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From conflict to catalyst: using critical conflict as a creative device in design-led innovation practice

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Cyberspace is global; it allows for an unimaginable number of actors and interactions. The internet can be a place for creativity, fun and community, yet it is also a vehicle for criminal and damaging behaviour. It is, therefore, not surprising that on topics of cybercrime there are many stakeholders with contrasting perspectives. If, in a design-led approach to wicked problems, it is vital to involve people from diverse backgrounds, it is important to consider how to make the process of generating ideas based on frames accessible to them. A collaboration with a regional law enforcement agency provided the context for research into participatory design approaches that considered the question: what design-led approach and resources construct and present critical human conflicts as creative stimulus for participatory design events? This paper explores the challenges, limitations and value of a 'Creative Tensions' device that aimed to help participants develop solutions by offering 'frames' that they can 'look through', that may well deviate from their own experiences. Using a set of semi-structured interviews, this research presents an analysis of the device (its production, context and use) detailing practical steps and resources that support the development and use of frames in a multi-disciplinary multi-stakeholder participatory design event.

This abstract includes 202 words.

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Introduction

This research has been conducted as part of an ERDF- and AHRC-funded research programme, Creative Fuse North East, henceforth CFNE (Creative Fuse, 2018). The programme aims to design and pilot models of innovation which see industry, cultural organisations, charities and the public sector collaborating and working towards growth across the North East of England. The programme is delivered by the five Universities in the North East and involves ‘Innovation Pilots’; grants for SMEs, freelancers and creative and cultural organisations to partner with university academics to explore models of innovation consisting of a fusion of arts, design and digital skills. The study in this paper is located within one of N University’s Innovation Pilots, Cybercrime: Public Awareness and Behaviour Change.

This Innovation Pilot project responded to cybercrime challenges identified in collaboration with a regional law enforcement agency to explore the question ‘What interventions can be designed and developed to raise awareness and influence behaviour change to address cyber vulnerabilities?’. The project took a design-led approach to working towards solutions within this complex challenge. Literature suggests that in challenges such as this the abductive approach taken in Design Thinking is vital and one way in which to do this is through frame creation (Dorst, 2015b). Furthermore, it is important to facilitate collaboration between multidisciplinary participants in order to generate viable solutions. However, this paper argues that what is less established is how to facilitate deep empathy between participants and stakeholders and how to enable participants to consider multiple different perspectives (Michlewski, 2015).

This paper contributes an approach to ‘framing’ using conflicts within innovation projects translated into creative stimuli. It provides a set of examples of the framing process addressing critical human and human-system conflict within innovation projects. This research is valuable for Design Thinking practitioners and researchers as it offers practical understanding of the process of situation framing and what material is effective in guiding and stimulating participation in participatory design events. The core question that is being addressed is: how can a design-led approach construct and present critical human conflicts as creative stimulus for participatory design events?

Solving wicked problems through participatory design practices: Literature review

Design Thinking offers a way to solve today's complex problems using a process of framing to support an abductive route from problem to solution. What is yet to be fully considered are the ways in which frames can be used to engage and direct participatory design event attendees in generating solutions.

Cybercrime: a complex networked problem

Many contemporary societal challenges are complex and hard to manage (Dorst, 2015b). These types of networked, problems have been described as 'wicked' (Rittel and Webber, 1973; Crowley and Head, 2017). Some of the characteristics of wicked problems include unclear boundaries, multiple potential solutions, additional associated wicked problems, and high stakes (West Churchman, 1967; Buchanan, 2010). Although originally coined as a term in relation to politics, Rittel and Webber's (1973) criteria has been updated to apply to problems across fields and in particular, with regards to design, to include notions of trial and error, and failing fast (Thienen, Meinel and Nicolair, 2014). Opposing points of view from stakeholders are a key factor in contributing to the wickedness of a problem.

Returning to the project discussed here, cyberspace is truly global and effectively allows a limitless number of actors (Loader, 1997). The internet can be a place for creativity, fun and community, yet it is also a vehicle for criminal and damaging behaviour. It is therefore not surprising that there are many stakeholders with contrasting perspectives, and it is becoming increasingly difficult to manage the safety of users.

