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Abstract:

This paper discusses the co-design process developed in the Winter School, a course run by the Designing Out Crime (DOC) research centre at the University of Technology Sydney. Projects undertaken in this course address crime prevention from a holistic, designerly perspective that contrasts with traditional approaches such as Crime Prevention Through Environmental Design (CPTED). The design collaboration at the Winter School involves partner organisations, the DOC team and students, all of whom work together to develop innovative design concepts that improve community wellbeing and safety. This paper illustrates, using three project examples, the advantages and challenges of applying the co-design process in the domain of socially responsive design.

Key words: collaborative design, crime, design thinking, reframing, CPTED, shared knowledge

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1. Introduction

Using design to prevent crime is not a new idea. One of the traditional frameworks that aims to integrate the concepts and practices of design and criminology is Crime Prevention Through Environmental Design (CPTED). CPTED scholars content in that the application of this framework contributes to reducing crime and fear of crime. However, the literature also evidences the difficulties in demonstrating its effectiveness (Crowe 2000; Cozens, Saville & Hillier 2005; Cherney 2006; Ekblom 2011).

The idea of stakeholder collaboration is also not new. Stakeholder involvement is purportedly part of CPTED practice; however, the prescriptive, principle-based design approach provides limited scope for participants to contribute to creative outcomes. In view of this approach, flexible, creative collaborative design processes are ever increasingly recognised as being critical to the development of effective solutions to complex problems such as crime (Alexiou 2010; Sanders & Stappers 2008; Svihla 2010) At the Designing Out Crime research centre (DOC) at the University of Technology, Sydney (UTS), we are developing a co-design approach that promotes exploration and experimentation in crime prevention.

The DOC research centre was established at UTS late in 2007, following a competitive tender process initiated by the New South Wales Department of Justice and Attorney General (DJAG). The idea for the centre stemmed from the innovative and highly regarded work of the Design Against Crime Research Centre at Central Saint Martins University of the Arts, London. DOC is positioned within the Faculty of Design, Architecture and the Built Environment. At DOC, organisational relationships, learning processes and design practices are structured to provide an environment in which designers, students and partner organisations can experiment with different conceptualisations and solutions to crime problems. Design solutions considered and developed at the centre range widely from the design of products, buildings and urban environments to the design of partnerships, organisational systems and information infrastructures. This work is done in partnership with businesses, government and community organisations, among others.

At the core of DOC's learning and design practice is the Winter School, a collaborative learning and design practice program involving students, academics and external partners. The Winter School is an intensive four-week course conducted between semesters during the Australian winter break in July. The design concepts and solutions developed in the Winter School are conceived under the premise that they are likely to be implemented in the real world; therefore they should be viable, clever, sustainable and user-centred.

This paper discusses how, through the Winter School, we are developing a new way of working that draws on co-design approaches to address crime prevention. The discussion illustrates the key aspects of our process using examples of projects developed in the 2009 and 2010 Winter School sessions. A key concept embedded in our approach to co-design is that of 'reframing', which is analysed throughout the paper. In the context of the Winter School, reframing helps to redefine the role of users and stakeholders and reinterpret aspects of the multi-layered milieu of crime prevention.

This discussion will show that the co-design approach we are developing is valuable in advancing practice-oriented design education as well as contributing to a more socially responsive practice of design for crime prevention.

2. Methodology

This paper emerged during a course review of past Winter School sessions. The methodology used for its construction involved qualitative document analysis, followed by members' checks via personal communication. In this process the authors:

- Collected archival data related to the 2009 and 2010 Winter School programs;
- Analysed the data according to categories such as the role of the client, the design process and the benefit to students;
- Presented preliminary analysis to key participants (clients, students and tutors) from past Winter School programs by way of personal communication for clarification and to ensure reliability.

From the interpretation of the data and consultation with participants other categories for analysis emerged. A limitation of this methodology was that we were unable to access a greater number of students who undertook the course (since the majority of these students have now graduated.)

