INTERNATIONAL CONFERENCE ON ENGINEERING AND PRODUCT DESIGN EDUCATION
7 & 8 SEPTEMBER 2017, OSLO AND AKERSHUS UNIVERSITY COLLEGE OF APPLIED SCIENCES, NORWAY

ENCOURAGING CREATIVE RISK TO REDUCE RISK TO LIFE

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ABSTRACT

Encouraging creative risk to reduce risk to life explores how a collaborative, cross disciplinary design research and teaching methodology can provide a platform for tackling projects in the complex industrial risk at sea scenario. Our research discusses the culture of design engaging with risk in the context of the wicked problems we identified, the methods and techniques used to tackle these challenges, how cross disciplinary projects can lead to novel insights, and how design education can be used to engage with industry and users to bridge the gap between technological innovation and user needs. The Royal College of Art funded by the Lloyds Register Foundation, working with a group of industry stakeholders, investigated two major areas of risk within the maritime context: Safe Sea Transfers from ship to ship, and making the Thames the safest city river by the year 2030. The contrasting questions of the deep, complex design issues in ship to ship transfers and the broad strategic future requirement for the River Thames in 2030 were explored using a range of approaches that encouraged collaboration, innovation and risk taking in design practice. Our conclusions support the view that an approach of increasing creative risk in education can provide insights into the use of design led innovation in order to reduce risk to life. Furthermore, we uncover the implications this has in terms of projects, disciplines and practices in the role of design thinking in general, and more specifically in the context of risk and safety at sea.

Keywords: creative risk, design thinking, design innovation, safety at sea

1 INTRODUCTION

Encouraging creative risk in order to reduce risk to life seems like a contradiction of sorts. Human life is prized most highly of all and to suggest that we should experiment or use methods that result in very different ways of delivering solutions to reduce injuries and losses of life seems at odds with the practices of engineering through tried and tested processes or designing iterative solutions well within known performance parameters. When dealing with risk reduction some of the current approaches fail when dealing with the broader picture. Especially the wider context of a risk situation taking into account other factors including social, cultural and psychological factors.

2 DESIGN RISK CONTEXTS

The combined research and teaching project described here evolved this approach as a result of the context and challenges when faced with two design safety projects of a very different nature. The project was initiated by the Lloyds Register Foundation as the first of their grand challenges looking at safety at sea. The foundation has supported a significant number of research projects exploring different aspects of risk mainly from engineering, scientific and technical domains. This project is the first funded project by the foundation to combine design thinking and innovation strategy to safety at sea and on rivers. The project has two overarching aims of demonstrating the value and perspectives that design thinking can bring, and also to develop and deliver tangible design solutions that have potential impact and applicability in tackling risk scenarios. The underlying intention of both projects was to look at risk and safety from a different perspective that framed design as a platform that can open up new approaches and create impact by reducing the numbers of injuries and fatalities at sea. Since the beginning the foundation was clear that changing the culture of safety was a key aim and this coincides well with design reaching beyond physical products into systems and human experience.
After a number of different contexts were examined we selected two to show how design could tackle a specific complex in-depth situation and a broad strategic future design challenge. The first challenge