Whilst problems are often wicked because of the multiple conflicting points of view held by the multiple stakeholders affected or affecting the problem, paradoxically, we cannot solve wicked problems working in isolation as individual knowledge can only be partial (Russell, 2010; Bailey, Aftab & Duncan, 2014). Rather, collective wisdom from multiple disciplines and perspectives must be directed towards a common goal in order to solve wicked problems (Boradkar, 2010).

An answer? Design Thinking

Complex, ill-defined problems such as cybercrime, and situations involving multiple participants and approaches require specific working

practices to frame and address them (Brown & Katz, 2011). Design Thinking and designerly ways of working have been recognised to be effective at tackling wicked problems and offering the working practices required (ibid.). Evidence for this recognition can arguably be seen in the increased numbers of design-trained people in senior management, government and academia (Dorst, 2015b). We refer to Design Thinking here as an approach to problem solving activity which involves reasoning and making sense of things (Johansson-Sköldberg, Woodilla and Çetinkaya, 2013). Amongst the contributions of a Design Thinking approach to solving wicked problems Thienen et al. (2014) propose:

- Providing ways to manage multiple stakeholders such as through creating a shared goal and offering ways to enhance communication between stakeholders using visualisations.
- Focusing on human values and employing empathy to see that solutions will neither be right nor wrong, just meet stakeholders' needs with varying degrees of success.
- Manage large amounts of complex information and generate creative solutions that actually work through providing space for structured play and idea generation.

Additionally, Michlewski (2015) in his book, *Design Attitude*, discusses the characteristics of the design profession's unique attributes, one of which he describes as forming 'Deep Empathy' with stakeholders. This research focuses on an approach to achieving an accelerated, augmented empathy with multiple stakeholders as a creative device.

Framing: choosing how to see the world

Designers have developed practices and strategies to deal with open, complex networked problems (Thienen et al., 2014). Central to a number of descriptions of Design Thinking is abductive thinking, the process of working from an observation or inference to identifying potential ways to reach the desired solution and the solution itself. Design Thinking involves identifying what solution will lead to the desired outcome without there being a pre-established route or method to arrive there, thus we have to create or choose both a "what" and a "how" (Dorst, 2015a: 25). An abductive approach is necessary in the case of wicked problems where there is insufficient knowledge or clarity to take a deductive approach (Dorst, 2010; Thienen et al., 2014).

Framing is important when tackling wicked problems as it offers a way to sort through and make use of the complexity of the context and stakeholders involved in order to take an abductive approach. Framing involves suggesting new potential ways to look at a problem in order to generate solutions. Dorst (2015b) suggests this involves a deep investigation of the problem, identifying the paradoxes which make it hard to solve, mapping the context in which the problem operates, identifying themes and phrasing these as different views or 'frames' on the problem, before exploring which frames lead to solutions. Thus, the complexity of the situation is acknowledged and seen as a stimulus rather than a barrier (Dorst, 2015a). If we seek to involve people from diverse backgrounds in the solving of wicked problems, it is important to consider how to make the process of generating ideas based on frames accessible to them (Sanders, Brandt and Binder, 2010).

Participatory design has largely sought to involve stakeholders by employing various tools and techniques that help them tell and explore their own stories and/or evaluate potential solutions as they emerge (Robertson and Simonsen, 2012). This paper, however, explores how to help participants develop solutions by offering 'frames' that they can 'look through' that may well differ from their own experiences. Sanders et al. (2010), describe design tools as either for priming participants by providing information about the problem or for helping them generate ideas for the future. Here we are concerned with tools that help participants to *engage with and act upon* the information provided in order to generate solutions.

Wylant (2010) observes that it can be difficult to look at a problem from multiple perspectives at the same time, suggesting instead an iterative approach can be employed, taking each perspective in turn. This article suggests a way to manage the complexity of wicked problems without having to limit oneself to one viewpoint at a time through an approach to framing which takes critical human conflict as its basis.

The paper has established that the nature of wicked problems means they benefit from Design Thinking and in particular design abduction, and that frame creation offers a way to deal with their complexity.

It has also been recognised that wicked problems require people from different backgrounds to work together to find answers. This paper contributes to the ways we currently approach wicked problems by proposing a way to make problem frames accessible and workable for diverse participants in order that they can produce viable solutions.

