LIBERTY VERSUS SAFETY: A DESIGN REVIEW

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Abstract

It is our contention that when designing against terrorism, it is important to fully understand both terrorist perpetrator techniques and terrorism prevention principles and to establish the myths and realities about 'fear of terrorism', before catalyzing new design innovations. This paper assesses the requirement for designers to mediate issues of user liberty versus security. We assess the troublesome design tradeoffs between accommodation of users and exclusion of terrorist misuse and abuse linked to bicycle parking, using the Conjunction of Terrorism Opportunity framework. We include the case study of the Biceberg automated bike parking system in relation to the fitness for purpose versus resistance to terrorism debate.

When working on the design of secure street parking, our research revealed that 'fly parked' bikes are regularly removed by the police from locations thought to be high-risk terrorist targets. 'Fly parking' needs further definition and is coined by Adam Thorpe of Bikeoff to describe the securing of bicycles to street furniture not intended for that purpose, i.e. railings, lamp-posts, parking meters, benches, street signs and so on (Gamman *et al.* 2004). It demarcates the user desires of cyclists as regards parking provision in a similar fashion to the way desire lines (footpaths worn in grass by people avoiding the prescribed routes and taking shortcuts) demarcate the way people wish to move through their environment. Fly parking is a consequence of user demand for proximity to destination and often should be viewed not as 'nuisance' behaviour by cyclists, but connected to lack of adequate provision by the authorities.

Our research has revealed that since the Bognor and Brighton bike bombs, fly parked and other bikes are regularly removed by police in Westminster, London from locations thought to be attractive to terrorist acts. For example, bikes were banned from Parliament Square (London, June 2006), removed and regularly impounded when parked in the proximity of the Labour Party conference in Brighton September 2005:

> Bicycles are being removed to avoid a repeat of the IRA bike bomb blast in Bognor on August 13, 1994. A bomb hidden in a bag on a bicycle chained to railings in the town centre detonated, causing damage to shops but no injuries. Police found another bike chained up near the Palace Pier in Brighton with 5lbs of Semtex hidden in a saddlebag but carried out a controlled explosion before it could go off. If it had detonated it would have killed anybody within a 46 metre radius. Over the next few weeks bicycles left chained up near the Brighton Centre could be removed and taken to a police pound. During the conference, police will aim to stop cyclists before they have time to chain their machines to the fences. Sergeant Pete Hutin said: 'We have removed quite a lot of bikes over the last year and it has been a challenge reuniting them with their owners.' There is no defined zone where bikes are not allowed but those with saddle bags or panniers parked near the conference

> centre are certain to be investigated by the police and could be removed. (The Argus 2005)

This policing strategy is not an over reaction. Bike parking sites **are** attractive to terrorists. This is not a fictional assessment or our personal assertion. "It was a remote controlled bike bomb on the roadside which targeted a Ministry of Interior police bus " (Kabul, October 11, 2006). There are many similar press reports about bike bombs that can be easily accessed via the web, which also offers access to a 3 min video clip of the streetscape outside of Yishun MRT train station, Singapore, seen through the eyes of a terrorist. It features the voice of Hashim bin Abas. Bin Abas reviews bike parking from the point of view of someone looking for a place to plant a bomb. The videotape was recovered from Afghanistan and led to his arrest for hostile reconnaissance/ terrorist activities. On this tape (transcript is available on Channel News Asia website (Channel News Asia 2007) Bin Abas says:

'You will notice that some of the boxes placed on the motorcycles, these are the same type of boxes that we intend to use. '

The camera pans across the bicycle stands to motorcycle racks and other parking facilities and the voice continues: 'This is a taxi stand, our bicycle can be parked there also; either bicycle or motorcycle. This is a view of the pickup point from the rear, there is a tree next to the bicycle bay, this is the place where the military personnel will alight from the bus or queue up for the bus.' The use of bike bombs is a known urban terrorist MO. In recent years, linked to conflict and insurgency in the Middle East, there are many examples where bike bombs have been used to kill soldiers as well as civilians and create terror in Afghanistan (Command Post 2007, Scotsman 2007, Deutsche Welle 2007), Pakistan (Dawn 2006, China Daily 2007) and more recently Baghdad (Peoples Daily Online 2007). We include press reports in the endnotes for further analysis. Clearly, the policing strategy in relation to cycle parking on London's streets is intended to address, via social policy, what Roach *et al.* (2005) in their account of the conjunction of terrorist opportunity (CTO), locate as crucial principles to avoid terrorism i.e. 'restricting the resources available to the terrorist; excluding terrorists from the situation; and promoting *'deterrence'* via situational interventions deployed to 'raise the perceived risk of getting caught or failure for terrorists.'

In relation to cycle usage in cities 'troublesome tradeoffs' (Ekblom 2005) between designing to promote the benefits of cycle usage and designing to reduce the threat of terrorism are glaringly apparent.

We note that: 'It is estimated that up to 1,600 people can die prematurely each year due to health problems caused by breathing London's polluted air.' (Mayor of London 2002). So it may be argued that the risk associated with bike bombs is superseded by that of traffic pollution. Additionally, the pollution threat is discriminate in that it directly affects the most vulnerable, 'children, older people and those with heart and lung problems.'

