

Abstract

This paper reviews the core findings from recently published place-based crime prevention research. It critically evaluates the available evidence on the contribution of Crime Prevention Through Environmental Design (CPTED) as a crime prevention strategy.

CPTED is both an increasingly fashionable approach and is being implemented on a global scale (Cisneros, 1995). Additionally, individual components such as territoriality, surveillance, maintenance, access control, activity support and target-hardening are being widely deployed. However, the evidence currently available is inconclusive and much criticised, which effectively prevents widespread intervention and investment in such an approach by central government. The authors detail the difficulties associated with demonstrating the effectiveness of CPTED and conclude that although empirical proof has not been definitively demonstrated, there is a large and growing body of research, which supports the assertion that CPTED is a pragmatic and effective crime prevention tool. This review provides an extensive bibliography of contemporary CPTED and a follow-up paper will discuss the future research priorities for CPTED.

Introduction

Crime and the fear of crime are pervasive and endemic concerns in modern post-industrial society and criminal justice systems are clearly failing to tackle both issues.

Brantingham and Brantingham (1991) have argued that there are four dimensions to any crime namely, the law, the offender, the target and the location. Place-based crime prevention strategies focus upon the crime site – the spatial aspects of a target and the specific location of crime. Crucially, Herbert and Hyde (1985) note that if the spatial distribution of offences and offenders were random, then environmental criminology would be of little interest to either scholars or commentators on either criminal or social policy. Indeed, crime is not randomly distributed and ‘hot spots’ of crime have been acknowledged since the mid-nineteenth century (Guerry, 1833; Fletcher, 1849; Mayhew, 1862) as the Industrial Revolution produced a new and previously unconsidered scale of urbanisation. The study of ‘hot spots’ has received increasing attention in recent years (i.e. Nasar and Fisher, 1993; Lupton, 1999). As a place-based crime prevention strategy, Crime Prevention Through Environmental Design (CPTED) emerged as an independent theory and is now increasingly fashionable and is being implemented worldwide (Cisneros, 1995).

Empirical research which attempts to measure the component parts of the built and social environment, to make purposeful modifications to it and evaluate the effectiveness of such interventions, is fraught with difficulty. Indeed, Schneider and Kitchen (2002, p158) comment that in practice, “it would be as difficult as untangling a spider’s web to evaluate the effectiveness of specific place-based crime prevention measures”. Gill and Turbin (1999, p180) concur “policymakers and practitioners want quick decisions about whether a measure has been ‘effective’ or has reduced crime, while academics stress the need to do things properly, which takes time”. In stating that, this paper will briefly discuss CPTED and present the key arguments for the application of the component parts of CPTED and more comprehensive CPTED programmes. This review also provides an extensive bibliography on the subject of CPTED.

What is CPTED?

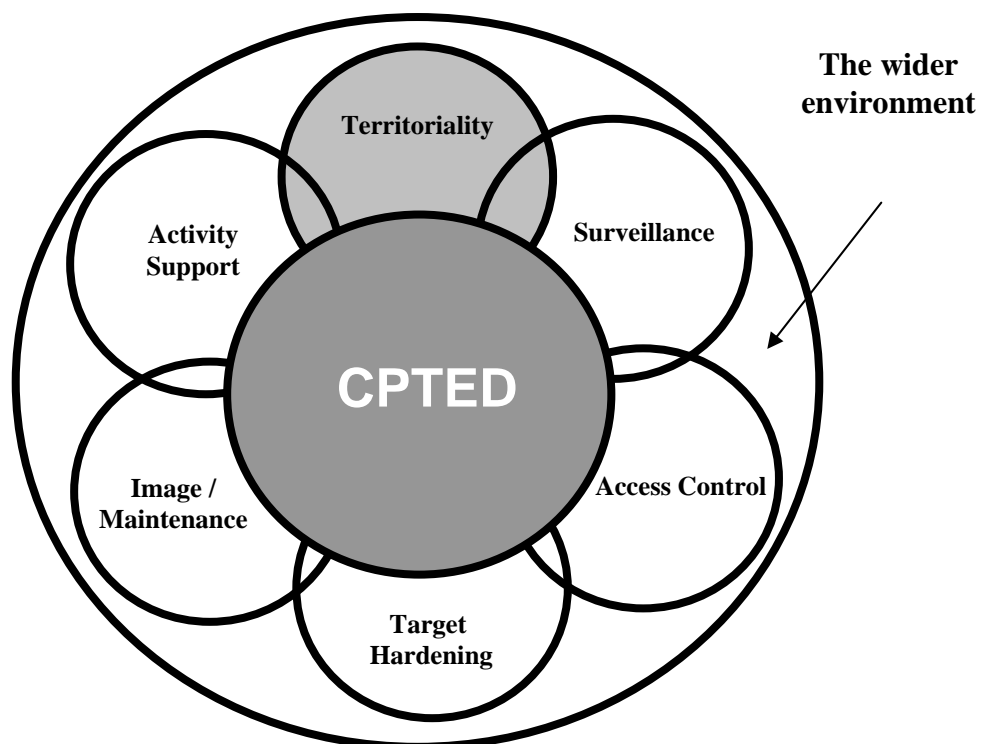
CPTED is an acronym for Crime Prevention Through Environmental Design which asserts that “the proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime, and an improvement in the quality of life” (Crowe, 2000, p46). It is based on studies executed from the mid-twentieth century onwards (Lynch, 1960; Jacobs, 1961; Angel, 1968; Jeffery, 1971; Newman, 1973; Gardiner, 1978; Clarke and Mayhew, 1980; Poyner, 1983; and Coleman, 1985).