A reflective enquiry: Methodology

This research has been conducted through a multi-method approach involving reflection on practice, observation and semi-structured interviews with four members of the academic team and one member of the postgraduate student team involved in the Innovation Pilot project. In order to describe a new device that has emerged from practice, the paper is a reflection on the preparation and delivery of a participatory design event, as part of the Innovation Pilot. The event, entitled Cyber-Wellbeing Solutions Hack, was a 12-hour Open Innovation event (Bailey et al, 2018) . Its purpose was to seek solutions to some of the current challenges posed by teenager's unsafe behaviour online. The objective was to have developed a series of actionable solution proposals, by the end of the hack. To achieve this, we used our expertise in inclusive design-led innovation approaches to encourage the sharing of knowledge, skills, experience, expertise and opinions and combining these to create new ideas or build on existing ideas.

Reflective account of the preparation and delivery of Creative Tensions at the Cyber-Wellbeing Solutions Hack

The Cybercrime Innovation Pilot involved a 12-week period of research (including interviews and design-led workshops), conducted by a multidisciplinary team of six postgraduate students from N University working alongside CFNE academics. This research was aimed at informing, designing and prototyping provocations, stimulus material and tools to deliver a participatory design event, 'Cyber-Wellbeing Solutions Hack', a 12 hour, one-off, open innovation event.

Developing frames from stakeholder perspectives

Developing the Creative Tensions as a set of resources to stimulate teams of participants went through two phases. The first phase sought, within the limitations of a postgraduate project, to understand: 1) a set of recurring vulnerabilities that teenagers are exposed through particular online behaviours and attitudes; and 2) a range of different perspectives on those situations from people, or organisations concerned with the protection of individuals or groups of young people. The second phase converted the insights and data from the first phase into a set of resources

to stimulate and direct the spectrum of participants within the constraints of the design event.

Phase 1 engaged with: cyber-crime experts from a regional police force; cyber-crime academics; parents; teachers; and groups of young people (14-16 yrs. old). Creative workshops, semi-structured interviews and surveys were conducted to understand online vulnerabilities and the attitudes that different people hold toward the crimes, the vulnerabilities, the technological infrastructure, and the behaviours and attitudes that underpin them. The collected data was synthesised using a derivation of the Dynamic Stakeholder tool (Rojas, English, Young & Spencer, 2017) (figure 1)¹. This allowed the researchers to visualise and integrate the distinct sets of stakeholder perspectives and the relational patterns that connect across categories. This process helped to identify core themes and recurring or/and provocative points of view, which were then communicated as a series of exaggerated quotes.

¹ Under development as part of doctoral research by an academic at N university

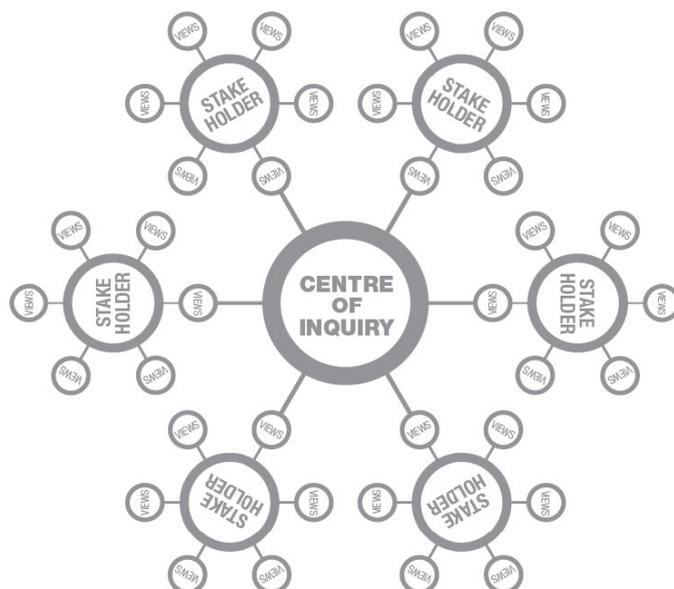


Fig.1 The Dynamic Stakeholder tool; the tool is based on the development of distinct radiant mind maps for it's construction and has three tiers of components: (1) centres-of-inquiry; (2) Stakeholders; (3) Stakeholder views.