It is already established that 'most [air] pollution in London comes from road traffic', the major contributor being the '11 million car journeys made [in London] every day'. The Mayor of London's Air Quality Strategy (2002) identifies increased cycle usage

as part of the solution to this lethal problem. He advocates measures aimed 'to help staff to walk, cycle or use public transport to get to work; for example by putting in cycle racks and showers'.

Desirable as it is to eradicate the threat of bike bombs from our cities, deterring cycling by banning cycle parking in busy locations (considered high risk) cannot be the answer given the benefits of cycling in relation to health and quality of life issue. The issue of 'risk', discussed at length by Durodié (2005) needs to be carefully understood and reviewed. Indeed, if the benefits of bike use are more significant for daily commuters than the threat of terrorism how far should anti terrorist thinking influence or impede the design, context and availability of bicycle parking?

We believe the above question is the crux regarding the design of anti terrorist objects/ environments for public space. To address the tradeoffs that inevitably arise, we advocate a rigorous assessment of the design conflicts and confluences between security and user requirements.

Liberty versus Security – Assessment of conflicts and confluences of cycle parking user requirements and terrorist misuse.

1. In the security corner…

When considering Roach *et al'*s Conjunction of Terrorist Opportunity Framework (2005) in relation to public cycle parking, seven of the principles are particularly useful for identifying areas of conflict between user requirements and measures necessary to deter or prevent terrorism.

A definition of terms, abbreviated from Roach *et al.*'s (2005) original text is necessary to appreciate how these principles relate to situational terrorism prevention through design:

1.1. Excluding terrorists from the situation
'Excluding suspects from places within a country … (e.g. injunctions to stop suspected animal rights activists from going near the homes of pharmaceutical company employees)' may be an appropriate consideration in relation to cycle parking. Those individuals considered to be high risk being denied access to sites considered high risk.'

1.2. Deterrence
'Raises the perceived risk of getting caught or failure for terrorists; *discouragement* makes the terrorist think that the effort to commit the act is too great for the reward. On the situational side are a range of familiar techniques to: increase the effort for the terrorist, increase the risk, reduce the reward, reduce provocations, remove excuses and enhance empathy.'

1.3. Target vectors
Target vectors are the immediate targets of terrorist action. Terrorist engagement with the *target vector* is a means to an end. The action on the *target vector* is not the end in itself but the mechanism by which to deliver a message to a broader audience.

‘Interventions that prevent people and things becoming *target vectors* will be largely situational.’ For example ‘The use of the twin towers in New York by Al Quaeda as a target vehicle (and the concern about nuclear power-plants becoming targets) has led to the introduction of many situational prevention measures’ such as ‘Construction of buildings that are not head and shoulders above the rest’ Ekblom notes: ‘ But there is again a trade-off between being prudent versus giving some kind of surrender message to target audience and the enemy’. Consideration of the bicycle in an urban context as a *target vector* is appropriate as the banning of bicycles from public spaces, due to the threat of terrorist misuse, may deliver the message that the benefits of bicycle usage are denied those who are in conflict with terrorists. It is important to consider the range of situational prevention measures that may prevent bicycles becoming *target vectors*. It is also important to be wary of the possibility that a ban on parked bicycles in high risk areas may send a surrender message.

1.4. Target enclosure
‘Well-established techniques such as target hardening and access control used to modify situations to prevent crime are applicable to preventing acts of terrorism. Multi-layered target enclosures and associated access control (the onion skin approach) can confer defence in depth.’

1.5. The wider environment
‘Changes which make the environment less attractive, less likely to generate offending or less logistically/tactically favourable for offenders.’ Interventions may be local in focus and may involve changes in the design and management of facilities and locations. ‘Areas containing specific national icons may attract terrorist attention; so may require broad protection via surveillance, redesign of road layouts, access points etc.’

1.6. Boosting preventers (*including capable guardians*)
Preventers are people who may make terrorism less likely to occur or make it harder for a terrorist to succeed.
‘This can be through formal control (e.g. increased security patrolling, surveillance, intelligence-gathering and investigation, and the acquisition/placement of informants [site managers, guardians of targets]) or informal social control (e.g. increased employee and public vigilance).’

1.7. Discouraging or deterring terrorist promoters
Promoters are people who may make terrorism more likely to occur or make it easier for a terrorist to succeed. Promoters can be considered to be *deliberate* or *careless*.
In relation to bicycle parking an address to *careless promoters* is appropriate.
‘Measures against careless promoters can include anything from reminding people to lock doors or take their bags when leaving trains...[or parked bikes]’

2. In the user corner…

When considering the design of cycle parking provision, there are a number of key design drivers that prescribe ‘fitness for purpose’. Design of an appropriate facility, likely to meet user requirements, and therefore encourage optimum usage, must consider the following issues that we have extrapolated from existing cycle parking design guidelines and Bikeoff research.[1]

2.1. Length of stay
Short stay (<2 hours), medium stay (2-6 hours), long stay (6+ hours). Short stay should be located within 25 metres of the destination it is to serve. Longer stay requires greater security from theft and can be located up to 50 metres from the destination it is to serve.