3. A Criminologist's Approach to Crime Prevention Through Design

Until recently, Crime Prevention Through Environmental Design (CPTED) has been the dominant design-led practice approach for reducing the occurrence of crime (Vallée 2009). CPTED has strong links both with criminology and the built environment disciplines and is primarily concerned with how the design of the environment influences offenders' opportunities to commit crime in specific situations (Cozens, Saville & Hillier 2005; Crowe 2000; Katyal 2002). Contemporary CPTED practice generally prescribes a linear, structured design process for preventing crime. Environments are assessed according to the CPTED principles of natural surveillance, territorial reinforcement and access control (Atlas 2008), and solutions are found largely by drawing on past examples of similar environmental settings where design modifications have been made to promote natural surveillance, territorial reinforcement and access control (Cherney 2006).

CPTED has been valuable in promoting an awareness of crime as a design issue, and has been the basis of some good initiatives. However, we hold that it presents a limited view of the possibilities for using design to prevent crime as the actual process of developing design solutions is prescriptive and limits creativity. Ekblom (2008) has argued that CPTED and the crime prevention field in general could benefit from the skills, expertise and methods that have developed in the design disciplines for tackling complex problems. He recommended conceptualising crime prevention *as* design – a process of exploration and experimentation around potential solutions to crime problems. We agree, and contend that developing design solutions to complex crime issues requires a collaborative design process with the flexibility and dynamism to deal with the complexities inherent to problems of crime.

4. A Different Approach: Crime Prevention through Co-design

At DOC our design practice, as exemplified in the Winter School program, purposefully takes a different approach to crime prevention. The Winter School utilises a co-design approach to draw on the unique perspectives of clients, stakeholders, tutors and design students in developing solutions to crime problems.

A key process in DOC's approach to crime problems is that of 'reframing' (Schön, 1995). Dorst (2006) has described reframing as the process of 'taking a giant step back, to reconsider the very basis on which you have been working, to rethink your view of the problem.' Reframing seeks to give 'fresh eyes' to a problem (Schön 1995, Schön & Rein 1994); to 'problematise' a problem and catalyse its evolution through investigation of the context. Akin's (1990) discussion of the creative potential of *problem restructuring* is consistent with these understandings of the advantages of reframing; problem restructuring helps to achieve '…the development of major breakthroughs, not necessarily arriving in the form of a flash but revealed as a result of a fundamental alteration of the manner in which the problem at hand had been viewed'.

Reframing is important to the success of design outcomes in the field of designing out crime and is a key aspiration at DOC. By applying the knowledge that derives from notions on reframing, we seek to explore the context to see if a crime problem can be redefined in terms of broader social and environmental issues that are more amenable to design interventions. In this way our design processes remain focused on desired outcomes – the kinds of environments we would like to achieve – rather the problems that spoil the environments. This permits the emergence of a range of possible solutions that are unlikely to come to light with a problem-focused approach.

5. The Winter School

The DOC Winter School functions as a collaborative design laboratory, involving discussion, reflection, and explication of real needs that result in creative explorations of a problem arena. The methodologies used in the Winter School address co-design by engaging the parties from the conception of ideas to the final implementation and monitoring of results. The parties are: partner organisations (also termed 'stakeholders' in this paper), the DOC teaching and research team (including tutors engaged for the duration of the program), and the students enrolled in the course. Each party has a leading role at different stages of the process and the effort is collective throughout the whole design process. The various stages of the Winter School process include: the preparation of the initial project briefs (by partner organisations in conjunction with DOC teaching staff); the reframing and redefinition of the project brief (by students and tutors, in conjunction with partner organisations); the presentation of design concepts (by students); the development of an implementation strategy, including progression of the students' design concepts (by DOC and partner organisations); and, ultimately, implementation (by partner organisations).

5.1 The Partner Organisations

The external partner organisations participating in the Winter School are the linchpin of the entire program. The partnering organisations are drawn from a range of sectors – community organisations, local councils, government agencies or corporations, the design industry and other private industry.

