



Assessment of crime and safety issues in parks



Asifa Iqbal

Licentiate thesis

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Royal Institute of Technology
School of Architecture and the Built Environment
Department of Real Estate and Construction Management
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Abstract

The aim of the thesis is to obtain a better understanding of the importance of parks for urban quality, particularly for safety. This is achieved in two ways; first, by assessing parks' impact on the perceived quality of the urban environment (whether it is incorporated into housing prices or not) in Stockholm. Second, the study investigates whether safety in parks may be assessed using principles of Crime Prevention through Environmental Design (CPTED) using a high-crime park in Stockholm's inner city. The thesis starts with an introduction to the theme, with a brief discussion of background theory, literature review, the study area and the methods. Then, it reports the results of the articles included in the thesis and discusses their main contributions to the field of research.

A mixed methods approach utilizes both quantitative and qualitative data analysis. Regression models and a Geographic Information System (GIS) were used in Paper I, which aims to clarify how park proximity affects housing prices and, when considering residential properties and park type, how crime rates in parks affect housing prices. Findings show that the further away an apartment is located from a park, the higher the discount on its price effect, but this effect (dependent on the park type), as an accumulated measure of parks, lowers prices or is negligible. Paper II assesses the use and adequacy of CPTED principles to guide the assessment of safety conditions of an urban park. The historical development of CPTED is presented followed by an analysis of a case study, Tantolunden, in Stockholm. Site observations, crime mapping, people count and interviews were conducted. Results show many entrances in this particular park defy the principles of access control and in turn impose limitations on park maintenance. Findings also show that interrupted sight lines create limited surveillance. The paper concludes by identifying the potentialities and challenges of CPTED principles when applied to safety in parks.

Findings presented in this thesis are relevant for many stakeholders in society as results show the variation in crime and safety in urban parks, and the way they can be assessed and tackled.

Key words: Green spaces, perceived safety, GIS, hedonic modelling, crime mapping, CPTED principles, physical environment, Stockholm.

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Journal of Scandinavian Studies in Criminology and Crime Prevention, 16(1), 97-121.

Paper II - Iqbal, A., & Ceccato, V. (2015 b). Is CPTED useful to guide the assessment of safety in parks? A study case in Stockholm, Sweden. Presented in the *Stockholm Symposium of Criminology* and submitted to *International Criminal Justice Review* (June 2015).

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Part I – Introduction to the thesis

There is a common perception that parks and green spaces are considered *an urban amenity* (a tangible or intangible benefit from a physical entity that by its existence increases an area's comfort, its quality and may contribute its attractiveness [Ceccato, 2014]). Indeed, parks can contribute to the overall wellbeing of a city by providing social and recreational focal points for residents and visitors. Yet, it is difficult to quantify parks' impact, for instance, how parks affect people's quality of life and how they contribute to urban environmental quality. A closer look at the international literature shows that effects of parks depend on their attributes. This includes the positive perception of contact with nature and freedom (Chiesura, 2004), proximity to green areas (Geoghegan, Wainger, & Bockstael, 1997; McCormack, Rock, Toohey, & Hignell, 2010) aesthetic value (Geoghegan et al., 1997; Kestens, Theriault, & Rosiers, 2004), proximity to a waterfront (Jim & Chen, 2010; Luttik, 2000), proximity to a forest (Tyrväinen & Väänänen, 1998), recreational facilities (McCormack et al. 2010), proximity to a golf course (Cho, Poudyal, & Roberts, 2008) and safety (Jim & Chen, 2010).

However, parks or green areas may also be associated with *urban disamenities* (undesirable qualities of a place that affect negatively its quality and the place's surroundings [Ceccato, 2014]). Examples of these disamenities include traffic, noise, pollution, or crime. During the last few decades, there has been a rapidly increasing interest in preventing crime and the fear of crime in parks and public spaces. Furthermore, the international literature shows that parks and open spaces that concentrate crime impoverish the quality of the nearby environment and affect people's quality of life (Saville & Cleveland, 1998). It has been discussed that the location of the park plays a vital role in terms of property value, for instance a park or open space can be more effective at maximizing property values in the surrounding area and may motivate potential homeowners to live near parks (Troy & Grove, 2008). The connection between physical environment, social organization of urban space and crime is also discussed in the literature. Research indicates that dense foliage and poor lighting in large public areas with little formal or informal control may attract offenders (Groff & McCord, 2011). In the Swedish context, Knutson (1997) suggested that drug users and drug dealers find parks to be suitable locations to get high or to trade. Moreover, it is suggested that crime in parks changes future buyers' perceptions (Iqbal, 2012). If safety is one of the reason influencing people's decisions of where to live, then it is essential to observe the relation between safety and the decisions people make, such as, whether or not to live close to an (un) safe park.

1.1 Aim

The aim of the thesis is to understand the importance of parks to the urban quality particularly safety in parks. This is achieved by, first, assessing whether parks have an impact on the perceived quality of the urban environment (whether it is incorporated into housing prices or not) using Stockholm as the study area; and second, by looking at ways one can measure safety in parks. The second study investigates whether safety in parks may be assessed applying principles of Crime Prevention through Environmental Design (CPTED) using a high-crime park in Stockholm's inner city as a case study.

Why is this research important? In the literature, there is a lack of research on crime in parks. Several studies assess drug use and deal with crimes in parks (Groff & McCord, 2011; Knutsson, 1997; Tower & Groff, 2014) but very few researchers have evaluated the effect of crime in parks on housing prices (but see Troy and Grove, 2008 as they are one of the few who do evaluate this effect). Each of the included papers contributes to different parts of the research field, although they overlap as well (in terms of data and methodology). Paper I explains the effects of park proximity and how crimes in parks affect housing prices, while Paper II evaluates the use and adequacy of CPTED principles to guide the assessment of safety conditions of an urban park in Stockholm. The methodology involves a mixed method approach including GIS and hedonic modelling in Paper I; and site inspection, crime mapping, people count and interviews in Paper II. The data used in this study are from different sources: real-estate data (purchase date, price) from a broker transaction company in Stockholm, land use data from Stockholms Stads Utrednings- och Statistikkontor (USKAB), neighbourhood data from the Stockholm City Planning Office and crime data from Stockholm Police headquarters. Moreover, data from selected parks in Stockholm were collected during a pilot study in 2012, with later observations in a specific park (Tantolunden) taken during 2014 for Paper II. The thesis utilizes existing theories and findings, as well provides a clearer perception for the analysis and gives suggestions for practice and policy implications.