2.2. Location
Should reflect user desires. Fly parking is a good indicator of demand.
For cycle parking to be attractive to users it should be located 25-50 metres from the destination it is to serve.

2.3. Layout.
Sites serving multiple destinations should be provided parking in small clusters of stands (<6). Sites serving single larger destinations should be placed together in adequate numbers. Layout should consider sight lines to facilitate easy monitoring of stands.

2.4. Spacing
Should allow easy use of parking and circulation of users.

2.5. Access
Should be easy for cyclists on and off their bikes and avoid conflicts with other users of the space and its approaches. Long stay parking or site-specific parking (e.g. workplace) may consider controlled access.

2.6. Guardianship, Surveillance and Lighting.
Parking should be well lit such that monitoring and use is facilitated. Those personnel monitoring the surveillance and those providing guardianship should be informed and empowered as to potential threats to the security of the facility and its users. Such measures should consider the approaches to the parking as well as parking itself.

2.7. Maintenance and servicing equipment should be low maintenance. Servicing is necessary to signal a secure, well-managed facility and is likely to be attractive to users.

2.8. Signage
Should be clear and instructive to all languages and should inform users as to the most appropriate usage of the facility.

2.9. Charges are only appropriate on long stay parking where security is highly considered.

2.10. Scales of Provision. Scale should reflect demand and allow for expansion. Fly parking is a good indicator of demand.

Once user requirements and CTO principles are defined their cross consideration may assist designers in identifying the areas of conflict between ‘fitness for purpose’ and resistance to terrorist misuse or abuse.

A table illustrating cross comparison of these CTO principles and cycle parking design requirements is featured at the end of the article (Figure 8). It assists the designer in identifying the troublesome tradeoffs and convenient correlations between user requirements and the techniques that deter terrorism. Having determined these conjunctions, knowledge of terrorist MOs is required to enable the designer to understand how to mediate, reducing conflicts and amplifying confluences.

3. Summary of conflicts and confluences

A summary of these conflicts and confluences, within design of cycle parking, can be stated as follows:

3.1. *Length of stay* is a high conflict consideration as cyclists require the option to leave their bikes parked, and unattended, for whatever length of time they desire. This pattern of usage provides cover for terrorists as it legitimises the presence of unattended bikes. One confluence is that users of 'long stay' parking require greater security, including controlled access, surveillance and guardianship. Thus long stay facilities provide good opportunities to design "against terrorism" without user conflict.

3.2. *Location* is a high conflict consideration. Research shows that for short stay cycle parking to be used it should be located within 25m of the destination served and 50m for long stay parking (Sustrans 2004). The lethal blast radius of 5lb of Semtex (as hidden within a saddle bag in Brighton in 1994) is 46 meters. Thus, the user requirement for parking to be close to the destination it serves is **problematic**, especially at iconic sites that may attract terrorist attention.

By reviewing the above standards, we clearly identify that it is undesirable to users and sustainable transport objectives for the authorities to adopt a strategy that involves removal of bikes from the location (as in Westminster, London), and creates 'exclusion zones' for cyclists.[2] A thorough analysis of terrorist MOs, in pursuit of mediation of this conflict, is necessary, and in our opinion, reveals that in the vast majority of cases, explosives are NOT concealed in the bike itself but in bags placed on the bikes, and we include numerous press accounts in our endnotes in support of this assertion (Davenport 2006, Dawn 2006, Scotsman 2007). Therefore, it may be appropriate, in cases where 'short stay' parking is desirable, to address risks of terrorism by removing **bags on bikes** (rather than bikes) from the high risk locations.

Proximity to destination the bicycle parking serves does offer some anti-terrorism benefits in that it may *boost preventers* by appropriating guardianship from personnel at the destination served. It is necessary for these guardians to be alerted, motivated, and empowered to be effective. Again 'long stay' facilities are most compatible with anti-terrorist considerations as these facilities acknowledge a user requirement for guardianship.

3.3. *Layout* can easily be modified to benefit users and deter terrorist misuse and abuse by offering improved sight lines that deter concealment (of terrorist surveying opportunity, planting bomb, and bomb itself) and facilitate surveillance. Also by ensuring access for security equipment (bomb disposal) should the need arise.

3.4. *Spacing*. Similar concerns to layout are apparent; spacing can readily accommodate anti-terrorist considerations.

3.5. *Access*. 'Short stay' and smaller facilities generally allow and require free and easy access that is problematic from security perspectives. Long stay facilities may warrant greater investment in access security and may readily accommodate controlled, surveyed and recorded access of benefit to both the security of users and their bikes and terrorism prevention.

3.6. *Guardianship/ surveillance/ lighting* is a factor of high confluence with terrorism prevention. Appropriate training and education of guardians will provide *formal preventers*. Deployment of appropriate technology (sniffers/ digital recognition/ Video Content Analysis) will aid *formal preventers.*

3.7. *Maintenance* of a facility and its security systems signals quality of management and surveillance. A well-managed facility will deter terrorists and attract users. Clean facilities, clear of obstruction, whilst of benefit to users, may also remove possible concealment for bags or bombs left unattended.