A range of theoretical criticisms of CPTED have been expressed (e.g. see Adams, 1973; Hillier, 1973; Kaplan, 1973; Bottoms, 1974; Mawby, 1977; Mayhew, 1979; Booth, 1981; Poyner, 1983) and are discussed elsewhere (see Cozens *et al.*, 2001a). However, ongoing refinement, of what is now known as 1st Generation CPTED, by researchers, practitioners and policy makers, has arguably responded to criticism to craft a more robust and rigorous approach referred to as 2nd Generation CPTED (Saville and Cleveland, 1997). This refinement extends beyond mere physical design to include social factors. 2nd Generation CPTED uses risk assessments, socio-economic and demographic profiling (Saville, 1996; Plaster Carter, 2002) as well as active community participation (Sarkissian and Perglut, 1994; Sarkissian and Walsh, 1994; Saville, 1995; Sarkissian *et al.*, 1997; Plaster Carter, 2002). Such developments in CPTED (e.g. Taylor *et al.*, 1980; Wilson and Kelling, 1982; Poyner, 1986; Sarkissian and Walsh, 1994; Saville, G. 1995; Crowe, 2000; Zelinka and Brennan 2001) and Situational Crime Prevention¹ in Britain (Clarke and Mayhew, 1980; Clarke, 1992, 1995, 1997) have popularised, refined and advanced the design-affects-crime debate.

Following Newman (1973), Moffat (1983) proposed that there are six broad characteristics to 1st Generation CPTED concepts; territoriality, surveillance (informal and formal), access control, image / maintenance, activity programme support and target hardening (see Figure 1).

¹ Like CPTED, Situational Crime Prevention (SCP) seeks to reduce opportunities for crime. However, it is centred upon highly specific categories of crime (Clarke, 1992) and extends beyond environmental design using specific products, technology and procedures to reduce opportunities for crime. SCP utilises 24 techniques in four broad categories with the objective of increasing perceived effort, increasing perceived risks, reducing anticipated reward and inhibiting rationalisations.

Figure 1. 1st Generation CPTED – The Key Concepts



Adapted from Moffat (1983, p23)

By optimising opportunities for surveillance, clearly defining boundaries (and defining preferred use within such spaces) and creating and maintaining a positive 'image', urban design and management can discourage offending. This is explained by the fact that offenders are potentially more visible to 'law-abiding' others, and therefore, perceive themselves to be more at risk of observation and subsequent apprehension. Additionally, a well-maintained and appropriately used environment can signify that a sense of 'ownership' and proprietary concern exists within the community. Some researchers (e.g., Fisher and Nasar, 1992) have introduced a threefold grouping of physical features; prospect (for the user), refuge (for the potential offender) and escape (for the user and potential offender) into CPTED theory and Taylor and Harrell (1996, p9) conclude; "research confirms that fear [of crime] is higher in locations that offer good refuge for the potential offender but low prospect and escape for the user".

Research Supporting CPTED Component Parts

Since CPTED is a complex strategy that will include a range of interventions and behavioural responses from various user groups, the research examined will be presented and analysed under six broad headings (not always mutually exclusive), namely; territoriality, surveillance, access control, activity support, image / management, and target hardening. CPTED studies using multiple interventions are also examined.

Territoriality

Territoriality is a design concept directed at reinforcing notions of proprietary concern and a 'sense of ownership' in legitimate users of space thereby reducing opportunities for offending

by discouraging illegitimate users. In 1st Generation CPTED it is the primary umbrella concept upon which all the others are based. Different forms include symbolic barriers (e.g. signage) and real barriers (e.g. fences or design that clearly defines and delineates between private, semi-private and public spaces). Access control and surveillance will also contribute towards promoting territoriality by promoting legitimate users' informal social control. CPTED emphasises crime prevention techniques that exploit the opportunities in the environment "both to naturally and routinely facilitate access control and surveillance, and to reinforce positive behaviour in the use of the environment" (Crowe, 2000, p37). These strategies are not independent of one another, and they act in concert to use physical attributes to separate public, public-private and private space, to define ownership (e.g. fences, pavement treatments, signs, landscaping and artwork) and define acceptable patterns of usage, in addition to promoting opportunities for surveillance.

A study by Brown and Bentley (1993) showed how some burglars used territoriality to evaluate risk and territoriality was also supported by the findings from a study of fear of crime (Perkins and Taylor, 1996). Eliminating any unassigned spaces and ensuring all spaces have a clearly defined and designated purpose, are routinely cared-for and monitored is also a component of territoriality. Research on territoriality has shown it to be most effective at the local level (Brown and Altman, 1981; Taylor, 1988; Ratcliffe, 2003) although it is fraught with difficulties associated with definition, interpretation and measurement. Indeed, Merry (1981) observes how territoriality varies between cultures, neighbourhoods and individual groups. Although still controversial, enhanced levels of territoriality have been linked to reduced levels of recorded crime and fear of crime (e.g. Taylor *et al.*, 1985; Brown, 1987; Brown and Perkins, 1992; Perkins *et al.*, 1992; Perkins and Taylor, 1996; Brown, 2001; Ratcliffe, 2003).

Surveillance

Physical design has the capacity to promote informal or natural surveillance opportunities for residents and their agents and surveillance is part of capable guardianship (Painter and Tilley, 1999). If offenders perceive that they can be observed (even if they are not), they may be less likely to offend, given the increased potential for intervention, apprehension and prosecution. Different types include natural (e.g. residents' self-surveillance opportunities as facilitated by windows) formal or organised (e.g. police patrols) and mechanical surveillance strategies (e.g. street lighting and CCTV).

Surveillance – Informal / Natural

Angel (1968) predicted that certain critical levels of street activity and population density were linked to crime. A critical crime 'zone of intensity' was therefore one that could support low numbers of people but in sufficient densities to contain both victims and offenders. Loukaitou-Sideris (1999) has proposed that a second level population density exists; where the density is sufficiently high to mask a range of less serious offences such as pick pocketing and petty theft.

In a review of studies relating to residential burglary, Sorenson (2003) observes how burglars avoid targets that are readily overlooked by neighbours and / or passers-by. Properties with low levels of lighting at night, high walls / fences, or thick trees or shrubbery can provide concealment opportunities for burglars particularly when close to points of access such as windows and doors (Weisel, 2002). The intervisibility and enhanced surveillance

opportunities provided by terraced housing, for example, have been noted by a number of researchers (Newman, 1975; Pascoe, 1993; Steventon, 1996; Hillier and Shu, 2000a; Cozens *et al.*, 2001b) and the UK government, explicitly in the DETR Bulletin No. 32 – The Layout of Residential Roads and Footpaths (DETR, 1998). Research being conducted at University College London, at the Space Syntax Laboratory claims “linear integrated spaces with some through movement and strong intervisibility of good numbers of entrances ... are the safest spaces” (Hillier and Shu, 2000b, p4).