The thesis is structured as follows. Part I first gives a general introduction to the theoretical background on parks and willingness to pay for (safe) parks. This is followed by a brief overview about the geography of crime and urban environments, which is also presented together with micro- and meso-level theories in the context of a park. Next, the geographical study area and the methodology used in the thesis are presented. Part I concludes with

summaries of the included papers, limitations and reflections on the results and policy implications. Part II includes the two papers discussed in Part I.

1.2 Theoretical background

Willingness to pay for (safe) parks

Parks and public green spaces in a city have the potential to act as a common good for all in terms of recreation and aesthetic experiences. For some people, the only way to experience nature in everyday life is by visiting parks and green spaces in their surrounding areas. For instance, children as well as parents with small children, elderly people and people with mobility impairments are also dependent on nearby green spaces for their daily use of leisure time (Iqbal, 2012). Parks also support people's mental and physical well-being (Colman, 2015).

The quality of the urban environment can indirectly be measured by people's willingness to pay for a property. Rosen (1974) developed the most commonly used method, the 'hedonic model', for assessing the impacts of urban conditions on a property's value. The hedonic model defines that the value of a property is an outcome of a large number of characteristics in which the most important are context and location (Kestens et al., 2004). Each of these characteristics adds or detracts from the property's overall total price according to how residents value that characteristic (Bartholomew & Ewing, 2011).

In the case of housing, we can express the hedonic model as:

$$y = \beta x + \varepsilon \quad (\text{equation 1})$$

Where y is a vector of observations on the apartment's sales price; X is a matrix of observations on the property attributes including neighbourhood characteristics, parks and crime; β is a vector of regression coefficients (the marginal implicit price of each attribute); and ε is a vector of error terms.

The literature shows that willingness to pay for a park can be measured with stated and revealed preferences. For instance, urban parks, green open spaces (Cho et al., 2008; Iqbal & Ceccato, 2015 a) and golf courses increased the value of housing prices (Bolitzer & Netusil, 2000; Lutzenhiser & Netusil, 2001). Open-spaces are more effective at maximizing property value benefits than are parks that offer developed sports facilities (More, Stevens, & Allen,

1988). Moreover, a positive relationship is found between residential properties and being close to a high-quality park (Dehring and Dunse 2006; Morancho 2003; More et al. 1988). The positive value of larger green spaces gradually decreases as one moves away from the city centre (Geoghegan et al. 1997; Cho et al. 2008). More et al. (1988) found that a house located 20 feet away from a park sold for \$2675 more than a comparable house located 200 feet away in Worcester MA, USA. Geoghegan et al. (1997) found that the proportion of open space positively impacts land value within a tenth of a kilometre, but negatively impacts it within one kilometre. They concluded that individuals value open space within view from their residence.

Using data from Spain, Morancho (2003) found that proximity to green areas is more relevant than the size of the property, as the housing price drops approximately 1800 Euros every 100 meters from a green area. In Aberdeen, Scotland, a positive effect in apartments' price was detected within 800 meters of city parks. The property layout, the nature of the location, type of park and, to some extent, the nature of the local population and the type of property involved are the most essential variables when assessing the premiums associated with parks (Dehring & Dunse, 2006). Additionally, it is a common verdict that people consider the educational environment when buying a new home (Goodman & Dubin, 1982; Goodman & Thibodeau, 1998; Iqbal, 2012; Kong, Yin, & Nakagoshi, 2006). Moreover, Kong et al. (2006) concluded that a better educational environment reflects higher property values in Jinan city, China.

Conventionally, parks are considered as a place where one can escape from one's daily life routine, problems and troubles. It is obvious that people will not visit parks or public recreational facilities if the park generates noise that effects residents or attracts criminogenic activities. It has also been pointed out that when the neighbourhood is perceived as unsafe, people may use it less, which leads to insecurity and less willingness to pay for a property in these areas (Ceccato and Wilhelmsson, 2011). Residents expect the city to ensure public safety in parks and other public open spaces. Nevertheless, crimes in parks and surrounding areas have contributed to a keen awareness of and concern for security in parks and public spaces. Troy and Grove (2008, p.242) reported "crime as the critical factor conditioning how residents perceived parks and valued in the Baltimore housing market." They also suggested that the parks' impact is mediated by crime levels in the area. Park proximity decreased property values, if local crime levels were above the national average; but housing prices

would go up, if it was below average. It is also worth noting that individuals' perceptions of attributes varies from person to person, where some desirable attributes of a park or its location might compensate for the negative ones, for instance, parks in inner city areas (Iqbal & Ceccato, 2015 b). As mentioned earlier, there is a lack of research about crime in parks and available written material is mostly limited to drug use and drugs dealings in parks, which is also true for Stockholm's parks. During a study of Vasaparken, Stockholm, Knutsson (1997) used the terms 'legitimate' and 'illegitimate' to describe users and their behaviours in parks.

In Los Angeles, California, the sales of single-family, detached houses were analysed by Saphores and Li (2012). In their study, the value of different types of land covers, including parks, cemeteries, golf courses, trees, grassy areas, rivers and lakes, may depend on various variables including ethnic background, population density, school quality, lot size, crime rates, and income level. They found that trees act as a barrier against the adverse impacts of crime on house values in higher crime areas. However, irrigated grass and non-irrigated grass were observed to have an opposite effect on high property and violent crime rates. Parks, on the other hand, had a positive impact on property values when the crime rate is relatively low (Saphores & Li, 2012).

