

3 The architecture of crime and fear of crime

Research evidence on lighting, CCTV and CPTED features¹

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3.1 Introduction

Urban design shapes the built environment and the types of human activities that take place in it. A safe environment is one that maximizes the use of public places with a mix of users carrying out a variety of routine activities; it is a place that encourages social interaction. A safe environment depends on what happens in this place, and what happens in it depends on how safe it is perceived to be. Lighting is essential for feeling safe in a place (Green, Perkins, Steinbach, & Edwards, 2015; Johansson, Rosen, & Kuller, 2011), but the impact on safety of other environmental features, such as security technologies, is less obvious (Lorenc et al., 2013; Lum, Stoltz, Koper, & Scherer, 2019). For some people the presence of a closed-circuit television camera (CCTV) reduces their confidence, while others feel empowered and safe (Koskela, 2002; Yavuz & Welch, 2010). So what makes a public place safe?

The aim of this chapter is to discuss the evidence in the international literature of the effects of urban design on safety—in particular, the relationship between features such as lighting and CCTV to the occurrence of crime and/or individuals' safety perceptions. Potential unexpected side effects of these features on a city's overall quality are also discussed.

To achieve these goals, the literature from 1968 to 2018 was searched, using as references the Scopus, Web of Science and JSTOR databases. Bibliometric visualization software was used to manage and map the vast material, spanning more than five decades of research, on crime and fear of crime and to answer the following questions.

- Does urban design, indicated by crime prevention through environmental design (CPTED) features, have any impact on crime and/or safety perceptions, and if so, how?
- Does lighting and/or CCTV have any effect on crime, and if so, what are the mechanisms? Are safety perceptions affected by lighting and/or CCTV, and if so, what are the mechanisms?
- Is there any risk (or “side effect”) when prioritizing safety over other sustainability goals?

The literature overview focuses on particular features of accessible public places (streets, parks, etc.) and neighborhood structure, because it is at this scale that crime and fear take shape. In addition, it is at this scale that the impact of planning decisions is experienced and planning solutions can be implemented. Finally, it is also at this scale that many safety problems can be addressed through inclusive policies by direct involvement of local stakeholders (police, safety experts, community groups) and those voices normally excluded from planning decisions.

The decision to focus this literature overview on lighting and CCTV was taken because the international literature has been strongly dominated by these features in recent decades (Painter & Farrington, 1994; Piza, Welsh, Farrington, & Thomas, 2019; Quinet & Nunn, 1998; Ratcliffe, Taniguchi, & Taylor, 2009; Sutton & Wilson, 2004; van Rijswijk & Haans, 2018; Welsh & Farrington, 2009; Williams & Johnstone, 2000).

This chapter is structured as follows. First, the importance of assessing the state-of-the-art research is introduced with a focus on urban design, crime and safety. Then methods are reported, followed by the results. In the final section, gaps in the literature and suggestions for a research agenda close the chapter. Note that in this study “public places” and “public spaces” will be used interchangeably.

3.2 Public places, urban design and safety

“Public space” (or here “public place”) means a space legally open and accessible without the permission of anyone else, such as a common (Németh, 2012). In reality, most public spaces are conditionally “free”, because action allowed in these spaces falls within the law of the locality in which the space is located. Accessibility is thought to be a basic characteristic of these places. Yet, although public spaces/places might be accessible to everyone, why is it that safety in these places may not be attainable by all?

First, safety is a function of the way one perceives these places, so an individual’s fears depend on her/his individual characteristics: physical and psychological abilities, age, gender, ethnic background, sexual and socioeconomic statuses (Box, Hale, & Andrews, 1988; Garofalo & Laub, 1979; Pain & Smith, 2008). It is also these characteristics (individually or intersectionally) that determine an individual’s risk of victimization of crime. Although men are more victimized by crime in public places, it is women who fear public places the most (Ferraro, 1996; Pain, 1997).

Second, as previously suggested, safety also depends on what happens in these public places, and what happens in them depends on how safe these places are perceived to be. Loukaitou-Sideris and Eck (2007) indicated that walking and cycling are greatly influenced by what happens in streets and other public spaces. Safe public places invite outdoor activities, including daily walks. Poor maintenance or signs of physical deterioration of an area are thought to be more important determinants of fear of crime than the actual incidence of crime. Either way, fear may inhibit people from using a public place or lead them to avoid certain times of the day (Gray, Jackson, & Farrall, 2011; Jackson & Gray, 2010). Wilson and Kelling (1982) suggested that acts of vandalism and public disorder

function as symbols of the extent to which an area is in decline, which might affect subsequent levels of crime and safety perceptions.

Third, public places are often contested places where individuals relate to rules conduct and publicness (Smith & Low, 2013). The right to feel safe rests on a *thin equilibrium* between place users of all types and what Eck (2019) called “place managers”, they are those people and organizations that are physically and legally able to prevent crime in a place. Each public place bears a certain morality that defines what can be done in it (under or beyond the rule of law). This morality also determines those who are the “legitimate users” (Knutsson, 1997) and those who are not.

Finally, public places vary in their levels of crime and/or in the way they are perceived. Crime and fear of crime are different phenomena. What makes a place criminogenic does not necessarily make it unsafe, and vice versa (e.g., Ceccato & Lukyte, 2011; Ferraro, 1995; Gray, Jackson, & Farrall, 2008; LaGrange, Ferraro, & Supancic, 1992; Pain, MacFarlane, & Turner, 2006). This fact has implications for both research and practice, because the root causes of crime are often not those that affect people’s poor safety perceptions of a place, although they may share similar triggers. Because the environment plays an important role in affecting victimization and/or shaping fears, we focus in this chapter on environmental factors that have a direct impact on crime occurrence and fear.

As suggested in Chapter 2, poorly designed and managed built environments can create opportunities for crime and make people feel unsafe (Clarke, 2012; Crowe, 2000; Jongejan & Woldendorp, 2013; Monchuk, 2011; Reynald, 2011). A safe environment is the one that maximizes the use of public places by a mix of users with different routine activities; it is a place that encourages social interaction, increases visibility and surveillance by passers-by and, as a result, reduces the risk of crime. Crime is less likely to occur in places where there are clear, well-defined routes and people can easily enter and leave, a place that avoids barriers and obstacles. In addition, public places that are well managed and maintained generally feel safer and encourage people to use them; they exhibit “ownership”. This in turn encourages activity and natural surveillance. As indicated in Chapter 2, these principles are well encapsulated by CPTED (Crowe, 2000) and in principles of routine activity (Cohen & Felson, 1979; Felson, 2002) and Situational Action Theory (e.g. Wikström & Treiber, 2017).