3.8. *Signage* offers a great opportunity for terrorism prevention by recruiting *informal preventers* amongst users and the public via messaging such as: 'Please report any bags left on bikes.' Also by instructing legitimate users to avoid usage that may provide 'cover' for terrorist MOs i.e. messaging such as 'Do not leave any bags, panniers or containers on your bike'.

3.9. *Charges* benefit prevention of terrorism as payment facilities often require some form of registration and access control. Charges usually denote greater security. Payment for usage may also finance security interventions.

3.10. *Scale*. Whilst there is a minimal risk that large-scale facilities may become targets for terrorism, it is also true that larger facilities allow for centralisation of resources and justify implementation of the measures listed above.

In brief, after analysing the above user requirements and CTO principles it is our view that an appropriate anti-terrorist bike parking facility may be described as;

i) Large scale with convenient and controlled access (possibly with a fee charged),
ii) Well managed, lit and maintained; and
iii) Regularly surveyed by appropriate informed and empowered guardians.
iv) The design of the site should facilitate good surveillance (sight lines) and deny opportunities for concealment.
v) Ideally, the parking should be situated within a robust enclosure (to contain an explosion should the worst happen).
vi) Layout and spacing should facilitate easy observation and access for security equipment as well as users.
vii) Signage should communicate with users as to appropriate usage i.e. 'no bags to be left on bikes', 'please report any bags left on bikes'.
viii) Long-term facilities can readily accommodate these requirements. Short-term facilities will find it harder to implement these measures but in high risk areas should consider the principles above and apply them where possible.

ix) All facilities should prohibit bags or other containers being left unattended on bikes in parking facilities.

Having identified where the conflicts lay, an understanding of terrorist MOs (perpetrator techniques) may enable designers to mediate these conflicts within their proposals. And thus we would argue one of the best means of equipping designers to design against terrorism would be to make sure these perpetrator techniques are documented and understood, Paul Ekblom has argued (in conversation with us) for much more in depth analysis of criminal perpetrator techniques and scripts, and we would make the same case regarding terrorist MOs.[3]

Also other questions need to be addressed. Why would the terrorist, of all the objects in the urban environment to choose from, select a bike as their bomb carrier? Is the bike park close to a high risk target? Is a bike the only thing that can get close to the target and be left unattended? Are other potential carriers subjected to searches or authorisation? It is appropriate to ask these questions first as it may be that the need for an address to terrorism at all is unnecessary, given risk analysis of context, or that the context warrants even greater consideration of terrorism deterrence.

In relation to the Westminster parked bike parking ban described earlier, a review of terrorist MOs related to bike bombs, reveals that the majority of bicycle bombs are located within bags on bikes rather than in the bike frames themselves. In fact we have been unable to identify bike bombs integrated into the bike frame, with the exception of N. Ireland in the 1970s (Bowden 1976). There is not sufficient information on record to detail the impact of this MO. We do know however that all other terrorist interventions using 'bike bombs' have located the explosive device within a bag or other container on the bike. This is significant. It indicates the bike frame does not offer easy accommodation of terrorist intentions. This is significant in terms of policy about bike parking. It prescribes an intermediate action between removing bikes from the scenario, at a cost to quality of life issues (including convenience, environment and health) and that of no-response to the potential terrorist risk presented by parked bicycles and their accessories.

Clearly we should not be complacent about the risks of terrorists using bombs integrated into bikes in public places. We are well aware that terrorists are what Ekblom (1997) describes as 'adaptive criminals' so that 'displacement' of the terrorist bomb from bag to bike frame may occur in a short space of time.

We would advocate that knowledge of terrorist MOs be continually re-appraised to empower designers to keep up with the 'adaptive' terrorist. Indeed, where possible designers and their expert advisors should seek to outmanoeuvre the terrorist threat by designing against risk prior to its occurrence (in this instance perhaps via the design or urban bicycles or cycle lockers that would contain a blast). However, we must be wary to avoid 'scientific and technical [or design] developments where we increasingly elevate risk over opportunity' (Durodie 2002) at a cost to quality of life and user freedoms. Designers and cycle parking providers should avoid what Durodie (2002) describes as 'vulnerability-led' responses. These tend to focus more on speculative 'What if' type questions - particularly emphasizing low incidence/ high consequence scenarios… at the expense of realistic 'What will?' and 'What has?' type evidence.

We also tend to agree with Hille Koskela's (2002) who in her account of 'tolerance versus prejudice' states 'it is sometimes worth taking a risk in relation to security when considered against quality of life issues given that 'hard solutions' faint [fade?] over time.'

