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From wicked problem to design problem: Developing actionable briefs and solution opportunities through a collaborative, multidisciplinary design-led approach

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This paper argues that using a design-led approach is highly beneficial when tackling complex problems to transform ambiguity into actionable design briefs and solution opportunities. This is evidenced by way of an ongoing project with a large public-sector organisation. Northumbria University's School of Design academic experts use design-led approaches to innovation that promote 'creative fusion' between diverse stakeholders in order to tackle 'wicked problems'. The authors continue this work as part of an AHRC/ERDF-funded programme entitled Creative Fuse North East (CFNE), along with five regional universities, of which the project discussed here is a part. The main objective of which is to develop and deploy approaches to innovation that apply skills from creative graduates to benefit the wider creative economy, address barriers to innovation and promote growth and sustainability within and without of the Creative, Digital and IT sector (CDIT). It will be argued that to do this it is vital to convert stakeholders into co-creation activists empowered with the creative confidence required to speculate about uncertain futures.

design catalysts, co-creation, problem framing

1. Introduction

Many problems we face today are ill-defined, networked, dynamic and seemingly intractable (Dorst, 2015). We may feel as though we do not know enough to solve them. Such problems have been termed 'wicked problems' (Rittel & Webber, 1973). Much has been written about the importance of looking at the world as interconnected, where relationships are shaped by their historical and cultural context, as opposed to seeing the world from a deterministic and predictable perspective (Boulton, Allen, & Bowman, 2015). Accordingly, the factors that shape complexity in our world are systemic, path-dependent, contextual, emergent and episodic (Boulton et al., 2015). We therefore have to take account of many factors.

Wicked problems require specific working practices to frame and address them, "[w]e are at a critical point where rapid change is forcing us to look not just at new ways of solving problems but to

new problems to solve" (Brown & Katz, 2009). We cannot achieve this in isolation as individual knowledge can only be partial (Russell, 2010). Rather, collective wisdom from multiple disciplines must be directed towards a common goal, i.e. tackling the wicked problem. Furthermore, the methods of inquiry and decision-making need to be flexible so that one can remain open to revisions in response to new information (Russell, 2010). It is not straightforward to work collaboratively or to work within an ambiguous and complex space such as this. Collaborators and stakeholders can bring conflicting requirements and their personal or institutional perspectives to collaborations (Brown, 2010; Dorst, 2015) and uncertainty can be uncomfortable. Here, a design-led approach can be invaluable.

A design-led approach has been argued to offer a holistic way to tackle complex, ill-defined and ambiguous problems (Hocking, 2010; Lam, 2017). When applied during the 'problem framing' phase of a project, it can transform seemingly intractable, complex problem spaces into actionable briefs and solution opportunities that bring clarity, meaning and direction (Dorst, 2015). The value that design practice can bring to different problem spaces has been established, for example in the context of business innovation (Bucolo & Matthews, 2011; Gulari & Fremantle, 2015; Innovate UK, 2015; Wrigley, 2017). Often, the special way that designers think and do things is cited (e.g. Cross, 2006). This can be captured as a working practice involving flexibility and action. For example, Hocking (2010) describes designers as considering:

> questions about what could, should or ought to be [...] through the ability to enact knowledge in an iterative process where the identity of the designer is central and the paths they follow have dynamic variability [...] characterised by playfulness and praxis, bridging knowledge and action. (p. 244)

These abilities are employed strategically within organisations to enable them to: identify emerging opportunities; investigate and visualise how issues are interconnected within ill-defined problem-spaces; frame focused questions to tackle the core issues; and collaborate with diverse disciplines through design-led methods and tools (Lam, 2017). However, it could be argued that Hocking's (2010) 'identity of the designer' should be replaced by the '(designerly) identity of the team'. This change reflects the importance of co-creation, evidenced in this paper by way of a case study involving a collaboration between Northumbria University's team[1] and Northumbria Police. This project is part of a large research programme entitled Creative Fuse North East (CFNE) which seeks to develop and deploy approaches to innovation- that apply skills from creative graduates to benefit the wider creative economy, address barriers to innovation and promote growth and sustainability within and without of the Creative, Digital and IT sector (CDIT). This innovation approach has been previously termed as 'creative fusion' (Garner et al., 2014; Sapsed et al., 2013).

This paper focuses on how design-led approaches can transform wicked-problems into actionable design opportunities. The paper describes, through a case-study review, the multiple enablers that design-led approaches afford multidisciplinary, co-creative teams when addressing seemingly intractable, networked problems. The case study in question addresses the complex, wicked problem of cybercrime vulnerability. In this case study, the team have enabled people to work together in this uncertain and complicated environment in order to reach strategic solution opportunities. This has been achieved through facilitating those who may not feel comfortable with ambiguity to welcome it and encouraging people to bring ideas to life in ways that encourage speculation and 'what if?' questions (Coyne, 2005).

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[1] Collectively known as 'the team', Northumbria University's Creative Fuse North East team consists of design-led innovation academics, researchers and Innovators in Residence (IiR) – recent Masters Graduates who support the projects whilst being mentored by the University as they launch their own businesses.

2. Context: A design-led approach to multidisciplinary teams, co-creation and problem framing

The value of multidisciplinary teams within industry has been established, for example Bailey, Aftab, and Duncan (2014) discuss a design-led context, Gibbons et al. (1994) argue that these teams are flexible and responsive, and the cultural and economic benefits of multidisciplinary work have been promoted (Wallace & Barber, 2013). A breadth of knowledge and perspectives seems likely to produce a breadth of solutions (Alves et al., 2007). However, meaningful collaboration enables teams to be more than the sum of their parts and achieve things they could not have done by working individually. Amongst other benefits, multidisciplinary teams can act as 'outsiders' to each other to identify and question assumptions (Nissani, 1997). Previously separate concepts, expertise, products or services may be united in new and unexpected ways to create innovative solutions (Fong, 2003; Nissani, 1997) and "new ways of thinking, communicating and working" (Bailey, Smith, & Aftab, 2013, pp. 12-13). These are not new ideas, but they remain pertinent evidenced by, for example from policy (Department for Business, Energy & Industrial Strategy, 2017). Particularly relevant to this paper are recent proponents of using designers to instigate and facilitate collaborations, for example calls from industry (Design Council, 2015) and academia (Bowen et al., 2016; Sanders & Stappers, 2008).

Hand-in-hand with a multidisciplinary approach, the authors advocate an inclusive process, where stakeholders are actively involved as experts during problem framing activities (Björgvinsson, Ehn, & Hillgren, 2010; Broadley et al., 2016). In the project described below, stakeholders 'co-created' the knowledge base, design briefs and solution opportunities. Co-creation is a broad term, but can be loosely defined as two or more people working creatively in collaboration (Sanders & Stappers, 2008). This approach is based on the principle that everyone, with good facilitation, can be creative (Stappers and Sanders, 2008). A design-led approach to co-creation includes activities that encourage participants to (amongst others):

- visualise information to enhance understanding and communication (Schoffelen et al., 2015);
- make physical things to make sense of the problem space and prototype ideas (Sanders & Stappers, 2014; Vaajakallio & Mattelmäki, 2014);
- look at issues from different perspectives, for example through storytelling (Bornet & Brangier, 2016)
- engage with ideas in a meaningful way through play (Björgvinsson, Ehn, & Hillgren, 2012a; Gray, Brown, & Macanufo, 2010).

Multidisciplinary co-creation presents challenges, especially when working with 'wicked problems', that can be addressed through a design-led approach. All collaborations can sometimes be difficult and this may be heightened when participants come from different backgrounds. For example, teams need to build trust (Broadley et al., 2016), identify a common purpose (Spencer et al., 2017), and find effective ways to communicate and generate a collective knowledge base (Sanders & Westerlund, 2011). Furthermore, roles must be clarified (Facer & Enright, 2016) and conflicting perspectives managed (Björgvinsson, Ehn, & Hillgren, 2012b). Therefore, collaborations require facilitation as people may not have worked in this manner before, "people live and socialise in unfused professional, disciplinary and social communities. When these different cultures are brought together, it often exposes cultural mismatches rather than creative opportunities" (Sapsed et al., 2013, p. 68). A design-led approach can be used to address these challenges and ensure groups arrive at implementable outcomes (Norman & Verganti, 2014).

A design-led approach helps collaborators to accept the inherent ambiguity in the imperfection of wicked problems through activities which frame ambiguity positively as a space for speculation (Dorst, 2015). Being prepared to speculate to build a deeper understanding is a key capability within design and innovation practice (Sanders & Stappers, 2014). By employing designerly methods, these

speculations can be brought to life in physical, visual or narrative forms. Generating multiple potential speculations and solutions both develops the team's understanding of the problem, i.e. 'framing' it, and facilitates refinement of the most promising solutions into viable propositions (Boer & Donovan, 2012).