Although the international literature shows much evidence for the effect of CPTED features on safety, the evidence is mixed; for a review, see Cozens, Saville, and Hillier (2005), Cozens and Love (2015) and Farrington and Welsh (2002). Building on these previous reviews of the literature, this chapter aims to contribute to the evidence in this area by collecting and systematizing scholarly knowledge on the effect of urban design on urban safety—in particular, the impact of features such as lighting and CCTV on crime and/or perceived safety.

3.3 Data and methods

The literature search covered 50 years, from 1968 to 2018, of publications in the databases Scopus, Web of Science and JSTOR. The bibliographic selection

was conducted in two steps: first, we focused on the bibliometric analysis and then on in-depth analysis of the material as described in sections. This is a review of literature inspired by the principles of the *Cochrane Handbook for Systematic Reviews* (Higgins & Green, 2011) as well as the PRISMA checklist (Moher, Liberati, Tetzlaff, & Altman, 2009). One of the features that distinguish this type of review from others is the pre-specification of studies following a set of eligibility criteria (Higgins & Green, 2011). In this case, we considered both quantitative and qualitative analysis. This means that some studies did not focus on causal links between urban design and crime only but included studies of a more qualitative character typical in the planning literature. We also extended our search of articles to fear of crime and to reports. This opened up for evidence beyond the European and North American literature.

The bibliometric analysis included 4,730 articles obtained and selected from the databases (in *.ris) in different stages. VOSviewer version 1.6.12 (www.vosviewer.com) is a free-access software tool that was used to create bibliometric maps based on the keywords cited in each selected article and to group the terms in clusters according to their linkages (van Eck & Waltman, 2019). The criterion of a minimum of two repetitions criterion aimed at avoiding terms without links or with weak links to the theme and, secondly, ensuring terms were covered and articles were representative. Output files from the database were used to produce informative network maps by theme. A number of themes were selected based on the clusters that emerged from the literature and are discussed in Section 3.4, Figure 3.1.

These themes supported the selection of topics that were thought to be relevant for further investigation in an in-depth analysis of the 106 articles (Figure 3.2). The effect of, for instance, lighting on crime and/or safety was assessed in four ways: lighting has a *positive effect*, namely, reducing crime and/or increasing perceived safety; lighting has a *negative effect* on crime and/or perceived safety, namely, increasing crime and reducing safety perceptions. *Inconclusive/conflicting effect* was when the different, contradictory effects were observed and finally, *no effect/difference*, when no statistically significant impact was found on crime and/or fear of crime. The analysis also checked whether there was any relationship between lighting and crime and/or fear of crime and the location of the study area by continent.

Note that the types of methods and datasets used in the analysis covering 106 publications (35 on lighting, 22 on CCTV and 49 on CPTED) varied greatly, even among the quantitative pieces, which makes it difficult to strictly compare effects. Various studies showed that the effect of lighting, for example, on safety was dependent on crime types, levels and contexts. In addition, the search of the literature focused on public places in general and encompassed a variety of environments, from open streets to shopping malls. The analysis was based instead on a comparative assessment of the author's declared findings and conclusions in each publication. Caution is therefore necessary when drawing conclusions.

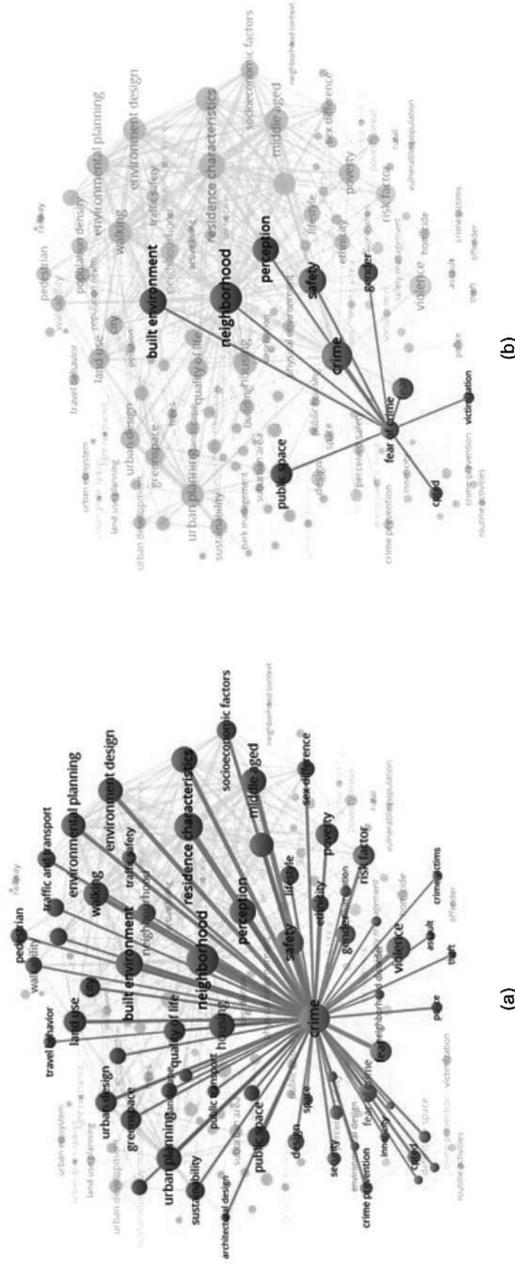


Figure 3.1 Network visualization map with focus on (a) “crime” and (b) “fear of crime.” $N=4,730$, 1968–2018 (Minimum strength = 5 links and 3 clusters, min. size: 20, in Scopus, Web of Science, JSTOR).

3.4 Results and discussion

Overall bibliometric trends

Internationally, research in this area has significantly increased in the past three decades. The bibliometric analysis for both crime and fear of crime resulted in three clusters as an outcome of the literature search based on 4,730 articles. Figure 3.1(a) shows a cluster associated with crime and victimization; another cluster with neighborhood and socio-economic conditions; and another one, which refers to studies on urban planning and landscape of the city. The greater the weight of an item by level of importance, the larger the circle. The distance between two keywords indicates the relatedness of the keywords, in terms of co-citation links. Note that there are many more articles on crime linking these three clusters than for the articles on fear of crime (Figure 3.1(b)). This complexity is not found when “fear of crime” is visualized as the focus, and articles on “built environment” are relatively “far” from “fear of crime” when compared with articles dealing with “crime”.

The in-depth analysis revealed that there were 37 studies showing the effect of lighting (69 percent) out of 53 archived articles from the international literature: 72 percent of them found a positive impact of lighting on crime and/or fear (Appendix, Table A3.1). These articles were mostly published between 1998 and 2018, with a peak in 2008 (from 1968–2019), from Western Europe and the United States, but also from Asia and South America (Figure 3.2). In terms of methodology, 23 were classified as quantitative pieces, eight qualitative articles and four mixed methods. In the next section, some of the most important studies, starting from those dating back to the late 1980s and early 1990s (Griswold, 1984; Painter & Farrington, 1994; Poyner & Webb, 1987), will be discussed in detail.