Preventing cyclists from parking easily by applying bicycle exclusion zones, or bike parking restrictions, is also not the only troublesome tradeoff we need to think through regarding anti terrorist design strategies. Cycling has recently become a 'hot' political topic, not least because of the success of sustainable transport discourses. There are more cyclists on the road in London resulting from measures such as congestion charging, and some argue because of the bombing of the London Underground on 7 July 2006, which catalysed a 400% increase in cycle sales in the capital in the weeks that followed.[4]

The relationship of the bike to such discourse has been 'heightened' or to use Innes (2004) account has been 'signalled' and therefore could easily become a symbolic terrorist target. When considering why a bicycle would become a terrorist *vector* situational considerations may not be the only motivating factors. The potential to embarrass the authorities and scupper their attempts at developing more sustainable transport options needs to be considered too. Perhaps the ultimate troublesome tradeoff is between the negative impact upon 'on street' cycle parking provision that would inevitably ensue should a terrorist using a bike bomb 'succeed' occur and the measures necessary to prevent this occurrence. A terrorist success in using a bike bomb may lead to over-reaction by the authorities and circumvention of the requirement for cycle parking to be freely and readily available to users to promote urban cycling whilst over determination of measures to prevent this scenario may themselves deter cycle usage.

2. Biceberg – A Cycle Parking Case Study

To consider these troublesome tradeoffs in practice we offer a review of 'Biceberg' an innovative urban cycle parking solution, designed and used in Spain.

The Biceberg[5] underground parking system is automated. It collects bikes from, and returns them to street level (Figure 1). It comes in different model sizes able to store 46 bikes, 69 bikes or 92 bikes. In addition to bike storage, the space provided for the bike by the Biceberg can also be used to store accessories such as a helmet, backpack or even a laptop (Figure 2).

Insert Figure 1. here
Insert Figure 2. here

When we asked a number of police officers to review the system for London (we featured a model of it at the **Reinventing the Bikeshed** exhibition[6] during the London Architectural Biennale, we were surprised that all those officers who spoke with us mentioned their concerns about possible terrorist abuse.[7]

The Biceberg system was first conceived in 1994 by Jaime Palacios and his company MA-Sistemas, S.L. It was further developed in 2003 to an operational standard, and has now been installed in six locations in Spain (Figure 3). In 2006, we understand from the designer, there were several expressions of interest in using the system from other European countries, including France and Denmark.
The exterior housing for the automated system, shown below, is located at ground level.

Insert Figure 3. here

The see-through 'casing' has been designed using laminated toughened glass to maintain transparency. Much thought has gone into the design of the machine in regard to technological ease of use, aesthetics and information design in relation to providing a user-friendly experience. The first point where the cyclist interacts with the machine, is consequently easy on to the eye as well as to the user (Figure 4).

Insert Figure 4. here

It provides easy-to-understand messaging when users interact with the computer screen to access the bike storage. User-centred detailing such as the groove in which to stand the cycle, next to the machine before loading is clearly thought through and again easy to use (Figure 5).

Insert Figures 5. here

The system works by storing bikes in individual underground container segments, (like slices of a circular cake) forming carousels. The different model sizes (46, 69 and 92 bikes), are attained via deployment of a modular system which comes in carousel stacks of 23 bikes per level, as can be seen from the images below taken inside the store area (Figures 6 a and b).

Insert Figures 6. a and b here

The user carries out these operations using a chipped smartcard and enters a secret personal code, in a process comparable to using an ATM (Figure 7).

Insert Figure 7. here

Waiting time and interface are also similar to that of an ATM. It is estimated that loading or accessing a bike for storage or retrieval takes 25 to 30 seconds. First time users will need a little longer to get used to the system. The 'smart cards' are the key to accessing the facility and retain details about the user on a central database that monitors patterns of use. Six cameras, built-in to the installation, monitor what is introduced to and retrieved from the storage units. The video cameras are activated specifically when someone inserts or removes objects via the system. Upon loading the bike into the machine the contents are also weighed, to further confirm what has been entered or removed (to check it conforms to usual bike weights) and to prevent, for example, a child or a person (drunk 'stag night' attendee for instance) being inappropriately loaded into the bike park. The system also currently integrates

equipment for the detection of any living beings or species introduced - this works via a combination of infrared and microwave technologies.

The key strengths of the system, from a user perspective, include the fact that Biceberg offers space sensitive underground parking that can contain extra mobile objects (helmets, bags) as well as bikes. Also, on street, the housing offers exhibition or advertising potential for the promotion of cycling. Its SmartCard and Pass-Code controlled access system means that users have exclusive access to their own property and that it is relatively safe from theft at any the of day or night.

Concerns in relation to fitness for purpose are limited to the fee paying aspect and multi-user access at times and locations of peak usage. Installation of several smaller (46 bikes) as opposed to one larger (96 bikes) facility would go some way to resolving this issue.

Despite this positive user review security experts to whom we showed the Biceberg system, prioritised concerns about bombs being planted by terrorists in bags or on bikes, who were imagined to be able to gain access by stealing smart cards or obtaining them in false names. We identified from the start that the design of the underground concrete bunker, which forms part of the pre-fabricated structure, in which bike are stored could protect the public from the worst of any potential bomb blast at street level linked to terrorist activity, but this fact did not alleviate their concerns.

When we raised these issues with the owner/ designer James Palacious, his first response (when interviewed by Marcus Willcocks in Barcelona 2006) was to say that adding explosive detecting sensors wasn't impossible in design terms, just entirely 'unnecessary.' He argued that the system already had enough 'defensiveness 'designed into it via password protected, smart card access control systems, and CCTV, to be safe. 'Yes' the system could be adapted further to include explosive detection, but the owner thought it pointless unless ordered by direct customer specification. Also the extra costs of this added security could, in his opinion, be prohibitive for the majority of customers.