looked at Safe Ship Transfers focusing on the activity of Ship's pilots boarding from a cutter onto the deck of a large vessel. From an initial site visit to the Port of London Authority at Gravesend Reach we learnt that this port alone delivers 10,000 ship's pilot transfers each year. London and the south east of England have a reserve of around 3 days of petrol and 4 days of food. With 98% of the country's produce being imported by ship the safe operation of pilot boarding is an essential if overlooked role for the national infrastructure. Accurate accident rates are hard to source though one southern UK port described a 1 in 100,000 accident rate. The global rates are also difficult to define but the CHIRP website [1] gathers incidents and the IMPA conducts regular surveys [2]. Although none of these sources have definitive numbers and the aim of this research was not to gather data on incidents it became clear that significant number of risks to life incidents were taking place. During the research project a fatality was reported at Gravesend Reach [3] happening on a direct crossing on a flat sunny day demonstrating the very real risk of this activity in all conditions. The central piece of equipment being explored is the Ship's Pilot ladder (Fig 1.), an item that has not seen much technical development for the last 300 years [4]. However, the rigging of the ladder and associated equipment continues to be a major issue and results in many accidents resulting in an international standard being agreed in 2008 [5]. The design challenge here concerned looking at the entire boarding activity from before the pilot leaves the port until the pilot safely returns whilst considering all of the physical and psychological elements that may affect the activity. Pilots readily acknowledge that one of the main challenges designers will face is the low investment and 'grandfathering' attitudes of the industry which can cause a resistant attitude towards change and innovation.

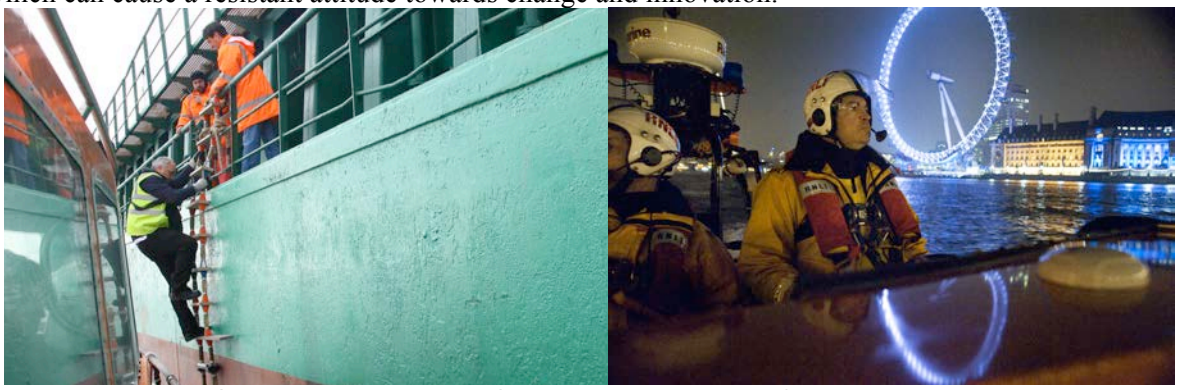

Figure 1. Ship's pilot boarding at Greenwich Reach Port of London Authority station and RNLI Thames river rescue

The second challenge came from the Royal National Lifeboat Institution (RNLI) and was based on their recent Thames Vision strategic report [6]. During their history, the RNLI have saved over 140,000 lives and the Tower Lifeboat station on the Thames is the busiest in the country with the fastest rescue times answering over 465 incidents in 2015 alone [7]. Future planning developments along the Thames aiming to deliver the Mayor's 'City in the East' vision state that 200,000 new homes will be built in the vicinity of the river. An increase in the number of people living in close proximity to the river will lead to an upsurge in river usage for transport and leisure activities leading to the RNLI aim of making the river Thames the safest world city river by the year 2030. The Thames vision report discusses a number of risks on the river and these can be broken down into two main groups with two main risks in each; regular small casualty numbers - drunken falls and suicide attempts, and infrequent large casualty numbers - major transport issues like the Marchioness disaster [8] potential terrorist threats, and large-scale flooding and climate induced risks. The design challenge in this instance is to select a design risk opportunity that can be tackled through the project and to understand when future technologies may support delivering a solution. Ultimately the ambition of this design challenge is the opportunity to grow the outcomes to a global scale, thus positioning the RNLI as promoter of safety culture though design and innovation.