However, the existence of natural surveillance opportunities within the built environment does not necessarily mean that surveillance is routinely taking place, or that any direct action by citizens (e.g. challenging, reporting or direct intervention) is guaranteed (Barr and Pease, 1992). Indeed, this is one of the reasons for the development of 2nd Generation CPTED, which now seeks to engender positive social activities and diversity to encourage neighbours to take ownership of space and take advantage of natural surveillance.

Surveillance - Formal / Organised

Formal (or organised) surveillance is also provided by local stakeholders (shop keepers, security guards). Four studies of increased formal guardianship at parking lots and garages have demonstrated reductions in car-related crime (Poyner, 1991; Laycock and Austin, 1992; Poyner, 1994; Barclay *et al.*, 1996) while one study found no such reduction (Hesseling, 1995). Poyner (1991) notes that strategies to control access may reduce thefts of vehicles, but may do little to impact on theft from vehicles, raising the issue that what guards actually do may be as important as their physical presence.

In the retail industry, in stores with two, as opposed to one member of staff on duty, fewer robberies were reported in a number of studies (Hunter and Jeffery, 1992). Even though a study by La Vigne (1991) found no such relationship, a major study by Figlio points to a strong effect (National Association of Convenience Stores, 1991). That study examined 340 retail stores in America and found that robberies declined in stores that changed from employing one to two staff. Where police evaluated a city regulation requiring two staff to be on duty, robberies declined immediately after the regulation was introduced (Clifton, 1987) and for several years afterward (Bellamy, 1996). CCTV and silent alarms did not reduce robberies in a study of 55 stores (Crow and Erickson, 1984), although interactive CCTV did reduce robberies in their first year of introduction (National Association of Convenience Stores, 1991). Retail store redesign to enhance surveillance yielded significant reductions in shoplifting in one store (Farrington *et al.*, 1993).

Security guards have long been used to reduce crime and have been shown to prevent bank robberies (Hannan, 1982) along with the use of protective screens (Grandjean, 1990). In Victoria, Australia, a range of security devices (screens, guards and cameras) reduced bank robberies (Clarke *et al.*, 1991) although patrols by the mobile security guards known as the Guardian Angels at railway stations did not reduce crime in America (Kenney, 1986) or on the London Underground, England (Webb and Laycock, 1992). An increase in ticket collectors at a Canadian ferry terminal reduced fare evasion by an estimated 20% (Deschamps *et al.*, 1992) while a Dutch initiative using over 1,000 unemployed young people to monitor ticket use resulted in significant reductions in cases of recorded assaults and harassment (VanAndel, 1986). However, neither of these studies used control groups as a baseline comparison against which to measure existing trends, or to include other independent factors that may be acting to reduce crime in the wider community.

Surveillance – Mechanical (CCTV)

Evaluating the effectiveness of CCTV is also problematic and despite the rapid growth in the deployment of CCTV, particularly in British cities Armitage (2002, p1) argues, “there is very little substantive research evidence ...that CCTV works”.

However, some studies report positive findings. Poyner (1988) reviewed the effectiveness of the installation of CCTV on buses and found reductions in vandalism on the targeted buses and the diffusion of benefits to the entire fleet. Webb and Laycock (1992) found CCTV installation at London Underground stations reduced robberies compared with a control group and similarly CCTV at parking lots has been found to reduce car-related crime (Poyner, 1991; Tilley, 1993). Brown (1995) reported on three evaluations of CCTV in Britain, which resulted in reductions in burglaries, car thefts and theft from vehicles. Some studies also revealed that CCTV can significantly reduce levels of fear of crime within the community (Chatterton and Frenz, 1994; Sarno, 1996; Mahalingham, 1996).

Eck (1997) reviewed one empirical CCTV study of 15 housing complexes for the elderly in England (Chatterton and Frenz, 1994) and reported significant reductions in burglary. Skinnis (1998) evaluated CCTV in Doncaster (UK) and found vehicle crime reduced while other property crimes were not. Armitage *et al.*, (1999) discovered CCTV significantly decreased all recorded property crime (burglary, car crime, criminal damage, handling stolen goods and fraud) in Burnley (UK).

CCTV may deter criminal offences (e.g. vehicle crime or burglary) due to a perceived increase in the risk of detection (that may outweigh the perceived potential benefits). However, in alcohol-related crime (such as public disorder) where ‘rationality’ is often absent, the deterrent effect of CCTV may be nullified.

More recently, in a Home Office study, Welsh and Farrington (2002) systematically reviewed the crime prevention impact of CCTV in 18 evaluations. The evaluation incorporated meta-analytic techniques (the arithmetic extraction of net success, Pawson, 2001) and used before-and-after measures of crime for both experimental and control areas. Overall, a 5% reduction in recorded crime was reported and half of the studies, (all in the UK) revealed a fall in recorded crime. CCTV was found to have a significant crime reduction effect on recorded vehicle crime (from 8 studies) but no effect on violent crime (from 5 studies). This anomaly may be partially explained by the link between violent crime and alcohol / drug abuse.

In terms of the city centre and public housing areas there was little evidence of crime reduction and in four public transport studies, two found reductions, one found no effect and one found an increase in recorded crime. In car parks, however, there was evidence of a significant (41%) reduction in vehicle crime in experimental areas compared with control areas (although other strategies, such as lighting and signage, were also present in all the five studies of car parks). The studies of city centre and public transport measured a much wider range of crimes and Welsh and Farrington (2002) raise the question as to whether the package of interventions, focused on a specific crime type (car-related) is what made the CCTV-led schemes in car parks apparently so effective. Armitage (2002, p5) summarises this review (Welsh and Farrington, 2002) suggesting, “CCTV appears to have no effect on violent crime, a significant effect on vehicle crimes and it is most effective when used in car parks”.