Problem framing involves collecting perspectives from stakeholders, systematically visualising and interrogating this information, and then using it to generate more pertinent and strategic questions (Lam, 2017). One aspect of this is balancing goal-orientated and experimental activities (Lam, 2017). De Mello Freire (2017) frames this as pursuing non-linear thinking (characterised by changing circumstances, multiple parts, and adaptability) in a manner that is beneficial rather than detrimental to linear thinking. This activity may appear chaotic and undirected (Sanders & Stappers, 2008). Nevertheless, there is an overall trajectory towards more definable and actionable briefs and solution opportunities. It is this trajectory that this paper explores.

Co-creation at Northumbria University (NU) is grounded in design practice and supported by business knowledge. It uses strategic, creative and generative methods to encourage innovation. The key ways that the team facilitate this way of working can be summed up by 6 'co-creation enablers' which pick up on some of the themes from the literature highlighted above:

- Enabler 1: Environment. A safe environment is created which includes both appropriate physical space and resources, and a supportive non-judgemental intellectual and visceral space for open engagement (Bailey & Smith, 2010).
- Enabler 2: Attitude. An open and questioning attitude (Michlewski, 2015) is facilitated based loosely on Sinek's (2011) 'why, how and what' questions. However, critically, these are accompanied by 'what if?' questions in order to generate provocative speculations, the genesis of concepts (Bailey et al., 2013).
- Enabler 3: Structure. A confident, deliberately semi-structured approach is taken which is open to change as circumstances change and ideas develop.
- Enabler 4: Visualisation. A range of tools used to translate 'what if?' questions into tangible forms to aid communication, sense making and reflection (Björgvinsson et al., 2012b; Schoffelen et al., 2015).
- Enabler 5: Participation. Establishing and engaging with a network of stakeholders to contribute diverse knowledge and expertise. Participants include experts (who contribute knowledge) and activists (who are involved in co-creation activities) indeed participants may be both.
- Enabler 6: Agents. Students are catalytic agents in a problem situation due to their 'creative naivety' (Bailey, Aftab, & Smith, 2015) - they are curious and knowledgeable, and give 'professionals' permission to work creatively and ask naive questions which often challenge company-held perceptions and preconceptions around the problem space.

Application of these enablers will be traced through the case study. This serves to demonstrate some of the highly beneficial ways a design-led approach can help frame wicked problems through facilitating meaningful collaboration and co-creation between people from diverse backgrounds.

3. Raising Awareness and Changing Behaviour: From a wicked problem to actionable solution opportunities

Earlier, we proposed 6 co-creation enablers that support people as they move a wicked problem-space from a position of ambiguity to one where there are strategic and actionable opportunities. This is evidenced and explored further here by way of a case study. This case study is part of NU's ongoing collaborative innovation project with Northumbria Police.

The project responded to challenges associated with digital policing practices around cybercrime and cybersecurity. This challenge is a true 'wicked' problem; it is large in scale, involves multiple stakeholders and is ill-defined, for example key factors are rapidly changing and difficult to clearly

establish. The project has involved 12 key design-led activities to date, labelled here with a letter (A, B, C and so forth). A summary of these activities is depicted in the project journey timeline below Figure 1 & 2.
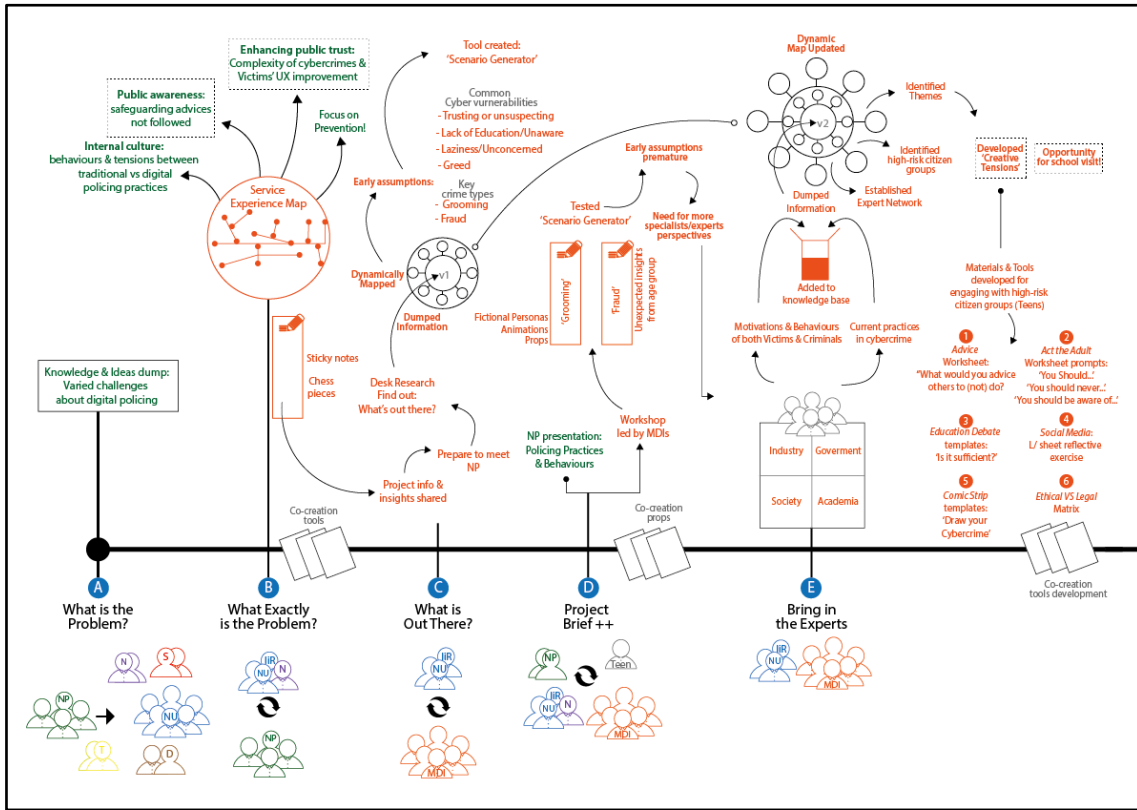

Figure 1. Part 1 A timeline of the project's innovation journey, illustrating the key design-led activities undertaken to date
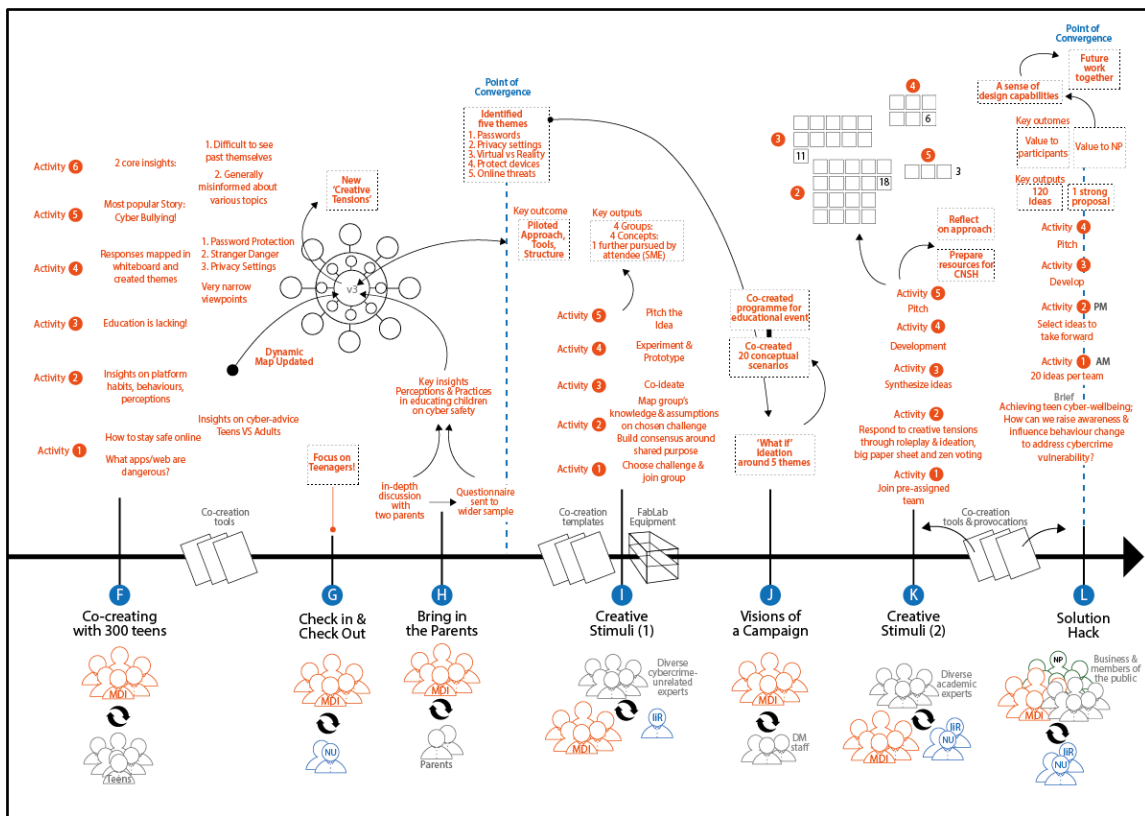

Figure 2. Part 2 A timeline of the project's innovation journey, illustrating the key design-led activities undertaken to date

3.1. *Project Activities*

3.2. *A: What's the problem?*

During facilitated preliminary conversations with Northumbria and CFNE partners, police representatives highlighted areas of cybercrime policing that they saw to be key concerns. These included crime prevention initiatives such as creating changes in the culture and behaviour surrounding internet use, engaging with local software developers and horizon scanning, and to issues with investigation, such as improving internal communications within the police. NU proposed to narrow the focus of the project to behaviour change and to consider ways to tackle unsafe digital practices (e.g. leaving the Bluetooth on, not applying privacy settings or not installing updates). The project goal was to co-create design proposals with small and medium-sized CDIT businesses, students, academics and Northumbria Police staff which could then be developed further in the future.

