Original Article

Security in Stockholm's underground stations: The importance of environmental attributes and context

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Abstract The aim of this article is to report on the security conditions in underground stations and surrounding areas in Stockholm, the capital of Sweden. The study is based on a comprehensive fieldwork combined with Geographical Information Systems techniques and regression models. Findings show that a relatively small share of reported events is crime; acts of public disorder are more common at the stations. Events tend to happen in the evenings – nights, holidays and weekends – and, at least for theft, in the hotter months of the year. Although the highest number of events is found in the central station, the so-called 'end-stations' show often higher rates than those located in the inner city. Results show that opportunities for crime are dependent on stations' environmental attributes, type of neighbourhood in which they are located and city context. These findings lend weight to principles of traditional urban criminology theory such as routine activity and social disorganisation. The article concludes with directions for future research and suggestions for policy.
Security Journal (2013) **26,** 33–59. doi:10.1057/sj.2011.32; published online 26 December 2011

Keywords: crime and disorder; transport nodes; GIS; regression models; Scandinavian capital

Introduction

A sustainable city enables the fulfilment of the mobility needs of their citizens via accessible, reliable and safe transportation systems. Security is one of many factors influencing the mobility of individuals in an urban environment. If one assesses security by the levels of crime events, how safe are the transport nodes, such as bus stops and underground stations? Literature shows that security in transport nodes is not necessarily worse than in other parts of the city in terms of crime incidents; on the contrary, studies show that at certain times one can be safer on public transport than in the city overall (LaVigne, 1997; Loukaitou-Sideris *et al*, 2002). However, several studies have shown that transport nodes facilitate the occurrence of crime and disorder in various ways (Sloan-Howitt and Kelling, 1990; Easteal and Wilson, 1991; Clarke, 1997; LaVigne, 1997; Loukaitou-Sideris, 1999; Church *et al*, 2000; Loukaitou-Sideris *et al*, 2001; Newton, 2004). Transport nodes are often called *crime generators* and *crime attractors* (Brantingham and Brantingham, 1993, 1995) as they concentrate large flows of people and are social spaces, which make it easier for offenders to commit crime. Some physical and social characteristics found in transport nodes may draw the attention of people with high levels of criminal motivation. They can potentially pull motivated offenders towards them. For instance, at certain times of the day, the crowds at a station may encourage the offender to pickpocket. In this article, we are interested in security conditions in transport nodes, particularly in underground stations.

Different parts of an underground station are exposed differently to crime and disorder. The design of these facilities and the internal and external environments of the stations may influence the level of crime. According to Smith and Clarke (2000), the targets of crime also vary and can include the system itself (vandalism, fare evasion), employees (assaults on ticket collectors) and passengers (pickpocketing, assault). At the stations, crime is a product of two dimensions: the environment of the transport node itself (for example, design of platforms, CCTVs, dark corners, hiding places) and social interactions that take place in these environments (for example, poor guardianship, crowdedness). Such vulnerability can also be associated with the context in which transport nodes may be embedded. Previous research indicated that the characteristics of the surrounding environment in which a transport node is located (for example, type of neighbourhood) is important for security at the station, but this effect is not well understood (for example, Loukaitou-Sideris *et al*, 2002).

In this article, we suggest that security in transport nodes is dependent on multi-scale conditions that act at various levels in an urban environment. These conditions are determined by the environmental attributes of the station, the characteristics of the immediate environment, the type of neighbourhood in which the station is located and the relative position of both the station and the neighbourhood in the city. To test this conceptual model, we use the underground stations of Stockholm city, Sweden. Stockholm's underground stations have been chosen for several reasons.

Most international literature on security in transport nodes is highly dominated by North American and British evidence (however, see, for example, Alm and Lindberg, 2004; Stangeby and Nossum, 2004). Stockholm is also an interesting case because, contrary to North American or British cities, the capital of Sweden has been shaped to a large extent by planning practices that were a result of welfare policies from the 1950s onwards. A typical characteristic of this was the fairly spatial distribution of the stations over the city, always followed by the construction of a new neighbourhood. Underground stations were planned and located as an integrative part of these new settlements. These areas are often lively places where people converge. There are reasons to believe that the stations' proximity to such a mixed land use makes the underground environment more criminogenic than its surrounding areas.

The objective of the article is to assess security conditions in underground stations and the surrounding areas where individuals' trips take place. This will be achieved by identifying the nature, levels and patterns of crime and disorder in the underground stations over time and space. The analysis also involves (i) an evaluation of the relationship between events of crime/disorder and environmental attributes of underground stations and surrounding areas, and (ii) an assessment of the importance of neighbourhood context (demography and socio-economic characteristics) on levels of crime in underground stations and areas close by. Geographical Information Systems (GIS) techniques and regression models are used in this research in combination with data from different sources.

In order to provide a comprehensive picture of what happens at the stations and in the surrounding areas, three databases were used: Stockholm Public Transport's calls for service, Veolia's personnel register and police-recorded data in an area within 100 m of the underground stations.

The novelty of this study is to make use of GIS, spatial data analysis and regression models to assess security conditions at underground stations with data from multiple sources. The article advances the knowledge basis in this area also by adding evidence of underground system of a Scandinavian city – a research area so far dominated by North American and British examples. The article is based on a conceptual model that stems from theories in urban criminology, situational crime prevention and crime prevention by design.

The structure of the article is as follows. First, the vulnerability of stations to crime is discussed, focusing on attributes of the station and its location in relation to the neighbourhood and overall city. Then, a conceptual model for assessing the stations' vulnerability to crime is suggested, followed by a set of hypotheses. We then discuss the nature, levels and patterns of crime and disorder in the underground stations over time and space. The results of modelling will show whether the environmental attributes of stations and their surroundings affect crime and disorder levels at the station. Directions for future work and the implications of the results for policy conclude the article.

Security at Transport Nodes: Theory and Hypotheses

Security in underground stations is dependent on multi-scale conditions that act at various levels in an urban environment. These conditions are determined by the environmental attributes of the station, the type of neighbourhood in which the station is located and the relative position of both the station and the neighbourhood in the city (Figure 1). Different types of crime occur in different places and vary over time (Jochelson, 1997; Cheatwood,

Figure 1: Security in underground stations: A tentative conceptual framework.

2008), which is also true for underground stations. Crime reflects people's activities and daily habits that are rhythmic and consist of patterns that are constantly repeated. Most crimes depend on the interrelation of space and time: offenders' motivation, suitable targets and absence of responsible guardians, as suggested by *routine activity theory* (Cohen and Felson, 1979). This convergence does not happen in a vacuum. The vast majority of crime occurs within the *offender's awareness and activity space* (Brantingham and Brantingham, 1995). An underground station can be the place where offender and victim awareness spaces converge, a condition that may lead to crime.

The conceptual model relies on principles of traditional theories of urban criminology, situational crime prevention and crime prevention by design. These theories underlie the discussion in the next sections.