Armitage (2002) observes how the effects of CCTV on crime can begin before the cameras become operational (Brown, 1995) by virtue of publicity campaigns. She also highlights the fact that the preventative potential of CCTV has a life cycle such that, unless routine management and publicity is maintained, any initial reductions in crime will evaporate (Webb and Laycock, 1992; Brown, 1995; Tilley, 1993; Armitage *et al.*, 1999). Forthcoming research by the Home Office and Department of Transport and Local Regions (DTLR) will seek to address the lack of systematic evaluation (Armitage, 2002). Wilson and Sutton (2003) review open-street CCTV in Australia and note that Pawson and Tilley's 'realistic evaluation framework' (1997) is widely considered as a sophisticated evaluation methodology noting that both Brown (1995) and Armitage *et al.*, (1999) have applied it. They conclude that the effectiveness of CCTV "remains to be established in what locations and under what conditions" (Wilson and Sutton, 2003, p6) but warn against jettisoning the strategy, implying there is potential for CCTV as a crime reduction tool. Moreover, in consideration of the extensive range of different CCTV systems and the variable and unscientific monitoring and management strategies that are in operation, the problems associated with measuring and comparing studies on the effectiveness of CCTV is exacerbated still further.

Surveillance – Mechanical (Lighting)

After dark, surveillance opportunities are affected by lighting conditions and much research has been conducted on this subject (for a review see Cozens *et al.*, 2003). In America in the 1960s many cities began major street lighting programmes to reduce crime and initial results found that such improvements produced substantial reductions in recorded crime (Berla, 1965; Wheeler, 1967; Wright *et al.*, 1974; Tyrpak, 1975; Hartley, 1974). These projects resulted in the decision by the Law Enforcement Assistance Agency to fund a review of these 'positive' results (Tien *et al.*, 1979). Of 103 studies, only 15 were considered sufficiently rigorous for evaluation and the review of these studies found that the results were inconclusive, and that other indicators of crime should be used in addition to recorded crime data. Farrington and Welsh (2002) argue that this review should have stimulated more studies but was mistakenly interpreted as demonstrating that lighting had no obvious effect on levels of crime and funding for research on this topic in the USA evaporated.

In the UK, lighting studies in Hammersmith and Fulham (Painter 1991a) and the North West of England (Painter 1991b) reported reductions in crime and disorder. A Home Office funded study (Atkins *et al.*, 1991) conducted in Wandsworth found no effect on crime, as did a review by Ramsay (1991) although it did suggest improved street lighting could reduce the fear of crime. Other studies in Cardiff (Herbert and Moore, 1991), Hull (Davidson and Goodey, 1991), Leeds (Burden and Murphy, 1991) and Strathclyde (Ditton *et al.*, 1993) produced inconclusive findings using "before" and "after" comparisons but failed to provide a control area (Painter and Farrington, 1997). Bainbridge and Painter (1993) studied improved lighting in Birmingham's inner city, which despite the collection and analysis of some additional social survey data, also proved inconclusive. Methodological inadequacies have raised serious doubts about the validity of many of these exploratory studies (Painter and Farrington, 1997).

A study by Painter and Farrington (1997), which used experimental and control areas, showed reductions in crime and an increase in pedestrian street use. They concluded "in the experimental area, there was a substantial and significant decrease in the incidence of all categories of crime after the improved street lighting" (Painter and Farrington, 1997, p221).

The most recent review of lighting and crime research re-examined a number of studies conducted in the UK and the USA (Farrington and Welsh, 2002). This systematic review (which excluded several poorly designed lighting evaluations) found that improved street lighting reduced recorded crime overall by 7% in the eight American studies and by 30% in the five UK studies, and reductions in recorded crime were also demonstrated during the day – suggesting that street lighting is likely to have an effect by increasing community pride and informal social control rather than by simply improving surveillance opportunities (Farrington and Welsh, 2002). Across all the studies the crime reduction effect was 20%. The UK studies included Poyner (1991), Shaftoe (1994), Poyner and Webb (1997), Painter and Farrington (1997; 2001a) and Painter and Farrington (1999).

Studies have also revealed that the financial benefits (based upon government estimates of the financial costs of various crimes) of improved street lighting schemes far outweighed their initial costs (Painter and Farrington, 2001b). In the context of recent research, Pease (1998, p2) argues the case is proven and states “our aim should now be to use context-appropriate lighting schemes as part of a full repertoire of crime reduction tactics”.

In summary, natural surveillance (e.g. residents’ self-surveillance opportunities as facilitated by windows) formal surveillance (e.g. police patrols) and mechanical surveillance strategies (e.g. street lighting and CCTV) have all proven effective in reducing both crime and the fear of crime.

Access control

Access control is a CPTED concept focused on reducing opportunities for crime by denying access to potential targets and creating a heightened perception of risk in offenders. Access control can include informal / natural (e.g. spatial definition), formal / organised (e.g. security personnel) and mechanical (e.g. locks and bolts) strategies (the latter two are discussed under the sub headings surveillance and target hardening respectively). Studies by Newman (1973; 1980; 1996) and others (Poyner, 1983; Coleman, 1985; Poyner and Webb, 1991) have all indicated an association between design features and levels of crime; particularly features that allowed unrestricted pedestrian movement through residential complexes. However, researchers have also found that busier streets with some pedestrian movement have experienced reduced levels of recorded crime (Hillier and Shu, 2000a; 2000b).

Poyner (1992) evaluated the impact of widening aisles at an open-air market in Birmingham, England, finding significant reductions in recorded robberies over a two-year period. At Clason Point in New York’s Bronx district such routes through the public housing complex were reduced in number and the lighting and surface appearance of the buildings was improved. A significant reduction in crime (54%) was reported (Newman, 1996) although there was no control group. In a study by Poyner (1994), overhead walkways were removed from a British public housing project with reductions in purse snatching but not burglary (no control group). In Chicago (Popkin *et al*, 1995a, 1995b), ground floor entrances to public housing complexes were enclosed in new lobbies with the installation of concierges and metal detectors. Most residents reported significant reductions in shootings, violence and drug dealing (no control group). From this overview, Eck (1997, p7-8) states; “these evaluations are suggestive of possible beneficial effects in reducing pedestrian movement through large public housing complexes”.