The partner organisation, as the 'client', can also be defined as the 'user' in the Winter School co-design process. However, the partner organisation is also the mouthpiece for another, much larger group: the 'end-user' community it serves. The partner organisations hold important local knowledge about, and influence over governance, management, cultural attitudes and service provision in their respective areas, whether housing, transport, health or safety etc. They have spent time building relationships with local communities, and as such are a critical point of access to the community, its needs and its knowledge.

An example of a partner organisation is the City of Sydney Council, whom DOC has engaged in the Winter School on several occasions. As a city council, the City of Sydney represents the interests of diverse user groups and stakeholders and has direct influence over the use and management of public space (S. Matthews 2011, pers. comm., 13 Jan.)

A single Winter School project often combines multiple external partner organisations. Other organisations with whom DOC has partnered in a Winter School project known as 'Living Laneways' involved the City of Sydney council, as well as included small business owners, residents, representatives from the arts community, workers and the general public (Figure 1). Multiplied in the Winter School context, the partner organisations bring diverse interests and agendas to each project, sharing their expertise as well as their experience, the obstacles they face individually and collectively, and their frustrations about the problems to be addressed in the brief.
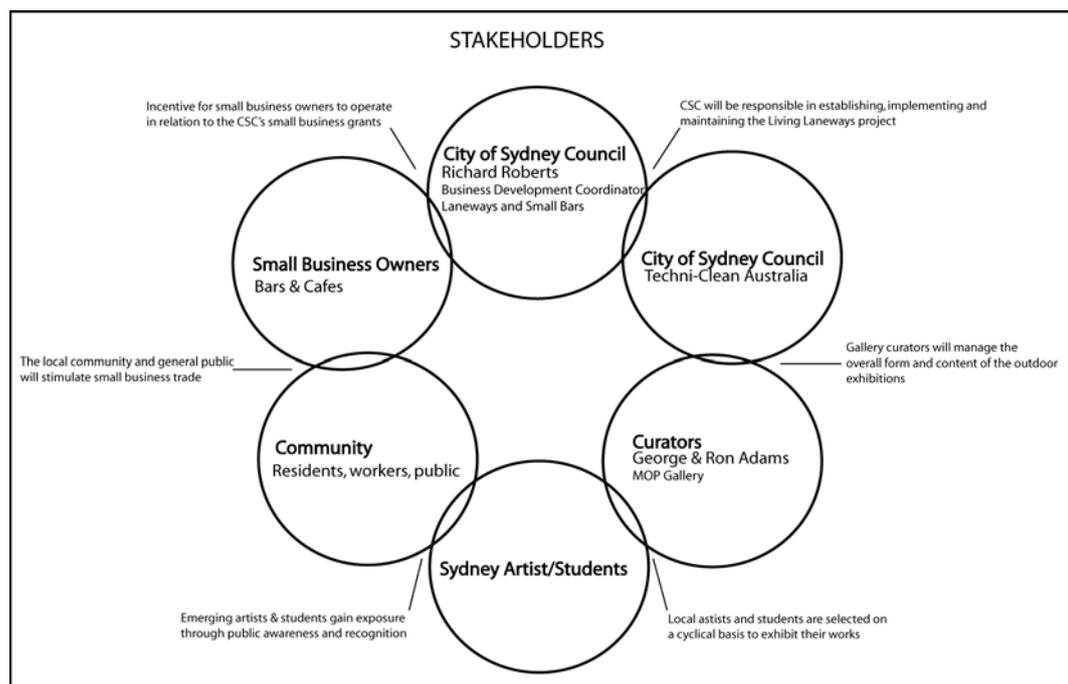
Figure 1. Diagram showing the range of stakeholders in the *Living Laneways* project, which aimed to create design concepts to enliven and rejuvenate neglected service lanes in Sydney city. (Source: Morrison, Raine et al, 2010)

5.2 The DOC Team
The role of the DOC team throughout the Winter School process is to facilitate the teaching and learning process as well as to provide expert design advice and resources. DOC administers the Winter School program with the help of tutors drawn from relevant

departments in the faculty of Design, Architecture and Building. Tutors from other disciplines are also engaged to participate in the program.