3.3. *B: What exactly is the problem?*

This 2-hour session aimed to find out more about the challenge as perceived by the problem-owners (Northumbria Police). The team's key objective was to foster mutual understanding around the challenges. This was done through questioning and exploring: the context in which the problem exists, relevant stakeholders, and any established assumptions.

Northumbria Police were not familiar with the creative nature of the session and therefore the space was curated in order to make it interactive and engaging, rather than static and hostile. For example, the team strategically removed all seating from the room with the aim that attendees would be spending their time 'doing'. Desks were dressed with large sheets of paper and various co-creation resources such as multi-coloured marker pens, sticky notes, and chess pieces (to indicate hierarchy) were provided. Tea, coffee and lots of chocolate fuelled the creative thinking.

In order to better understand the problem space, generative participatory techniques were used to facilitate conversations, capture insights and enable participants' discourse and reflection. The structure was intentionally open and Northumbria Police were asked to identify a pertinent cybercrime scenario and describe how the event unfolded. Using a derivation of a service mapping exercise, participants co-created a process/experience map that visually articulated current issues and challenges in digital policing practices, answering why, how and what was going on Figure 3.

Figure 3. A snapshot of co-creation activity during a creative problem definition session with the problem-owners

It became apparent that cybercrimes can be perpetrated from anywhere in the world and are, therefore, difficult to solve. This resulted in Northumbria Police's focus being on prevention to explore how best to educate the public about how to better protect themselves online? Northumbria Police felt that their previous efforts in educating the public had been largely unsuccessful and therefore it was clear that innovative approaches were required. The 'swamp of data' (Spencer et al., 2017) that resulted from the mapping exercise was filtered into actionable issues which revealed three interconnected 'cybercrime' challenges:

1. Raising public awareness about cybersecurity: Northumbria Police has found that citizens and businesses do not follow data safeguarding advice resulting in avoidable cybercrime.
2. Enhancing trust between the public and the police: This could be done by improving public understanding of digital policing practices and processes, e.g. by communicating the complexity of cybercrime and improving victim's experiences during cases.
3. Internal culture: Different practices and attitudes within traditional and digital policing creates tensions which result in slow and inaccurate responses to cybercrimes.

After the first creative problem-framing session, the team proposed an initial project plan that was agreed with Northumbria Police. The project, entitled 'Cybercrime: Public Awareness and Behaviour', was launched and involved Northumbria Police, CFNE partners and NU academics. The project aimed to develop early stage concepts or solution opportunities. This would be achieved through preparatory design work during a series of co-creation problem-framing and definition sessions with diverse stakeholders. Solution opportunities would then be developed into working prototypes by CDIT businesses. To support this preparatory work, the team engaged six postgraduate students in Multidisciplinary Innovation (MDI) as catalytic agents for new thinking. MDI students[2] contributed diverse backgrounds to the project including industrial design, textiles, economics and business management.

3.4. *C: What's out there?*

After being briefed on the project the students were asked to familiarise themselves with the problem-space. To document and reflect upon their secondary research the students used a variation of a dynamic stakeholder mapping tool (Knowles & Spencer, 2016). This stage lasted one week and resulted in initial assumptions regarding common cyber-vulnerabilities (e.g. 'trusting or unsuspecting', 'uneducated or unaware', 'lazy or unconcerned') and two key cybercrime types, grooming and fraud. Based upon these assumptions, the students produced a 'scenario generator', a tool that included a set of creative props representing social media platforms, users and behaviours. This tool would be used during the briefing session with Northumbria Police to help them generate cybercrime scenarios for further exploration.

3.5. *D: Brief++*

The team and the students hosted a 2-hour session attended by Northumbria Police representatives, student participants, and NU academics. During the first 30 minutes, Northumbria Police outlined key cybersecurity issues and behaviours. This was followed by a creative workshop run by students using their 'scenario generator'. Attendees were divided into two teams with each including a Northumbria Police representative. The physical space had been prepared with long paper sheets, sticky notes, multi-coloured pens, and the 'scenario generator' props (Figure 4). The session was semi-structured in that there was some guided activities. Two short videos created by students introduced grooming and fraud, the two cybercrime types previously chosen to explore. What was key to this session was that the students had the creative confidence to expose incomplete knowledge and ideas to Northumbria Police experts and academics in a highly engaging and playful

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[2] Multidisciplinary Innovation students are referred to as 'the students' whilst other students engaged in the project as participants are referred to as 'student participants'.

manner. This helped the students to understand, early on, that their assumptions about the problem-space were incomplete, simultaneously eliciting new knowledge from the experts.

Figure 4. Example of the co-creation props used in the 'Scenario Generator' tool during the Brief++ activity

3.6. E: Bring in the experts

The students conducted 24 one-to-one interviews and sent questionnaires to experts from industry, government and academia over the 12-week project. Analysis revealed significant insights into the behaviours and motivations associated with victims and criminals. Moreover, the students were able to identify existing cybersecurity initiatives. Key points from each interview were dynamically mapped (Figure 5) and used to update earlier versions of the map created during activity 'C'. More critically, through data analysis, students identified groups that were a high-risk of cybercrime (e.g. teenagers and older people) and key players in cyber-education (e.g. teachers and parents). Additionally, it was noted that different types of cybercrime effect different demographics. The complexity and diversity of cybercrimes means they cannot be tackled by just one solution. Sufficiency of relevant education practices was questionable and advice around actions to cybercrime prevention was unclear. The conflicting nature of the attitudes and behaviours collected from experts with different backgrounds were themed and labelled as 'creative tensions'.
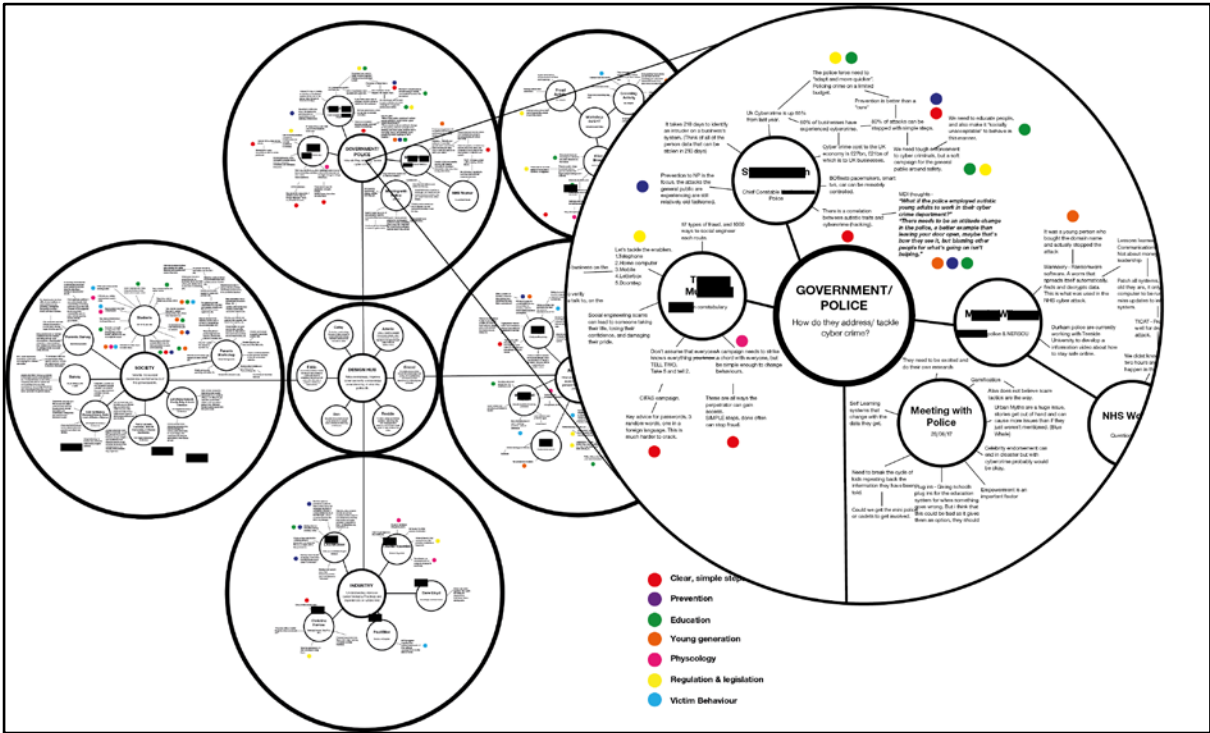
Figure 5. Example of the dynamic stakeholder map created by students to visualise the evolving network of experts engaged during the project