Security conditions at the station

The station's design and layout affect its vulnerability to crime. Their design and layout affects the potential offender's likelihood of escaping without being detected (Clarke and Felson, 1993). According to *rational choice theory*, potential offenders evaluate their own risk before making a decision to commit a crime – and the environment plays an important role in their decision. For instance, the study by Harris (1971) suggested that the physical characteristics of stations – such as lighting, fencing, open design and security hardware – reduce crime opportunities. Different studies have indicated evidence of the effectiveness of street lighting as a crime prevention measure (Ramsey and Newton, 1991; Poyner and Webb, 1993; Pease, 1999; Welsh and Farrington, 2007), although not always conclusively (Barker *et al*, 1993). Nevertheless, if good illumination does not affect opportunities for crime, it may at least impact on passengers' perceived security. A case study in South Wales, UK, showed that poor lighting at railway stations was the main security concern among passengers (Cozens *et al*, 2003).

The location of escalators at the end of the platforms, ticket booths clearly visible at the entrance lounges, and overpass walkways for overviews and separation of passenger flows are factors affecting security at stations (Gaylord and Galliher, 1991; Myhre and Rosso, 1996; LaVigne, 1997). Loukaitou-Sideris *et al* (2002) suggested also the importance of the external layout of stations to security. Elevated stations (compared with underpass ones) suffer from poor visibility and are more often targeted by crime. They also indicated that crime against persons more often happens on platforms, escalators and access stairways, where the station design lacks good possibilities for surveillance.

Security relates directly or indirectly to the visibility of passengers, the possibilities of being seen and seeing others, in other words natural surveillance: the 'capacity of physical design to provide surveillance opportunities for residents and their agents' (Newman, 1972, p. 78) – a central concept in *defensible space theory* (Newman, 1972). Cozens *et al* (2003) found visibility to be the most crucial part of security at railways stations. In Los Angeles, a study of Green Line light-rail stations (Loukaitou-Sideris *et al*, 2002) showed strong links between crime rates and stations with dark, hiding places or with poor visibility of the surroundings (the opposite was shown for stations with good visibility).

Poor visibility can also be translated into poor surveillance. For instance, the evidence of the positive effect of Closed-Circuit Television Surveillance (CCTV) cameras on crime reduction has been shown in several studies, but its effectiveness may differ by offence type and results are not always conclusive (Tilley, 1993; Brown, 1995; Short and Ditton, 1996; Squires, 1998; Armitage, 2002; Welsh and Farrington, 2002). For instance, the installation of cameras on the London Underground showed some positive effects on the reduction of robberies and assaults (Webb and Laylock, 1992), as also CCTV usage on the Stockholm subway seems to have led to fewer property crimes but with no effect on assaults (Priks, 2009).

Formal and informal social control has an important role to play in determining crime levels in transport nodes. Disorder and physical deterioration promote the notion that no one is in control – a development that goes hand in hand with high levels of community social disorganisation (Shaw and McKay, 1942; Kornhauser, 1978) and low collective efficacy (Sampson *et al*, 1997; Sampson and Raudenbush, 1999). Chaiken *et al* (1974) showed, for instance, that crime rates on New York's subway were reduced when the number of police increased at a certain time, with no sign of crime displacement in the rest hours. Brit (1989) also showed evidence of the effect of guards in the station in the Dutch public transport system. A number of studies also indicate the role of informal guardians at the station in crime reduction (Reynald and Elffers, 2009). However, Felson (2006) suggests that the existence of informal surveillance does not necessarily guarantee that surveillance is occurring. Ceccato and Haining (2004) suggest that transport sites are often crowded but lack 'capable guardians', persons who, sometimes just by their presence, discourage crime from taking place.

Hypothesis 1: Crime and disorder rates at underground stations are affected by stations' environmental attributes (station design and social interactions). Different types of crime reflect different environmental conditions and may vary over time (daily, weekly and seasonally).

The station in the neighbourhood

High levels of crime at a station or bus stop are often correlated with high levels of crime in the surrounding neighbourhoods, sometimes triggered by the socio-composition of the population or particular land uses. The relationship between neighbourhood conditions and crime was assessed in the seminal work by Shaw and McKay (1942) in Chicago. They argued that low economic status, ethnic heterogeneity and residential instability led to community disorganisation. *Social disorganisation theory* links many forms of crime with the presence of weak informal social controls, often present in high-crime areas, regardless of where they are located. This lack of social organisation results, they argued, in a culture of violence and high rates of delinquency. According to Morenoff *et al* (2001), not until the 1970s and 1980s was the theory of social disorganisation explicitly conceptualised by Kornhauser (1978) and Bursik (1988) as 'the inability of a community structure to realise the common values of its residents and maintain effective social controls'. The literature show many examples of how deprived areas have higher risks of crime, as do transport nodes located in those areas (Pearlstein and Wachs, 1982; Hirschfield *et al*, 1995; Loukaitou-Sideris, 1999; Loukaitou-Sideris *et al*, 2002; Ihlanfeldt, 2003; Newton *et al*, 2004). There are, however, exceptions as well; LaVigne (1997) shows, with the exception of assaults, that Washington's subway crime rates by station did not covary with crime rates for the census tracts where Metro stations are located. Variations are found between above and below ground rates.

Incidents of vandalism plague transit systems (Loukaitou-Sideris *et al*, 2002) but not only this type of offence. There are reasons to believe that stations with high levels of physical damage and public disorder also attract other types of offences. The mechanisms are not well known for underground stations; however, according to Wilson and Kelling's 'Broken Window' Syndrome (Wilson and Kelling, 1982), unrepaired damage to property encourages further vandalism and other types of crimes. Public disorder and vandalism also promote the notion that no one is in control – a condition that goes hand in hand with high levels of community social disorganisation (Shaw and McKay, 1942; Kornhauser, 1978) and low collective efficacy (Sampson *et al*, 1997).

Pearlstein and Wachs' (1982) study showed that most crimes occurred on routes passing through typical high-crime areas in general, and all transit crimes were highly concentrated in these parts of the city. Ihlanfeldt (2003) shows evidence from Atlanta, USA, that rail stations have a significant influence on the levels of crime in the neighbourhoods and vice versa. Loukaitou-Sideris *et al* (2002) also produced similar findings in their study on station crime in Los Angeles, USA. By comparing population densities, high and low income levels, and ethnicity and gender and age distribution, they showed that crime rates at light-rail stations are related to the socio-economic levels of their surrounding neighbourhood. Table 1 summarises their findings.

The relationship between surrounding land uses and crime incidents tends to be significant as certain environmental features either attract offenders (potentially good opportunities) or influence criminal activities (as concentration of potential offenders and encouragement of anti-social behaviour) (Loukaitou-Sideris, 1999). Kinney *et al* (2008) suggest that commercial areas, shopping centres and entertainment locations, and multi-functional areas correlate with high concentration of crime events. In Merseyside, UK, the damage of bus shelters was related to the presence of youth, play parks, open spaces and schools with high truancy levels rather than pubs or other alcohol-related premises (Newton and Bowers, 2007). The impact of bars and liquor store on crime rates is not new but is not always straightforward. Block and Block (1995) found, surprisingly, that areas with the highest concentration of bars and liquor store were not necessarily the areas with the highest crime levels.

Hypothesis 2: The context in which stations are embedded has an impact on what happens in the underground stations in terms of crime and disorder.

Table 1: Socio-demographic variables related to station crime

Variables associated with higher crime rates	*Variables associated with lower crime rates*
High population density	Owner-occupied homes
More persons per household	High-income households
Younger population	Neighbourhoods with majority white population
Population with less than high school education	High numbers of population with college education

Source: Loukaitou-Sideris (2012).