Phase 2 aimed to produce a set of communications that would capture some of the critical human conflicts at play in this complex situation and frame the specific challenge. This meant converting the knowledge and insights generated from phase 1 so that it matched the resources and human capital expected at the Cyber-Wellbeing Solutions Hack. To achieve this the team developed materials around seven different cyber vulnerabilities summarised in Table 1. The challenge was framed through five elements: context, value, conflict, consequence and call to action, derived through thematic analysis of practice. Figure 2 shows an example of the material provided to Solutions Hack participants which has been annotated in red to draw attention to these elements.

Context: The problem-opportunity space in which the intervention is situated. In the case of the solutions hack, two 5 minute presentations were made, one by the regional cybercrime unit and one by the CFNE team, each

aimed to highlight why this issue was important. Further, a small set of information sheets summarising key conclusions derived from the secondary and primary research were provided as reading materials.

Value: The primary goal, the value which is being aimed for. In the case of the solutions hack, “achieving teen cyber-wellbeing”.

Conflict: The “point” in which two or more differing perspectives held by the stakeholders engaged in the problem space clash. This is the tension which sums up the different ways the two parties view the problem context.

Consequence: The resulting impact of the tension for the stakeholders involved. For example, in the Cyber-Wellbeing Solutions Hack this was summarised to participants as an attitude of particular stakeholders which lead to a behaviour which, as a consequence, produced a vulnerability.

Call to action: This outlines the challenge and desired outcome of the participant’s engagement with the creative tension within the problem context. In the case of the Cyber Wellbeing Solution Hack, the challenge was posed as a question, “How can we raise awareness and influence behaviour change to address cybercrime vulnerability?”, with the desired outcome posed as a title, “Achieving teen cyber-wellbeing”.

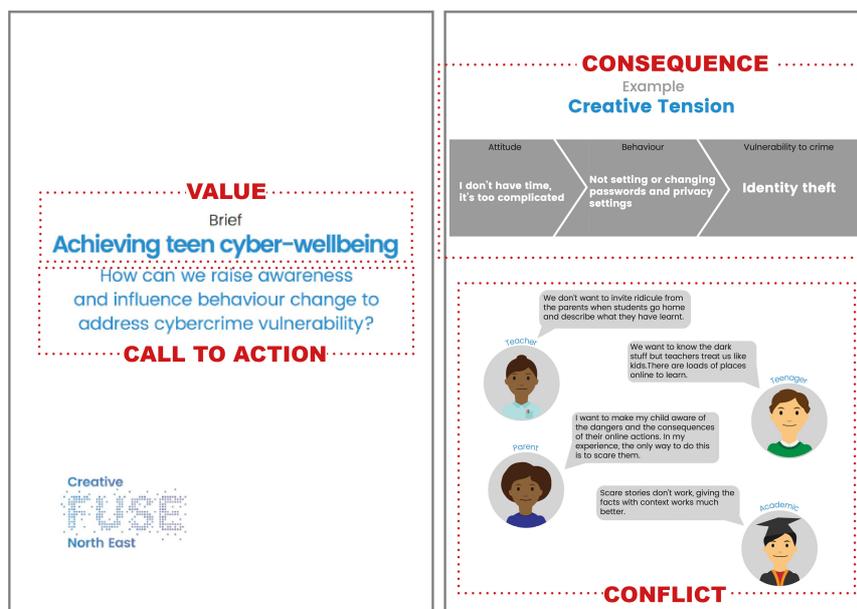


Fig 2. Example of one Solution Hack brief pack with the key elements highlighted

Table 1: Summary of provocations included in Solutions Hack brief packs

Attitude	Behaviour	Vulnerability
I'm afraid of missing out	Using inappropriate or unsafe social network sites	Grooming
I am being safe with people of my own age	Being overly trusting about who to connect with online through sites which appear to be safe	Grooming on Minecraft ²
It's not a real crime – I'm just having a laugh	Acting abusively towards others online	Mental health issues
The benefit for me	Keeping Bluetooth on to	Data grab

² Minecraft is an online open-world game where players can interact with others from around the globe.

outweighs the risk	connect with smartwatch	
I don't have time, and it's too complicated to protect myself	Choosing insecure passwords	Identity theft
I want to fully embrace technology	Collecting and publicly posting location information on Strava ³	Physical attack
I know what I'm doing	Not being cautious about suspect emails	Ransomware

Delivering the cybercrime Solutions Hack

This event consisted of a one-off engagement of police representatives and technology SMEs and freelancers aimed at generating early-stage solutions which could then be developed into actionable briefs by the N University CFNE team. The participants of the event engaged with each other for the 'co-conception of ideas' (Fridlington, McKay, Spencer & Watson, 2016). However, the event's activities fed into the overarching CFNE pilot project to support 'co-scoping' of value and 'co-strategising' (ibid.).