Since the partner organisations are so important to the Winter School process, the DOC team undertakes to create and maintain robust partnerships with these organisations prior to and following the Winter School. In building relationships with partner organisations, the DOC team aims to create channels of communication that allow for the exchange of information and ideas which will assist with the development of briefs for the Winter School program, as well as the implementation of design concepts at the program's conclusion.

5.3 The Students
The students participating in the Winter School are primarily third (final) year undergraduate students, organised into groups. Most students come from design disciplines such as interior, fashion and industrial design, visual communications, architecture and urban planning, although some projects have also involved students from the law faculty (N Karlovasitis 2011, pers. comm., 12 Jan.). This multidisciplinarity also helps to define the individual roles that students adopt in their project groups – such that, for example, architecture students would typically take responsibility for environmental design concepts while visual communications students create a branding strategy. The curriculum is being further developed to permit students from other disciplines to enrol, so as to enhance the multidisciplinary and co-design strengths of the course.

5.4 The Project Brief
The project brief, in short, outlines the crime problem/s requiring design solutions. The preparation of the project brief is a process done in collaboration between DOC and the partner organisations. The project brief must: be comprehensive yet targeted, to ensure that projects are context oriented; lead to design explorations and concepts; be manageable within the timeframe of the course; be at the level of complexity suitable to third year undergraduate students; involve an issue of interest in crime prevention; and have potential for multiple solutions (D Tomkin 2011, pers. comm., 10 Jan.).

The project briefs must be specific enough for students to develop design concepts but flexible enough to permit a range of possible creative solutions. Building project briefs is, therefore, a challenging task that needs to take into account the pedagogic and the practical benefits of each idea.

5.5 Rewriting the Brief
Upon receiving the project brief, students embark on a process of redefining and rewriting the brief, facilitated by tutors from relevant design disciplines. This is the point at which tutors encourage students to think about reframing the problem as is it presented to them in the project brief (N Karlovasitis 2011, pers. comm., 12 Jan.).

Aided by their tutors, students begin familiarising themselves with the crime problem and exploring the physical and non-physical aspects of the problem context. This is done through detailed discussion and interview with the stakeholders, as well as site visits where students build up their own impression of the physical context of the crime problem, taking photographs, noting design issues and interviewing willing 'end users' to enrich their own understanding of the problem context. During this part of the design process, students come to appreciate that a crime problem is rarely the result of a linear cause-effect development, but

rather arises from a complicated set of issues that coevolve into a negative outcome (J Wong 2011, pers. comm., 11 Jan.).

In their groups, students then rewrite the brief. The redefined brief incorporates students' idea of how the problem should be reframed. This reframing is often expressed through narratives or metaphors that help redefine the context of the problem. Students then present their ideas to the partner organisations, listen to feedback and, together with tutors and partner organisations, negotiate the details of the design brief until all parties are satisfied that the project is on the right track (D Tomkin 2011, pers. comm., 9 Jan.).

After the brief has been redefined, the students (with the tutors' assistance) assign themselves to individual project roles. Student groups are encouraged collectively to ensure that each individual's workload is equal and fair, and to view their peers as equal collaborators. Examples of project roles which might be adopted include those of co-ordinator, facilitator, research manager, visual presentation manager, spokesperson and evaluation manager, and other roles where required. The solution-oriented approach helps to generate a range of possible solutions to test and experiment with them.

5.6 Creative Experimentation and Concept Delivery
With their redefined briefs, students spend an intensive couple of weeks developing and experimenting with possible design solutions. Tutors are sounding boards for ideas during this process, and aid each group to hone their strongest design concepts (N Karlovasitis 2011, pers. comm., 12 Jan.).