The station in the city context

Transport nodes are also influenced by their relative position in the city. Urban criminology has shown plenty of evidence on how city centres are more criminogenic than other parts of the city (Sherman *et al*, 1989; Wikström, 1991; Ceccato *et al*, 2002; Loukaitou-Sideris *et al*, 2002; Smith, 2003; Ceccato, 2009). Thus, it could be expected that stations located in inner-city areas would tend to be more targeted by crime and disorder acts than those in the outskirts.

As Kinney *et al* (2008) discuss in their study on Burnaby (Vancouver, Canada), the greatest number of crime incidents are concentrated in and around commercial and civic-institutional land uses: assault rates, for instance, are six times the rates in residential areas. Policing operations along transportation routes in London and Liverpool, UK, showed that increased patrolling on the routes and along the routes decreased crime levels even up to 400 m from the route (Newton *et al*, 2004). A study on crime and bus stops in Newark (USA) suggested that both the presence of bus stops and commercial centres were related to higher levels of crime (Yu, 2009). The author points out that the presence of bus stops resulted in higher numbers of crime for all types of offences. Although much was explained by the geographical location of the bus stops in high-crime areas, the bus stops were found to function as high crime attractors towards their surroundings creating even more criminogenic places.

Hypothesis 3: The underground station's relative position in the city determines its levels of crime and disorder. As crime is often concentrated in city centres, it would be expected that the more centrally located a station is, the more criminogenic it is.

Study Area and Data Acquisition

Stockholm's underground system is composed of 100 stations, of which 47 are underground (most central) and 53 above ground. There are three lines: Red, Green and Blue (Appendix A). In this study, we will report on crime and public disorder events in the whole Stockholm underground system, but because of data limitation the modelling section ('Modelling public disorder and crime') will use 82 per cent of the stations, those located in Stockholm municipality.

Stockholm is part of an archipelago, and therefore water occupies a large part of the urban landscape as the city is spread over a set of islands on the southeast coast of Sweden. The islands are well connected by roads and an efficient public transportation system, comprising buses, the Stockholm underground system, rail systems and commuting trains. The main public transport junction is located in the Central Business District, in the central area of the inner city. All underground lines pass through the Central Station, which is the main railway station of the capital, making this area a place where many travellers and workers pass daily. The central station is the only station connected to all three lines. According to Stockholm Public Transport's Annual Report (2006), on a normal weekday, the flow of people travelling to and from the central station is around 215 000 people. The central square, and one of the main meeting points of the city, is a relatively high criminogenic area, where violence and drug-related offences tend to be concentrated (Ceccato *et al*, 2002).

The environment of underground stations follows some common standards, but they are far from being homogeneous, which potentially impacts on the stations' vulnerability to crime and disorder. In order to assess these differences, we conducted a systematic and detailed 'inspection' of all underground stations in the Stockholm underground system (including a photographic documentation), as well as a check on their surrounding areas, in summer 2010.[1] All underground stations were inspected on a weekday, between 10:00 and 16:00, avoiding atypical hours (rush hours and busy weekends). The inspection was based on fieldwork observation of five parts of stations, as shown in Appendix B. The station *platform* is constituted by the platform where the trains arrive and passengers wait, whereas the transition area is the area between the platform and the gates/ticket window, which commonly includes stairs and elevators to the platform. The *lounge* is the area before the gates/ticket booth to the exits or tunnels. The *exits* are areas before entering the lounge area either directly from the street or via a tunnel. The *surroundings* included the immediate surroundings around each exit, the field of view from a station's exits. Figures 2 and 3 illustrate the environmental characteristics inspected in the fieldwork.

Data from the fieldwork inspection (checklists) were inputted in spreadsheets and then imported to GIS together with data on land use, crime and demographic and socio-economic data of the population. Stations and crimes were mapped as point data,

Figure 2: Environmental attributes of underground stations that promote security: (**a**) good overview of the whole station, clear sightlines of platforms in Odenplan station; (**b**) stations' external environment with clear overview from the train (and from outside) in Rågsved; (**c**) visible real-time train arrival display in lounge allows passengers better plan their trips in Akalla.

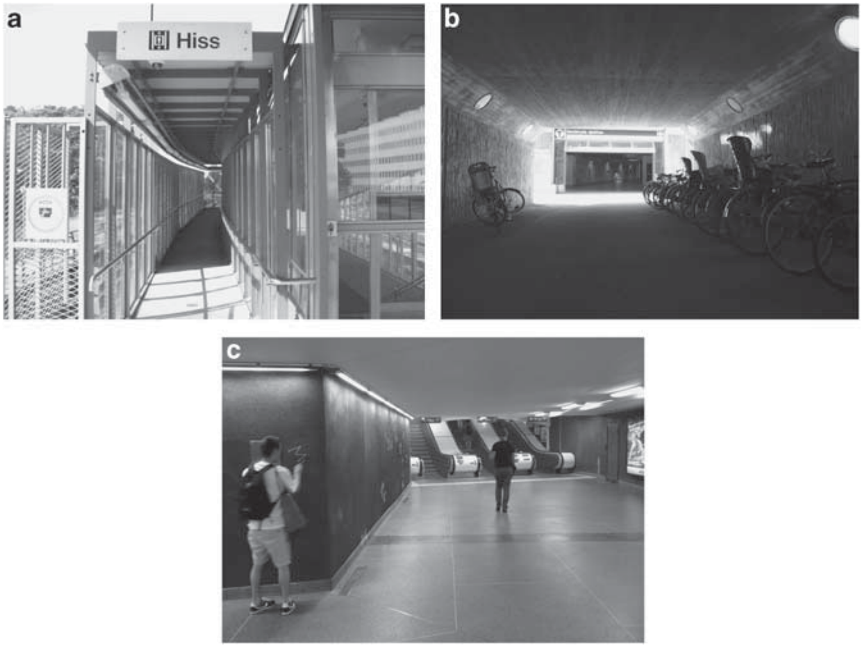

Figure 3: Environmental attributes of underground stations that do not promote security: (**a**) secluded entrance to an elevator in Råcksta station (on the left, 'keep away from danger' sign, entrance close to a motorway); (**b**) a dark tunnel as entrance to the underground station in Danderyd sjukhus station (during the day); (**c**) graffiti being applied on a wall behind a corner in Slussen station between the platform and the transition area.

whereas the Stockholm demographics and socio-economic data were linked to small unit statistics (*Basområde*). In order to assess the influence of the surroundings on crime and disorder events at each station, a number of criminogenic land-use indicators were manually mapped: the location of automated teller machines (ATMs), schools, police offices and state alcohol selling outlets (*Systembolaget*) in Stockholm.

Crime and public disorder data were gathered from Stockholm Public Transport (2006–2009), Veolia (2005–2008) in combination with 2008's Police recorded statistics obtained from the Stockholm Police Headquarters by *x*,*y* coordinates of all types of offences by date. Although coordinates were available, it was not possible to know where the event occurred (during the trip, at the station, wagon, other nearby premises). Instead of using crude data of crime events by stations, rates per 1000 passengers were calculated based on the passenger flow at each station.