This section illustrated the field of research that deals with people's willingness to pay for a property close to an amenity, in this case, a park. Since not all parks bring quality to an area, focus was therefore given to the negative potential impact that crime may have on parks. Crime and poor perceived safety as a park disamenity are expected to be incorporated into the housing market through the buyer's willingness to pay for a property that is close to an (un)safe park.

Crime and parks

Micro-level theories

Crime is dependent on physical urban environments at the micro level (Morgan, Boxall, Lindeman, & Anderson, 2012) for instance, a building façade, a set of stairs, a gate, and they all, combined, may create the necessary conditions for crime. But when do these micro-environments become criminogenic and unsafe? Crime has an inherent geographical quality (Chainey & Ratcliffe, 2005:3) because it occurs at a certain location with particular environmental characteristics. Crime is not randomly distributed (Chainey, 2011), as some

places are more likely to experience crime events than others, such as areas with overgrown vegetation or isolated dark corners near an underpass.

Newman (1972) highlighted the importance of the urban environment via 'defensible space theory', in which the author suggested that an open layout of a place gave better opportunities to control the area. Defensible space theory also helps to distinguish between private and public areas to increase visibility in public spaces and to reduce crime. Kuo and Sullivan (2001) highlighted that the presence of vegetation, particularly in public spaces, can decrease crime because attracting many users provides better social supervision that may reduce criminal activity.

The relationship between lighting levels and perceived likelihood of crime has also been discussed by many researchers. For instance, Hoyt (2005) suggested that places with well-lit entryways and corners observe and report less criminal activity. Indeed, fear of crime is more closely related to lighting levels and accessibility than is crime itself. Furthermore, it has also been suggested that lighting levels may have a stronger relationship with certain types of crime such as burglaries (Severin, Sorensen, Hayes, & Atlas, 2008, p.73). Numerous studies have shown that the time of day and the location of the crime may produce the high degree of variation in fear of crime (Cordner, 2010; Föbker & Grotz, 2006). Moreover, Föbker & Grotz (2006) found that people, especially women and elderly, experienced higher levels of fear in dark places, especially at night.

Parks serve as amenities when they act to decrease crime in their surrounding area. Jacobs (1961) suggested that parks attract more conventional users and provide better informal control networks by attracting families and other specific users and activities, including organized sports, etc. Jacobs (1961) also suggested that well-used parks have enough users to monitor what is happening. 'Eyes on street' help to keep the park and its surrounding area safe because of the additional guardianship and surveillance (Jacobs, 1961). Groff and McCord (2011) found that it is the design and setting of the park that do affect the space and determines whether it is a well-used, dynamic space or one that is neglected and dangerous.

The presence of people also plays an important role in defining where crime occurs, about which Cohen and Felson (1979) developed 'routine activity theory'. This theory suggests that each crime event has at least one motivated offender and at least one personal or property

target, and requires the absence of an effective ‘guardian’ who would be capable of preventing the crime occurrence (Cohen & Felson, 1979). Also, that the presence of motivated offenders shapes spatial patterns of crime when joins the suitable targets at a specific place, if there is no person to guard the target. Routine activity theory is an important theory for understanding parks as an urban (dis)amenity. As a meeting place, a park can be a place where these three elements – motivated offender, accessible target and absence of effective guardian – regularly converge (Iqbal, 2012). Moreover, Iqbal & Ceccato (2015 a) suggested that the routine activity of capable guardians in the form of participants, users, coaches and parents at small parks with playgrounds plays an important role in maintaining low crime rates.

The willingness of offenders to commit the crime depends on the nature of offending and of offenders (Cornish & Clarke, 1987). ‘Situational crime prevention’ (SCP) theory was originally developed at the British Home Research office in the late 1970s and early 1980s. Instead of focusing on the criminal, Ronald Clarke focuses on the event of the crime trying to understand the physical and social settings within broader societal arrangements. The concept of situational crime suggests that more crime opportunities lead to more crime, and easier crime opportunities attract more offenders. Clarke suggested that “SCP can decrease the number of opportunities for crime in a systematic and permanent way by involving the design, management, or manipulation of the immediate environment” (Clarke, 1983:225). According to Severin et al. (2008), SCP was influenced by Jeffrey and Newman’s work with ‘defensible space’, however SCP is based on opportunity theory, which was an integration of rational choice theory and, as discussed above, routine activity theory. Routine activity theory assumes that offenders are always present while rational choice theory assumes that offenders search for benefits, and that the making of decisions and choices are controlled by limits, ability, and the availability of relevant information. For example if the offender wants to commit the crime in a crowded place, he must have to decide the type of crime. A violent crime is less likely to be committed compared to pickpocketing as committing a violent crime in a crowded place entails a greater chance of getting caught, while it is hard to spot pickpocketing in a crowded place. Rational choice theory is commonly used to explain that opportunity crimes for instance, property and drug offences while routine activity theory used to explain how the daily activities of teenagers put them at a higher risk of being involved in offending behaviour and of being victimized (Myers, 2008). Cornish & Clarke (1987) argued that at different stages of decision making among different crimes, the decision process and

the factors that influence the decision are likely to vary. For example, an offender can reconsider his actions if there is a sudden change in environment or no hiding place or easy escape. The environment plays an important role as certain features of the environment may contribute to higher or lower risks of being seen and getting caught (Uittenbogaard, 2014).

Clarke (1997) argued that specific kinds of crime depend on a group of particular environmental opportunities, and these opportunities may need to be blocked in specific ways, reducing opportunities for crime by situational crime prevention. The environment is designed to affect the cost-benefit assessments made by potential offenders to commit particular crimes. Situational prevention does not, however, draw distinctions between criminals and others because all people are considered to have some probability of committing crime depending on circumstances. Moreover, the decisions made by potential offenders include some moral evaluation; some are more comfortable with pickpocketing while others would be willing to snatch a purse from someone in the street. Thus, making it harder to find motivation for criminal action may sometimes be an effective opportunity-reduction technique.