For the students, the Winter School process concludes with the formal presentation to stakeholders of their design concepts, including the redefined brief and a proposal for implementation, following which they receive final feedback from the stakeholders.

The presentations represent the end of the actual course but the beginning of a dialogue in which the partner organisations and/or DOC consider the design concepts and devise ways to implement them.

5.7 Analysis of Projects/ Case Studies

The following sections present three case studies of projects developed during the Winter School programs of 2009 and 2010. They analyse the creative process including the manner in which reframing occurred in each example. The projects in the following section cover crime issues in the areas of public transport, social housing and late night economies.

5.7.1 Passenger Safety at a City Railway Station

The following example illustrates a project which aimed to improve safety and reduce crime at one of Sydney's busiest public rail stations (Lewicki et al. 2010).

For this project students focused their analysis and design solutions on Town Hall station, in Sydney CBD. The project began with the project brief prepared by DOC and the rail authority, which outlined some of the key crime issues at the station, such as assault and theft. Following this, student sought further information on the context, which they gained from a discussion with the rail authority at the initial project briefing.

At this briefing the students learned that the station's strategy for the safety of passengers on

its platforms consisted of a limited number of roaming, uniformed security guards, and a number of 'help points' – emergency buttons fitted to station walls which could be pressed to allow passengers to communicate with the station security centre.

Students visited the station to examine the station environment, the help points, and interview passengers. Their findings suggested that these help points were ineffective for a variety of reasons. Few passengers (including the students themselves) were aware of where to find them and how to use them. Help points were sparsely distributed throughout stations, and in many cases were difficult to see on walls cluttered with other information and service structures. Additionally, each help point was accompanied by a sign informing potential users that misuse of the help point would result in a fine, although 'misuse' was not defined. As the students aptly pointed out in their redefined brief, the issue of 'ambiguity about what kind of situation would warrant the use of the help point, coupled with a fine for misuse, discourages the use of the help point... A person should not have to think twice about using a help point in the moments during and before a potential emergency.' In consequence of confusion and threats of a penalty, passengers were more likely to seek help from an ordinary (non-security) station worker than to use the help point service ostensibly in place for their protection.

Indeed, students' analysis of the help points revealed that they might actually decrease public perception of safety. Meanwhile, their perceived ineffectiveness as a security device ensured that potential criminals were not deterred from committing crimes of theft and assault on passengers in unpatrolled parts of the station.

Having made these observations, it was clear to students that the problem with safety at Town Hall Station was not just the occurrence of crime, but the fact that potential victims of crime – the station's law-abiding rail users – were restricted in their ability to seek help in the event of a crime.

Students reframed the problem and rewrote the brief to shift focus, first and foremost, to the needs of the appropriate (law-abiding) users. It was evident that the station's passengers needed access to emergency-related information, and emergency help, immediately when necessary and at any location. A solution would not work if it required learning or remembering (as with the locations of help points) or if its use by those with a genuine or potential need was in any way restricted (such as by a written warning about fines for misuse). At the same time, it would have to acknowledge the need of station security staff to respond only to real emergencies.

After creatively experiment with a variety of ideas, students came up with the idea of an interactive 'help strip' (Lewicki et al. 2010). The help strip concept consists of a continuous, high-visibility LCD touchscreen strip encased in heavy-duty perspex and mounted at waist-height along the station's publicly accessible walls. The strip would be integrated with current security systems. Throughout the day messages instructing passengers on how to use the help strip scroll along the screen. If security assistance is required, passengers press the screen for 5 seconds or tap it rapidly (as instructed on the screen itself). The screen and surrounding LED lights respond with each tap or each elapsed second, indicating that an emergency function is being, or has been activated. After three taps/seconds a nearby security camera will focus on the area, which in some cases will provide enough information for security personnel to respond accordingly. After 5 taps/seconds a speaker and microphone will be activated, enabling the passenger to speak directly with a member of security staff to get help.