3.7. *F: Co-creating with 300 teens*

Through the network they had established, the students had an opportunity to lead a workshop at a regional high school, with young people, one of the identified high-risk citizen groups. The team designed and developed six design-led activities aimed at gaining a deeper understanding of the young people's experiences of interacting with digital devices. These activities encouraged participants to adopt different roles including advising others on cyber-security ('advice worksheets'), forming positions as if they were an adult ('act the adult' activity), evaluating current educational practices ('education debate'), reflecting on their use of social media ('social media' activity), exploring what is ethical and legal ('ethical vs legal' activity) and drawing scenarios to describe perceived cybercrimes ('comic strip' activity) (Figure 6).
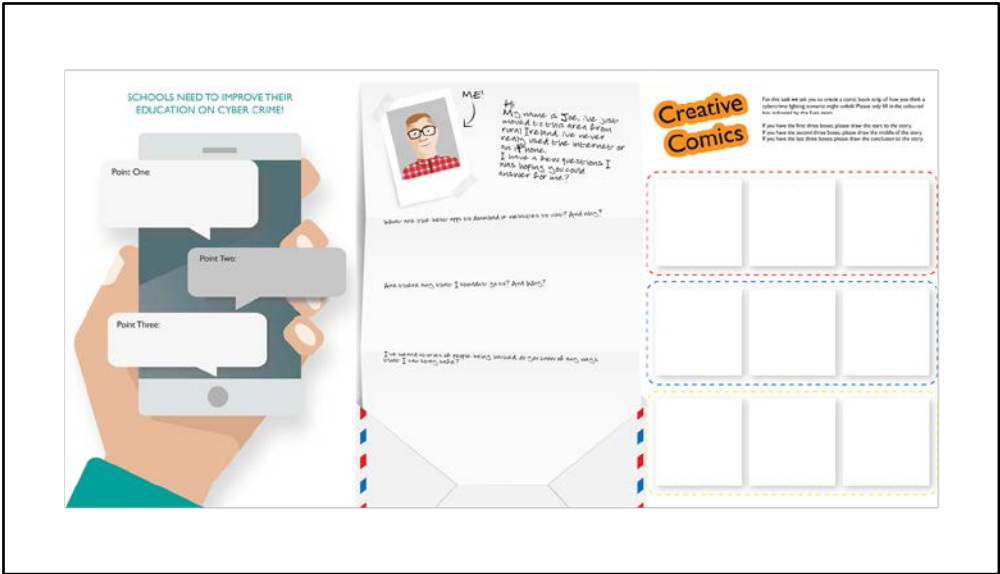

Figure 6. Examples of creative materials designed to engage teenagers in several co-creation activities around behaviours and attitudes in cybercrime

The students engaged with around 300 teenagers during the day and generated significant insights into the attitudes and behaviours of young people, and the challenges surrounding cyber-education (Figure 7 & 8). Findings regarding teenager's use of social media and digital platforms included: their 'overdependence' on them as a result of peer-pressure and fear of missing out; the ways that friendship fallouts or bullying can be amplified through them; and criminal or hurtful behaviour not being perceived as 'real' when enacted over the internet. Significantly, the findings pointed to a shared consensus amongst teenagers and the various experts interviewed in the earlier phases that cybercrime education in schools is not sufficient. For example, these are focused predominantly on traditional grooming, 'stranger danger' and the sharing of indecent images, but very little about much else, such as cyber-bullying, grooming through online games, password protection, privacy settings, and ID theft.
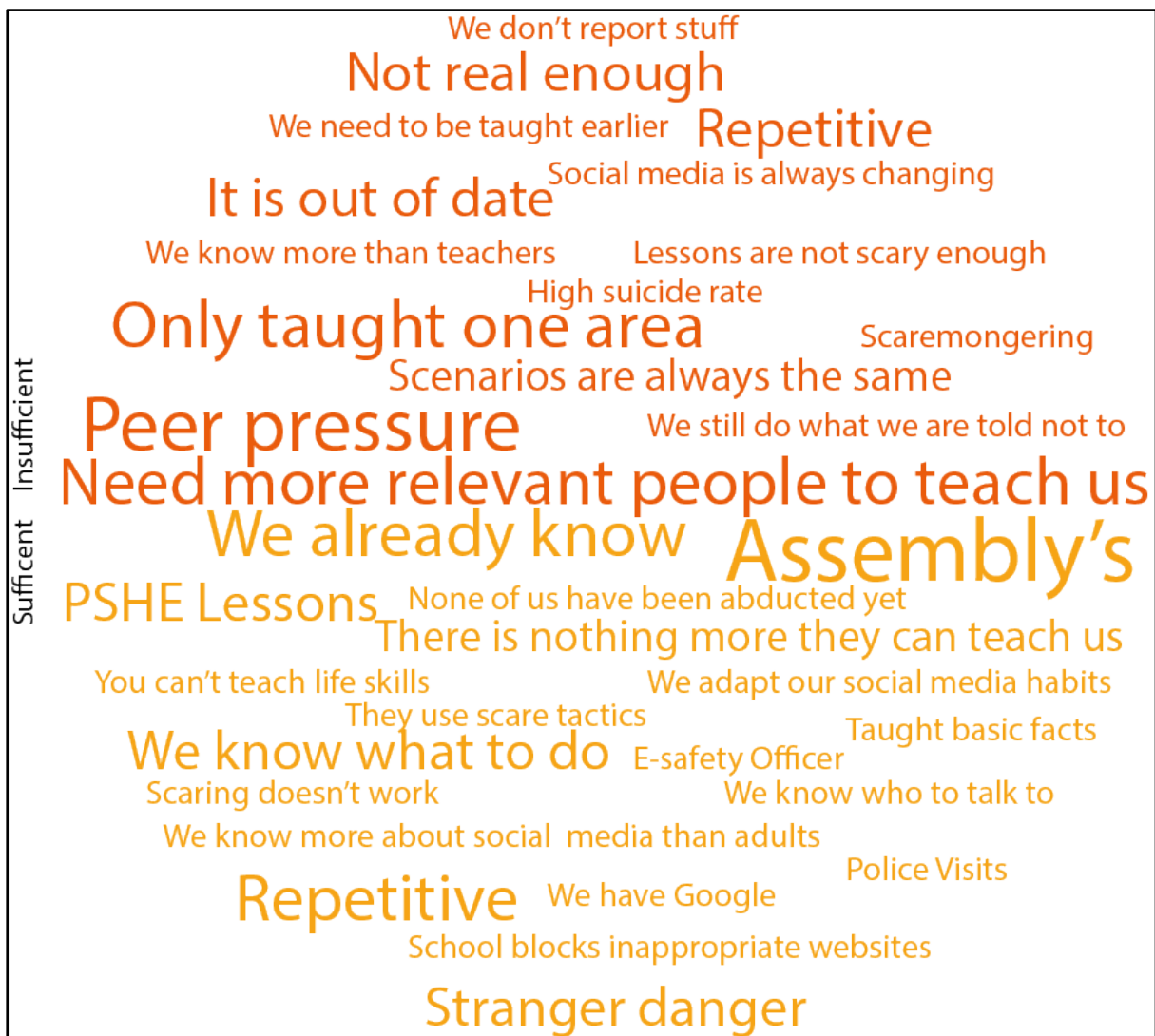