The Nature and Levels of Crime over Time and Space

Public disorder is the most common type of event reported at stations (around 80 per cent of all events). Typical examples of such a report are cases of drunken people at the station or people found sleeping on a train, but also unjustified use of emergency brakes, fire extinguishers or fire hoses. More serious offences, often violence, thefts and vandalism, constitute about 20 per cent of events. Most reports of violence are against passengers and guards or other personnel. Threats against personnel are typical events, followed by threats against passengers and drivers. For robbery, data at the station show that most reports are made by passengers at the stations. The police robbery data also show a large number reported at the stations, although the majority of all records is related to places such as shops and supermarkets at the station. Theft can generally be divided in two types in underground stations: theft from persons and of objects at the station. The latter includes theft of bikes and cars, which is not uncommon around underground stations (parking lots or streets). The actual time of offence for car-related crime is likely to be an estimate and is biased towards the time of discovery (when the victim found out about the event). When recorded by the police, the time of discovery is often used as a (inaccurate) proxy. Given the volume of car crimes on public transport property, this factor could skew the mean times associated with property crimes overall. Theft from persons is mainly covered by stolen goods from transients and passengers using the underground system. Vandalism is frequent at underground stations. Acts of vandalism include graffiti on walls or floors, as well as damage to objects, rarely inside the trains. This section will take a closer look at these different acts of crime and disorder over time and space.

Figure 4(a) shows that regardless of the data source, records are stable over times of the day. Most crimes in underground stations, particularly violent ones, happen in the evenings and night (Figure 4). Although there are variations between data sources and crime types, the common trend is that people tend to be victimised after 15:00, with peaks between 19:00 and 22:00 and the early hours of the morning. Note that the underground stations have limited opening hours, and during weekdays most stations are closed between 03:00 and 05:00. Police crime data within 100 m of the stations show that theft is committed mainly around late afternoon, whereas vandalism happens in the evenings and violence offences are more reported in the night (Figure 4(b)). Holidays and weekends show higher reported rates for all types of crimes and events of public disorder than weekdays. Conflicts often reach a peak when people meet each other in their free time, at evenings, weekends and holidays. This temporal pattern reflects people's routine activity in the city (Cohen and Felson, 1979), when people are on the move.

As many as 62 per cent of all offences in Stockholm municipality take place within 500 m radius of an underground station, which are spread over just 28 per cent of Stockholm municipality's entire area. The surrounding areas of the stations are not criminogenic just because the stations are located there but because they are surrounded by mixed land uses that are known crime attractors (for example, pubs, restaurants, offices, alcohol selling stores, banks).

The central station might show a concentration of the highest number of events in Stockholm municipality, but it does not keep its top position after events are standardised by daily passenger flow. Instead of using crude data of events by stations, rates per 1000 passengers were calculated for the three databases and crime types. Three patterns stand out:

1. The so-called 'end-stations' often show higher rates of events than stations located in the inner city areas (exceptions are Medborgaplasten, Skanstull and T-centralen for thefts, for instance). Hjulsta, Farsta Strand and Hagsätra show high rates regardless of crime type. Some stations are 'crime specialised', showing more problems with violence, whereas others show high theft or vandalism.

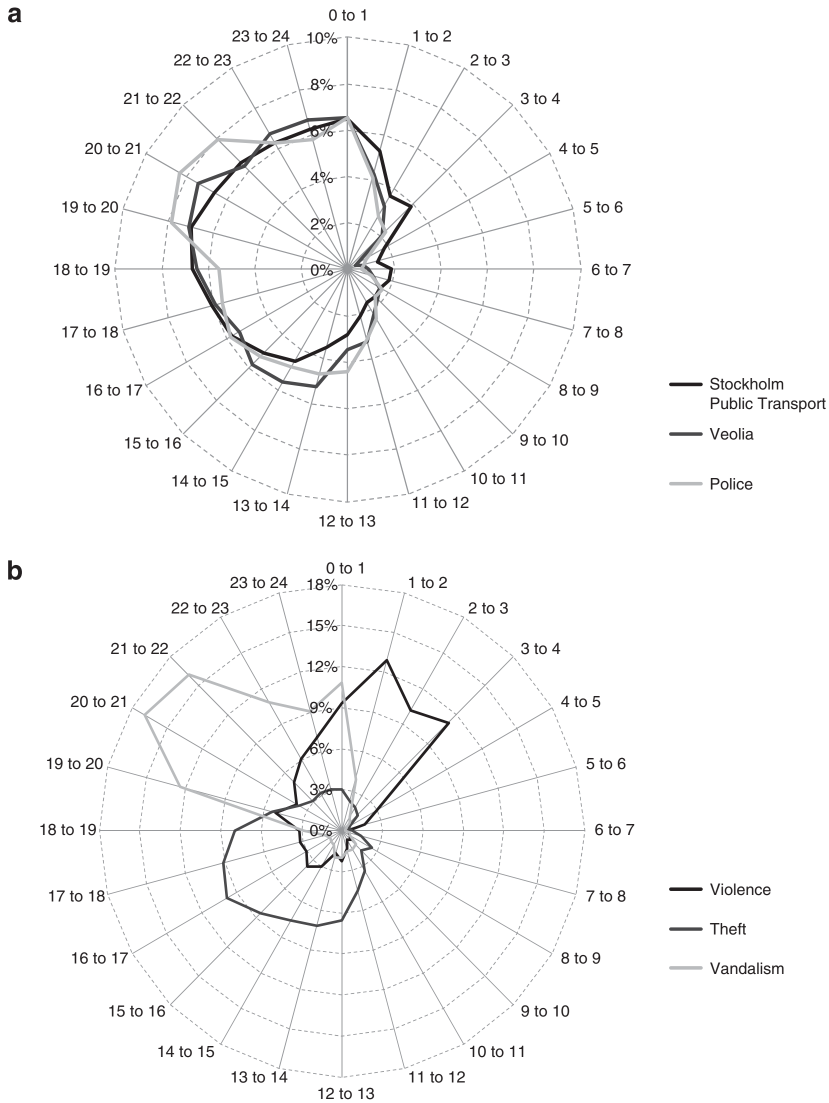

Figure 4: (**a**) Distribution of crime and disorder by hour of the day and data source;
(*Source*: Stockholm Public Transport Database (2006–2009), Veolia (2005–2008) and Police Statistics (2008),
(**b**) distribution of theft, vandalism and violence offences by hour of the day.
(*Source*: Police Statistics (2008).

2. By comparing maps of hot spot areas with the locations of the underground stations, we noticed that high crime rates in underground stations are often associated with hot spots of crime in the surrounding neighbourhoods; however, this relationship is context dependent – it happens either in the city centre or in the periphery of the city. This is clearer for violence than for property offences. Using visual inspection,

we see that as many as 60 per cent of the stations with top violence rates belong to a 'significant hot spot area',[2] taking into account the distribution of violence both in space and time. For thefts, 40 per cent of stations with highest rates are also part of Stockholm's 'hot spots' for property crimes. However, note that sometimes areas may show high relative high rates but do not turn out to be a significant hot spot; thus, they are not included in these percentages.

3. The more peripheral a station is, the greater violence rates it tends to have. However, for property crimes, the picture is different. Stations located in more central areas tend to show higher theft rates than stations located in the Stockholm periphery (Figure 5).