In addition to delivering security assistance quickly and with minimal inconvenience to passengers in distress, the help strip would increase security presence, making people feel safer and reducing opportunities for crime. The students also suggested that the strip be used for advertising at intermittent spaces, to provide revenue and compensate for any advertising space that would be lost with the installation of the help strip. The help strip could also be used for other information functions, such as news headlines, which would increase awareness of the help strip and its use.

The help strip project research provided a fascinating example of how poorly conceived crime prevention devices (such as the help points) can inadvertently penalise law-abiding users while failing entirely to reduce opportunistic crime; and that concepts focused on improving the experiences of appropriate users can result in innovative solutions.

Figure 2a. Visualisation of the 'help strip' concept proposed for Sydney's Town Hall station. (Source: Lewicki, Lancuba et al, 2010)
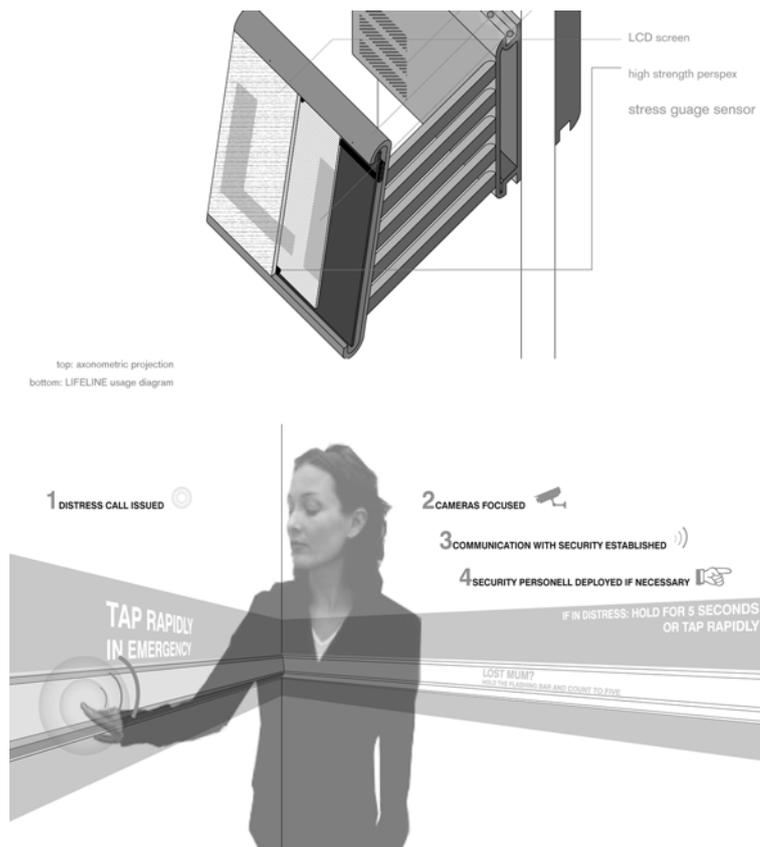
Figure 2b. The mechanism and function of the help strip. (Source: Lewicki, Lancuba et al, 2010)

5.7.2 Designing with the Community at Shalvey, NSW

In this example, the Winter School co-design model has demonstrated positive outcomes in a disadvantaged social housing estate.

The physical context for this project is Shalvey, a suburb in Sydney's west, has a high concentration of public housing and accommodates residents with diverse needs.

The partner organisation in this project, Housing NSW (the NSW government's public housing authority), manages this housing estate and simultaneously provides other community support and facilities. One of these facilities is the Shalvey community centre, a residential dwelling converted for community use. Not long after it was opened, the centre was vandalised and broken into several times. In their haste to protect the facility, Housing NSW erected a barbed-wire fence around the perimeter of the property. The fence, large and imposing around the modest brick building of the community centre, was fairly effective in preventing crime but also succeeded in repelling locals, and patronage of the community centre declined.