As for CCTV, 67 percent of 22 articles (out of 63 that were selected, Appendix, Table A3.2) show that this technology had a reductive effect either on crime or perceived safety, the great majority of them in Europe and the United States. Of these, half were quantitative studies, about a quarter used mixed methods and the remainder used qualitative analysis, most revealing some effect on safety perceptions. Similar to the findings of Welsh and Farrington (2004) that CCTV had an effect only for car parks (in a data meta-analysis of 41 studies), this review showed that one quarter of the articles either showed no effect of CCTV or were inconclusive, with mixed results.

Some studies used one or various CPTED principles together to assess safety (Appendix, Table A3.3, these were selected using CPTED in the keyword, in the title or abstract). Although 65 percent of them indicated some positive impact on either crime or safety perceptions, they evaluated different aspects of CPTED and varied greatly in method and how rigorous they were performed, so caution is necessary when drawing conclusions. A bit more than half of them (27 articles) were composed of studies devoted to the importance of the physical environment and spatial arrangement as the core of the analysis. Only four included aspects of city livability, health and sustainability issues, and the remainder included aspects of community engagement and social cohesion or

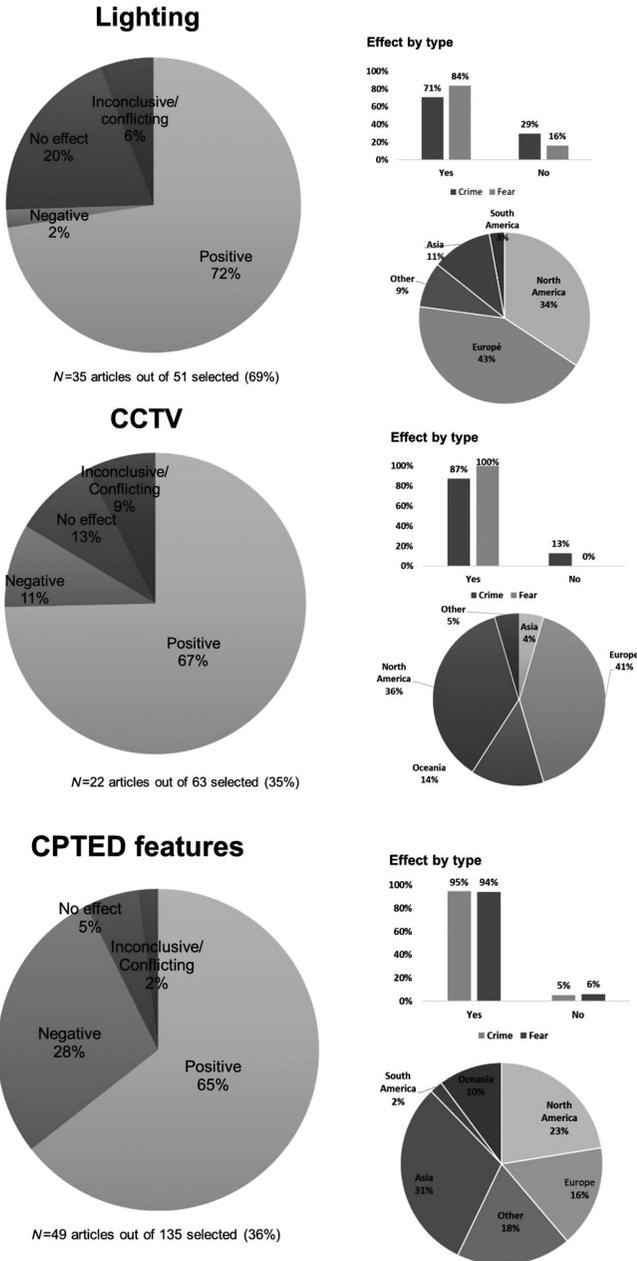


Figure 3.2 Effect of lighting, CCTV and CPTED features on crime and fear of crime according to the international literature 1968–2018. N=106 articles.

user's perspective. Figure 3.2 summarizes the characteristics of publications that link crime and fear to CPTED principles, CCTV and lighting.

The effect of lighting on crime and fear

There is no other feature of urban space that is more controversial with regards to its effect on safety than lighting. Lighting is thought to improve safety perceptions, but previous research shows that its effect on crime is conflicting (Cozens, Neale, Whitaker, Hillier, & Graham, 2003; Green et al., 2015; Lawson, Rogerson, & Barnacle, 2018; Painter & Farrington, 1994). Although there has been evidence that introducing street lighting reduces road traffic collisions and crimes, there was no evidence of any increase in crime or accidents where street lighting was reduced at night (Perkins, Steinbach, & Tompson, 2015). Traditionally, it is believed that modifying nighttime visibility in urban areas should affect opportunities for crime by increasing the perceived risk of offender detection, or, alternatively, lighting increases the chances for certain types of crimes by making victims more visible: the “fishbowl effect”. At the same time, an improvement of street lighting may have an extra indirect effect. Residents are believed to invest more in their community and show that people in that area are in control, encouraging potential offenders to find other areas that are “less risky” in terms of detection. What does this literature overview indicate?

Out of 35 articles, the overall effect of illumination on crime is positive: 72 percent of studies show that (good) lighting has a positive effect on safety, in other words reduces crime and/or fear of crime. Such an effect is slightly more prominent on perceived safety than on crime occurrence (Figure 3.2, see effect by type: crime and fear). These results reflect a diverse flora of studies, with different methods, types of crime, safety perception indicators and geographical contexts. For example, crimes vary greatly by type, from theft and robbery as well as less frequent offenses with very different mechanisms and records, such as violent crimes, homicides, police calls for service and total crime. The spectrum of urban environments varies widely, too, from large cities to rural communities as well as computer-generated landscapes, but the reductive effect is consistent.

After several small-sample analyses in the United Kingdom, the seminal study by Atkins, Husain, and Storey (1991) broke fresh ground by showing that better street lighting had little or no effect on crime. However, they also found that the improved street lighting was warmly welcomed by the public and that it provided a measure of reassurance to some people, particularly women, who were fearful in their use of public space. The study by Herbert and Davidson (1994) examining the impact of improved street lighting upon crime and community safety in two British cities also concluded that perceived safety was increased by improved street lighting, although similar effects on crime rates were difficult to assess. Mixed effects were also found in Japan for property crimes, by Takizawa, Koo, and Katoh (2010), in the United States, by Groff and McCord (2012), and by Cozens, Neale, Whitaker, Hillier and

Graham (2003) and all these three studies suggest further research on the effect of street lighting on crime.