Participants attended for the morning or afternoon sessions of the Hack, or both. There were 30 attendees in the morning including nine participants from the regional law enforcement agency and five of their cadets. The remaining attendees were a combination of current Multidisciplinary Innovation (MDI) Masters students (5), MDI graduates (now in employment) (6), and members of the public (one of which represented a SME). In the afternoon 15 people engaged with the activities, including two senior officers from the police. The event was facilitated by 5 members of N University staff, from their CFNE team.

In the morning 5 teams from diverse backgrounds worked together to generate ideas in response to their briefs. For the afternoon session attendees were reorganised into two new teams. Participants selected ideas from the 80 generated in the morning that they felt had potential for development. Each team took inspiration from their chosen ideas and worked to construct and pitch a solution proposal. This process was aided by the intermittent introduction of challenges in the form of 'what if...?'

³ Strava is a mobile app aimed at athletes which enables them to track and share routes and times, and compete against others. Detailed locations and timings can be made publically accessible.

prompts and feedback from the police representatives as expert consultants.

The strongest proposal was for a framework which supported the development of primary school children's awareness of digital ethics through exploring actions and consequences at increasingly sophisticated levels as they progressed through school. The framework was supported by a portfolio of exciting and engaging activities allowing young people, their peers, teachers, family and carers to blend digital and physical interactions, communications and encounters to collectively try to understand the very real consequences of digital ethics.

Components of Creative Tensions: Discussion

Thematic analysis of the collateral provided to the participants and the data generated through reflective interviews with the academic team suggest that generating and delivering Creative Tensions involves key considerations that are likely to affect the degree that participants engage with the tension and the quality of their engagements. Here we suggest that Creative Tensions need to be researched, relatable, authentic, provocative, networked and facilitated.

Researched

The creative tension must be accurate and reflect real perspectives of stakeholders involved. Whilst it is acknowledged they can never represent all users' perspectives they are instead aimed at being valid portrayals of *some* stakeholders. Reflection suggests that this can be achieved through generating a rich and diverse body of research, which can focus on fragments of human value as opposed to a representative sample and data set. The critical point is that the tension and the stakeholder perspectives need to be authentic and held in opposition so that they represent a creative conflict. Solutions won't always resolve the tension, but solutions should be developed mindful of the tension and what that might mean for the implementation and acceptance of any solution.

Several interviewees noted that the students' research and the development of the Creative Tensions was rigorous in that they conducted multiple iterations of design and testing. By doing this they refined the tensions and were able to test their hunches and early stage conclusions. Observations from the academic team supervising the masters' student project noticed how the iterative approach allowed new knowledge to

challenge previous assumptions and conclusions and also experiment with the ways in which the Creative Tensions were presented.

There is an inherent limitation in framing which needs to be recognised. Frames need to be seen as temporary; as a useful device that allows groups to act; to scope solutions as part of a reflective practice. In this project, the Creative Tensions were limited by the research that informed them. The cyber-wellbeing challenge aimed to reach a vast and hugely diverse audience. Teenagers' attitudes and behaviours are affected by a wide range of factors and the number and variety of those interviewed had to be limited to those the student team could engage with during the 12-week period of the project. It may be that the research could have been developed by gaining greater depth, for example one interviewee suggested that participants could have been questioned further to better explore the nuances of their perspectives, suggesting that "workshop environments were not an effective context to interrogate motivations and attitudes in detail". At the same time, additional comments from interviewees argue that the research activity failed to consider a plethora of factors that would affect the point of view such as socio-economic background, ethnicity, and level of education as the research participants were of a certain demographic, within a certain region. The challenge of speaking to a diverse range of participants whilst also collecting rich data from them is a consistent challenge in Design Thinking practice. The question is, what research can be done, what should be done and how much is needed to allow those involved in co-creation to act?