When viewed in relation to the design recommendations identified in the above cross comparison of user requirements and CTO principles, the Biceberg appears to us to be a highly appropriate solution for cycle parking in certain areas, currently considered to be at high risk of terrorism. We can see that it would work well in certain contexts, (if not all) even in cities like London that are regularly on high security alert, with one provision. When considering Biceberg in relation to its robustness to terrorist misuse or abuse, the feature which the manufacturer considers to be one of its key user benefits, is in our opinion, one of its greatest weakness, i.e. the ability and encouragement to store bags as well as bikes. The above analysis prescribes that storage of the bags or other items capable of concealing explosives must be denied. This is a serious claim, and means that in using a strong theoretical framework, the CTO framework, to create an informed opinion about a design, we can balance the opinions derived from expert review, and identify that the real issue linked to terrorist misuse or abuse, and use is counter intuitive. Rather than Biceberg being a likely terrorist facilitator it could in fact be a good cycle parking solution in high risk areas.

Conclusion

Cycling is good, bombs are bad. And bombs in bags on bikes are more common than bombs integrated into bike frames (so far...). In the context of fears about bike bombs, we should not negate the opportunities for increased cycle usage via restriction of provision of on street cycle parking, for fear of creating opportunities for terrorist misuse and abuse. However, as the threat of bike bombs is not entirely delusional we must, where possible, design against them in an appropriate and proportionate manner. To do this requires the designer to i) identify areas of design conflict and confluence between liberty and security (i.e. sites of conflict/confluence between use and misuse/abuse), ii) where conflict or confluence exists an address to both user freedom and exclusion of terrorism is appropriate. iii) At such conjunctions it is essential that the designer mediates between security and liberty, accessing sufficient knowledge and metrology by which to consider levels of risk and thus action appropriate and proportionate response. At all times, designs for exclusion of terrorism should be covert and clandestine so as to avoid promoting fear of terror through their design language; to avoid the design itself becoming what Innes (2004) would refer to as a 'crime [or terrorist] signal' or Roach *et al*. (2005) describe as a '*vector'*.

Ultimately, we agree with Frank Furedi (2002) who argues against a 'culture of fear', and also Bill Durodié (2002) who warns against over-reaction from the authorities, and states the need to develop responses based on clear values rather than focussing on vulnerabilities.

To paraphrase Durodié: 'To restore some balance [within the user liberty versus security debate] demands acting calmly [or designing calmly] confidently, and above all rationally.'

If we are to benefit from design opportunities, spanning troublesome tradeoffs between security and user requirements with ingenuity, rather than suffering the consequences of 'vulnerability-led' responses, designers must embrace what John Thackara (2005) has described as 'design mindfulness'. We must also heed Benjamin Franklin's warning that 'Those who would give up Essential Liberty to purchase a little Temporary Safety, deserve neither Liberty nor Safety.'[8]

Acknowledgements

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Insert Figure 8. here (in landscape page layout)