According to Eck (1997) research has suggested that areas with unregulated access have more crime than areas with street layouts with more restricted access (White, 1990; Beavon

et al., 1994). In Miami, Atlas and Le Blanc (1994) reported on the closure of 67 streets with no significant reductions in recorded robberies and assaults compared with two control areas. Newman's study of the changes to a grid street layout of the Five Oaks neighbourhood in Ohio (1996) found that total recorded crime in the city rose 1% while in the target neighbourhood recorded crime declined by 26% and violent crime declined by 50%. Half of the residents stated that fear of crime had been reduced and Newman reported that housing values had increased.

In London, two attempts to reduce street-level prostitution used road closures, rerouting and an increased police presence. After road closures (and an increase in policing prior to the road closures) in Finsbury Park, soliciting and kerb-crawling virtually disappeared (with little recorded displacement) and reported crime fell by 50% (Matthews, 1992). In Streatham a similar project reported a decline in traffic flows along major thoroughfares, a reduction in arrests of kerb-crawlers (although there may be several explanations of this) and residents reported a decline in prostitution at street level (Matthews, 1993).

As a 'real' and 'symbolic' barrier to crime, protective screens on buses have significantly reduced assaults (Poyner and Warne, 1988) while new automatic gates have curtailed fare evasion on public transport and reportedly increased ticket sales of some 10% in comparison with control stations without gates (Clarke, 1993). New gates at transit stations in New York have led to a reduction in arrests (Weidner, 1997). Bulletproof barriers at banks reduced robberies significantly (up to 65%) compared with the control group (Ekblom, 1987, 1988) and time lock cash boxes (Clarke and McGrath, 1990) at betting shops in Australia reduced robberies considerably compared with the control group. Furthermore, exact fare requirements for bus users in New York resulted in a dramatic (90%) reduction in robberies of bus drivers (Chaiken *et al.*, 1974).

A retrospective American study (Lasley, 1996) in Los Angeles reported on the installing of barriers on 14 streets with high levels of drug trafficking, shootings and homicides. Part of a larger law enforcement initiative, the barriers were designed to make the drive to and purchase of drugs more difficult and to prevent drive-by shootings. Lasley (1996) compared reported crime for one year before installation, the two years during installation and for the four years afterwards, along with reported crime in four adjacent control areas. The net effect was a 65% decline in homicides. Although Eck (1997) observes that no significance tests were conducted for this study, he concludes that street closure evaluations have been conducted with greater rigour and appear to be promising.

Ekblom (2002) reports on an alley-gating project in Birmingham, England where 80% of burglaries were committed using access from rear alleys. After erecting 62 alley-gates, steel palisade fencing, the distribution of 400 ultraviolet property-marking kits and stickers and a local newsletter, a 53% decline in burglaries was reported. However, it is impossible to isolate the impact of alley-gating per se, due to the multiple interventions undertaken.

Activity Support

Activity support involves the use of design and signage to encourage intended patterns of usage of public space. Crowe (2000) notes how within reason, activity generation and support seeks to place inherently "unsafe" activities (such as those involving money transactions) in "safe" locations (those with high levels of activity and with surveillance opportunities). Similarly, "safe" activities serve as magnets for ordinary citizens who may then act to

discourage the presence of criminals. This approach clearly contains elements of territoriality, access control and surveillance.

Although increased numbers of pedestrians may provide additional 'eyes on the street' and potentially discourage some offences, this may also actually encourage and provide other targets for crime (e.g. pick-pocketing).

Crucially, in terms of theory, practice and policy the issue of 'permeability' (the levels of through traffic and pedestrian movement) is currently hotly contested with some CPTED applications seeking to minimise escape routes (e.g. SBD), while others (e.g. 'New Urbanism') support optimising permeability to promote maximum activity levels. However, Schneider and Kitchen (2002, p225) argue it is about choice and that "although there is a clear clash of ideas here, that does not mean that they cannot co-exist". Sorensen (2003, p34) observes, "pedestrian traffic thus seems to increase risk (from the standpoint of target selection) and decrease risk (from the standpoint of natural surveillance) depending on whether that traffic is through traffic or local traffic".

There is a growing body of research on mixed-use neighbourhoods where it found that opportunities for crime are reduced by virtue of the increased range of activities in spatial and temporal terms (Poyner and Webb, 1991; Pettersson, 1997). It is contended that the systematic zoning of areas for particular uses reduces the number of potential 'eyes on the street' (Jacobs, 1961). Furthermore, promoting street-level activity by encouraging the practice of residential provision above retail units is a relatively recent innovation (Wekerle and Whitzman, 1995; Office of the Deputy Prime Minister, 2004). Research concerning the mapping and monitoring of pedestrian movement (Hillier and Shu, 2000a; 2000b) is clearly supportive of more permeable layouts, which promote intervisibility.

Image / Management

Promoting a positive image and routinely maintaining the built environment ensures that the physical environment continues to function effectively and transmits positive signals to all users. The significance of the physical condition and 'image' of the built environment and the effect this may have on crime and the fear of crime has long been acknowledged (Lynch, 1960) and an extensive body of research now exists. In terms of the management of private rental housing, Eck (1997, p7-10) argues, "we have strong evidence that improving management of rental properties can reduce drug related crime". Vacant premises have been found to represent crime 'magnets' (Spelman, 1993) and smaller buildings were a preferred site for drug dealing since they had less management and financial resources to regulate such criminal activity.

On public transport, a clean up programme was undertaken to remove graffiti from all train cars and stations (Sloan-Howitt and Kelling, 1990) on the New York subway system. Graffiti was significantly reduced and in spite of increased police attention to graffiti, arrests for the offence also declined. In Victoria, Australia, following a programme promoting the rapid repair and rehabilitation of vandalised equipment, Carr and Spring (1993) found that train availability increased 45% and reported crimes against the person declined 42%. At the New York Port Authority Bus Terminal 63 specific design interventions (including access control, cleaning and enhancing formal surveillance by staff) significantly reduced robberies and assaults (Felson *et al.*, 1996).