Relatable

The Creative Tensions aim to force participants to step into the different stakeholders' shoes. As discussed in the literature review, adopting perspectives other than your own can be difficult. For example, during one of the workshops the masters' students ran with stakeholders, a parent expressed reluctance and difficulty in adopting the perspective of a teenager. Similarly, another parent commented that they were uncomfortable assuming the role of a teenager, identifying that their point of reference was radically different from teenagers' concerns today, saying it was catapults and air rifles rather than social media and the internet that were prominent in his teenage years.

To help participants feel comfortable stepping into other people's shoes the Creative Tensions must be relatable. It is argued that this is achieved by equipping participants with an understanding of the context of the

perspectives in the tension and how the stakeholders represented arrived at that outlook. The more the stakeholders' perspective and background differs from the participants, arguably the more work needs to be done to help them empathise. One interviewee illustrated this by way of a comparison between a project which asked someone familiar with offices to consider a problem context set in an office (where not much work to aid empathy is needed) or "living and farming in sub-saharan africa and working in the fields" (where support would be needed). Consideration will be given in the future to how to equip participants to empathise by providing this context.

Authentic

Analysis suggested that the way the Creative Tensions are presented may have an impact on participant engagement in terms of how 'real' the stakeholders represented seemed. It was speculated that this would have an impact on the degree to which participants fully tested and therefore adopted their perspectives. In the Cyber-Wellbeing Solutions Hack tensions were presented by way of speech bubbles containing the first-person perspective of several stakeholders, each represented with a caricature. The tensions could have been presented as facts or statistics, or alternatively as perspectives attached to a stakeholder group rather than a representation of an individual person. Interviewees commented that these decisions lent each perspective a sense of authenticity, representing "real people and all their complexity". However, one interviewee pointed out that attaching each perspective to an individual may overly narrow the mindset of participants.

Interviewees also suggested alternative ways that Creative Tensions might be presented to enhance the authenticity of the perspectives represented. For the Hack each caricature was labelled with the name of the stakeholder group they represented, e.g. 'Teenager' or 'Parent'. One interviewee commented that this might be limiting how 'real' they seemed and thus did not communicate the quality of the research underpinning the development of the perspective. Consideration could be given as to how to imply this connection to a body of research. Other interviewees compared this delivery to some of the options the master's students had tried during their iterative testing. For example, previously role play had been used to communicate the perspectives in a lively and engaging manner. Animation had been used by the students during their preparation for the Solutions

Hack and one interviewee suggested this may be a way to communicate more content (and thus more accurately reflect the rigorous and rich data collected during research). Alternatively, using photographs instead of caricatures was discussed, although the interviewee cautioned that these would need careful consideration as they would “add nuance to the [participant’s] understanding”. A final manner in which authenticity may be enhanced is through demonstrating the body of research that supports the final Creative Tensions. In order to aid clarity, they are concise, but this may mask their rigorous and evidenced nature. One interviewee commented that this was a “balance to be struck”. It seems that the manner in which the Creative Tensions are communicated has the potential to affect the degree to which participants readily engage with the perspectives represented and view them as credible, and that further exploration could consider more lively, creative and playful ways to do this.

Provocative

Creative Tensions are devices that aim to use the conflict within a problem/opportunity space as stimulus for the creation of ideas and solutions and therefore need to be generative. Interviewees described Creative Tensions as deliberately crafting and presenting polar points of view around a particular issue. One interviewee suggested that exaggeration and heightening the polarity of the two perspectives was key to stimulating participant engagement:

Without exaggeration, the subtlety in which they manifest could be lost in the complexity of real life. For example, something that is found mildly irritating until some other factor causes us to overreact to it and exaggerate its significance; e.g. a foot-stool sticking out. You may continuously tuck it in, but it isn’t until the consequence is experienced, stubbing the toe, that would cause one to consider taking [permanent] action.

The polarity of perspectives seems key in provoking participants’ ideation and thus this is the manner in which the research described above should be mined in order to inform the Creative Tension.

Networked

Reflecting on the Solutions Hack, interviewees highlighted that wicked problems have the potential to generate multiple, networked Creative

Tensions. Although teams were presented with Creative Tensions that seemed to act independently, they had in fact been developed as a set. Interviewees suggested that presenting teams with distinct Tensions might limit the potential that the solutions generated accurately deal with these networked Tensions. Therefore, in the future there is the potential to explore ways to facilitate participant's engagement with multiple tensions and how to communicate them in a clear and concise way.