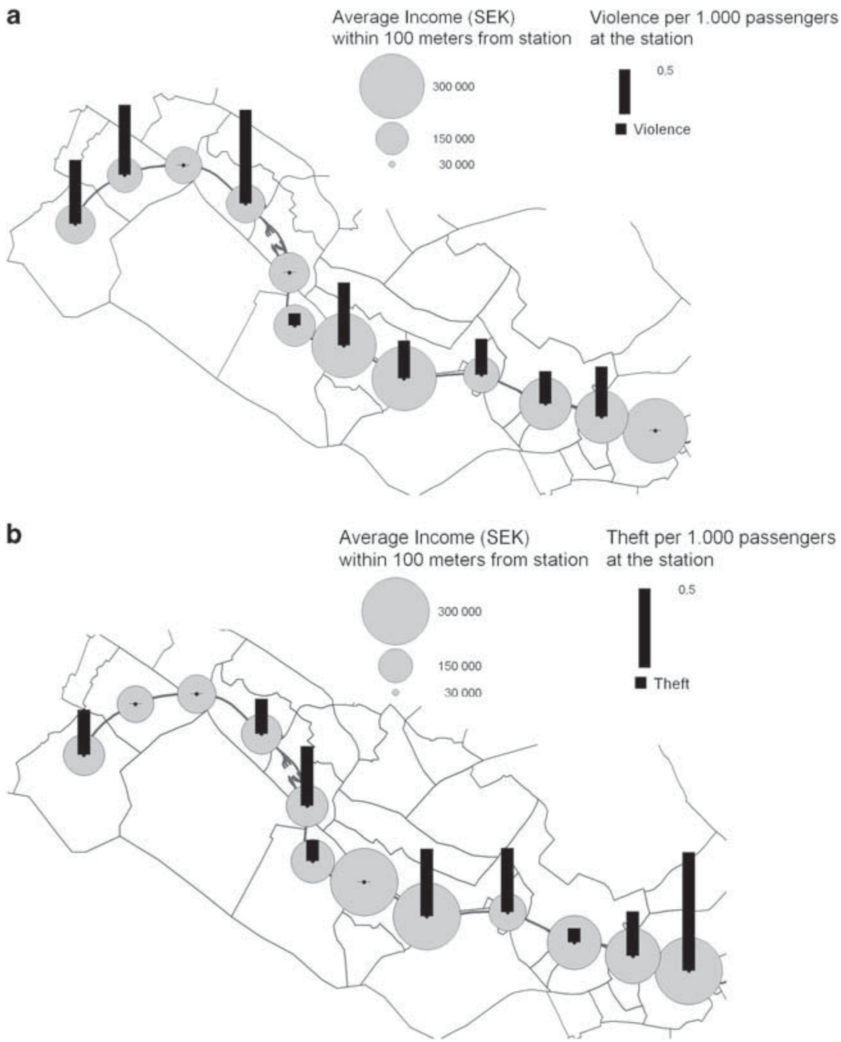

Figure 5: (**a**) Violence and (**b**) theft rates at stations and surrounding income levels.

Modelling Public Disorder and Crime

We now model the crime and public disorder rates in the underground stations using environmental attributes of the stations and demographic, socio-economic, and land-use covariates of the surrounding areas following the conceptual model shown in Figure 1. The purpose is to explain the variation in station-specific rates for various types of offences. The dependent variables in this study are rates for selected offences from data at the station (from Stockholm Public Transport) and within 100 m of the stations (police-registered offences). These 100-m buffer zones were created around the station objects and later used to calculate the total police records assigned to each station. These rates took into account the proportion of the population passing close to the station (daily population) using area interpolation procedures in GIS. The modelling is tested using 82 per cent of the Stockholm underground system, that is, all stations covering the whole Stockholm municipality. As Stockholm Public Transport and Veolia databases show events that happen at the station and they tend to show similar results in the modelling, we are going to report here only the results from the Stockholm Public Transport database. The results from the station's models are then compared with those based on offence rates created around 100 m from each station.

The modelling strategy is composed of three steps. First, using Ordinary Least Square regression (OLS),[3] we modelled offence rates at the station as a function of the environmental attributes of social interactions that happens at platform, lounge, transition area, exits/entrances.[4] Significant variables were selected at 90 per cent level and higher. In Step 2, crime and disorder rates were modelled for each crime type using only significant variables from Step 1. The result was a model for the whole station, type of event and data source. Then, in order to assess the effect of the surroundings, offences rates were modelled as a function of stations' attributes, neighbourhood context and station's relative location in the city in Step 2. Interaction effects were tested for a number of variables such as distance to city centre, and income in combination with other station's variables, but this strategy did not produce meaningful results. Moreover, we performed modelling centre and peripheral stations separately, but results turned out to be poor and limited by the number of stations/variables. Figure 6 illustrates the modelling strategy. The objective of testing several modelling frameworks was to attempt to show a complementary picture of the criminogenic conditions at these transport nodes generated from different modelling scales (at the station and surroundings) and data sources (Stockholm Public Transport database and police records).

We expected that some environmental attributes would become more important to explain crime and disorder rates in the winter than in the summer. As the seasonal variations of light and temperature are notable in Scandinavia, models were tested using a new set of variables during winter, such as illumination, overcrowding and littering in stations.

Results

Step 1

Social and physical environmental attributes of platforms, transition areas and lounges turned out to be more important in explaining the variation in crime and disorder rates at

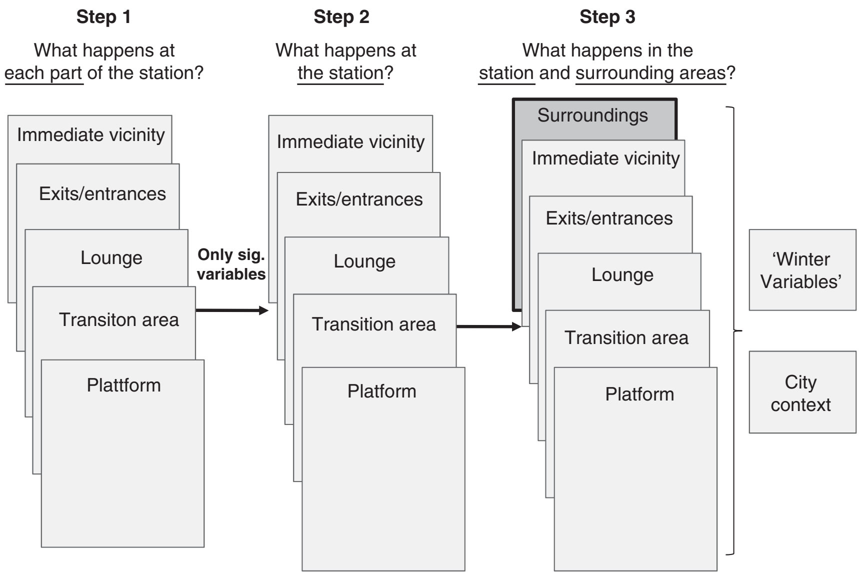

Figure 6: The modelling strategy.

the stations than those conditions found at exits/entrances. Across all parts of the stations, variables indicating barriers to formal and informal social control were related to higher rates of offences. According to the modelling results from Stockholm Public Transport database, high rates of disorder and offences were found on platforms with low guardianship (less crowded), often in stations with multiple platforms or transition areas with poor illumination. In models based on the police records, platforms seem to be less exposed to crime and disorder when CCTVs are present or visible. Lack of illumination in transition areas is often related to high rates of crime and disorder in both sets of models (Stockholm Public Transport data and police data). However, the role of CCTVs is not clear in transition areas, as the variable either does not come out as significant or shows different signs in different models. The presence of cafés in lounge areas tends to generate fewer offences recorded in the Stockholm Public Transport database. However, shops in lounge areas of the stations tend to promote crime, particularly for property offences. The effect of shops and cafés completely disappears in models based on the police data in lounge areas. More important to explain the variation of crime and disorder are indicators of informal social control (lack of benches, few people around, CCTVs and their visibility). The conditions found at exits of the stations and immediate surroundings have less impact on rates of crime and disorder than platforms, lounges and transition areas (fewer variables were significant and they showed contradictory signs depending on crime type).