3 DESIGNING RISKY RESEARCH

The challenge therefore was how to build a collaborative academic-research project and organise a set of interconnected relationships that delivered academic value and design impact in the field. Overall the project duration was eight months including the final four months comprising the student group based project. The design research team comprised thirty-two postgraduate master's students in eight

project groups and six researcher-tutors from a variety of disciplines across the Royal College of Art (RCA). Students worked in interdisciplinary teams of 3-4 from a number of disciplines including Innovation Design Engineering, Global Innovation Design, Design Products, Architecture, Visual Communications, History of design, Sculpture and Information Experience Design. The academic team followed an action research approach facilitating the design team, partner engagement and using this along with the literature reviews and semi structured interviews to develop insights. Their role was positioned both inside the research sourcing insights and leading creative processes but also external observing dialogues and events and reflecting on developments. The student design research teams worked as participatory designers bringing stakeholders into the projects for expert insights.

The research team undertook a number of field trips to the RNLI headquarters in Poole, Marine Pilot Association Conference, Port of London Authority at Gravesend, Lloyds Register Global Technology centre at Southampton University and RNLI rescue stations along the Thames. A literature review was undertaken with a thematic identification process clustering groups of documents aimed at informing creative design thinking along with a state of the art review of some of the new innovations that had been trialled in the past. Students were also taken on field trips to the RNLI headquarters in Poole, along the Thames in a cutter with the PLA and also to the PLA station at Gravesend Reach. The postgraduate student element of the project was design to coincide with AcrossRCA, a cross institutional initiative aimed at bridging disciplinary boundaries and connecting students across the college to elect into interdisciplinary workshops. Following the one week full-time intensive activity which included a briefing, literature overview, facilitated brainstorming session, field trip visits and talks by visiting expert stakeholders the design teams presented three concepts per group at the end of the week. In the following three-and-a-half-month gateway reviews were carried out for preferred concept and developed concept alongside field trips and individual stakeholder connections delivered made each group.

The Lloyds Register Foundation Grand Challenge researchers and tutors met with students to support development of their work and supported the design and building of the projects collaboratively bridging the academic-student divide and working more as a design-research collective. We were able to research aspects of the project alongside the students and bring in this knowledge to enhance projects. At the same time we were also developing a separate stand-alone research activity which gathered insights via participatory observation from a combination of the field trips, stakeholder and partner meetings and more formal research insights from the literature review, state of the art review and inputs from collaborative project development sessions to submit in a final report. Although the RCA has a long history of commercial master's studio projects and funded research with the occasional student workshop this format was new for the institution of building a long-term student project embedded and interlinked with a staff research project to this extent. One of the students commented that the experience was the best part of their education so far through meeting experts, partners, experiencing field trips and access to sophisticated manufacturing facilities. The foundation expressed an equal enthusiasm for the commitment of the participating students and the quality and variety of thinking presented during the project gateway reviews.

4 RISKY ENCOUNTERS

The following three short case studies show the diverse student design risk approaches ranging from software for ship's pilot boarding driven from a social behavioural angle, an augmented reality concept driven by gamification and a future technology projection for a radical life saving aquatic system. Each of the projects increased creative risk by using abductive thinking [9] to project new future possibilities at different levels of realisation.

Sea Pilots Assistant (SPA) - The insight for the SPA concept (Fig. 2 right) came from evaluating the whole design risk scenario and realising that Ship's pilots want confidence in the quality and rigging of the ladders they are using. This came about from a realisation that a pilot will only know how well a ladder is rigged once they have successfully climbed the ladder and that many incidents occur from badly rigged ladders. The designers understood the potential of behaviour change by leveraging the

human factor between the pilot and the ship crew; the dynamics of trust relationships, incentivisation and confidence building. The smartphone app allows pilots to share confidence and doubt about the rigging of ladders in real time with images and video if required and is a global system. The current system can flag a dangerous ladder and report it on to the next port but the feedback loop of whether repair work has been done is missing and standards and adherences globally can be variable. SPA helps a pilot once the boarding ship has been identified to trace the star rating history of the ship to gauge the level of confidence and risk while boarding. It also creates a new form of culture of trust that impacts the global scale by designing a network of information. In adverse weather conditions and low visibility this can be a distinct psychological advantage to the pilot and reduce stress. The concept provides a low investment global solution that supports confidence. The elevated creative risk is in introducing a social-media model to the safety at sea situation.