Simultaneously, another 'situational' approach to crime prevention was being developed in the United States, called CPTED. The term CPTED was coined by the criminologist and sociologist C. Ray Jeffery in 1971 in the book 'Crime prevention through environmental Design' (Jeffery, 1971). According to CPTED, the urban physical environment can discourage crime and limit the number of suitable targets through physical design by presenting the living space as well-maintained, cared for and controlled. Under such conditions, any potential offenders will be easily recognized and not tolerated (Newman, 1972). As suggested by Atlas (2008), architects were fearful about the fortress mentality of criminology/security professionals, while security professionals were concerned about architects' failure to include security elements in the design (Atlas, 2008). The concept of CPTED is closely connected to both professions and looks at place-based strategies for reducing crime in relation to the perception of safety and security.

Meso-level theories

The socio-economic context of a place plays an important role in defining the safety conditions of the area. To support this claim and the greater understanding of the geographical distribution of offenses and offenders in urban areas, Shaw and McKay (1942) introduced 'social disorganization theory'. They did not attribute crime to the residents, but to the characteristics of the areas including physical deterioration, ethnic heterogeneity and low

rental costs. In other words, residential location plays a significant role in the likelihood that a person will become involved in crime, as the theory suggests that residential location is more important than the person's individual characteristics (e.g., race, gender or age). For example, youths from deprived neighbourhoods acquire criminality from a subculture that tolerates delinquency. Furthermore, Sampson (1993) suggested that communities that are socially connected are more likely to identify strangers, report crimes, and pass along warnings. He also mentions high-rise housing and high rates of residential mobility as important factors contributing to weak social connections. In socially connected communities, schools, churches, and the police act as responsible guardians, while in poor communities the organization and political connections are often weak in obtaining resources for fighting crime.

The socio-economic context of a park plays an important role in determining where crime happens. Moreover, research has shown that places with high levels of traffic (people and vehicle) may result in higher crime risk. In a study of urban parks, Groff and McCord (2011) suggested that neighbourhood parks meet the criteria for being crime generators. Parks act as a common place to gather people in the neighbourhood. Parks also attract a certain proportion of potential targets and motivated offenders. In addition, any physical disorder may indicate a lack of social disorder to potential criminals and result in higher crime rates. Wilson and Kelling's (1982) 'broken window theory' addresses these issues of physical and social disorder using indicators including dilapidated buildings, graffiti, litter and public drunkenness. Broken windows create the perception (for the potential criminal) that the neighbourhood is not well cared for, managed or controlled, and therefore is suitable for criminal activities. Moreover, it is also argued that this perception results in the residents perceiving a lack of safety.

In summary, this section presented major theories related to the geography of crime and urban environments that are relevant for parks. These theories can be described as fitting together under the umbrella of environmental criminology. Together, these theories explain the relationships between crime and place at three levels: micro, meso, and macro. As this thesis looks at specific places (parks) and their influence on housing prices in the surrounding areas, macro-level theories are not of particular relevance to the issues dealt with in this thesis and thus will not be discussed further. However, micro and meso theories are more pertinent to the study of safety and parks. This section has shown that whilst theories on the micro level (such

as defensible space, routine activity theory) focus on explanations of crime at the detailed spatial level, settings; meso level theories (e.g. social disorganization theory) deal with crime at the level of the neighbourhood or community and, in this thesis, refer to the context in which parks are located.

1.3 The study area

Stockholm is known for its parks and green spaces that occupy 35% of the total area of Stockholm (Stockholm City, 2009). The city, which includes islands, is situated between Lake Mälaren and the Baltic Sea. The municipality of Stockholm has about 880 thousand inhabitants, and the prognosis is one million in 2020 (Stockholm City, 2013). The municipality of Stockholm is geographically divided into three basic parts: central, west and south. Central Stockholm of major cultural, social and commercial activities including shopping centers, museums, theaters, bars, restaurants, and cinemas. Central Stockholm also has the privilege to have lower unemployment with lower proportions of persons with social assistance than all other parts of the city. Contrary to this West Stockholm have the opposites of all these measures while South Stockholm is in between. More than 50% of apartments are also located in the central part of the city with high prices. An average apartment in Central Stockholm currently costs 82,434 SEK per square meter (Mäklarstatistik, 2015).



Figure 1 - Parks and green areas in Stockholm, Sweden.
Data source: Stockholm municipality, 2008.

Figure 1 shows the distribution of all parks and green areas in the Stockholm city area. Parks in Stockholm are classified into 1046 green spaces in three major categories (See Paper I, Iqbal & Ceccato, 2015 a, Appendix 1). The majority of the parks are neighbourhood parks (19%), large natural area parks (19%) and playgrounds (18%). Square parks, beach parks, and community garden plots comprise 4% of all parks in Stockholm, while inner city parks, hilly parks, port parks and cemeteries comprise only 1%, and the remaining 28% are miscellaneous park types (Stockholm City, 2006).

How is Stockholm impacted by crime? In comparison with other European cities, Stockholm is considered a relatively safe city. However, many offenses go unreported. Excluding narcotics and penal code offenses, approximately 192,723 offenses were reported in Stockholm during the year 2012 (USKAB, 2013). Internet-based financial crimes increased the most, although pickpocketing, assaults, unlawful threats, non-sexual molestation and sexual offenses increased as well (Brå, 2014). About 16% of vandalism events were reported in 2013 (USKAB, 2013). Various types of theft, robbery and burglary comprised 25% of all reported crime including car thefts, shoplifting and bank robberies, while reported violent offenses were numerically dominated by assaults. Assault and sex crimes comprised 8% of total reported crime in Stockholm, traffic offenses without drugs stood for 8%, and fraud for 5% (USKAB, 2013).