Among studies that found crime reduction in association with lighting, Quinet and Nunn (1998) reported on an evaluation of the effects of streetlights on crime in several neighborhoods in Indianapolis. Also in the United States, Loomis, Marshall, Wolf, Runyan, and Butts (2002) found that bright exterior light was associated with reduction of homicides in workplaces. Byun and Ha (2016) found that lighting was associated with the reduction of burglaries in Seoul, South Korea. Peek-Asa and Casteel (2010) indicated that good lighting presents a reduction of total robbery, controlling for a number of factors in the retail setting. In a rural context in the Global South, the study by Arvate, Falsete, Ribeiro, and Souza (2018) showed that better lighting is associated with a decrease in homicides. Farrington and Welsh (2002) reported a systematic review incorporating meta-analytic techniques of the effects of improved street lighting on crime to indicate that good lighting has a positive effect on crime reduction. More intriguing was the study by Stolzenberg, D'Alessio, and Flexon (2017) who investigated the effect of moon illumination on reported crime occurring outdoors between the hours of 10pm and 2am in 13 US states, as well as the District of Columbia. Findings showed that moonlight had a reductive effect on outdoor crime, though no significant influence on indoor crimes and total crime. In addition, in England and Wales, Skudder et al. (2018) showed that external and internal lighting were effective and also had a small carbon footprint.

In terms of safety perceptions, there is positive evidence of the effect of lighting, but some of the studies are also inconclusive. It is important to keep in mind that these articles are based on different methods with varied statistical rigor and large differences in sample sizes. In Ohio, in the United States, Tseng, Duane, and Hadipriono (2004) showed that lighting was the most significant factor in determining the quality of users' perceptions of parking garages. In Sweden, where the winters are dark and long, Tjoa and Devon (2010) showed how illumination in a Swedish city positively affected perceived safety and influenced accessibility, walking and cycling. Also in Sweden, Johansson, Pedersen, Maleetipwan-Mattsson, Kuhn, and Laike (2014) found a positive effect of lighting on accessibility and perceived safety. Yet another study in Sweden, by Lindgren and Nilsen (2012), confirmed the importance of good illumination in relation to greenery in residential areas. In a qualitative study by Pain et al. (2006) in the United Kingdom, findings showed that individual's reports are complex and reflective about the influence of lighting on crime and fear.

There were a number of experimental studies to test the effect of lighting on safety. Using artificial urban scenes, Stamps (2005) found that the perception of safety was strongly correlated with the lightness of the scene. Using computer-generated urban scenes, Nikunen and Korpela (2012) found that lighting had a positive effect on overall fear, while Haans and de Kort (2012) demonstrated that people prefer having light in their own immediate surroundings rather than on the road that lies ahead. Also using computer-generated

landscapes, Nasar and Bokharai (2017) found that uniform lighting would be judged more appealing or safer than would non-uniform lighting, but its effects are uncertain. Using a simulation analysis in South Korea, Kim and Park (2017) found that increased illuminance could not be linked to an improvement in pedestrians' visibility or perceptions of safety because many factors were thought to be important to be considered for a real improvement in visibility. An interesting study was performed by van Rijswijk and Haans (2018) in which participants reported increased perception of safety in improved lighting environments after an evaluation of 100 pictures of different streets at night in the Netherlands. Using real-time data, Castro-Toledo, Perea-Garcia, Bautista-Ortuno, and Mitkidis (2017) assessed fear in urban public space in Spain, Denmark and the United States and found that lack of good lighting was associated with psychological reactions of arousal related to fear, and heart rates collected seemed to sustain that finding.

The type of lighting and its impact on safety perceptions was the focus of a number of studies in particular settings, with mixed results, such as university campuses, bridges and roads (De Boer, Heylen, & Teeuw, 2014; Fotios, 2016; Fotios, Unwin, & Farrall, 2015; Haans & de Kort, 2012; Kim & Noh, 2018). Others focused on the effect of lighting in transit environments (Chandra, Jimenez, & Radhakrishnan, 2017; Ferrer, Ruiz, & Mars, 2015; Green et al., 2015; Rankavat & Tiwari, 2016; Srisuwan, 2011).

The effect of CCTV on crime and fear

One of the most seminal works was published by Brown (1996), who found mixed evidence of the effective use of CCTV on crime in three British cities. A well-known meta-analysis in this field was done by Welsh and Farrington (2009), who concluded that cameras are effective if systems are designed with close attention to the setting and its specific crime problems. They performed a meta-analysis of 41 studies to show that for car parks, CCTV has a reductive effect, but results are inconclusive for total crimes (Welsh & Farrington, 2009). The reductive effect of CCTV was also confirmed by other studies elsewhere (Caplan, Kennedy, & Petrossian, 2011; Ratcliffe et al., 2009; Tjoa & Devon, 2010), while others show mixed results, such as those by Lett, Hier, and Walby (2010), Tjernberg and Granhag (2019), La Vigne et al. (2011), Ceccato (2013), Taylor, Koper, and Woods (2012), and no effect by Gerell (2016).

The most recent evidence is reported by Piza et al. (2019), which is a systematic review and meta-analysis of the effects of CCTV surveillance cameras on crime. The findings show that CCTV is associated with a significant and modest decrease in crime. The largest and most consistent effects of CCTV were observed in car parks. The results of the analysis also demonstrated evidence of significant crime reduction in other settings, particularly residential areas. CCTV schemes incorporating active monitoring generated larger effect sizes than did passive systems. Schemes deploying multiple interventions alongside CCTV generated larger effect sizes than did schemes deploying single or no

other interventions alongside CCTV. As for the effect on safety perceptions, several studies show inconclusive findings of the effect of CCTV or that its effect was dependent on other security measures such as lighting (Cozens & Davies, 2013; Fussey, 2013; Peek-Asa & Casteel, 2010; Sanders & Hannem, 2012; Skudder et al., 2018; Yavuz & Welch, 2010).

Crime prevention based on modern technologies, such as cameras, alarms and lighting sensors, is often associated with large cities and rarely linked to rural areas (Weisheit and Donnermeyer, 2000). However, recent literature has shown signs of the expansion of technology as a preventive measure against property and wildlife crimes in rural areas (Aransiola & Ceccato, 2020; Ceccato, 2016). This expansion trend was noticed early on by Sutton and Wilson (2004), who executed a descriptive analysis of data obtained through in-depth interviews on all 33 Australian CCTV schemes. The authors noted significant expansion of CCTV surveillance in smaller regional and rural centers and in suburban locations but were unclear about the effect in these environments. In a rural context, Mears, Scott, and Bhati (2007) made use of data from agricultural censuses, victimization surveys and interviews to test the effect of CCTV. They found CCTV to be associated with higher levels of victimization in rural areas in the United States. The direction of causality was a problem also mentioned in the study in rural Australia by Anderson and McCall (2005), that found that if perception of crime increases, CCTV usage also increases.