Step 2

As suggested in Hypothesis 1, there are a number of environmental attributes of the stations that *together* affect crime and public disorder rates. Note that in these models, only significant variables deriving from Step 1 were regressed against crime and disorder rates. Results are discussed below and shown in detail in Table 2. Models based on Stockholm Public Transport database show that overall crime, violence and vandalism tend to be lower in transition areas with good illumination and platforms with many people around. These results are also confirmed by previous evidence found by Harris (1971) and Welsh and Farrington (2007). The number of platforms has the opposite effect. Rates of violence, threat, theft and social disturbance are higher in stations with more platforms, which is an indication that stations are larger, and more central underground stations. The pleasantness of the stations, with fewer observed events of social disturbance (for example, loud speech/kids fooling around) and littering tend to relate to fewer acts of violence, threats, robbery and other minor criminal events.

Models based on police records confirm the importance of formal and informal social control at stations (people around, existence of benches), but also show signs of the importance of other security dimensions. For instance, features that might hinder good visibility and consequently affect surveillance (for example, the presence of physical barriers, significant in half of the models) tend to be associated with higher rates of disorder and crime. Hiding places and existence of corners are significant in models of both violent and property crimes. Similar results were suggested by Gaylord and Galliher (1991), Myhre and Rosso (1996), LaVigne (1997), Loukaitou-Sideris *et al* (2002) and Cozens *et al* (2003). More often in models of the police data than in those based on Stockholm Public Transport's data, the number of CCTVs in the station and their visibility are linked to less crime and disorder (significant in five out of eight models). Table 3 summarises the attributes at the station related to crime and disorder from the two data sources.

The list presented in Table 3 reflects the frequency of the variables, which came out significant in the following models: total crime, violence, theft, vandalism, robbery, burglary and other types of events at the station. We tried to exclude from the table variables that showed different signs for different types of offences. For instance, seating places or benches seemed to reduce robbery but increase public disorder. The number of CCTVs also showed unexpected signs for two offences. For violence and burglary, findings show that having a visible CCTV camera at any part of the station is associated with greater rates when using Stockholm Public Transport database. These results are, however, not confirmed by the model using police records, where the variable for the number of CCTVs shows the expected sign for violence but unexpected for burglary. One of the reasons for this mismatch is that cameras were installed in certain stations in the first place because they were already known as 'problematic' (and may not yet have been effective enough to deter burglary). Similar reasoning can be used about the existence of mirrors as a supporting security device at stations. Contradicting signs for different offences is not new in the literature (see, for example, Webb and Laylock, 1992; Priks, 2009).

Step 3

Variables reflecting the conditions at the stations explain around 30 per cent of the variation of crime and disorder rates; this percentage varies by offence type and reaches its highest at 64 per cent for vandalism when variables indicating the conditions of the neighbourhood and city context were added to the model (Table 2). The addition of these variables

Table 2: Results of the regression analysis: Y=Log of offence rates at stations and surroundings

Database	R^2 *(per cent)*	*At station*	R^2 *(per cent)*	*Station and surroundings*
Crime				
Stockholm Public Transport	31.0	Pcrow***(−), Tillu**(−)	51.9	Pcrow***(−), Tillu***(−), CityD***(+), Cpolis***(−)
Police	39.9	CCTV***(−), Tvis***(+), Tcross***(+), Eesup***(−), Esocd**(−)	51.8	CityD***(+), CExit**(+), CCTV***(−), Lseat**(−), Tvis**(+), Tcross***(+), Eesup**(−), Esocd**(−), Forg**(−)
Violence				
Stockholm Public Transport	26.5	Psecu*(+), Pnum*(+), Tnice***(−)	44.2	Psecu**(+), Pnum***(+), Pcrow**(−), CAtm***(+), CCTV***(+), Cit-yD***(+), Forg**(−)
Police	43.9	Pcorn***(+), Cctv**(−), Lvis**(+), Lillu**(+), Lsur***(−), Lseat*(−) Thid**(+), Tvis*(+), Tcross**(+), Tdetr**(+), Esur***(+)	35.6	Pcorn***(+), Cctv**(−), Lvis*(+), Lillu*(+), Lsur***(−), Thid***(+), Tdetr**(+), Esur***(+)
Robbery				
Stockholm Public Transport	32.4	Pundr***(−), Lsun***(+), Lseat***(−), Lundr*(+), Lsocd ***(+), Tlitt**(+)	20.5	Pundr***(−), Lsun**(+), Lseat***(−)
Police	36.0	Tvis***(+), Thid**(+), Tesup**(+), Telvs***(+), Eopen**(+)	55.7	Ploun**(−), Tvis***(+), Thid***(+), Tesup***(+), Telvs*(+), Tcross**(+), Eopen***(+), CityD***(+), Popd*(+), Villa**(+)
Vandalism				
Stockholm Public Transport	54.6	CExit***(−), Proug*(+), Pcrow***(−), Tillu**(−), Tsur**(+)	64.0	CExit***(−), Proug**(+), Pcove***(+), Ldetr**(+), CityD***(+),Tillu**(−), Pin-out**(−)
Police	41.5	Cctv***(−), Eesup***(−)	41.5	Cctv***(−), Eesup***(−)

* Significant at 10 % level; ** Significant at 5 % level and *** Significant at 1 % level.
(+) positive effect
(–) negative effect
Pcrow=Overall crowded at platform; *Tillu*=Transition areas are well illuminated; *CityD*=Distance from city centre; *CPolis*=Number of police stations within 100 m; CCTV=Number of CCTVs placed at station; *Tvis*=Visibility in transition area; *Tcross*=Cross-sections/junctions/disruptions at transition areas; *Eesup*=Exits have escalator(s) going up; *Esocd*= Presence of social disorder at exits; *CExit*=Number of exits; *Lseat*=Presence of seats/benches at lounges; *Forg*=Percentage of population with foreign background in 2007 within 100 m; *Psecu*=Platform has CCTVs placed visibly; *Pnum*=Number of platforms at stations; *Tnice*=Transition areas have a nice/pleasant atmosphere; *CAtm*=Number of ATMs within 100 m; *Pcorn*=Presence of dark corners at platforms; *Lvis*=Visibility in lounges; *Lillu*=Lounges are well illuminated; *Lsur*=Possibility of surveillance by others in lounges; *Thid*=Presence of hiding places at transition areas; *Tdetr*=Transition areas have presence of physical deterioration; *Esur*=Possibility of surveillance by others at exits; *Pundr*=Platform located underground; *Lsun*=Sunlight easily illuminates lounge; *Lundr*=Lounges located underground; *Lsocd*=Presence of social disorder at lounges; *Tlitt*=Presence of any litter at transition areas; *Tesup*=Transition areas have escalators going up; *Telvs*=Elevator smells/has lot of graffiti in transition areas; *Eopen*=Exit layout is of open type without walls and roof; *Ploun*=Platform visibility towards lounge area; *PopD*=Population density within 100 m; *Villa*=Housing is villas (owned housing); *Tsur*=Possibility of surveillance by others at transition areas; *Pcove*=Platform covered by (rain) shield; *Ldetr*=Lounges have presence of physical deterioration; *Pin-out*=Net population(difference between population moving in and moving out from the area in 2007).