Figure 7. A word cloud capturing diverse points of view about sufficiency VS insufficiency of current cyber-education in schools
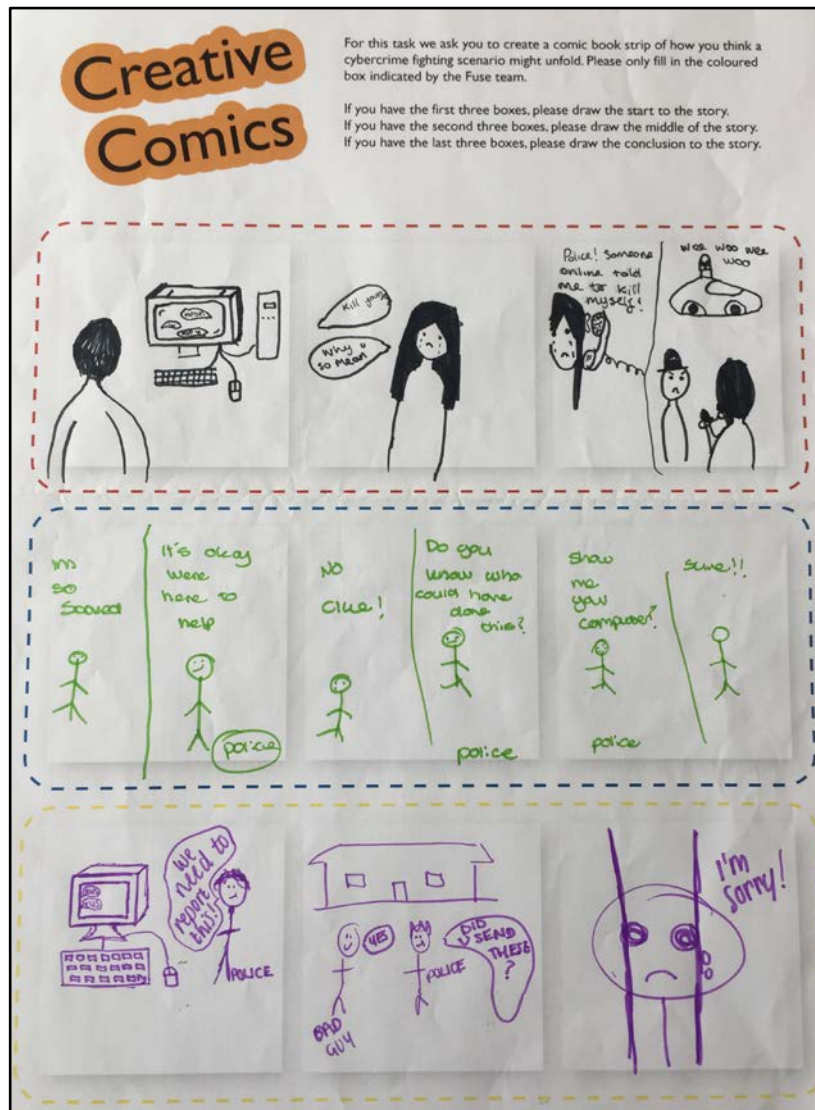
Figure 8. Example of a perceived cybercrime scenario drawn by a teenager

3.8. *G: Check in and check out*

The students met with the team at the midpoint of their 12-week involvement with the project to reflect on their findings and create a future direction for the project. Findings about young people seemed to stand out as both the most prolific and raise the most powerful challenges. The team chose to focus on young people as a demographic where raising awareness and changing behaviours could have the greatest long-term impact. The team and the students also decided to consider early stage ideas and opportunities to address the challenges associated with that age group. This meeting acted as a catalyst for the remainder of the project as it brought clarity and an impactful direction.

3.9. *H: Bring in the parents*

Having decided to focus on teenagers, the students sought to gain further insights from the perspective of parents. They organised a 2-hour workshop with parents of young people to investigate how parents educate their children around cyber-safety (Figure 9). Although low attendance at the workshop affected the breadth of perspectives, it instead resulted in detailed data. Findings suggested that parents differ regarding the level of independence online and safeguarding advice they give their children. Notably, parents of people in their twenties said that they had provided little guidance, as they themselves were not brought up with computers and the

internet. In order to gain a wider perspective, students used insights from the workshop to compile an online questionnaire which was then sent out to parents and guardians. Analysis of the 20 responses revealed parents found it difficult to discuss cybercrime with their children and there was an expectation that children's cyber education should be a shared responsibility between parents, schools, government and industry. Findings from the parent-focused research activities and the school workshop were dynamically mapped and themed to reveal new 'creative tensions'.
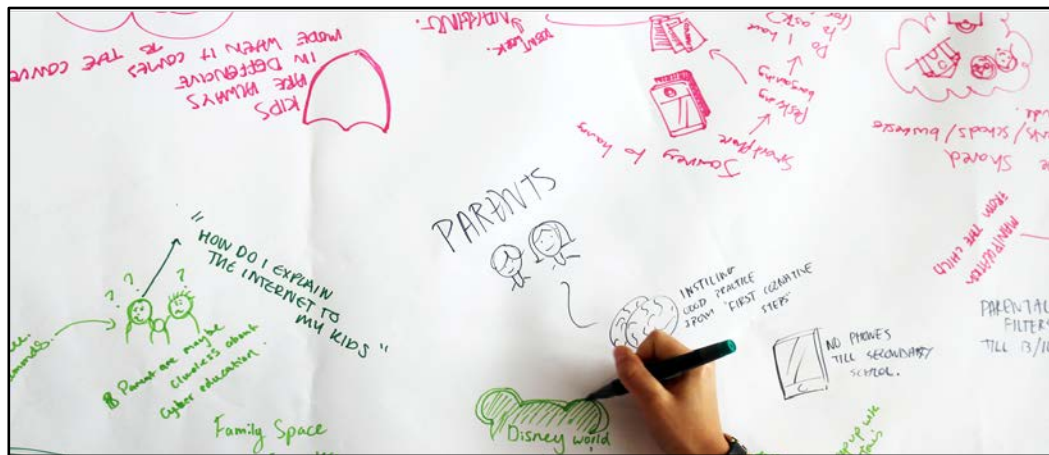

Figure 9. A snapshot of the co-creation workshop with parents

3.10.   *I and K: Stimulating provocations*

As mentioned, one of the key project goals was to conduct preparatory design work to form positions (briefs) and stimulus material and to co-create early stage proposals and solution opportunities with small CDIT businesses, student participants, academics and Northumbria Police staff. To inform a future open innovation event (titled 'Solution Hack' and discussed below), the students needed to translate the breadth of knowledge generated through preparatory work into provocations, labelled as 'creative tensions', building on those already identified. To trial the running of this event and explore how the creative stimulus materials would fuel it, a process of trialling and refining took place at two pilot events.

Firstly, the team was invited by another Creative Fuse North East partner to co-lead a 12-hour workshop (Creative Stimuli (1)) which involved diverse academics, businesses and experts in intense ideation and development of physical prototypes/solutions using the partner organisation's 'FabLab' space, including 3D printers and other machinery, in response to a set of challenges. The students devised four provocative briefs, informed by their previous research, around digital behaviours and also acted as creative facilitators during the event. Members of the team and the students facilitated the workshop and produced a series of actions to work through along with several design-led tools. These resulted in each of the four groups creating 'provotypes' (Boel & Dorovan, 2012), i.e. provocative concepts and prototypes (see e.g. Figure 10). This workshop had a high impact on the project as it provided first-hand experience of running a 12-hour workshop thereby informing the design of future ones.

The procedural and thematic knowledge gained from the 'Creative Stimuli (1)' event informed the design of a second pilot co-creation event, called here 'Creative Stimuli (2)' (Figure 11). This day-long event was essentially the culmination of the students work over the past two months and its fundamental purpose was to apply their findings and pilot their ideas and tools for the 'Solution Hack' event. It was also a chance to create and develop some initial solution opportunities relating to the problem-area. 17 participants drawn from the network of experts the students established in earlier phases of the project, attended the day which resulted in 18 idea cards, synthesised to 11 for further development from which 6 were further refined and 3 made it to the final pitch and presentation stage. A number of observations in relation to the participants' behaviours during the

event (e.g. a tendency of choosing the easiest to make ideas when it comes to development and pitching) and in the day's structure (e.g. long breaks impact on momentum and the importance of making clear when different sessions start and finish) were recorded and many of the initial recommendations in the design of the forthcoming 'Solution Hack' event were altered as a result.