CPTED, crime and fear

The international literature is richly populated by examples of how one or a combination of multiple characteristics of houses, neighborhoods and street features come together to affect the geography of crime and perceived safety. Such studies accounted for more than half of the studies reviewed and belong to what is normally called “first generation CPTED” (Saville, 2013). Although most studies make use of CPTED principles to tackle crime and reduce fear, a share of them are of a different type. They are “before–after analyses” of a safety intervention. The maintenance and perception of an area are important for safety, but equally important is people’s involvement in voluntary activities, from neighborhood cooperation to safety walking. The effectiveness of these activities is difficult to assess and varies; short-term evaluations dominate these studies.

Several examples of the literature show how specific and crime-tailored crime prevention interventions need to be in order to be effective. Positive results were found by Poyner (1991) after security improvements were made to parking lots, as well as by Tseng et al. (2004) in relation to the layout and management of garages; retail environments by Hunter and Jeffery (1997); parks by Knutsson (1997) and Iqbal and Ceccato (2015); streets by Armitage (2011); and schools by Bradshaw, Milam, Furr-Holden, and Lindstrom Johnson (2015) and Vagi et al. (2018).

Maintenance is a fundamental aspect of the safety of public places and an essential CPTED component assessed in many studies. Poorly maintained urban

land affects people's perceptions of safety and also victimization (Branas et al., 2018). Poyner (1994) illustrated the effect of demolition in the United Kingdom showing that property crime decreased. In the United States, Freedman and Owens (2011) found that new construction and rehabilitation of existing housing led to reductions in violent crime but not in property offenses. In Chicago, Aliprantis and Hartley (2015) found significant reductions in homicide rates around demolition sites. Similar findings were reported by Kondo, Andreyeva, South, MacDonald, and Branas (2018) for violent crimes and alcohol availability, and by Branas et al. (2018) for overall crime and nuisances in neighborhoods below the poverty line.

Research also shows examples of urban design producing safer environments. Gray and Novacevski (2015) stated that architecture can encourage a more equitable use of the space and may diminish the sense of fear. Gray (2015) also showed how the built environment has an important role to play in addressing safety problems by presenting opportunities for local stakeholders. In addition, Vagi et al. (2018) assessed CPTED in school environments and showed that students' performance was generally associated with higher perceptions of safety and lower levels of violence perpetration and perceived risk.

CPTED, crime and fear in transit environments

Bus stops and transit stations are criminogenic places (Bowers, 2014; Cozens, Neale, Whitaker, & Hillier, 2002, 2003; Cozens & van der Linde, 2015; Loukaitou-Sideris, 1999, 2012, 2014; Loukaitou-Sideris & Stieglitz, 2002; Newton, Johnson, & Bowers, 2004; Uittenbogaard & Ceccato, 2014). Previous research in transit environments has shown that design that promotes visibility and clear lines of sight, through the absence of nooks and corners, visible ticket booths, overpass (rather than underpass) walkways and separation of passenger flows promotes safety (Ceccato, Uittenbogaard, & Bamzar, 2013b; Gaylord & Galliher, 1991; Loukaitou-Sideris, Liggett, & Iseki, 2002; Myhre & Rosso 1996). Similarly, Smith and Clarke (2000) pointed out that high crime rates in transit environments are due to overcrowding (high density, more potential offenders) and lack of supervision (low density, low levels of natural surveillance).

The weight of empirical evidence indicates that environmental factors include good lighting, good visibility, maintenance/cleanliness and presence of people. Surveillance through CCTV cameras has also been found to have some effect on crime reduction, but its effectiveness may differ by the type of offense, and the evidence is not always conclusive for transit environments (Armitage, 2006; Ceccato, Cats, & Wang, 2015; Ceccato & Newton, 2015; Newton, 2008; Squires, 1992; Uittenbogaard & Ceccato, 2015; Welsh & Farrington, 2009; Winge & Knutsson, 2003).

Opportunities for crime are also dependent on stations' environmental attributes and type of neighborhood in which they are located (Ceccato et al., 2013b). This applies to city and country contexts (Ceccato, 2018). Venez

Moudon et al. (2018) found that crime rates at transit stops are higher in densely populated neighborhoods because there are more potential offenders, whereas crime rates are lower when there are more people at transit stops because they offer higher levels of natural surveillance. In Brazil, Ceccato and Paz (2017) found that sexual violence was concentrated at the busiest central stations and at stations that also attract other types of violence and events of public disorder. These results lend general empirical support to situational mechanisms at work in transit environments and surrounding areas. Also in Brazil, De Souza and Miller (2012) indicated how situational factors help explain homicide within the *favela*.

Perceived safety in stations and bus stops also highlights the importance of CPTED. Cozens et al. (2003) utilized interactive virtual reality scenes as the environmental stimuli to elucidate where passengers' fears were located in and around the station and how service providers can make stations safer, in a representative sample of railway stations on a network in South Wales using CPTED. CCTV, more staff and maintenance are a few suggestions to improve perceived safety among passengers. The importance of CPTED is also highlighted elsewhere in the literature for both subway stations and for bus stops by Abenoza, Ceccato, Susilo, and Cats (2018); Ceccato, Uittenbogaard, and Bamzar (2013a). Other studies focused on smaller municipalities. Cozens and van der Linde (2015) assessed two different railway stations in Perth, Australia, to find that rail users perceived the station that was not designed using CPTED to be marginally safer than the one that exhibited CPTED qualities, partly because of the contexts of the stations.

Unexpected outcomes and 'side effects' when planning for safe environments

The international literature shows examples of interventions that are planned to deliberately make public places safe. Most of them succeed to different extents. Others fail—for various reasons and despite all “good intentions”—so producing unexpected outcomes (e.g., Jeong, Kang, & Lee, 2017; Saleh, Saif, & Sartawi, 2015; Shamsuddin & Hussin, 2013). Although there might be many reasons why these interventions did not work as planned (e.g. lack of proper data, choice of study area, inadequate methods, organizational barriers), all these cases touched upon the importance of personnel training to obtain expected results (for further discussion, see for example Zahm, 2005).

This happens when, instead of improving safety, after intervention:

- (a) more crime and/or fear are observed,
- (b) crime decreased, but not for all types of crime,
- (c) crime goes up and fear goes down,
- (d) displacement of crime/fear in time or space were observed,
- (e) safety is improved, but not for everybody,

- (f) unexpected consequences to the sustainability of the whole city occur, such as exclusion of users or geographical segregation of areas (e.g., gated communities).
- (g) safety is improved but such an outcome is an unintended result of other factors or mechanisms not controlled for.