Crucially, much research suggests that the routine maintenance of the urban environment will significantly assist in reducing crime (Wilson and Kelling, 1982; Kraut, 1999; Ross and

Mirowsky, 1999; Ross and Jang, 2000; Cozens *et al.*, 2001b). Wilson and Kelling's 'Broken Windows' thesis (1982) stressed the vital importance of maintaining the environment as a physical indicator of levels of social cohesion and informal social control and various researchers have developed this theme (Skogan and Maxfield, 1980; Lewis and Maxfield, 1980; Lewis and Salem, 1986; Vrij and Winkel, 1991; Nair *et al.*, 1993; Kelling and Coles, 1996).

Ross and Mirowsky (1999) claim that research has consistently found that the presence of neighbourhood incivilities results in increased levels of fear (Covington and Taylor, 1991; Lewis and Maxfield, 1980; Perkins *et al.*, 1990; Perkins and Taylor, 1996; Rohe and Burby, 1988 and Taylor and Covington, 1993). In terms of criminal activity, the presence or absence of social and physical signs of disorder and decay may be crucial. Indeed, for Taylor (1991, p970) "the environmental 'image' offenders have of an area is associated with the extent to which the area is victimised".

Target Hardening

Target hardening increases the efforts that offenders must expend in the commission of a crime and is the most long-established and traditional approach to crime prevention. However, there is much disagreement concerning whether or not target hardening should be considered as a component of CPTED. It is directed at denying or limiting access to a crime target through the use of physical barriers such as fences, gates, locks, electronic alarms and security patrols. Crucially, excessive use of target hardening tactics can create a 'fortress mentality' and imagery whereby residents withdraw behind physical barriers and the self-policing capacity of the built environment is damaged, effectively working against CPTED strategies which rely on surveillance, territoriality and image.

One burglary reduction strategy is upgrading locks and security at points of access. Examples include the installation of deadbolt locks on doors, the reinforcement of the doors themselves, the installation of locks on windows, and the use of double-pane glass (which is both more difficult and noisier to break). In the UK, (Budd, 1999, p60) reports intimated that 61% of recorded burglaries involved forced entry through doors and windows (37% were forced open, 24% were smashed). However, 22% involved no forced entry, where locks and windows were left open (Budd, 1999).

A study by Allatt (1984) found that target-hardening strategies resulted in reductions in burglaries and Tilley and Webb (1994) compared two target-hardened English public housing estates with a control group, finding significant reductions in burglaries in both complexes.

In conclusion, Sorenson (2003, p36) notes that Budd's (1999) multivariate analysis of British Crime Survey (BCS) data "strongly suggests the effectiveness of security measures". Knights and Pascoe (2000) reviewed both British and international studies of the available evidence and concur. Most recently, findings from a study of burglary in the UK, USA and the Netherlands (Tseloni *et al.*, 2004) found 'security measures in the home' to be one of four variables affecting victimisation rates across all three countries, indicating the success of target hardening measures in reducing recorded burglary at an international level.

In summary, the review of the CPTED components of surveillance, access control, territorial reinforcement, activity support, image / management, and target hardening intimates that they have all individually contributed to reducing crime and the fear of crime in a broad range of studies.

Research Supporting Comprehensive CPTED Strategies.

This section examines research that has evaluated more comprehensive CPTED studies where multiple interventions were conducted.

CPTED in the UK is arguably operationally best represented by the Secured By Design scheme (SBD). It is a broad-based initiative; applicable (among others) to new-build housing and three recent SBD evaluations (Armitage, 1999; Pascoe, 1999 and Brown, 1999) have all reported positive results in terms of reduced levels of recorded crime and perceptions of fear of crime (for a review see Cozens *et al.*, 2004).

In the Home Office Briefing Note 7/00, Armitage (2000) reports that the additional average cost of incorporating enhanced security features at the construction stage has been estimated at £400 and notes that the average cost of burglary to the victim (at 1999 prices) was £2,300 (Brand and Price, 2000) Armitage (2000, p4) argues “the extra expenditure required to build or refurbish housing to SBD standards would appear to be a worthwhile investment”.

Furthermore, a recent study has highlighted ‘security against crime’ as the most important factor to be considered when designing a home (Armitage and Everson, 2003). This initiative has gained political support and momentum to the extent that it is now compulsory for all new-build public housing projects in Wales to be built to approved SBD specifications.

CPTED interventions can be found throughout the USA and Canada although the reporting of empirical findings is limited. However, from 1971 to 1973, urban planner Richard Gardiner was hired by the US Department of Justice to conduct the first empirical test of CPTED at the neighbourhood-level of planning. The Hartford Neighborhood Anti-Crime Study analysed the result of urban structure and crime opportunities in the Asylum Hill neighbourhood of Hartford, Connecticut. After three years of extensive data collection, it was the first comprehensive large scale study to determine there was a direct relationship between crime and the structure of neighbourhood design, and that properly designed urban form can help mitigate crime opportunities (Gardiner, 1978). The results of the Hartford study led to the nationwide development of a federal program to implement, and analyse, CPTED strategies in a number of cities across America.

Schneider and Kitchen (2002, p158) claim the Five Oaks project in Ohio is ‘one of the best documented cases’ which reported a 26% decrease in recorded crime after a range of CPTED interventions (Newman, 1996). However, multiple interventions inevitably obscure the detailed understanding of what each intervention contributed.

Schneider and Kitchen (2002) report on various CPTED projects in residential areas such as Harbordale in Florida, where interventions resulted in increasing property values (5.5%) and a significant decline in crime rates. Although intervening variables have complicated the issue “there is no doubt that residents perceive crime to be lower and the quality of life to be improved by virtue of the city’s place-based crime prevention interventions in Harbordale” (Schneider and Kitchen, 2002, p163).

After a range of CPTED interventions in Portland Oregon (Kushmuk and Whittermore, 1981), there was a reduction in burglaries of commercial properties and “a ‘stabilisation’ of the neighbourhood’s quality of life, physical appearance and social cohesion among the business community” (Schneider and Kitchen, 2002, p173). CPTED in industrial areas has also been implemented. One example in California (Peiser and Chang, 1998) focused on access control, reducing escape routes, improved signage, target hardening, improved lighting, CCTV and night time security patrols. Break-ins, vandalism and graffiti were

drastically reduced (from every weekend to bi-monthly) and the occupancy rate in the industrial park increased from 75% to 98% in one year. According to the Park's management, the costs of the security measures were far outweighed by income generated from increased rents, higher occupancy rates and shorter vacancy periods (Schneider and Kitchen, 2002). However, the precise details of what worked and how it worked are clearly not revealed in such a multiple strategy intervention.