Figure 10. Example of a 'provotype' developed during at 12-hour workshop. The 'Digital Condom' is a concept for a marketing campaign that encourages teenagers to practice good cyber-hygiene, in the same way people take care of their personal hygiene

Figure 11. A snapshot from the second 'Creative Stimuli' co-creation workshop

3.11. *J: Visions of a public cyber-wellbeing campaign*

The rich insights gathered from the school workshops really inspired the team. An early idea that derived from this inspiration was about creating a campaign that would target different demographics through creative events in local venues across the region in order to interact directly with the public and provide cyber education in a fun and playful way. An opportunity was established to engage with a regional museum to explore how they could become a pioneer in teaching this dynamic topic to local school children in new innovative ways. A co-creation workshop with key staff from a local museum was run by the students which initially sought to create a 'shared understanding' of both the project's context and the museum's purpose. It was found that, whilst the museum has an excellent permanent collection and has run many family-oriented programmes, there remains clear opportunity to engage with digital innovation. The students then introduced five themes that their research suggested an educational plan ought to cover: passwords; privacy settings; virtual versus reality; protect devices; and online threats. Ideation around these themes focused on the possibilities that a new educational program could provide. A number of fun and engaging activities were identified during the workshop focusing on helping young people learn through play. After the workshop, the students further developed the ideas and created a set of 20 activity recommendations (Figure 12) that the museum could implement as school sessions, family events, or permanent fixtures around the venue. The team is currently looking to materialise these activities in the coming year.
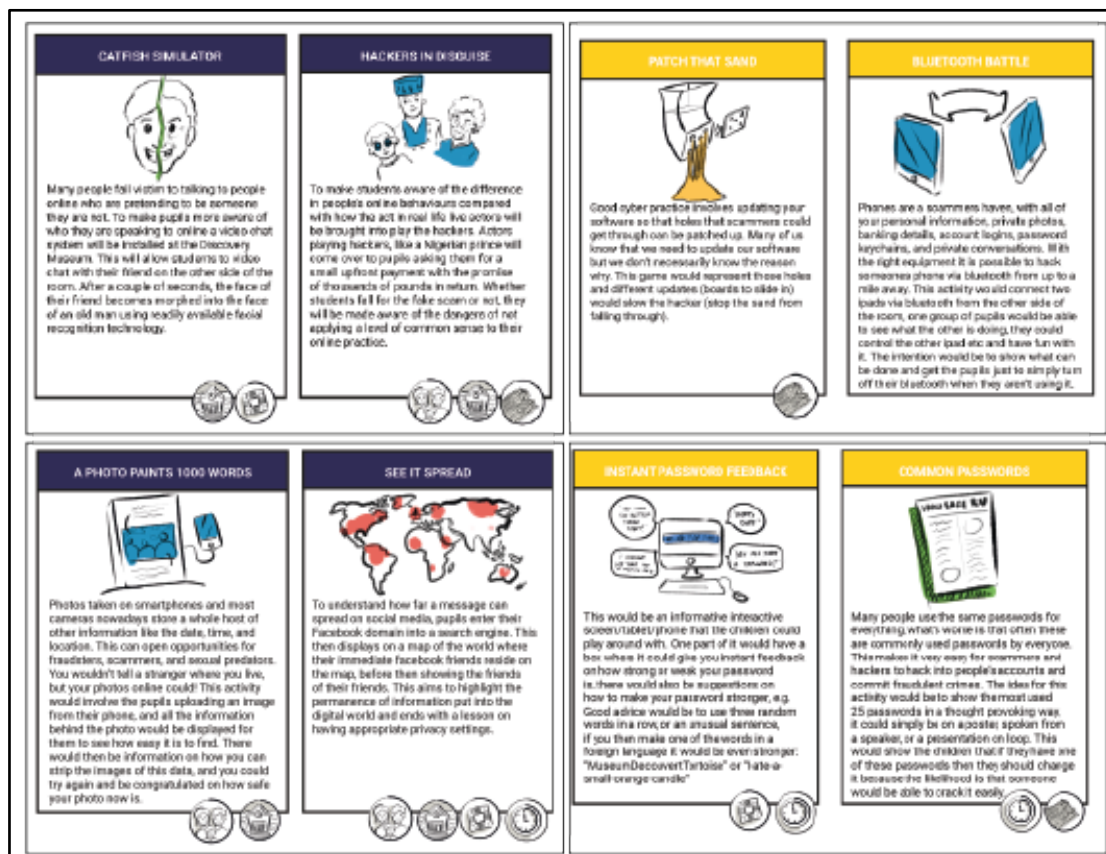

Figure 12. Examples of early stage ideas and solution proposals for a cyber-education campaign to publicly engage teens and parents

3.12. *L: Solution Hack*

The team designed a 'Solution Hack', a 12-hour open innovation event that brought together 30 participants from business, Northumbria Police, student participants and members of the public. A creative planning event was held by the team, using the same co-creative, generative, creative approaches that they deploy with external partners. It was in this session that the team resolved

planning the Solution Hack's agenda and created the 6 briefs, aligning and enhancing the creative tensions, including the notion of Attitude-Behaviour-Vulnerability that were central to the event's choreography.

The purpose of the Solution Hack event was to engage CDIT SMEs and Northumbria Police to generate solutions to some of the current challenges posed by poor cybersecurity amongst teenagers. The objective was to have developed a series of actionable solution proposals. To achieve this, the team used expertise in inclusive design-led innovation approaches to encourage the sharing of knowledge, skills, experience, expertise and opinions and combine these to create new ideas or build on existing ones. The event used the creative tensions previously designed to highlight conflicting perspectives about particular teen attitudes, behaviours and cyber-vulnerability. This, and a package of supporting materials (Figure 13), formed the brief: *Achieving teen cyber-wellbeing; How can we raise awareness and influence behaviour change to address cybercrime vulnerability*?
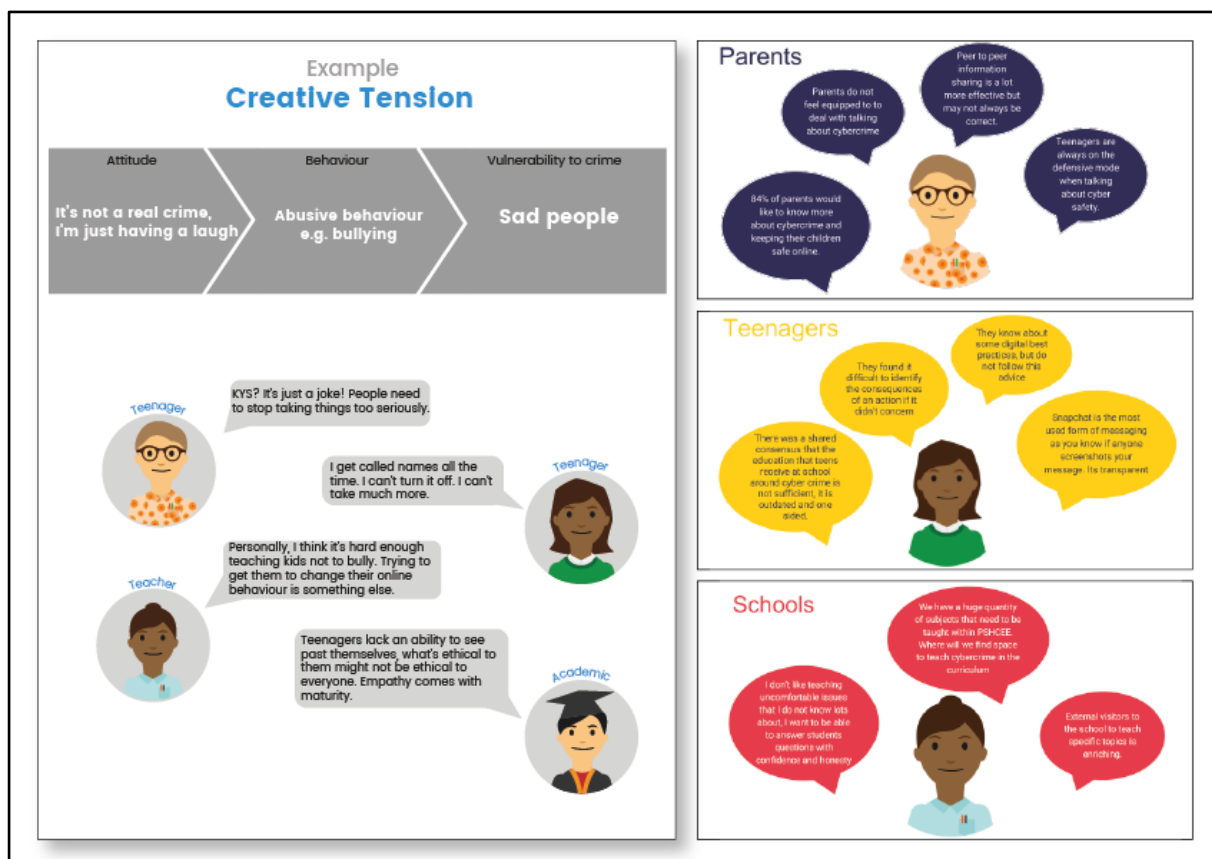

Figure 13. Examples of stimulus materials drawn from the team's research findings, provided to teams to describe the context and drive creative thinking amongst participants