DOC's Winter School students were presented with a project brief to help find more permanent solutions to the centre's crime problem. In reframing the problem and redefining the brief, students and tutors identified that the forbidding barbed-wire fence was a physical symbol of the tensions and distrust between Shalvey's residents and the housing authority (G Furzer 2011, pers. comm., 18 Jan). The fence made residents feel like criminals, and was interpreted as an aggressive response from the landlord, which exacerbated animosity within

the community. The sense of distrust of Housing NSW among the community was so strong that ill-feeling lingered despite a number of efforts from the housing authority to provide better community facilities in the area. As they explored the problem context, it became apparent to the students that their designs needed to treat the community as users rather than merely as abusers who were disengaged, indifferent or perpetrators of vandalism and theft. By reframing the problem in this way, the students realised that their solutions needed to focus on encouraging the community to use the facility as much as protecting the property.

In the design concepts presented to the housing authority, the community featured not just as the end user but as a key driver in the implementation of the concepts. The project's primary recommendation was the construction of a new fence that required community participation and collaboration for its design and completion. The version of the fence that the students envisaged consisted of a collection of vertical posts, of different sizes and materials, made by the students from the local vocational training college in conjunction with local artists. The irregular fence would be visually attractive yet hard to climb.
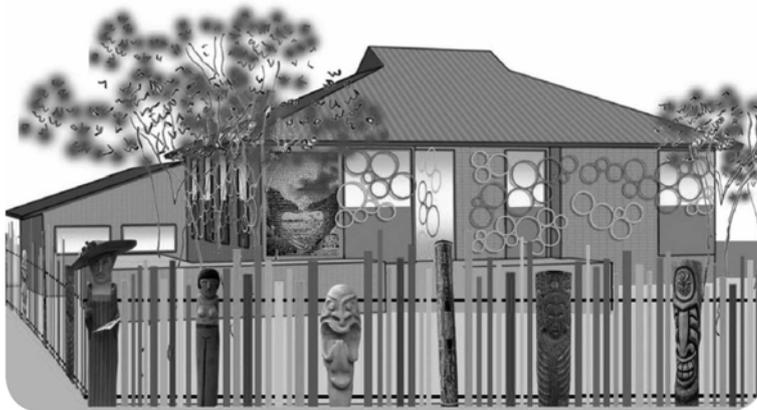
Figure 3. Illustration of the security fence and building treatment proposed for the Shalvey community centre (Source: Student poster, 2009)

The housing authority eagerly adopted the project, and although funding did not permit the construction of the fence design described in the project, the community were still an integral part of the project. The final fence was a simple metal palisade fence, erected and painted in different colours by local residents. This activity had a positive impact on community participation and contributed to reduce tensions between the housing authority and the community (K Williams 2010, pers. comm., 13 Dec.). The resultant fence looks friendly and inviting, and at the same time fulfils its purpose as it is not easy to trespass. Since this fence was built, other changes in the design of Shalvey community centre had been implemented, making it a central focus in the everyday life of Shalvey residents. Neither the fence nor the centre have been vandalised or broken into since the fence was built.

5.7.3 Rethinking Urban Space in a Party Precinct

This final example illustrates a development occurring in the transition to the implementation stage of a Winter School project.

This project focused on alcohol related violence in Kings Cross, a mixed red-light and clubbing precinct close to the Sydney CBD. The students working on this project proposed reframing the Kings Cross precinct as an official 'event precinct' on Friday and Saturday nights (Wilson et al. 2009), since the area attracts over 30,000 party goers each weekend.

The reframing of the Kings Cross precinct as an event precinct permitted expansion of the possibilities for development of design solutions, resulting in a diverse collection of concepts ranging from increased transport and communications strategies based on social networking, to urban design and service innovation (Becker et al. 2010; Chau et al. 2010; Wilson et al. 2009).

As the stakeholders were keen to implement the recommendations, DOC is now working on a detailed concept proposal and an animated flythrough that visualises how the Kings Cross precinct could operate as an official event destination. This concept proposal will be used to engage the top level of decision makers in the co-design process, which has the potential for further innovation and development.