Schneider (2002, p389) reviewed 'successful' CPTED case studies in Canada (though not independently evaluated) and argues that it is most successful "when residents are made aware of and educated upon the design strategies that have been implemented and their role in maximising the potential of these strategies".

Relating to public transport, Loukaitou-Sideris' (1999) empirically based research analysed environmental features associated with high crime bus stops in Los Angeles and confirmed 'desolation and lack of surveillance', 'crowding', 'broken windows', and 'easy escapes' as significant factors. In line with other research on the importance of convenience store location (Leistner, 1999), she advises that bus stops should not be located in 'dead spaces'. Furthermore, the Washington D.C. Metro System has been identified in the crime prevention literature as having been specifically designed to facilitate less crime by using CPTED strategies (La Vigne, 1997). When compared to three other urban rail transit systems recorded crime was lower and was not correlated with the crime levels associated with the spaces immediately above the station.

Four key reviews of place-based interventions provide valuable insights. Poyner (1993) reviewed 122 evaluations of crime prevention projects and found that for all crime, over half of the evaluations in the environmental design or improvement category (24 out of 45) demonstrated firm evidence of crime reduction. A further 12 evaluations indicated limited evidence of crime reduction. Some of the more positive evaluations included: lighting, fencing, design changes to improve surveillance by staff, clean up of neighbourhoods, road closures / street changes, wider market gangways, electronic access control, car steering-column locks and target removal or modification. Poyner (1993, p21) concludes that there is optimism in the field of crime prevention but "such a broad analysis does not tell us what makes an individual crime prevention project successful, but it makes it quite clear that many of the measures already known in the crime prevention field can be made to work".

Feins *et al.*, (1997) extensively reviewed four residential areas noting that the cases "are 'suggestive' that location-based crime prevention tactics ...do reduce crime, although they are not 'proof' that this is the result" (Schneider and Kitchen, 2002, p158).

In Sherman *et al.*, (1997) Eck reports on the situation regarding research evaluations of crime at places. Ninety-nine place-based crime prevention evaluations were reviewed and crucially, most (90%) displayed some evidence of crime reduction effects.

A review of 28 CPTED studies on robbery (Casteel and Peek-Asa, 2000) found higher reductions (from 30% to 84%) in multiple component CPTED studies (16) and all but one of the single component studies (12) demonstrating "the broad nature of the CPTED approach allows its adaptation to many settings, and results indicate this as an effective approach to reducing robberies".

In Eck's 1997 review, only one location-based study (Eck and Wartell, 1996) was ranked 5 (that is employing the most robust research techniques using randomised controlled

experiments², which seek to measure and compare the outcomes of two or more interventions) and cautiously, Eck (1997, p7-6) observes how “few studies have been replicated at a strong level of scientific evidence”. However, in a revised assessment Eck (2002, p242) notes that knowledge of which CPTED strategies work “is severely limited because places themselves have only recently become a subject of study (Eck and Weisburd, 1995)”. Since the 1997 review, improved lighting in public open spaces has been categorised as being an effective evidence-based intervention that ‘works’ (Eck, 2002).

In addition to these CPTED oriented studies, evaluations in other fields provide evidence of the effectiveness of the approach. In a U.S. Department of Justice review of over a hundred problem-solving projects conducted by police departments across the country, 57 percent of successful projects used CPTED strategies as a major response (Scott, 2000). In fact, beyond traditional criminal justice strategies to solve neighbourhood problems Scott (2000, p162) discovered that “the single most frequently used type of response was altering the physical environment to reduce opportunities for problems to recur. The police in these problem-solving initiatives demonstrated a willingness and capacity to modify the environment in which problems occurred as an effective means of modifying the behaviour of offenders and potential victims.”

Clearly, CPTED has been found to reduce crime and the fear of crime in numerous evaluations and to increase property values and investment in the area. At an empirical level, support for the effectiveness of comprehensive CPTED programmes has not been unequivocally demonstrated. However, Eck (2002, p241) claims “there are a large number of place-focused prevention tactics with evidence of effectiveness”.

Limits to the CPTED Approach

Despite the evidential support presented for CPTED, in common with all crime prevention strategies, there are limitations to this approach. Firstly, ‘irrational’ offenders (e.g. those intoxicated by alcohol or drugs) are potentially less likely to be deterred by 1st Generation CPTED strategies, but similarly, they might be less likely to respond predictably to any crime prevention initiatives.

Secondly, negative socio-economic and demographic dynamics can also reduce the efficacy of CPTED strategies, or enhance the efficacy of CPTED if those dynamics are positive. Realizing the importance of this fact was one of the driving forces behind the creation of 2nd Generation CPTED in the late 1990’s (Saville and Cleveland, 1997). Merry (1981) identified ‘undefended space’ where cultural and social factors influence the propensity for resident action and self-policing. Social conditions may nurture fear, reduce the inclination to intervene and result in the withdrawal of the individual into the home, which becomes heavily fortified. Atlas (1991) notes that it is not just town planners, designers and police officers that have successfully used the principles of ‘defensible space’. Atlas (1991, p65) observes how ‘offensible space’ may exist where drug dealers and criminals utilise CPTED principles to create ‘safe’ or ‘offensible’ space within and from which they may carry out their criminal activities.

² The randomised controlled trial is the ‘gold standard’ of evaluation and involves assigning subjects randomly to treatment and control groups, and comparing the outcomes recorded for each group. Because participants are randomly assigned, significant differences in outcome are attributable to the treatment as opposed to any other factor.

