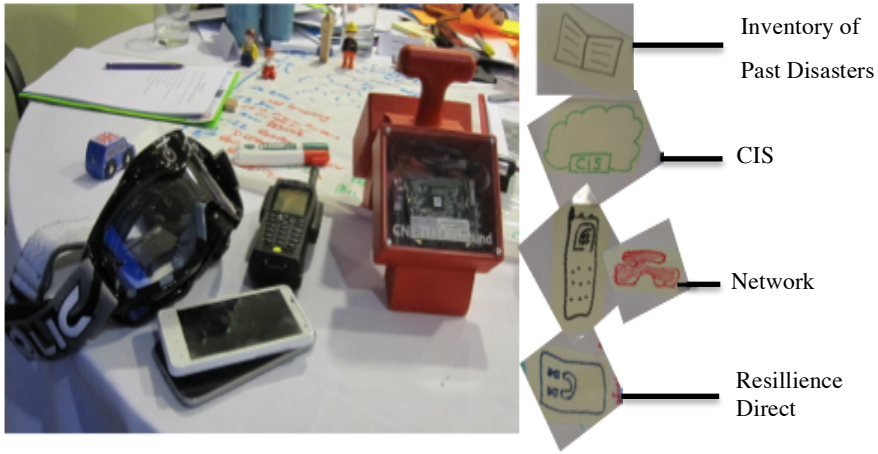

Figure 3. SecInCoRe technical prototypes and hand drawn iconic representations used to prototype potential practices and interactions with these new technologies.

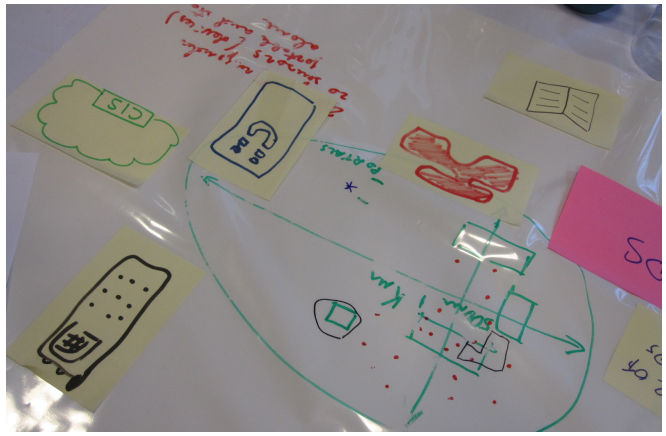

Figure 4. Prototyping in action, transposing past response efforts into a future with new socio-technical assemblages

Designing for Responsibility

"It's easy to decide who can access what when all the information is known. When information is being gathered it's less easy"

Questions about transparency, translation, and usefulness made visible that our design decisions do not just enable information sharing, but stretch and challenge informational responsibility. As the experts transposed past disaster response into a future where technologies like SecInCoRe's prototypes were fully functional, two conflicting messages were brought up: 1) the need for "*technology to manage who should know what*" and 2) the need for people to learn how to use the technology properly to manage it. To be able to act responsibly, users must be able to make the technology transparent. But users may also include members of the public who would wish to see a right to data considered in relation to a right to privacy and to what is appropriate for response. Introducing new forms of information sharing affects the tenuous balance between personal liability and the assignment of responsibility. For instance:

"We can't fight fires and have everything go back to the public, because it comes back to ethics: if you make the decision to sacrifice someone's property for the greater good and someone puts that out in the public domain, then it's going to get back, and then you are suddenly the target of the decision you made"

Technology needs to enable people to decide about relevance, appropriateness, proportionality, and accuracy.

A: *Was it safe to make the hole? No. That's why the town was evacuated.*
Q: So there was no data about what the container contains?
A: Not exact [data], no.

While providing information openly can lead to irresponsible use of it by the public, such links can also be vital to responsible use of resources in relation to the public.

Technology needs to enable these decisions over a range of more technical qualities, too. For instance, could a high-resolution still image carry meta-information about how often it is refreshed, the bandwidth needed for sending it. Could the network document how sending this image would affect the overall communication network? This discussion highlighted how effects of technology use also needed to be made transparent in an effort to use technology responsibly.

Designing for Sharing, Trust, and Politics

The exchange of information often prototyped well with partners with which an organization already worked. Information sharing was more problematic when unfamiliar groups were involved. The motto became not one of what was technologically possible but one of:

"We *can* share, but do we *want* to?"

While this lesson was nothing new to co-design, what the co-design process provided was a new understanding of the non-technical constraints that lead to such exclusionary actions and judgments. That is not only a matter of trust, it can be a matter of information politics. Even if fire department A knows that B has a special rescue truck that is closer to the scene, they might not call for information about it, because they want to get their own truck onsite for the sake of maintaining control. This was especially the case when it came to volunteers and social media publics, even when they were not actively involved. It became quickly evident that new information sharing technologies, even if not directly designed to engage with the public, are deeply intertwined with fears of impromptu volunteers and commentators, and difficulties of managing them as well as traditional media when faced with unpopular decisions. Even if they would only be sharing with other first responders, the experts present stated how they often decide to hold information back to avoid this potential. However, such decisions to draw barriers become more difficult when politicians see that sharing of information about resources and the resources is technically possible. Trust, then, becomes not a matter of matching data entry with variables of accuracy, but a matter of matching what is technological possible with cultural expectations of social interactions that go even beyond the immediate situation.

CO-DESIGNING EMERGENT ELSI

This preliminary discussion of ELSI arising from co-design around SecInCoRe's prototypes shows that this disruptive process challenges assumptions in all locations related to the anticipatory design. The issues raised here – transparency, translation, usefulness, flexibility, reversibility, inclusiveness, privacy, autonomy, joint responsibly, personal liability, and trust – can often stand in contradistinction to each other. However, as presented in co-designed practice, it becomes possible to envision these issues as intertwined, not oppositional. Inclusiveness becomes not a function of the technology, but is relative to the versatility of the system, capabilities to access, and the ability to remain autonomous. The greater the system allows for autonomy, for instance, the greater the trust that can be built creating the foundations for inclusiveness. Rights to data need not create a catch-all designed around access alone but also be designed around translations to avoid bias and to encourage a versatile system. In fact, enabling interactions around translations and transparency can set the stage for trust in a way that does not rely on control but instead relies upon autonomy. Considering ELSI in socio-technical imaginaries, as provided by co-design, can greatly enhance the effectiveness and resilience of a new technological system.

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