In the morning, five teams from mixed backgrounds worked together to generate 80 ideas in response to their briefs. For the afternoon session attendees formed two teams; each individual from each team selected those ideas that they felt had potential for development. Prompted by sets of challenges (Figure 14) that aimed to guide the development of ideas, and informed by feedback from police representatives, each team constructed and pitched a solution proposal. One of the proposals presented a concept for an integrated cyber-education programme that saw students acting as cyber-ambassadors, seeking to promote 'authentic' peer learning delivered by students, rather than the teachers. The second proposal was a framework for exploring digital ethics, through actions and consequences. The framework, aligned to primary school age groups, built 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 try to understand the very real ethical and potentially dangerous consequences of certain digital behaviours.
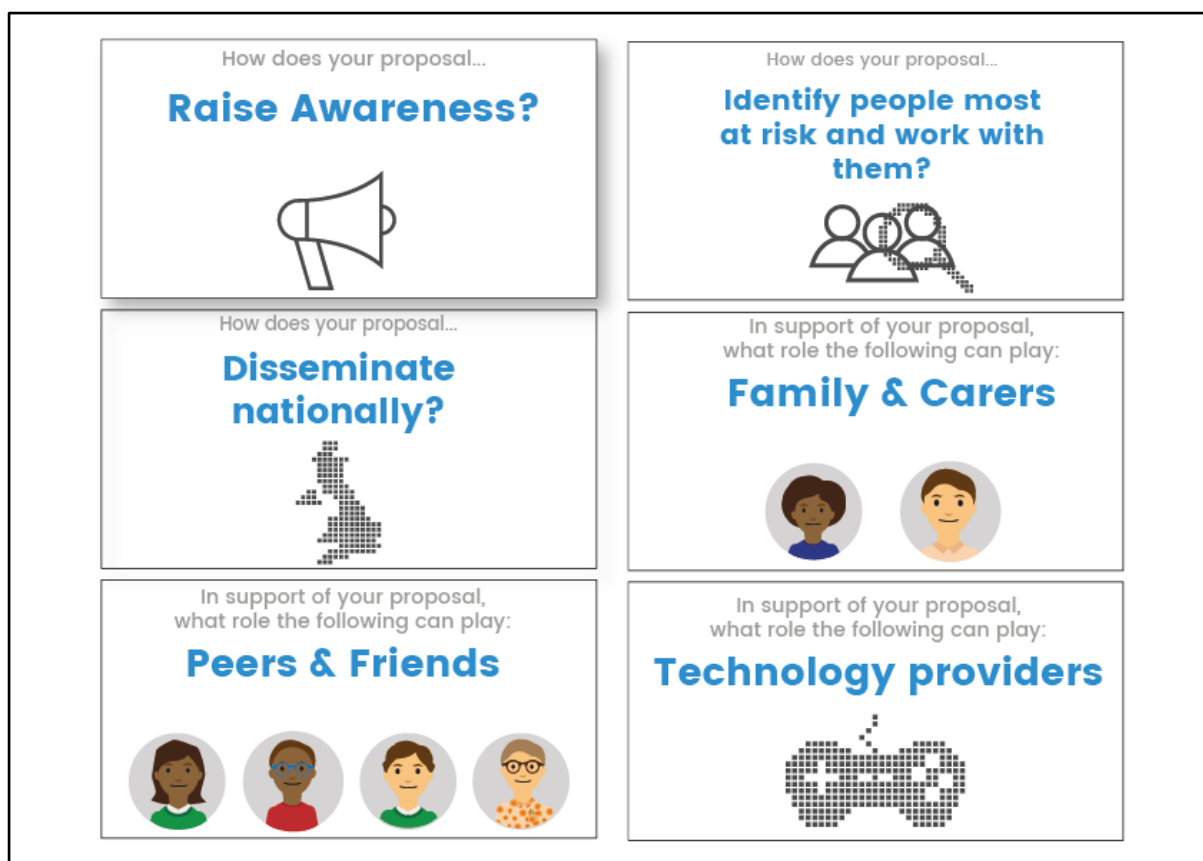
Figure 14. Design prompt cards were presented to each team during ideas development to inspire a multidimensional perspective to their proposal

The event created value to both attendees and Northumbria Police representatives; the former gained from being exposed to a pressing social challenge; experiencing a novel approach to problem solving; and by working with a range of new people from different professional and social backgrounds with different levels of experience and expertise. Northumbria Police reported that the event allowed them to work with a University in a new way, through an approach that generated ideas for future initiatives and actions;

> *Working creatively, with a range of experts, to generate solutions was tremendously exciting. If we can execute and deliver some of these ideas, they will catch on like wildfire, there is such potential to make a difference. (Senior Northumbria Police member)*

Throughout the 12 project phases, Northumbria University's Creative Fuse North East team have produced a set of actionable design briefs targeting specific value areas with sufficient clarity to commission delivery partners. Northumbria Police also commented that some of the solution proposals had the potential to scale nationally. Currently, the team is investigating the means and mechanism through which this development can occur. The team have gained a further case study about the value and application of inclusive design-led innovation practice and plan to continue to work with Northumbria Police to seek funding to see proposals emerging from the event through to pilot implementation.

4. Findings

Over the 12 phases of the project, the team arrived at two key convergent points, a) framing problem spaces and themes (activities A-H), b) early stage actionable solution opportunities that were used both for stimulating creative thinking and as strategies for developing solutions (activities

I-L). The project is currently in this 'strategy development' phase. Figure 15 depicts the range of enablers employed throughout the different phases of the projects and their points of convergence.
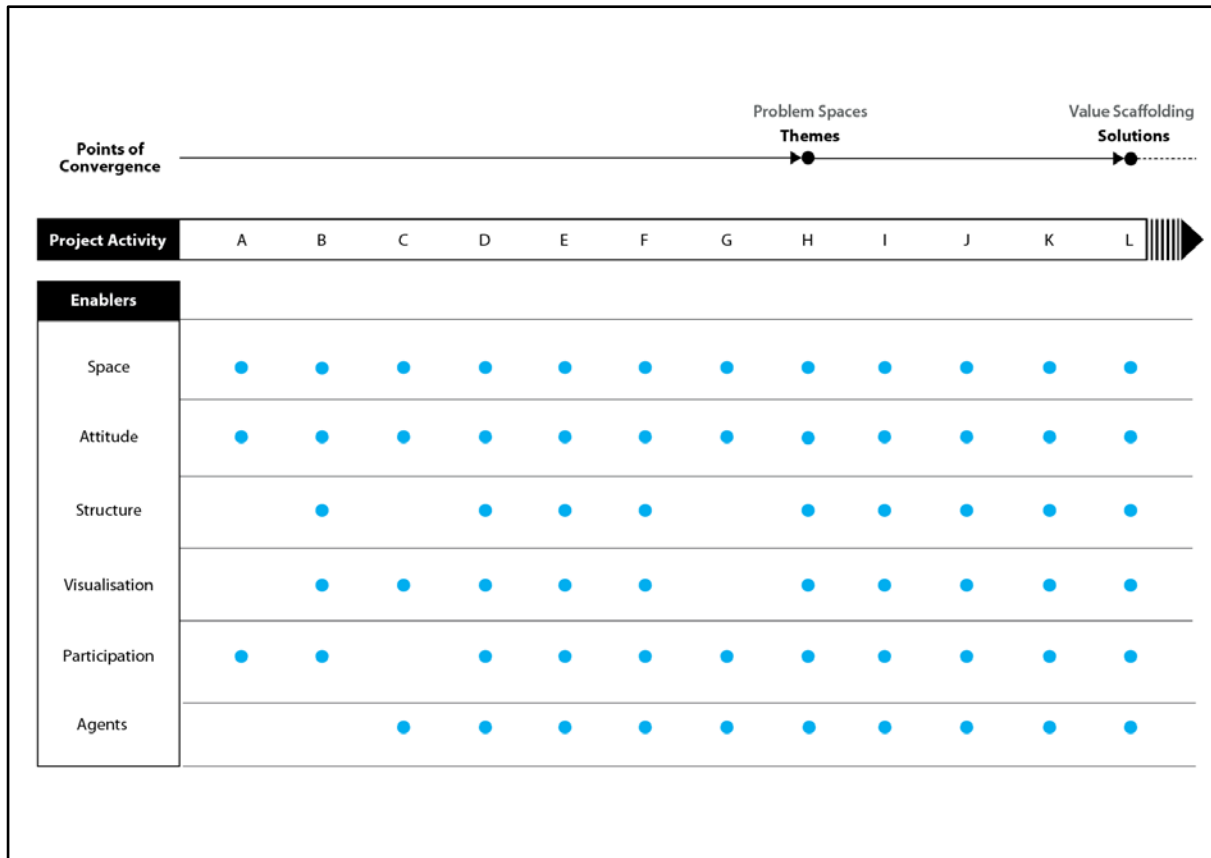

Figure 15. The different NU's design-led enablers employed during the 12 project phases

While it can be seen as though almost all enablers were present across the majority of the project phases, upon closer investigation, the intensity with which Northumbria University's design-led enablers influenced each phase's outcomes (hence, the project itself) varied. Where these enablers are referred to in the text they have been capitalised in order to highlight them.