Thirdly, displacement has been a major criticism levelled at CPTED. Hakim and Rengert (1981) claim that there are five types, where the implementation of crime prevention measures in one area can 'displace' existing crime in terms of location, time, tactics, targets and type of crime. However, recent research from America, suggests that displacement can be utilised as a positive tool, rather than as a negative side-effect (Saville, 1998). This can be achieved by monitoring the wider environment and considering and planning against the possible knock-on effects of CPTED initiatives. Moreover, it can also be argued that displacement occurs as a negative side-effect of all existing crime prevention initiatives and is not a criticism that is exclusive to CPTED.

Fourthly, the ecological threshold or 'tipping point' (Saville, 1996) of a neighbourhood is the notion that like any natural ecosystem, it has a limited capacity for certain activities and functions. Returning to the original social ecology formulations of CPTED from Jacobs (1961), tipping points treat neighbourhoods as social ecosystems. Environmental decline and increasing rates of vacancy in a given neighbourhood may breach the 'tipping point' and result in the out-migration of residents, social capital and economic resources and set in motion a vicious spiral of decline. Under such conditions all crime prevention strategies are likely to be limited in their effectiveness. This concept of neighbourhood capacity and the tipping point is one of the four principles of 2nd Generation CPTED, the other three being community culture, cohesion, and connectivity (Saville and Cleveland, 2003a, 2003b).

Finally, when CPTED is applied without sufficient community participation and becomes overly reliant on target hardening, a 'fortress mentality' can result, where citizens and neighbourhoods (e.g. gated communities) withdraw behind walls, fences, and fortified homes. This effectively works against CPTED concepts, designed to support social interaction and promote activity and 'eyes on the street'. This also raises the question as to how many studies are potentially limiting their crime reduction effectiveness by using 1st as opposed to 2nd Generation CPTED.

Impact and Scope of CPTED

The impact and scope of CPTED is certainly evident in the recent emergence of ideas regarding the synergies between CPTED and urban sustainability (Du Plessis, 1999; Napier *et al*, 1998; Vanderschueren, 1998; Cozens, 2002). Indeed, residents of crime-ridden communities often experience some of the most severe environmental and social problems. A sustainable community must therefore, be one that is defined as safe, perceives itself to be safe and is considered by others to be safe. Arguably, the standardization of CPTED concepts in planning processes could avoid the repetition of some of the 'unsustainable' design failures of the recent past and contribute towards a form of 'urban environmentalism' for the 21st century (Cozens, 2002).

Furthermore, it has been observed (Kennedy, 1993; Gordon and Brill, 1996; Hanson, 1998 and Grant, 2001) that courts in America are increasingly holding landlords and others "liable for failing to take sufficient security precautions to prevent criminal attack on their invitees, tenants and guests" (Kennedy, 1993, p106). Such cases have resulted in CPTED specialists being called upon to act as expert witnesses, where design is implicated as a causal factor. This trend is likely to migrate to Britain (Infield, 2000) and potentially, could have a significant, far-reaching impact elsewhere. Significantly, some nations / states (e.g. the UK and some American and Australia states) have begun to create / amend existing legislative and planning policy frameworks to incorporate CPTED practice and procedures into the planning process.

Conclusions

In the light of the recent reviews of place-based crime prevention (Poyner, 1993; Eck, 1997; Feins *et al.*, 1997; Casteel and Peek Asa, 2000; Eck, 2002; Sorenson, 2003) and the systematic reviews of lighting (Farrington and Welsh, 2002), CCTV (Welsh and Farrington, 2002), target hardening (Budd, 1999; Knights and Pascoe, 2000; Tseloni *et al.*, 2004) and SBD (Armitage, 1999; Brown, 1999; Pascoe, 1999) the research supporting the effectiveness of CPTED is clearly accumulating. There is confidence that as a comprehensive CPTED programme, the UK's SBD "works", although critics and supporters alike are still unaware as to precisely why (Topping and Pascoe, 2000; Cozens *et al.*, 2004) and such sentiments arguably apply to CPTED in general.

Schneider and Kitchen (2002, p158) comment that "despite the fact that the crime data support the contention that place-based applications work, the physical, management and community organisational interventions in these cases are woven together in complex ways that defy individual analysis". Furthermore, Draper (2000) observes that CPTED clients are often unwilling to fund follow-up research evaluating CPTED interventions and that even when this is an objective, client confidentiality can often result in the non-dissemination of findings.

Moreover, studies which do not support CPTED (of which there are many) tend to report that design factors were less effective than other variables, rather than reporting no effectiveness whatsoever. In Sherman *et al* (1997; 2002) the effectiveness of the majority of the place-based initiatives was categorised as 'unknown' and most failed to meet the rigorous methodological and evaluative standards, this does not necessarily mean that they did not work, merely that it cannot be empirically 'proven' that they worked. There are of course, studies of the effectiveness of the component parts of CPTED and of more comprehensive CPTED programmes that have not successfully managed to reduce either recorded crime or the fear of crime. It is also suggested that many of these studies may not have met the rigorous evaluative standards recommended by Sherman *et al.*, (1997; 2002) and therefore, in scientific terms, it cannot be unambiguously asserted that CPTED does not work.

Indeed, Eck (2002) reported that there were no place-based evaluations that did not work, claiming the existing empirical uncertainty about what works, at which places, and against which crimes "should not distract us from the broader finding that opportunity blocking tactics at places can be productive" (Eck, 2002, p281).

Grabosky (2003) has argued that science is beginning to inform crime control, highlighting the Campbell Crime and Justice website's³ extensive list of systematic studies (over 5,000). However, only a minority (24) are currently relevant to crime prevention and most are oriented towards developmental crime prevention, rather than place-based programmes. This is perhaps testament to the difficulties of measuring both crime (recorded crime and / or fear of crime) and the impact of complex physical interventions on behavioural patterns operating within a dynamic, multi-dimensional socio-spatial environment.

Crowe (2000, p220) argues "CPTED is a self-evident concept that has been used successfully for many centuries. Research and assessment over the last 30 years have confirmed the utility of what many people think is just good, common sense". In summary, the insights presented in this review clearly indicate CPTED can be effective in reducing recorded crime and the fear of crime. What is less certain is precisely how CPTED and its component parts work,

³ <http://www.aic.gov.au/campbellej/> visited 6th September 2004.

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where it works best and how to systematically evaluate its effectiveness (or otherwise) beyond reasonable doubt.

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