Facilitated

At the Solutions Hack participants were equipped with the Creative Tensions in their information pack but were not given guidance as to how much they should be guided or limited in their ideation by them. Interviewees suggested that teams, during the hack, were not as directed by the Creative Tensions as was anticipated. One interviewee attributed this to the presence of experts in the form of police participants who could speak from their vast and rich experience of investigating cybercrime. Here participants may have stepped into the police's perspective to a greater extent than they engaged with the stakeholders represented in their Creative Tensions. This suggests that consideration could be given to ways to recognise the value of participants in the room whilst also guiding them towards seeing the Creative Tensions as their route to engagement with the challenge. The degree that participants' engagement is facilitated may also have an impact on how much their ideation is dictated by the Tension. We have seen how stepping into someone else's shoes can be uncomfortable and difficult and therefore it may be that a facilitator is required to encourage and help participants to do this.

Developing deep empathy and valid solution proposals: Points for further research

The research conducted here points to a number of areas for further research that will be explored over the course of ongoing CFNE Innovation Pilots. Stemming from the components identified above these research points broadly concern how to ensure the Creative Tensions are credible in that they accurately reflect part of the challenge and appear to be credible to participants so that they are able to confidently engage with them.

Developing credible Creative Tensions

The tensions identified within wicked problems are highly likely to be networked rather than existing as discrete sub-problems. Therefore, in order for Creative Tensions to accurately reflect what is going on within the challenge space (thus being likely to result in good solutions) it follows that methods must be developed to ensure the Creative Tensions as a device represent their networked nature and communicate this to participants. However, it is also vital that the clarity and accessibility of them remains high in order that participants can readily engage with them. Research will also investigate how to organise teams of participants around Creative Tensions given that they need to be presented with a focused enough Tension, or set of Tensions, to direct in-depth engagement whilst also being able to access and acknowledge their networked nature. This may well require them being exposed to Tensions other teams are working on.

Appearing to be credible to participants

The Creative Tensions are a device aimed at rapidly developing deep empathy between participatory event attendees and the stakeholders of the challenge. Initial research described above indicated that the way the Tensions were delivered had the potential to impact how readily participants could engage with the frames investigating, for example, different ways of visually portraying the stakeholders such as animation and caricature. In addition to this, the format of delivery of the Tension has been speculated to have an impact on participant's engagement; for example, a video or animation may be more effective than a static visualisation.

In addition to the way Creative Tensions are presented visually, further research will investigate the impact on the level of facilitation on participants engagement. In the Solutions Hack discussed above a light touch approach was taken, however we can speculate as to the impact of facilitation which directs participants in a more rigorous way to engage with the Tensions. Given that rapidly engaging in deep empathy with people who may well have radically different experiences and perspectives to you is not necessarily straightforward it seems to follow that participants may be reluctant to do this and require support.

Addressing these points will feed into an overarching investigation of the effectiveness of Creative Tensions. This will be determined in terms of the guiding aim to offer attendees of participatory design events a lens through which to look through in order to engage with the different ways stakeholders view wicked problems. This research will also seek to,

crucially, consider the impact on the validity of the resulting solution proposals.

Creative Tensions as a device for engaging and directing participation: Conclusions

In the literature review we set out Thienen et al.'s (2014) propositions about how Design Thinking can contribute to solving wicked problems. These propositions can be summarised as multidisciplinary teams working towards a shared outcome, empathy, and handling complex information in a structured and playful way. We have argued here that Creative Tensions as a creative stimulus help multidisciplinary participants engage in the types of action that are necessary to develop solutions to wicked problems. They do this by offering a way to direct team action towards a shared goal by concentrating their efforts on particular perspectives. They help people use empathy to see the challenge through other people's perspectives. Additionally, we have argued that Creative Tensions help participants access and act upon complex information and use it as a trigger for ideation.

Literature has established the value of frame creation (Dorst, 2015b). In this article, we have developed current the current knowledge base by offering a device by which attendees of participatory design events can engage with the frames that research has suggested. This is done through the identification of core human conflicts within the challenge as the key frames through which it should be approached. These are then translated into Creative Tensions which are presented in an authentic and engaging manner. Here the Creative Tension brings clarity and direction to the complex situation and focuses the 'what' and 'how' of the abductive enquiry.

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