These types of unexpected results can be illustrated by the study by Cozens and van der Linde (2015) for rail stations and CPTED effectiveness, those discussed in White (1993) for commercial areas, or by England (2008) in selected neighborhoods in the United States. Similarly, promoting surveillance in an environment has been intended to create a safe place for customers, but it may also be perceived as an exclusionary practice to others who are non-customers (Akinci, 2015). These studies suggested that safety interventions have led unintentionally to social exclusion of certain groups of individuals.

Is there any risk (or “side effect”) when prioritizing safety (using barriers) over other sustainability goals? One of the side effects of creating barriers is intensification of geographical segregation. There are studies that illustrate when safety (of some) has been prioritized to the detriment to other aspects of urban life, such as public transportation (for all). Gated communities are an example of a “desired safety solution” that in many countries has been legitimized by high crime rates and socioeconomic inequality (Branic & Kubrin, 2018; Breetzke, Landman, & Cohn, 2014; Carvalho, George, & Anthony, 1997; Gliori, 2018; Grundström, 2018; Landman, 2004; Luymes, 1997). Inevitably, the outcome is that safety becomes a function of those who can afford it, a commodity objectified by the physical environment. In the South African context, Landman (2004) showed that gated communities have proliferated since 1994. Using as reference Johannesburg and Tshwane, Gauteng, the author suggested that these facilities cause a number of problems and raise serious concerns regarding social exclusion, citizenship and democracy. Her study calls for different planning approaches to different types of gated communities in order to begin to address some of the contemporary challenges that this type of housing/safety solution imposes to society as a whole.

Another side effect of gated communities is spatial fragmentation, namely “the break of continuity, contiguity and morphological coherence of urban” (Santos, 2020, p. 1). An example is illustrated by Gray (2015) who examined the fragmentation’s impact caused by the insertion of two shopping malls in the neighboring area. The author suggested that the fragmentation of the urban fabric has led to serious implications in the social and spatial dynamics of the area, for social cohesion and sense of place.

A third side effect is mobility restrictions. Gated communities and barriers affect human mobility and ultimately human health and life chances (Bornioli, Parkhurst, & Morgan, 2018; Branic & Kubrin, 2018; Duncan et al., 2012; Tanulku, 2018). Research in a South African context by Landman (2012) shows examples of how these facilities mean longer distances to public transportation and limit access to public facilities for the rest of the population. The

so-called ‘transit captives’, particularly women, elderly and children might be the groups most affected by these disruptions (Ceccato, 2017).

Note that in the 12 articles about gated communities that were reviewed in this literature overview, 68 percent of studies showed that this housing form was associated with lower crime rates or fear (often inside the compounds/facilities), 8 percent showed a negative effect (crime increase or fear increase), 15 percent showed no effect, and 9 percent were inconclusive. The effect of securitization of the urban environment seems to be more evident in studies of perceived safety than for victimization, especially because it is not easy to compare total crimes inside and/or outside these facilities (Rogers, 2005, 2007). Yet, in a recent study by Hedayati-Marzballi, Tilaki, and Abdullah (2017) residents in gated communities, despite experiencing relatively high levels of social cohesion, showed moderate safety levels when compared with those living outside.

3.5 Concluding remarks

The expected positive effect of lighting, CCTV and other CPTED features on reducing crime and maximizing safety perceptions is confirmed by the literature reported in this chapter, despite great variations in methods used in these studies. This conclusion derives from the overall assumption that there is a great deal of international research that shows significant links between the urban environment and safety, mainly from North America and Western Europe. Turning back to the initial question, what makes a public place safe?

Lighting and maintenance are for sure important components of a safe public place but these characteristics often do not come alone. In the studies reported in this review, lighting is often a “surrogate” (or interacts) with other aspects of the environment that lead to reduced crime risk, such as good visibility. Studies show that lighting has a reductive effect on a variety of types of crime, from public disorder to homicides, and on fear of crime. However, the “fishbowl effect” is also mentioned in a number of studies dealing with fear of crime.

Security cameras have an overarching effect of reducing crime but for safety perceptions; such an effect depends on the type of user. In addition, its effectiveness seems to be related to other investments, such as in lighting and other security measures. In recent decades, CCTV together with other modern technologies have become more widespread in rural areas as crime prevention tools. Research indicates that CCTV can become more effective if security systems are designed with great responsiveness to the urban design and its specific crime problems.

Among those classified as CPTED studies, maintenance is a fundamental aspect of the safety of public places, for a variety of environments, from school grounds and parking lots, to transit stations. Findings also show that, together with other interventions, people’s involvement in voluntary activities (e.g., safety walks, neighborhood watch) may reduce crime and/or improve safety perceptions.

Studies show that there are risks of “side effects” when safety interventions do not take into account the city’s overall sustainability—more research is therefore needed in this topic. Better processes and methods are needed to tackle safety problems other than reducing permeability and maximizing control by creating barriers (gates, fences, walls). Planning decisions must be made with regard to questions beyond the technical debate of whether or not a particular solution ‘works’ against crime or fear. Gated communities may be an effective technical solution but it is not, we state, a sustainable one. If a city has to be called sustainable, safety and mobility have to be rights attained by all. Therefore, future research should assess potential areas of conflict between these sustainability goals.

A note of caution is necessary, because this literature overview is based on studies with different types of methods and a variety of approaches. In addition, although our sample of articles covers more than 4,000 articles, it is biased towards expected positive results (it is impossible to know how many studies that have produced negative or “unexpected” results were never published). The impact of this positive biases towards evidence-based planning should be further investigated in future studies.

In addition, “good outcomes” (e.g., illumination reduces fear of crime) are more likely to get published. However, it is argued here that “bad outcomes” (e.g., illumination increases fear of crime) are just as valuable as those that show that the intervention has “succeeded”. Although there might be many reasons why interventions did not work as planned, lack of proper training has been highlighted as a common cause in many studies. Sometimes the intervention is evaluated too early in the process; in others, too late. Or it can be that the method used in evaluation is not appropriate. Sometimes the context and scale of a particular problem/case play a role in affecting outcomes. It is no surprise when an intervention that worked in big cities does not produce the same results in a rural community. There are lessons to be learned for future actions about “faulty processes” and “bad outcomes”: What can be done differently to avoid these pitfalls in the future?

Note

- 1 The chapter summarizes and builds on parts of the report written in Swedish by Ceccato et al. (2019), commissioned by the Swedish National Board of Housing, Building and Planning (Boverkets), that had as its main aim to inspect current national and international theories and practices in situational crime prevention and safety ensuring measures. The author would like to thank Lisandra Vasquez and Ana Canabarro for executing the data collection reported in Ceccato et al. (2019).