Augmented Lifesaving – The insight for this group who were tackling the River Thames 2030 project lay in realising that it's very difficult to simulate river survival situation in an indoor swimming pool or classroom and that new and emerging technologies could bridge the gap. One of the main issues for people who unexpectedly fall into the water especially during the colder months is the effect of cold shock [10]. This can induce uncontrollable gasping and an elevated heart rate than can cause drowning due to breathing in water or even cardiac arrest. Training for this situation involves incident awareness and some basic sea survival training. For some high-risk roles at it is possible to partially train for cold shock with regular exposure. The design team developed a concept for using an augmented reality (AR) headset combined with a container that could chill the human body to induce the feeling (but low risk) of cold-water shock. The target group was teenage school children and this was envisaged to work as a pop-up-shop concept. One of the interesting behaviour change features was to use gamification to encourage pupils to take multiple sessions on the trainer to improve their scores and performance. However, upon review in discussion with project tutors we realised that gamification could also have negative consequences of artificially inducing a sense of capability that was out of sync with real world scenarios (an AR environment will never fully duplicate a real-world experience) and potentially increase the risk to children through over confidence or even in extreme situations encourage experimentation. This illustrates one of the potential situations of increasing design risk without fully appreciating the implications. The group had foreseen this element and redesigned their simulation to avoid scoring and developed randomly changing scenarios instead. Thus, creating a unique scene, which can't be repeated instead of incrementally increasing perceived risk to reduce the gaming incentive and focusing on a variety of experiences.

Elly – Tackling future safety challenges on the river Thames requires fresh thinking and new risk reduction systems. The insight for this group came in realising that human based rescue speeds were already largely maximised and that an alternative and closer autonomous system needed to be considered if we were going to save more lives and particularly in the event of a mass casualty event which could swamp current resources. The group started to look at examples from the animal kingdom and came across a system that was used experimentally where birds were used to spot casualties at sea using superior eyesight. This promoted a search for other metaphors from the aquatic world and the group eventually selected jellyfish. Conceptually this used the idea of an inflatable robotic sea creature that could be deployed from the edges of the river to save lives. The Elly (Fig 2. Left) would hang underneath bridges and sheltered areas gathering solar and tidal power and when needed would jet quickly across the water to provide buoyancy, heat and light, and form lifesaving mats if required. While not providing all the capabilities of manned craft they can provide a stop-gap and support and heat a single or multiple casualties providing the extra essential support needed until more additional help arrives. One of the insights however is that jellyfish are generally considered to have a negative

association for people in the water and realising this creative design risk the group used this metaphor for the design phase but will market and propose the design under a different name.

Figure 2. Elly left and SPA right

5 DISCUSSION

The three project examples illustrate different ways that we have encouraged creative risk that tackles some of the complex risks to life in ship-to-ship transfers and the future river Thames. SPA used an idea from a social media platform of shared experiences and crowd sourcing quality opinions to give a numerical value based on the number of entries giving a reasonable indication of confidence and increase trust between the pilot and the ship crew over time. The creative risk involves shifting an idea from one domain to a very different one though its very likely that many pilots will have used something very similar albeit in a different sphere. The success will depend on the likely take up of the app though in principle this demonstrates the potential of enhancing creative risk by looking outside of conventional idea routes and understanding that experience motivation and behaviour can be equally impactful for safety at sea. Augmented lifesaving takes a very different creative risk in exploring how advanced technology could bridge the gap between real life sea and river training and education. The gamification insight was a fascinating example of how incentive could lead to increased risk and illustrates that when enhancing creative risk for positive benefits the negative scenarios also need consideration. However, the concept of simulating risk environments to enhance training and preparation has a history of successful deployment and new technologies and situations promise wider use. For the designers their creative risk involves understanding the delicate balance of motivation to engage and learn verses the falseness of an abstracted technologically based immersive environment that may well not look and feel close enough to the real thing. Elly enhanced creative risk in order to reduce risk to life by proposing an advanced autonomous robotic system based on the metaphor of a sea creature. While all of the robotic, AI and energy technology routes are under development it may take some time to develop a fully working prototype. The benefit with projects of this type is that they can explore and indicate roadmaps to develop new technologies and lifesaving solutions in the future. Additionally, this project also moves beyond the human led life saving assumption and recognises that in the near future autonomous systems will very likely be tested and trusted for early rescue and treatment.