Table 3: Attributes at the station related to crime and disorder

Variables associated with higher crime rates	*Variables associated with lower crime rates*
Few people around at station	Good illumination (transition area)
Objects hindering visibility/surveillance	Less presence of social disturbance
Corners, hiding places	CCTV cameras
Number of platforms	Overall station's pleasantness, littering

Table 4: Attributes at the stations, neighbourhood surroundings and city context

Variables associated with higher crime rates	*Variables associated with lower crime rates*
Few people around at station	Good illumination/visibility
Corners, hiding places	CCTVs cameras
Peripheral stations	Fewer ATMs in the surroundings
Fewer police stations	Lower population density
Fewer residents moving out	Less presence of physical deterioration

improved the model's goodness of fit but not for all offences. Nevertheless, some of the variables reflecting the conditions at the stations hit strongly in Step 3, for instance presence of hiding places/corners, good illumination/visibility and, to some extent, CCTVs.

Confirming findings from the section 'The nature and levels of crime over time and space', stations far from the central area are more often targeted regardless of offence type and model (the variable distance to city centre turned out significant in most of the models) even after controlling for a number of other socio-demographic and economic characteristics in the surrounding areas (Table 4). We cannot therefore corroborate our hypothesis that stations located in inner city areas run a higher risk of all types of offences. Thefts and property crime rates tend to be higher in a couple of inner city stations, but this pattern does not hold for other types of offences.

For total crime and disorder, the goodness of fit of the models is very similar for both Stockholm Public Transport database and police databases. The significant variables are, however, different as the first data set reflects only what happens at the station, whereas the second database covers incidents over 100 m from the stations. Guardianship and illumination explain 30 per cent of the variation of the crime rates from the Stockholm Public Transport database; it goes up to 52 per cent when other variables (number of police stations within 100 m, distance to city centre) and city context are added to the model. The importance of formal control (police station close to the station) has shown a strong effect on crime and disorder as suggested by previous research (Chaiken *et al*, 1974; Brit, 1989), which surprisingly disappears in the model based on the police data.

For violence, R^2 nearly doubles when surrounding variables were added to the model for the Stockholm Public Transport database. For violent rates based on the model from police data, despite poorer goodness of fit, the model shows that more crime and disorder are found where there are more dark corners at platform, more hiding places at transition areas, fewer CCTVs, transition areas with signs of deterioration and poor surveillance in lounge and exit area. For robbery, the situation is inverse; rates based on police data perform much better than the ones from Stockholm Public Transport database. Surrounding variables such as open entrances, distance to city centre, population density and presence of villas are all related to high rates of robberies from police data.

The model based on the Stockholm Public Transport database shows that vandalism rates tend to be related to fewer number of exits (an indication of centrality but also the size of the station), lounge with signs of physical deterioration ('crime attracts crime'), platform covered by rain shield, poor illuminated transition areas and neighbourhoods with people moving out. Not surprisingly, whereas the previous model explained 64 per cent of vandalism rates, the police data explained only 40 per cent, half by variable numbers of CCTVs.

Surprisingly, some of the variables depicting the surrounding areas turned out to be non-significant or to have an unexpected sign. For example, no effect was found for the location of schools or for alcohol-selling premises in the surrounding area or for neighbourhood instability, as suggested in previous literature (for example, Block and Block, 1995; Loukaitou-Sideris *et al*, 2002). In this study, alcohol-selling premises do not include restaurants and pubs, only state alcohol outlets (Systembolag), which may explain our results. Only ATMs show an increasing effect on violence.

We expected that some environmental attributes would become more important to explain crime and disorder rates in the winter than in the summer. As the seasonal variations of light and temperature are notable in Scandinavia, models were tested using a new set of three variables during the winter. Results, however, show that illumination, overcrowding and littering in the winter were not important to explain the variation of station's crime and disorder rates as they may have been in the summer (as the results were in general poorer compared with summer, they are not reported in Table 2). Often, the snow, gravel and dirt in public environments change the tolerance level for litter and garbage on the floor in the dark months of the year, something that would not pass unnoticed in the summer. This may also suggest that the threshold for what is good and poor illumination changes over time, affecting an offender's perception of opportunity and consequently the decision to commit a crime.

Conclusions and Recommendations

Underground stations are criminogenic places, but certain stations are more often targeted by acts of crime and disorder than others. In this study, we set out to understand why the vulnerability to crime varies over space and time, using the Stockholm underground system as a case study. We first discussed the nature, levels and patterns of crime and disorder in these transport nodes over time and space. We then assessed the importance of environmental attributes of underground stations and surroundings to explain the variation in rates of crime and disorder of these environments.

Findings show that a relatively large share of reported events, regardless of data source, is composed of events of public disorder (unlawful activities or anti-social behaviour). Typical examples are cases of drunken people on platforms or unjustified use of fire hoses or fire extinguishers. The majority of recorded crimes at the station are fights, vandalism and threats, followed by reports of other types of violence. Property crimes are more often recorded by police official statistics than by databases of Stockholm Public Transport and Veolia. As suggested in Hypothesis 1, there are clear temporal and spatial variations of both crime and events of public disorder. They tend to happen more often in the evenings/nights, during holidays and weekends and, at least for thefts in the hot months of the year.

Stations and their surrounding areas are criminogenic places: 62 per cent of police-reported offences take place up to 500 m radius from an underground station (which is only a third of the municipality's area). This environment is highly criminogenic because it is composed of mixed land use (for example, pubs, restaurants, transport nodes) and because nearly one-third of the stations are located in the inner city areas of Stockholm, where crime rates tend to be greater than in surrounding areas.

The central station concentrate the highest number of events in Stockholm but it does not keep its top position after events are standardised by daily passenger flow (the only exception is for theft). This finding gives legitimacy to standardisation of crime events by passenger flow – a procedure that has not yet been tested in the current literature. The Stockholm underground system shows that a map of crime counts by station reveals a monocentric geography around the city centre, whereas a map of rates of offences by station (standardised by passengers) shows an entirely different geography: more dispersed and peripheral. This finding has a major impact for policy intervention as we may be 'chasing ghosts'[5] if passenger flows are not taken into account. However, although rates are better indicators than counts, they are not problem free. A couple of stations show relatively high rates because the flow of passengers is low (for example, Skärmabrink station) or the opposite; they show low rate because of large passenger flow (for example, Tekniska hög-skolan station). These cases constitute not more than five cases out of a hundred stations and are not peripheral, which would therefore not affect the conclusions drawn in this article. We take the view that if a station has a poor flow of people (in relation to the number of events), this can *per se* be regarded a criminogenic factor that makes the station more vulnerable to crime (because of lack of guardianship) than others.