What is the role of the City Planning office in reducing crime in Stockholm? Stockholm City Planning office is working collectively through local crime prevention councils to increase safety conditions for the whole city. Local crime prevention councils are usually neighbourhood-based non-governmental organizations that identify issues, encourage public interest, bring people together, and generate resources for program implementation. Furthermore, research has shown that Nordic countries were slow to adopt crime prevention measures (Grönlund, 2012) because of the presence of the Nordic model for crime prevention (Johansson, 2014; Takala, 2004), which is a combination of social welfare policies and SCP with CPTED principles. In the late 1990s, the first CPTED guidelines started in Sweden and the Swedish National Council for Crime Prevention, Brottsförebyggande rådet [Brå], played a marginal role in the growth of crime prevention activities. The guiding principles involved the planning of housing, transport, municipal facilities and parks, the most famous guidelines on housing was documented by 'Botryggt05' (Botryggt, 2015).

1.4 Methodology

The methodology used in this thesis was by using a mix of method approach which means one method at a time or a combination of methods (without mixing them) to add breadth or depth to the analysis (Mason, 2006). According to Creswell, Klassen, Clark, & Smith (2010) the choice of methods should be based on the nature of the research question and the theoretical orientation of the subject. Moreover, Creswell (2003) suggested that certain types of social research problems call for specific approaches. In urban safety research, a variety of methods and techniques are being used. For example Philip (1998) argues that “researchers should think beyond this myopic quantitative - qualitative divide when it comes to designing a suitable methodology for their research, and select methods – quantitative, qualitative, or a combination of the two—that best satisfy the needs of specific research projects (p.273).”

A mixed methods approach is also useful to try to capture the best of both quantitative and qualitative methods, and it helps to generalize the findings but keep the richness of the detailed view of the phenomenon. Regarding strengths and weaknesses of a mixed methods approach, Johnson & Onwuegbuzie (2004) stated that in a mixed method approach, a researcher could use the strengths of an additional method to overcome the weaknesses in a research study. The best practices for mixed method approaches describe efficient data collection procedures for the replication and generalization of results, and for the comparison of groups and providing in-depth experiences. One of the most common weaknesses of a mixed methods approach is that it is time-consuming and difficult to carry out by a single researcher, i.e., it might require a research team (Johnson & Onwuegbuzie, 2004). The research methods employed in the papers included in this thesis are described in more detail in each of the individual papers. In this thesis, the choice of quantitative approach was facilitated by availability of secondary official data (Paper I). The available data on property attributes including neighbourhood characteristics, parks and crimes fits well for being analysed empirically, and the qualitative research is used to explain the context (Papers I and II), and human experience (Paper II). The qualitative methods facilitate the collection of data when measures do not exist, provide a depth of understanding of concepts, help to explore the setting or context, and emphasize the voices of participants over time (Creswell et al., 2010). Table 1 provides an overview of the methods employed in the papers included in this thesis. It shows that spatial analysis using GIS and fieldwork was performed in both Papers I and II, regression analysis in Paper I only, and interviews in Paper II only.

Table 1 - Mixed method approach as employed in the thesis

	Quantitative Analysis		Qualitative Analysis	
	Regression analysis	Spatial analysis using GIS/crime mapping	Fieldwork (Observations/countings)	Interview analysis
Paper I	✓	✓	✓	
Paper II		✓	✓	✓

In this paper, fieldwork was performed in order to characterize the parks in Stockholm as amenities and disamenities by employing a checklist (see Paper I, Iqbal & Ceccato, 2015 a, p.6). Later, follow-up visits were performed to a few, selected parks to obtain data on specific park characteristics. To check the temporal variations of the urban environment, fieldwork was done in both winter and summer seasons (March 2011 and July 2011). To categorize the parks into various types, metadata sheets from Sociotope mapping were used (metadata summarizes basic information about data. For details, see Paper I, Iqbal & Ceccato, 2015 a). Some of the park types included were nature parks, neighbourhood parks, strand parks, park blocks, square parks and landscape parks. In the park categorization process, the main categories for amenity were functions, aesthetical features, location, and management, and for disamenity, crime, mismanagement, darkness, smell, place with lost function, parks crowded with teenagers or gangs, and empty alcohol cans. Regarding the data used in the thesis, Table 2 provides an overview and shows that park data, land use data, crime records and field work are used in both Papers I and II, while property price data is used in Paper I only, and interviews in Paper II only.

Table 2 - Data used in the thesis methodology

	Property price data	Park and land use data	Crime records	Fieldwork observations/countings	Interviews
Paper I	✓	✓	✓	✓	
Paper II		✓	✓	✓	✓

Paper I

Spatial data analysis

Spatial data analysis was performed using GIS, followed by quantitative analysis of apartment prices and crime rates in the area. In this paper multiple data sources were combined in GIS order to gain a deeper understanding of the socioeconomic data, neighbourhood data, park data and crime data together through buffer analysis (various buffers were created from the park boundary to the apartments. For more details regarding the dataset and buffer analysis, see Paper I, Iqbal & Ceccato, 2015 a). In order to link the dataset to the x, y coordinates of each apartment sale, the map of Stockholm was overlaid with x, y coordinates (for more details regarding the method, see Ceccato & Wilhelmsson, 2011).

Modelling

At the second stage of this study, a regression analysis was performed. Creswell et al. (2010) emphasized that when the goal is to test theories or hypotheses, gather descriptive information, or examine relationships among variables (deductive research), the quantitative research is more suitable because of high reliability and has the potential to help to establish (probable) cause and effect. Ordinary least squares (OLS) regression model was used because relatively detailed statistical data was available to examine the relationships between urban parks and housing and neighbourhood characteristics. Four types of models were created so as to include the possible variety of all data available. A set of 46 variables used in the benchmark model (see Paper I, Iqbal & Ceccato, 2015 a, Appendix 2, for further details).