We did however observe different types of risk in both projects overall. Risk to the ship's pilots consisted of a 'grandfathering' culture and partner engagement, whether a 300-year-old tried and tested system can be improved, the technical challenges of +60c -40c extreme environments and the complex interactions of behaviours and complex cultures in shipping environments. MPA member Capt. Chris Hoyle in his introduction talk highlighted the fact that the majority of ship's crew came from countries that were at the higher end of the Hofstede index [11] for perceived distance. This generalised cultural attribute indicates the perception of distance between oneself and a superior manager. In this instance the indication is that the perception is the most extreme distance between the individuals that relates to a much lower likelihood that decision will be challenged hence reducing safety and increasing the likelihood of accidents. The RNLI Thames safest river 2030 has distinctly different project risks by engaging in a complex meta-challenge in how to identify a tackleable design brief, linking with representative stakeholders and how far to locate the future scenarios and delivery technologies. One of the key elements for increasing creative risks was to format the project into

groups of designers working in teams from mixing different disciplines and cultures. The cultural and disciplinary mix enhanced the variety for the group combined with permission giving activities in the early stages of the project (EG. design exorcism, creative characters etc.) and set the project stage to think differently. Indeed the jellyfish idea is a result of such permission giving exercises.

6 CONCLUSIONS

During the project the different cultures, practices and knowledge bases of the designers, researchers and partners led to an array of pioneering design solutions ranging from product-focused innovations through to systemic solutions, material innovations and educational strategies. We have discussed the culture of design engaging with risk in the context of safety at sea and the wicked problems we identified, the methods and techniques used to tackle these challenges, how cross disciplinary projects can lead to novel insights, and how design education can be used to engage with industry and users to bridge the gap between technological innovation and user needs. Our insights propose that there is potential to enhance creative risk in order to tackle complex safety scenarios, but that an account has to be taken of some of the more complex side issues that may develop of which the gamification issue is a good example. The method of interleaving a teaching and research project brought with it successes and learnings. We realised that the designers needed an open landscape and to this extent the research operated initially in a classic mode of literature review, state of the art and field trips then shifted into a responsive mode with partners during the design projects while being able to extract and analyse insights from the team's thinking. One of our key insights involves reflecting on how we mediate risk by encouraging creative risks in order to reduce real world risks; that is, greater creative risk in terms of experimental thinking, innovative materials and technologies, engaging with unfamiliar knowledge, methods and communities is more likely to lead to contextually effective concepts that can increase real world safety. Ultimately we began to see creative risk as the activity of using abductive thinking to imagine different futures not solely driven by equipment design and physical factors alone but combining the social, cultural, psychological, operational and technological activities on water. Looking towards the future we would speculate that one of the new opportunities for design thinking could be in strategic involvement with more complex risk scenarios where we can develop the combined physical and behavioural insights explored here to generate new and successful solutions in reducing risk and saving lives at sea.

ACKNOWLEDGEMENTS

This research was generously supported by a grant from the Lloyds Register Foundation Safe Ship Transfers Grand Challenge 2016-17. Lloyd's Register Foundation helps to protect life and property by supporting engineering-related education, public engagement and the application of research.

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