Figure 4. Still image from the flythrough visualisation developed for the Kings Cross project, showing concepts proposed as part of the reframing of Kings Cross as an event precinct. (Source: DOC research centre, 2011)

6. Reflections on the challenges and limitations of the Winter School

As discussed, the Winter School is developing a new way of using a co-design approach to crime prevention. The various components of the Winter School process are under constant review and experimentation. Each time this course is administered we test a number of tools for practice-oriented design with a pedagogic value. Overall, the key aspects of the course offer a number of significant opportunities and benefits that strengthen the design explorations. However, these also present a number of constraints that may compromise the potential of projects to evolve further outside the course. Balancing both the pros and cons is an important part of the experience and enriches the pedagogic value of the Winter School as well as its ability to fulfil clients' expectations. The following table summarises those aspects in terms of opportunities and constraints:

Opportunities/Benefits	Aspect	Constraints
New eyes for old problems	**Students as designers**	Naïve world view
Partners willing to engage with the university	**Education context**	Partners may or may not implement designs
Rich information context for design	**Co-design**	Overwhelming information context for students
Student's desire to innovate	**Student project**	Low or unrealistic partners' expectations
Students work for outcomes not marks	**Real problems**	Problems are complex and multi-layered
Creates focus and momentum	**Short timeframe** **Design Intensive**	Problem analysis can be superficial
Diverse strengths, rich discussions	**Multi-disciplinary**	Disagreement, difficulty focusing

Table 1: Analysis of the main features of the Winter School.

7. Concluding Thoughts

The Winter School is developing a novel application of co-design which is well-suited to crime prevention in the urban domain. The co-design process exemplified in the Winter School tackles the same crime prevention issues as classic criminological approaches such as CPTED, but from a more flexible, designerly point of view – incorporating the wider context, looking beyond the original crime problem and emphasising aspects of a situation or environment that may not directly be related to the crime issue to find novel solutions.

Although the program is continually being refined and improved, the immediate benefits of the Winter School are numerous. Partner organisations gain fresh ideas for design solutions and the advantage of viewing a long-troubling problem through new eyes. The students benefit enormously through the intensive, practice-oriented learning experience, gaining understanding about 'real' problems and realistic solutions, as well as the opportunity to have their work implemented in the real world. In terms of design education, the program's emphasis on reframing helps young designers to develop analytical skills in a way that is not yet common to design pedagogies. The DOC team benefits from the innovation and creativity generated by the projects, as well as through the initiation and strengthening of partner relationships that may subsequently form the basis for the centre's research activity. Through their various involvement in the program, each party gains new knowledge relevant to their situation.

Further, we propose that the model of co-design exemplified in the Winter School could have far wider application in areas of socially responsive design outside the immediate context of design for crime prevention.

In our experience, the Winter School provides a unique collaborative environment that is rarely encountered in the 'real' world. This environment creates space for the exploration of complex social problems via interaction between the representatives of stakeholder organisations whose formal interests in a shared problem are diverse and who – for reasons of politics and/or sheer lack of opportunity – would otherwise find it difficult to collaborate and co-operate in a meaningful way to achieve solutions.

In the non-combative, non-threatening environment of the Winter School, stakeholders are invited to set aside their professional armour 'for the sake of the students', and offer their views, advice and criticisms in front of other stakeholders as well as students. In attempting to reframe the problem to create a brief that satisfies all stakeholders, students emphasise the similarities between partner organisations. At the end of the process, the various stakeholders have not only met and shared ideas, but have tentatively established communication channels that they may choose further to strengthen by progressing and implementing the students' design ideas.

In conclusion, we emphasise that the students are key to the innovation represented in the Winter School model. While professional designers may be able to break down the barriers between multiple stakeholders and provide a similar context for collaboration, the involvement of students creates a uniquely neutral, mutually sympathetic environment which, we believe, is difficult to replicate without them.

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