In order to improve the quality of the regression analysis, all neighbourhood characteristics, park characteristics and crime rates (independent variables) were tested for possible correlations with Pearson's correlation using the statistical software program SPSS. Multicollinearity (high correlation between independent variables) and heteroscedasticity (differing variance) were also checked for with the Breusch-Pagan test and the Koenker-Bassett test using the geospatial analysis program GeoDa (for more details regarding methodology, see Paper I, Iqbal & Ceccato, 2015 a). As the presence of spatial dependence was identified, spatial lag and spatial error models were extensively tested in the last set of models (for further details regarding methodology, see Paper I, Iqbal & Ceccato, 2015 a).

Paper II

Crime mapping

Crime mapping was performed to highlight the crime distributions by identifying places where crime may have occurred more often. It also helped to analyse the area in order to look how offenders travelled to the location of the incident. Crime data records were collected from the Stockholm police department for the year 2008 (only available data) included burglary, robbery, theft, assault, sexual crimes, drug dealings, graffiti, violence and vandalism. The data was mapped using GIS and crime concentration points were used as the basis for the further assessment of CPTED principles in Tantolunden Park. In this paper a crime concentration point is defined as a relatively small area where the number of crime incidents is higher (as) if compared to the total study area (for further details, see Paper II, Iqbal & Ceccato, 2015 b, Figure 3).

Fieldwork

In relation to CPTED principles, a site inspection was conducted to check the specific characteristics at crime concentration points in the Tantolunden Park. For instance, whether territoriality, natural surveillance, the image of the place, access control, activity support and target hardening play a role in creating an image of a safe park and when the park fails to follow CPTED principles, and becomes a criminogenic area. For the site inspection, the park was geographically divided into various zones (see Paper II, Iqbal & Ceccato, 2015 b, Figure 3) and checklist was utilized to assess park characteristics and CPTED principles at crime concentration points (see Paper II, Iqbal & Ceccato, 2015 b, Appendix). For instance, when assessing surveillance, it is necessary to look at the land use at that place, as it is important for understanding the flows of vehicles and users. Windows facing the specific place provide possible 'eyes on the streets'. Sports activities provide potential guardians in the form of coaches, players, children, and parents. Public utilities, for instance bank machines, telephones, bus stops, car parking or public toilets, are another source of possible guardianship and surveillance. The placement of benches and pathways is also important to note if they may serve as entrapment points for offenders. On the other hand, vegetation may provide hiding places; thus, trees and vegetation should be kept clean and tidy so as to create clear lines of sight (for detailed checklist, see Paper II, Iqbal & Ceccato, 2015 b, Appendix).

The observations were carried out from the end of October to the middle of November at different hours of the day, roughly from 0900 to 1200 hours, 1300 to 1500 hours, and 1500 to

1700 and 1300 to 1500 hours on one weekend. Users were categorised via routine activities, for example walking, passing by, waiting, playing, jogging or working. In some parts of the park, a people count was also performed to estimate the level of surveillance in the area (see Paper II, Iqbal & Ceccato, 2015 b, Table 3).

Interviews

Two set of interviews were performed, one with park visitors and the park stakeholders (park manager, crime prevention council member). To introduce the users' experiences of the safety conditions of the park, Tantolunden, four short, semi-structured interviews were conducted with park users (two male and two female) together with a short questionnaire of rating questions. Approximately ten people were randomly approached with the request for a short interview - six refused, while two males and two females aged around 18-40 accepted. The conversation with the informant was more spontaneous, and there was the opportunity to ask follow-up questions. According to Valentine (2005:111) the interview is considered a more human-oriented method than questionnaires or surveys because the informant is not forced to choose one or more of the researcher-formulated answers. Instead, there is a possibility for the informant to tell their experiences in their own words, thus the interview method also reduces the risk of wrong interpretation (although question formulation influences answers a lot in interviews as well). Another major advantage of interviews is that informant can also highlight issues they deem relevant or important to discuss, which means a greater scope for equal dialogue to develop or justify questions and answers (Valentine, 2005:111).

It should also be noted that the results from interviews with park visitors provided a general overview of the safety conditions in Tantolunden and, of course, cannot be generalised for all park users. Interview data was recorded and analysed anonymously, although the participants' gender, age, place of residence and employment were included. The initial interview questions were related to what extent do she or he perceive the park as safe or unsafe and what they would like to do to make it safer. Some questions were also related to crime concentrated points, although this fact was unknown to the interviewee. For instance, how often the participant visits a certain place in Tantolunden; how safe she or he feels there; What she or he lacks in the area. The last question was an open question to encourage participants to give suggestions of what and where the participant would want to change in the park.

Finally, two short, structured interviews were conducted with a park manager (male) and a crime prevention council member (female). The interview questions were relevant to the park management and planning in relation to safety issues. The responses were designed on a ‘yes - no - I don’t know’ or ‘low – medium – high’ scale so that the participant could choose her or his level of agreement with the statements. These interviews helped to check the city’s vision with respect to the park’s planning, designing and management.

1.5 Summary of the articles

The papers focus on various aspects of safety issues in parks and the impacts on housing. The contributions lie in explaining the crime distribution of urban parks, variations in crime levels and perceptions of safety, as well as how these influence the surrounding environments and people’s appraisal of the area. The contributions also include giving suggestions on how to prevent crime and improve park conditions using a particular set of principles. These topics can be divided into specific research fields as illustrated in Table 3, which shows that Papers I and II both address the nature of parks and urban safety, and crime and planning of parks, while Paper I also addresses the effect of park proximity on apartment prices, and Paper II also discusses CPTED principles applied to parks.

Table 3 - Research topics in the papers

Research topics of the thesis	Paper I	Paper II
Nature of parks and urban safety	✓	✓
Effect of proximity to parks on apartment prices	✓	
Crime and park planning	✓	✓
CPTED principles applied to parks		✓

Paper I – Does crime in parks affect apartment prices?