Figures

Figure 1. © Biceberg

Figure 2. © Biceberg

Figure 3. © Biceberg


Figure 4. © Marcus Willcocks

Figure 5. © Marcus Willcocks

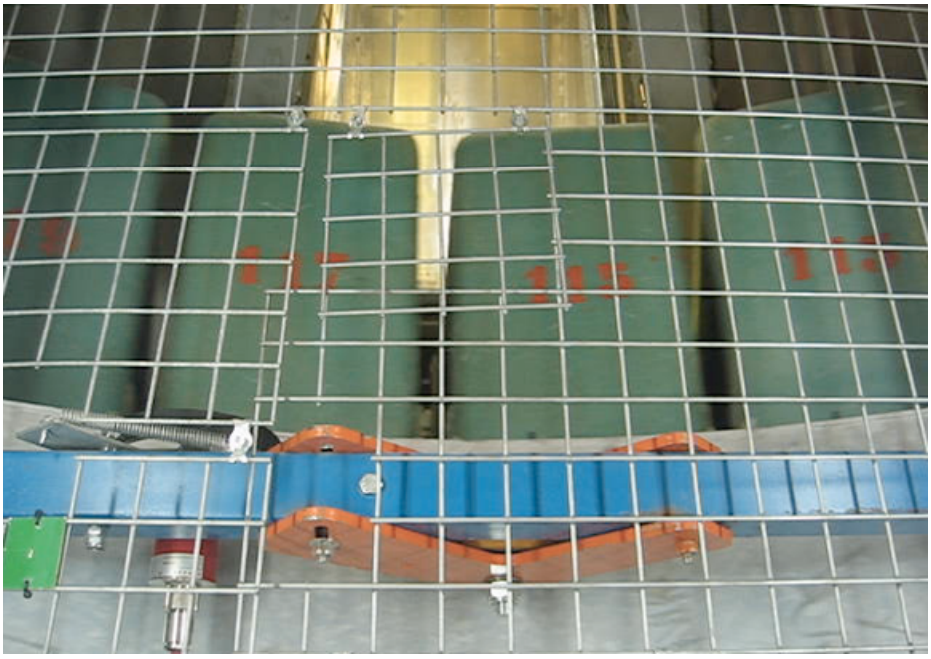

Figure 6. a © Marcus Willcocks

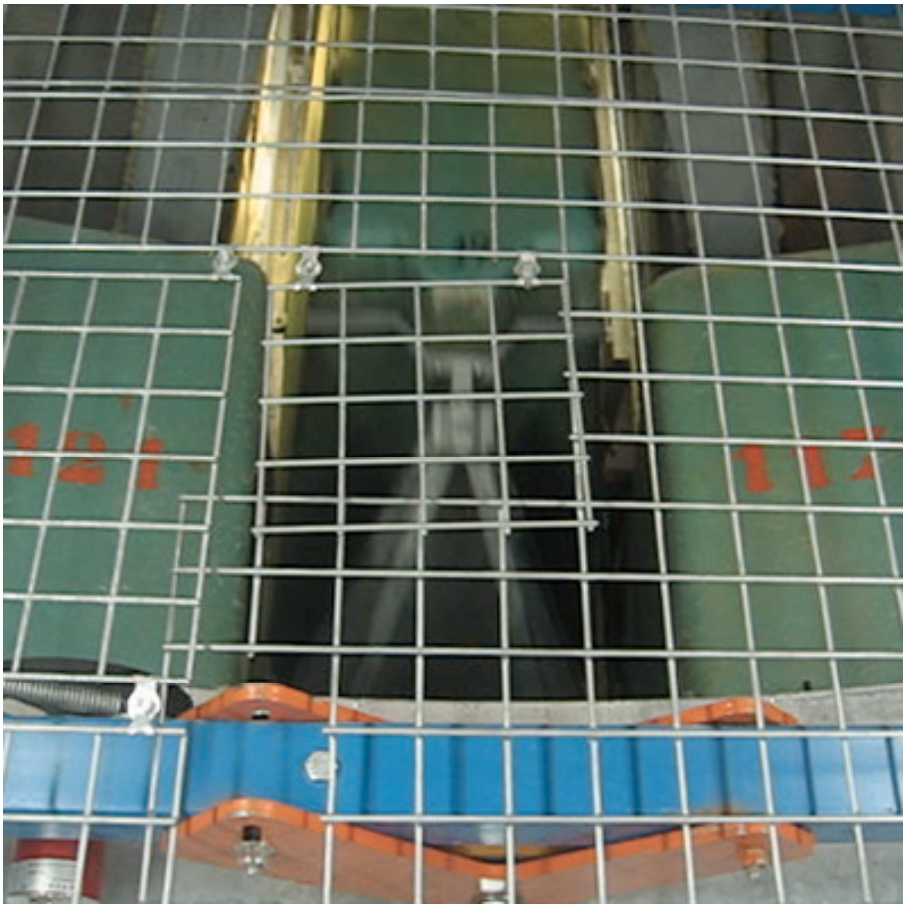

Figure 6. b © Marcus Willcocks

Figure 7. © Biceberg

Figure 8. Cross comparison of CTO principles and cycle parking design requirements

Key:
- = conflict
+ = confluence
0 = no relation

	Exclusion	Deterrence	Vectors	Enclosure	Environment	Preventers	Promoters
Length of stay	-	-	-	-/+	-	0	-
	Cannot limit presence	Legitimises presence of unattended object	A bike is generally innocuous a symbol of free to stay where it likes as long as it likes.	Short stay/ easy use doesn't allow for enclosure. Long stay can require enclosure and access control	Legitimises presence of unattended object for period of time		Short stay users are less likely to remove bags and containers thus becoming *careless promoters*
Location	-	-	-	+	-	+	0
	<25m means	Proximity to target could increase rewards	Bikes can go anywhere as they are perceived to be no threat.	Despite location parking can be physically enclosed to contain blast	High risk due to proximity to destination – particularly at iconic sites that may attract terrorist attention which may warrant special consideration	Proximity to destination served may allow for acquisition of personnel at destination to serve as *preventers*	

	Exclusion	Deterrence	Vectors	Enclosure	Environment	Preventers	Promoters
Layout	+	+	0	0	+	+	-
	Enable observation	Enable observation and increase risk of getting caught/being detected			Enable observation and access with bomb disposal equipment	May facilitate *preventers* by enabling observation	May conceal *careless promoters* by concealing their misuse
Spacing	+	+	0	0	+	+	+
	Enable observation and access for security equipment and personnel	Enable observation and access for security equipment and personnel			Enable observation and access with bomb disposal equipment	May facilitate preventers by enabling observation	May conceal *careless promoters* by concealing their misuse
Access	-/+	-/+	0	-/+	-/+	-/+	0
	Restricted access could limit opportunity for terrorist access	Restricted access could increase risk and effort for terrorist		Easy access denotes low enclosure. Restricted/ controlled access promotes enclosure	Easy access attractive to terrorists. Restricted/ controlled access less attractive	Easy access may inconvenience *formal preventers* by making it harder to identify legitimate users. Restricted/ recorded access assists *formal preventers*	