Chapter 3—Appendix

Table A3.1 The effect of lighting on crime and/or fear

<i>Study</i>	<i>Crime</i>	<i>Fear</i>	<i>Type</i>
Griswold (1984)	Commercial burglary (–)	–	Quant.
Poyner & Webb (1987)	Theft from shopping bags (–) benefited also other nearby markets	–	Quant.
Herbert & Davidson (1994)	Overall crime (/)	Fear of crime (–)	Qual./Quant.
Painter & Farrington (1994)	Crime (–)	Perceived safety (+)	Quant.
Quinet & Nunn (1998)	Calls for police service about property crime (–), overall crime (–)	–	Quant.
Loomis et al. (2002)	Homicides X bright exterior light (–)	–	Quant.
Farrington & Welsh, (2002)	Overall crime (–)	–	Qual./Quant.
Cozens et al. (2003)	Overall crime (/)	Perceived safety (/)	Qual.
Tseng et al. (2004)	Overall crime (–)	Perceived safety (+)	Quant.
Stamps (2005)	–	Perceived safety (+)	Quant.
Pain et al. (2006)	Overall crime (/)	Fear of crime (/)	Qual.
Takizawa et al. (2010)	Snatch theft (/)	–	Quant.
Peek-Asa & Casteel (2010)	Robbery (–)	–	Quant.
Tjoa & Devon (2010)	–	Perceived personal safety (+), Accessibility by walking & cycling (+)	Quant.
Srisuwan (2011)	–	Accessibility (/) Visibility (/)	Qual.
Lindgren & Nilsen (2012)	–	Residential perception of safety (+), Well-lit green areas & perception of safety (+)	Quali.
Groff & McCord (2012)	Disorder crime (–), Violent and property crime (/)	–	Quant.
Haans & de Kort (2012)	–	Perceived safety (pedestrians) (+)	Quant.
Nikunen & Korpela (2012)	–	Perceived restorativeness (+), Overall fear (–), Path preference (+)	Quant./Qual.
Johansson et al. (2014)	–	Perceived personal safety (+), Perceived accessibility (+)	Quant.

De Boer et al. (2014)	–	Perceived safety (+), Accessibility (+)	Quant.
Ferrer et al. (2015)	–	Perceived safety (while walking) (+)	Quali.
Bradshaw et al. (2015)	–	Perceived safety (+)	Quant.
Byun & Ha (2016)	Burglary (–)	Perceived safety (/) (very little impact), Public service trust (+)	Quali./Quant.
Green et al. (2015)	–	Safety reassurance (+)	Quali./Quant
Fotios et al. (2015)	–	Perception of trust (/)	Quali.
Fotios (2016)	–	Perceived safety against traffic crashes (pedestrians) (+)	Quant.
Rankavat & Tiwari (2016)	–	Accessibility (+)	Quant.
Chandra et al. (2017)	–	Perceived safety (+)	Quant.
Nasar & Bokharaci (2017)	–	Perceived safety (+)	Quant.
Stolzenberg et al. (2017)	–	–	Quant.
	Moon illumination in relation to total crime (/), indoor crime (/), outdoor crime (–)		
Castro-Toledo et al. (2017)	–	Reactions of arousal and fear (–)	Qual./Quant.
Kim & Park (2017)	–	Perceived safety (x), Visibility (x)	Quant./Qual.
Skudder et al. (2018)	Residential burglary (–)	–	Quant.
van Rijswijk & Haans (2018)	–	Perceived safety (+)	Quant.
Arvate et al. (2018)	–	–	Quant.
Kim & Noh (2018)	Homicides (–)	–	Quant.
	–	Facial recognition (+), Perceived pleasantness (+), perceived suitability of a space (–)	Quant.

Table A.3.2 The effect of CCTV on crime and/or fear (publications mentioning CCTV in the title, keywords, abstracts)

<i>Study</i>	<i>Crime</i>	<i>Fear</i>	<i>Type</i>
Brown (1996)	(A) Burglary (-), Criminal Damage (-), Theft of Motor Vehicle (-), theft from Motor Vehicle (-), Other theft (-), Juvenile Disorder (-),—Risk for arrest, benefited also close No CCTV areas. (B) Crime (-), Robbery and theft from the person (-) Evidences of displacement of crime (C) Burglary (-), Assaults (-), Vehicle crime (x)	-	Quant.
Sutton & Wilson (2004)	-	CCTV	Qual.
Anderson & McCall (2005)	-	Surveillance (+) If perception of crime increases, CCTV usage increases too (+) formal surveillance (+)	Qual./Quant.
Mears et al. (2007)	Victimization in relation to CCTV (+)	-	Qual./Quant.
Welsh & Farrington (2009)	Overall Crime (x), vehicle crimes (-)	-	Quant.
Williams & Ahmed (2009)	-	Fear of crime frequency: Both a male target and CCTV (+)	Quant.
Ratcliffe et al. (2009)	Overall Crime (-), (Reduced in 13%)	-	Quant.
Tjoa & Devon (2010)	Vehicle Thefts (-)	-	Quant.
Lett et al. (2010)	-	Results not found	Qual.
Peek-Asa & Casteel (2010)	Risk of robbery (/), (effective in only 50% of studies)	-	Quant.
Yavuz & Welch (2010)	-	Perceived train safety (+)	Quant.
Caplan et al. (2011)	Vehicle Theft (-), Shootings (-),—Theft from vehicle (-)	-	Quant.

La Vigne et al. (2011)	When highly monitored, Overall Crime (-), Violent crime (-), Aggravated assault (-), simple assault (-), burglary (-), drugs (-), larceny (-), vehicle theft (-), public disorder, intoxication, nuisances (-), prostitution (-), robbery (-), sexual assault (-), vandalism (-), weapons (-)	-	Qual./Quant.
Sanders & Hannem (2012)	Police work (x)	-	Qual.
Taylor et al. (2012)	Vehicle Theft during study (/), -Vehicle Theft after study (+)	-	Quant.
Fussey (2013)	Crime control. (X)	-	Qual.
Cozens & Davies (2013)	-	-	Qual./Quant.
			Perceived burglary (-), Surveillance (-), Social interaction (-), Personal safety (-)
Tjernberg & Granhag (2019)	Effect by crime type drug offenses (-), vehicle crime (-), property crime (-), violent crime (/)public disorder (/), effect in different places: Residential (-), Parking lots (-), and centers (/)	-	Qual.
Park (2017)	Not re-offending burglary (+), strongly confident in not re-offending burglary (+), overall, including interaction effects.	-	Quant.
Skudder et al. (2018)	Residential burglary (-) (But not as sustainable)	-	Quant.
Lawson et al. (2018)	Overall crime (/)	-	Quant.