The first paper identifies if people in Stockholm are willing to pay extra for park proximity when purchasing an apartment near a (safe) park. Four hypotheses were tested through spatial data analysis and hedonic modelling. The analysis included an evaluation of the impacts of randomly selected parks at two geographic levels: 1) the local level (in the immediate vicinity of the park) and 2) the city level (discussed more below). The methodology involved two stages: fieldwork that helped to characterize the parks in Stockholm and a GIS distance

analysis to calculate the effects within a certain distance from the park and safety indicators (crime density and crime rates) on apartment prices.

To obtain detailed information about park characteristics, fieldwork was carried out at two different times of the year (March and July 2011) at forty parks selected from different categories identified by Stockholm City (2006). A checklist was developed to categorize the parks as amenities or disamenities, and the buffer analysis was performed using GIS. To test the effects of parks at the city level, Stockholm was split into four quarters with the city centre as the origin. Ten parks (varying in size) were randomly selected in each quarter. To analyse the parks at the local level, various buffers were created from the park boundary to the apartments within 50, 100 and 150 meters from the park boundary. The average prices per square meter were also checked. Later hedonic modelling was performed, and the regressions were run using the sales price as the dependent variable and the property attributes and neighbourhood characteristics, such as park characteristics and crime in the park, as the independent variables.

The results of the study strengthen the research on parks' impact on housing prices as related to crime rates. Buyers in Stockholm are willing to pay the extra amount for an apartment near to the park, but it depends on the park's attributes and location in the city. High-crime parks or parks in high-crime neighbourhoods may have a negative impact on housing prices. Furthermore, findings show that the effect of parks on property prices increased with features of cultural and national interest and decreased with ball games or boating facilities. More interestingly, areas with relatively high rates of violence and vandalism tend to decrease the apartments price.

This study contributes to the existing literature in numerous ways: first, it provides evidence that people in Stockholm are willing to pay a premium for an apartment in proximity to a park. Second, the study is based on fieldwork performed in a selection of parks in Stockholm, and third, the inspection served as a basis for assessing parks as amenities or disamenities, both contributing to a unique data set collected by the author. Furthermore, the study combines spatial data coming from GIS as an input into hedonic models for Stockholm.

Paper II – Is CPTED useful to guide the assessment of safety in parks? A study case in Stockholm, Sweden.

The second paper focuses on assessing the use and adequacy of CPTED principles to an urban park, Tantolunden, in Stockholm guiding the assessment of safety conditions in an urban park. The paper also points out advantages and challenges when applying CPTED principles to parks. A mixed methods approach was used including site observations, crime mapping, people count and interviews with park stakeholders. The data was mapped using GIS and included burglary, robbery, theft, assault, sexual crimes, narcotics, graffiti, violence and vandalism. In order to evaluate CPTED principles in Tantolunden, a field inspection was conducted to check whether territoriality, natural surveillance, image of the place, access control, activity support and target hardening play a role in making the park safe or not. For the site inspection, the park was geographically divided into a number of zones and a checklist was developed to assess crime concentration points according to CPTED principles. The fieldwork was performed from the end of October to the middle of November at different hours of the day, as discussed above. The average time spent at each crime concentration point varied due to weather conditions, topographical features of the site and the number of people in the area. Users were categorised by their routine activities, for example walking, passing by, waiting, playing, jogging or working. In some parts of the park, people counts were also performed to estimate the level of possible surveillance in the area. Four short interviews were conducted with park users. A further two interviews were conducted with managerial stakeholders regarding park management and planning in relation to safety issues.

The results of the study show that relatively large urban parks, such as Tantolunden, with many entrances, challenge principles of access control and impose limitations for park maintenance, which in turn, affect the image of the park. The analysis also reveals that crime concentration in certain parts of the park has a direct relationship with the design and maintenance of the park. Additionally, CPTED in Tantolunden poses a number of challenges in terms of its usefulness. A major challenge with the use of CPTED principles is that they overlap and contradict themselves when applied in practice, such as the potential contradictions between aesthetic and safety features. Another key challenge is to deal with the issues of park users, safety as a human right, and access to a public good, such as a park.

This study contributes to the existing literature in two ways: first, it provides an example of the assessment of CPTED principles in inner city Park. Second, it tests how CPTED

principles work (and does not work) when applied to parks. In doing so, the paper is written with the intention of aiding researchers and urban planners in using the lessons learned as a basis for reflecting on potential complications of applying CPTED principles to urban park.

1.6 Limitations and challenges

As any other empirical study, these two studies entail a number of limitations and challenges. First, the categorization of a park as an amenity or disamenity was challenging. It is evident that people naturally consider parks as an amenity and it is difficult to set standards of when to classify a park as a disamenity. For instance, a park in central Stockholm near a transportation junction is complicated because for some people it provides convenience for e.g. commuting to work, while for others it is noisy, and it always accommodates a wide range of users (including transients, criminals, homeless persons and addicts).

Second, it was not possible to collect complete information about the number of park users, their park activities, or the time they spent in parks. This requires more time and effort than was reasonable for this thesis. Future surveys could focus on users' use and preferences in greater detail.

Third, the data obtained only covered one year, narrowing down the analysis period. Neither was the crime data problem-free as the crime rates are an average of the polygonal area in which the park is situated, which means that the crime area may cover a larger area than the park. In contrast, polygons of 'total resident population' are generally smaller than the park polygons. Ideally one would want data regarding people passing by the park (non-resident population in the area), but such data is not available.

Fourth, the method linked to the over layering of polygons (park polygons on top of the apartment sales polygons) was not problem free. This may have resulted in an overestimation of the effects of parks in central city areas. Another essential issue is that in paper I, the hedonic equation only looks at the individual variables' contributions to price without addressing variable interaction. Although paper I, in its unpublished version; used to have models with interaction variables. It was shortened to make the paper publishable. Future work will analyse interaction effects in a separate paper.