For example, in activity D ('Brief++'), the 'participation' enabler was deficient; only a few Northumbria Police representatives made it to the session due to a security incident which demanded their attention. This in effect had an impact on the 'structure' enabler as the planned creative activities were devised with more expert participants in mind. Moreover, this deficiency affected the project by slowing down one important early stage objective: establishing and engaging expertise in the process.

During activity E ('Bring in the Experts') the students engaged with experts across industry, society, government, and academia all of whom contributed their knowledge. However, only some of the experts converted into activists (in that they actively participated in co-creation activity), thereby missing the opportunity of deeper engagement in subsequent events. Enablers such as being open to a changing 'structure' meant that students were able to identify that collecting teacher's perspectives would be beneficial, and to adapt their plans to include one-to-one conversations with teachers on a later date. In the same way, the flexibility of the 'Structure' enabler allowed students to compensate for the deficit of parents during Activity H ('Bring in the parents') by a) making the most of the opportunity by collecting in-depth data and b) devising other means to enable more diversity (i.e. questionnaires).

In activity I ('Creative Stimuli (1)), the team had little to no control over the environment and participants as these were managed by the partner institution. However, as the event took place at a

'FabLab', it helped foster a mindset of 'making' and 'experimentation'. To compensate for a lack of control, enablers such as 'structure' ranging from the creation of 'briefs' prior to the event, to the role of the team and the students had in facilitating the day were important, while the 'visualisation' tools and the 'attitude' enablers provided a set of fun and engaging activities.

Deficits were also observed in enablers 'structure', 'visualisation', and 'participation' during activity K ('Creative Stimuli (2)). For example, momentum was negatively impacted due to the lack of a well-planned 'Structure' in the day and the unclear start/finish points during different activities. This highlights the importance of balancing structure and flexibility. Moreover, participants were not obliged to stay for the whole day which caused disruption to the composition of teams and no proactive mechanisms were in place to anticipate this. On the other hand, the 'visualisation' enabler while consisting of a wealth of tools and creative stimuli, it was questionable whether their 'abundance' fostered a better engagement or whether they disrupted or overwhelmed participants. The lack of Northumbria Police expertise and lower engagement from academics of partner institutions (partly because of not turning enough 'experts' into 'activists') had a detrimental effect on the day's outcomes.

Finally, in activity L ('Solution Hack') the team identified two enabler deficits, 'visualisation' and 'participation'. In the former enabler, creative materials (provocations and tensions) it was observed that some participants treated them as 'descriptions of cybercrime' rather than 'context for action', thereby dismissing them in order to pursue solutions based on their personal experience (rather than based on the supplied research). In terms of the 'participation' enabler, this event fell short with achieving engagement with the Creative, Digital and IT SMEs. However, in contrast to activity K discussed earlier, the open to change 'structure' had anticipated the disruption caused when participants stayed only for part of the day and successfully enabled a non-disrupted event. Figure 16 depicts these varying densities between the enablers during the different project phases.
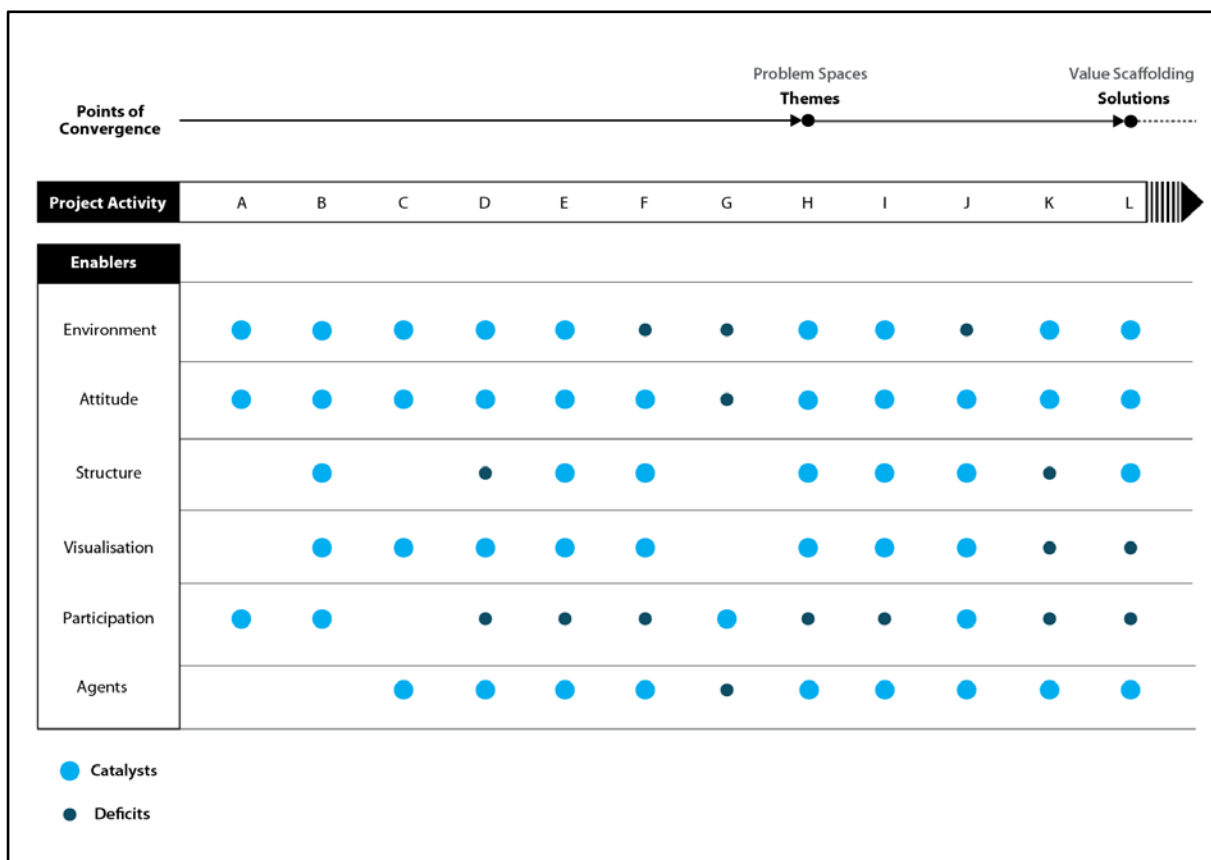

Figure 16. An illustration of how different enablers influenced project outcomes during the different phases. Larger diameter circles indicate greater density and importance, while the smaller indicate a deficit

5. Conclusions

The case study discussed in this paper described Northumbria University's design-led approach to tackle a complex, ill-defined and ambiguous problem: cybercrime. This approach was applied in this instance during the 'problem framing' stage of the project in order to transform the complex problem into actionable briefs and solution opportunities. To reach solution opportunities, we (re)framed and transformed the wicked problem into a design problem by collecting knowledge, asking pertinent questions, and generating speculative ideas. Such problem-transformation can be found in the way the problem was eventually framed; from 'cybercrime' to 'cyber-wellbeing' and from 'prevention' to 'raising awareness and influencing behaviour change to address cybercrime vulnerability'. Activities such as; engaging with diverse expertise across industry, academia, society, and government; identifying and engaging with high-risk citizen groups; trialling creative materials in pilot co-creation events; and a series of creative planning events, were amongst the most valuable in problem-framing. This framing was achieved through a process that needed careful facilitation to bring people together around a common purpose and foster their creativity. This paper proposed 6 enablers (space, attitude, structure, visualisation, participation, and agents) that were deployed to move from a position of ambiguity to one where there are strategic and actionable solution opportunities.

The evidence presented in this paper therefore suggests that amongst the 6 enablers, the 'participation' enabler is the hardest one to achieve. For example, questions that the team will seek to address in future projects are: How to convert 'experts' to 'activists' so that they are not only sharing tacit knowledge but actively co-creating new knowledge and solutions? How to incentivise and attract business engagement when there is no direct and/or immediate reward for them other than the opportunity to work with a range of new people from different professional and social backgrounds, learn new ways of working and which may (or may not) lead to forging new partnerships or developing innovative solutions? Northumbria's design-led strategy to tackle 'participation' deficits is through another enabler, 'structure'; having a highly adaptable structure enabled the team proactively to anticipate and reform in response to changing circumstances throughout the project.

Finally, it was observed that the 'agents' enabler, represented in this project by a group of multidisciplinary students, gave 'professionals' permission to behave creatively and ask naive questions through their 'creative naivety'. This had an amplifying effect upon every other enabler, making them a crucial ingredient in Northumbria's design-led approach to business-engaged research and innovation.

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