	Exclusion	Deterrence	Vectors	Enclosure	Environment	Preventers	Promoters
Guardianship/ Surveillance/ Lighting	+	+	-	+	+	+	+
	Informed personnel could watch out for terror MOs and record access	Staffed facilities with restricted and recorded access could increase risk and effort for terrorist	Targeting of a secure facility would demonstrate that no bike is safe.	Staffed and surveyed facilities assist in target hardening	Staffed and surveyed facilities will deter terrorists	*Capable guardians*, motivated, informed and empowered are effective *formal preventers.* Appropriate lighting and surveillance assists *formal preventers.*	Denies clandestine misuse of facility by *careless promoters*.
Maintenance	+	+	+	0	+	+	+
	Informed personnel could watch out for terror MOs	Informed personnel could increase risk and effort for terrorist	Successful targeting of a well maintained facility would demonstrate that no bike is safe		Well maintained facility and security features could benefit users and deter terrorists	Well maintained facility will assist *formal preventers*	Well maintained facility will deter misuse of facility by *careless promoters*

	Exclusion	Deterrence	Vectors	Enclosure	Environment	Preventers	Promoters
Signage	+	+	0	0	+	+	
	Legitimate users could be requested to take action not associated with terrorist MOs	Signage denying actions associated with terrorist MOs could increase risk and effort for terrorist			Signage denying actions associated with terrorist MOs will deter terrorists	Facilitates *formal preventers* in identifying deviance. Facilitates *informal preventers* by requesting vigilance and reporting	Excellent deterrent to *careless promoters* by warning against misuse that may provide cover for terrorist MOs
Charges	+	+	0	+	+	+	0
	For long-term parking. Could be designed to control access	For long-term parking. Could control access and increase risk and effort for terrorist		Charge facilities for long term. Could control access and increase risk and effort for terrorist	Charge facilities for long term. Could control access and deter terrorists also could pay for additional security measures	Charge facilities for long term. Could control and record access aiding *formal preventers*	

	Exclusion	Deterrence	Vectors	Enclosure	Environment	Preventers	Promoters
Scale	+/-	-/+	-	+	-/+	-/+	-
	Could enable centralise resources/ may become target due to volume of usage	Could increase provocation due to location and size or could serve to centralise resources	Large scale facility could increase provocation due to extent of potential impact	Large scale allows centralisation of resources which would afford enclosure techniques	Could increase provocation due to location and size or could serve to centralise resources	Small scale is likely to rely on *informal preventers*. Large scale could centralise resources and facilitate *formal preventers*	Large scale parking increases likelihood of *careless promoters*.

Notes

[1] See: http://www.bpsa.info/intro.htm, http://www.camcycle.org.uk/resources/cycleparking/standards/city.html among many others from local councils (and downloadable from TfL and SRA)

[2] See: http://www.westminster.gov.uk.

[3] AHRC Bikeoff 2 project meeting between Design Against Crime Research Centre and Jill Dando Institute of Crime Science, 24th January 2007.

[4] In conversation with Andrea Casalotti, proprietor of Velorution, 2005.

[5] The account herein of Biceberg is based on information supplied and drawn up by Gamman and Willcocks for Reinventing the Bike Shed exhibition, London 2006. Full details about Biceberg feature exhibition included:
Name of company: MA-Sistemas, S.L. Crtra.Nacional 330 km 647,500 Polígono Charlé-Calle 222700 Jaca -Huesca-SpainTel. + 34 974 357 07 Fax. + 34 974 357 074;
Name of Architect/designer: Jaime Palacios;
Supplier of parking equipment/ furniture: MA-sistemas, s.lL;
Type of parking equipment/ furniture (e.g. Sheffield stand or Double parker): eAutomatic underground bike park;
Location of installation(s) and facility/amenity it serves: Town centres, Transport interchanges, stations, University campuses, sports/ leisure centres etc;
Cost (of installation/build - not use): 46 bikes - €120,000 euros, 69 bikes - €135,000 euros, 92 bikes - €150,000 euros (based on costs installed in Spain);
Number of bikes stored: 23, 46, 69 or 92 per unit (i.e.- each level of underground storage takes 23 bikes - like a carrousel);
Length of stay the facility seeks to serve: short – medium - long term (most common use is medium – 1-8 hours) but overnight stay is possible;
Service period (how long the facility is meant to last): approx. 25 years (with preventative and software update maintenance).

[6] See: www.reinventingthebikeshed.com

[7]With thanks to many officers including Brian Howat, of British Transport Police Terry Cocks and Ike Gray of the Metropolitan Police, Camden.

[8] Those who would give up Essential Liberty to purchase a little Temporary Safety deserve neither Liberty nor Safety', is an often misquoted phrase commonly attributed to Benjamin Franklin. The quote is taken from, 'An Historical Review of the Constitution and Government of Pennsylvania,' first published anonymously in London in 1759. The quote is an excerpt from a letter written in 1755 from the Assembly to the Governor of Pennsylvania. Benjamin Franklin did publish the edition printed in Philadelphia in 1812, and most likely the original, but denies writing any part of it. The quote, however, may have originated from Franklin and been excerpted for the book by the author. (Wikipedia 2007)

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