Finally, the choice of models and variables is not problem-free. The most fundamental choice was the type of model to estimate. OLS modelling was used in Paper I, as it was considered as

an appropriate model to compare the crime rates with the environmental attributes of the residential areas and park characteristics. Another important issue was the selection between spatial lag and spatial error models for explaining the results. Choosing between spatial lag and spatial error models by simply inspecting the diagnostics can be a challenging task as both of these models are similar in statistical terms. The discussion in Paper I was based only on the results of the spatial error model as this model showed indications of better performance based on log-likelihood [LIK] and Akaike information criterion [AIC] values (for more detail, see Paper I, Iqbal & Ceccato, 2015 a).

It is also important to note that a multilevel model is generally considered more appropriate than an ordinary single-level regression model because it allows one to deal with the hierarchical structure of variables (for more detail, see Paper I, Iqbal & Ceccato, 2015 a). In future research, multilevel models will be used to obtain unbiased regression results including, but not limited to, hierarchical linear model, hierarchical linear regression model, random coefficients model, hierarchical mixed linear model, or Bayesian linear model (Kreft et al, 1990 in Park & Kim 2014). Another challenging task was related to endogeneity (variables correlated with the error term) that limits the ability to interpret the models. Moreover, this study (and base model) utilizes variables that ‘work’ in the Stockholm case, whereas in the context of another urban area, the base model could potentially need to utilize another set of variables.

In Papers I and II, It is important to consider the problems of faulty crime reports (time and location of the crime incident). Another common problem with crime records in parks is the positioning of the crime incident, which may provide wrongly recorded events, at different coordinates. The low levels of reported crimes must be kept in mind as well. A large percentage of all crime events remains unreported because of the unwillingness to report or lack of trust in law and police or not perceiving the crime as serious are noted among many other reasons (Uittenbogaard, 2014, p.16). Under-reporting and changing methods of the crime reporting have been discussed in detail by (Brantingham, Brantingham, & Taylor, 2005).

In Paper II, the limitations of the small sample size and the interpretation of self-reported data – for instance, how were the questions interpreted by the respondents and how should their answers be understood – should also be acknowledged. One cannot assume that all respondents were equally knowledgeable about the crime conditions in parks. There is also a

difference in response regarding perceived safety as this can strongly depend on the respondent's age or gender, proximity of residence, or frequency of park use. Some respondents focused on areas perceived as overgrown, while others focused on bicycle use in the park. Ethical issues were also considered in Paper II, in order to minimize the risk that may affect people interviewed in this study. Regarding the safety audit; it was conducted between the end of October to the middle of November 2014. It is important to keep in mind that the activities in the park were influenced by weather conditions and the time of year. Furthermore, the average time spent at each crime concentration point varied due to several factors, for instance, how many people were in the area at that moment, topographical features of the site, and the weather conditions.

This study also poses a number of challenges in terms of crime prevention and safety because CPTED does not provide assistance for dealing with the local context (e.g. neighbourhood or city), the influence of season, or sustainability. Crime prevention and safety in public spaces are also complex phenomena as they are influenced by many other factors such as gender, age, disability, and ethnic background while applied in practice (for the details see Paper II, Iqbal & Ceccato, 2015 b). Additional research is required to more deeply explore parks as amenities and disamenities, for example from the perspectives of different user groups (such as gender, age, special needs). According to rational choice theory, offenders assess the situation according to their own utility, which includes risk of getting caught. It can, therefore, be argued that if parks are improved towards deterring crime, offenders will find other places to commit their crimes. On the other hand, offenders are very creative and can also adjust to new situations by inventing new offending techniques to counteract or avoid the newly implemented interventions; thus, conclusions should be drawn carefully.

1.7 Reflections on the results and policy implications

The aim of the thesis was to understand the importance of parks for urban quality particularly for safety in the parks. This was achieved by, first assessing parks' impact on the perceived quality of the urban environment using Stockholm as the study area. Then, second, by exploring to what extent safety in parks may be assessed using principles of CPTED using a high-crime park in Stockholm's inner city. This study contributes to the existing literature in numerous ways; first it provides evidence that people in Stockholm are willing to pay for a property with proximity to park, but it varies from park to park. Second, spatial data coming from GIS was used as an input into hedonic models in this study. Third, the field observations

conducted in this study was performed for the very first time in parks in Stockholm. In the paper I the inspection used as a basis for assessing park characteristics as amenities or disamenities while in paper II it serves to assess the crime concentration points regarding CPTED principles in Tantolunden Park. This study also discussed some challenges CPTED faced regarding the implementation of segregated and gated zones and other measures to discourage unwanted users within public parks. This also opens up another discussion about who is allowed to visit parks and who has rights to have equal access to the parks.

This thesis addresses the relationships between parks, crime related to the physical environment, and the effects of perceived safety in an urban environment on the surrounding areas. Important to note that the outcomes of this thesis do depend on the type, location and size of the park and the crime types committed at the park or in the surrounding area. Yet, these results can be of interest for different stakeholders, for instance: homeowners or buyers, park managers, safety professionals and practitioners. Homeowners and potential buyers can use this research to decide whether to invest money when buying an apartment or property near a high-crime park. For park managers, these findings are helpful for thinking about where to invest time and effort to improve the condition of the park and to improve overall safety. For the safety experts and police, these results can be used to decide how to invest resources for example new lighting strategies at crime concentration points, and also to build and maintain some target programmes in parks, and on a practical level, to put more emphasis on proactively reducing or ultimately eliminating crime in parks and may be retaining the criminals in our communities as responsible, productive citizens.

When it comes to parks in Stockholm, based on this research it may be argued that the existing approaches to crime control, prevention and policy are poorly integrated and based on an insufficient understanding of the interactions between physical environment of a park and its contexts. A review of policy documents from Stockholm city indicates that few integrated strategies about the role of parks and their contexts are currently in place. Yet, findings of this thesis can be used to detect problems other than crime in the parks and their effect in their immediate vicinities. From a planning perspective, some questions about the types of activities and the nature of the parks should be further addressed in order to decrease park disamenities, such as crime, while maximizing park amenities.

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