Table A3.3 The effect of CPTED on crime and/or fear (publications mentioning CPTED in the title, keywords, abstracts)

<i>Study</i>	<i>Crime</i>	<i>Fear</i>	<i>Type</i>
Merry (1981)	Crime in relation to defensible space (/), defensible space together with social organization (-) Robbery—surveillance in relation to alleys and entrances (+), playground (-), front of the house (+/-), square (-)	-	Qual.
Brown & Altman (1983)	Residential Burglary in relation to openness (+), unoccupied appearance (+), territorial markers that show privacy and individuality (-), good visual contact with neighbors (-)	-	Qual./Quant.
Poyner (1991)	(A) Van Vandalism (-), theft of cars (-), theft from cars (/), benefited also nearby open parking lots (B) Vandalism (-), theft of cars (-), theft from cars (-)	(A) Perceived safety (+) (B)	Quant.
Hunter & Jeffery (1997)	Potential for Robberies (-)		Qual./Quant.
Robinson, M.B. (1997)	Residential Burglary in relation to unoccupied appearance (+), surveillance (-), accessibility (/)	-	Qual./Quant.
Brunson et al. (2001)	-	Perceived safety (+)	Qual.
Cozens et al. (2002)	-	Maintained designs (+), effective management (+), surveillance (+/-) (varies between groups)	Qual.
Cozens et al. (2003)	-	Improvements proposed to tackle fear include but it is not limited to more staff, maintenance, longer and more frequent trains, better accessibility.	Qual.
Hedayati-Marzbali et al. (2014)	Overall crime X social cohesion (x), overall crime X interaction among residents (-), sense of belonging X crime (-)	-	Quant.

Bray (2008)	-	Highly ordered spaces can be readily appropriated by far more coercive modes of power	Qual.
Cozens (2008)	-	Overall crime in relation to active participation of community and CPTED (-)	Qual.
DeKeseredy et al. (2009)	-	Women abuse in rural areas related to social organization (+/-), collective efficacy (+/-), community culture (-), connectivity (-), pro feminist masculinity (-), social cohesion (-), community threshold (-)	Qual.
Saville (2009)	-	Total crime (-), assault (-), sexual assault (-), robbery (-), break and enter (-), vehicle thefts (-), theft household property (+), personal theft (+)	Quant.
Armitage & Monchuk (2011)	-	Secured by design in relation to total crime (-), repeat burglary (-), repeat assault (/)	Qual./Quant.
Corral-Verdugo et al. (2011)	-	Family violence in relation to negative habitability (+), higher social economic status (is related to better habitability) (-)	Qual./Quant.
Cerdá et al. (2012)	-	Violence (-), homicide (-)	Quant.
De Souza & Miller (2012)	-	Situational factors in relation to -homicides (-)	Qual./Quant.
Grönlund (2012)	-	Crime rates in comparison with average rest of Stockholm (-), (most cases lower than Sweden's rates as well)	Qual./Quant.
Marselle et al. (2012)	-	Violence (-)	Qual.
Marzbali et al. (2012)	-	Burglary victimization (-)	Qual./Quant.
Abdullah et al. (2013)	-	CPTED associated with neighborhood cohesion X elderly (+), neighborhood cohesion X non-elderly (/)	Qual./Quant.
Carmel-Gilfilien (2013)	-	Shoplifting (-)	Quant.

Continued

Table A3.3 continued

<i>Study</i>	<i>Crime</i>	<i>Fear</i>	<i>Type</i>
Hino & Schneider (2013)	—	Perceived safety (+)	Qual.
Jongjan & Woldendorp (2013)	Burglary (-), Car-related crime (-), theft (-), vandalism (-), nuisance (-)	Fear of crime (-)	Qual.
Shamsuddin & Hussin (2013)	Design Layout (-), building design (-), accessibility and pedestrian network (-), landscape and urban design (-), lighting (-), safety equipment (-), management & maintenance (-)	—	Quant.
Patino et al. (2014)	Heterogeneous and disordered urban layouts associated with homicide rates (+)	—	Quant.
Sugino & Arima (2014)	Arson associated with <i>vulnerability</i> : Multi usage spots between buildings (+), low accessibility to arterial roads (+), void spaces (+), <i>resilience</i> : human traffic (-), observability (-), anonymity (-), community surveillance (-)	—	Qual.
Akinci (2015)	—	Surveillance (+), surveillance in relation to social exclusion (+)	Qual.
Cozens et al. (2015)	—	Station with CPTED intervention (-) in relation to station without CPTED intervention (+)	Qual.
Gray (2015)	—	Fragmentation of urban fabric in relation to social cohesion (-), sense of place (-), economic prosperity (-)	Qual.
Gray & Novacevski (2015)	—	Hostile Architecture in relation to sense of fear (+), anxiety (+),—suspicion (+)	Qual.
Haans & de Kort (2012)	Crime rates (-)	—	Qual.
Owusu et al. (2015)	Target hardening in relation to community crime levels (/)	Target hardening in relation to social cohesion (-)	Quant.
Saleh et al. (2015)	Violence (/)	—	Qual./Quant.
Iqbal & Ceccato (2016)	Crime rates in relation to hiding places (+), visibility (+), topography (hill) (+), park layout (+), surroundings (central, close to metro station, high crime rates and mixed land use) (+)	Perceived Safety in relation to target hardening (-), wide range of users (-), illumination in winter (+), image of the place/maintenance (+)	Qual.

Chiodi (2016)	-	Cities' safety in relation to e-participation in urban planning (+)	Qual.
Lee et al. (2016)	-	CCTV's (-), street lighting (-), maintenance (-), narrow alleys (+), deserted street (+), people that walk more frequently (-)	Qual./Quant.
Liu et al. (2016)	-	Risk or intensity of violent crimes associated with neighborhood socioeconomic features (+), demographic features (+), land use features (+), city central area (+)	Quant.
Heydari-Marzbali et al. (2016)	-	Burglary victimization (-)	Quant.
Matijsaatiene (2016)	-	Urban spaces in relation to robberies (+), connectivity and depth in relation to thefts from motor vehicles (+), integration and depth in relation to thefts from motor vehicles (+)	Quant.
Jeong et al. (2017)	-	Property crime (-), theft (+/-), violent crime (-)	Quant.
Bennetts et al. (2017)	-	Fear of crime (x)	Quant.
Schaefer & Mazerolle (2017)	-	Connectivity between pedestrian, routes (+), familiarity with the surroundings (+),—well-maintained spaces (+), smaller scale buildings (+)	Qual.
Sco & Lee (2017)	-	Likelihood of reporting serious crime in relation to victimization (+), lower collective efficiency (+), greater neighborhood frequencies (+), socioeconomic disadvantage (+), ethnic homogeneity (+)	Qual./Quant.
Armitage (2018)	-	Social activities (+), sense of community (+), fear of crime (-)	Qual./Quant.
Vagi et al. (2018)	-	Odds of missing schools (-), Perceived Safety (+), Perceived risk (-)	Quant.

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