The variable 'distance to city centre' is significant in nearly all models and indicates that when passenger flow is taken into account, 'end-stations' show higher rates of events (crime and public disorder) than stations located in the inner city areas (exceptions are Medborgaplatsen, Skanstull and T-centralen for thefts, for instance). The 'end stations' such as Hjulsta, Farsta Strand and Hagsätra show high rates regardless of crime type. Some of these peripheral stations are located in places that, although planned as part of the neighbourhood, do not easily allow guardianship and natural surveillance from outside. They are usually close to a motorway or are, to some extent, cut off from surrounding land uses by forests, lanes, far from people's movements, which potentially could be the 'eyes on the stations'.[6] Alternatively, if they are closely connected with the rest of the neighbour-hood, they tend to be part of criminogenic environments, such as a shopping area with mixed land uses. These regional centres have an underground station as a landmark, readily identifiable places that serve as external reference points and concentrate external temporary population in one place. These dynamics produce routine activities that are more criminogenic than elsewhere.

Population density and housing mobility also show an effect on crime and disorder rates at the stations but unexpectedly not demographic and socio-economic characteristics of the population close to the stations. The significance of these variables lends weight to the suggested hypotheses derived from social disorganisation theory.

This study corroborates the hypothesis that a combination of social and physical attributes at a station, together with surrounding and city context, affects crime at the station.

The attributes that affect crime and disorder may vary by offence type and data source. However, some attributes at the station constantly appear to be important to explain events at the station and surroundings, such as the presence of corners and hiding places, and poor illumination, particularly in transition areas. Although there was strong evidence in the literature about the impact of stations' exits/entrances on crime events, our models do not corroborate such results; only the number of entrances seems to have some effect on crime and disorder. In the case of Stockholm, social and physical characteristics of platforms and lounges tend to be more important in the models than exits. These findings flag for evidence in favour of theories that claim a link between environment features and crime causation, such as defensible space, rational choice and routine activity theories. Data permitting, future research should link crime rates by different sections of stations (platform, transition areas, lounges and exits) to their specific physical and social characteristics.

Findings of this study have policy implications at least for local and regional planning authorities. The most important message from the study is that security in underground stations is a function not only of the local conditions, but also the surroundings in which these transport nodes are located. This means that security in underground stations should be tackled by authorities that aim to safeguard passengers' security, having a 'whole journey approach'. The effort cannot be put in practice without cooperation from those responsible for security for the wagons, for station premises and for the surrounding environs where people walk to and from transport nodes. Surveys show that most passengers feel safe in the wagon and at the station's environments, but their perceived security levels decrease as they walk to/from the stations (Stockholm Transport Survey, 2009). Actions should also be based on all stations of the underground system, which means that security interventions will be dependent to some extent on how well municipalities in Stockholm County can cooperate to make surrounding areas safer. Although they may not have the power to make structural changes that affect the long-term socio-economic context of these stations (for example, population density, housing mobility, police patrol in the neighbourhood), this analysis offers a number of indications of how some specific environmental aspects (design and land use of stations) may be reconsidered to better promote security at underground stations. Findings support improvements in visibility and surveillance opportunities (avoiding corners, hiding places, few people around, illumination) but also suggest control of broken-windows indicators (littering, social disturbance, overall station's pleasantness) at stations.

There is also a need for specific targeting of particular stations and at certain 'time windows'. For instance, for violence, the time window for intervention should be between 22:00 and 02:00, for property crimes the whole afternoon from mid-day to 19:00, and for vandalism between 19:00 and 22:00. Peripheral stations are more often targeted by crime and disorder than central stations (except for thefts). Security interventions must be defined as a function of crime type. For vandalism, for instance, particular graffiti, it can be helpful in investing vandal-resistant materials but also providing alternatives, such as places for legal graffiti elsewhere in the city. Finally, previous research shows that poor accessibility at underground premises makes the travel of women and less mobile individuals less comfortable and consequently less safe. More research is needed to identify stations in Stockholm that are more problematic from this point of view. More elevators for easy access of the underground station while having to carry objects, strollers or young children should be investigated.

We believe that the results from this study can contribute to the current research on relationships between crime and disorder events in transport nodes by providing empirical evidence from underground stations in a Scandinavian capital. The analysis also combines different data sources, often complementary, to provide a comprehensive picture of what happens at stations and in surrounding areas. The study makes use of events per passenger flow, instead of counts only. However, the study shares limitations with other analyses of this type, namely reliance on data of events reported either by personnel or by the victim, which implies different issues regarding data quality. Data recorded by personnel tend to reflect particular targeted actions that may bias the 'real' distribution of events at the stations (more events of a certain type to the detriment of others). This includes particular programmes against activities that take place at the station, which are perceived as disturbing for passengers, resulting in the end, in more records. For instance, more than half of all records of acts of public disorder are composed of people using station premises to sleep or showing signs of drunkenness – a category that has increased over time, perhaps indicating that the tolerance for these events in public spaces is now lower than it was in the past. On the other hand, acts of public disorder rarely reach police statistics as victims tend to report an event to the police only when they themselves feel victimised, which rarely includes vandalism and disorder. Another limitation is that the modelling section is based on data for underground stations within the boundaries of Stockholm city only (82 per cent of all stations). This does not affect results for the Green line, but potentially impacts on the ends of the Red and Blue lines. With the whole transport underground system, one of the main challenges of future studies is to better understand why end stations are more targeted by crime and disorder than other stations, particularly for violence. Future analysis should also take into account how other aspects of the city's geography and the presence of different geographical barriers, such as a lake, a river or a park, are also influential in defining regional patterns of offences. These regional criminogenic conditions indirectly affect the security conditions at an underground station for example, providing hiding places, as well escaping opportunities for motivated offenders at the stations.

This study links environmental features of each part of the stations (platform, transition areas, lounge and exit) to their overall rates. Data permitting, future analysis should consider linking the place of the event to each particular section of the station. One way to produce the data is by having access to the so-called 'free-text' (unavailable for this study), with details of each event. As it is now, it is not always possible to attach the exact place of the event at the station to specific internal features of these settings. It is equally important to separate out car-related crimes from other property offences, as these are likely to be dictated by whether or not stations have parking facilities. Moreover, the modelling strategy adopted here has proven to produce meaningful results, but future attempts to model crime and disorder rates could instead test the use of composites or indexes to reflect more general conditions at the stations and in surrounding areas. Instead of using the individual variables broken down by sections of the stations, aggregated variables could be tested as overall indicators for, for instance, good/poor visibility or formal and informal social control. Another, perhaps more appropriate strategy is multi-level modelling. This would better capture the nested nature of the conceptual model with stations nested in neighbourhoods, which in their turn are nested within larger socio-demographic areas.

When interpreting these findings, we must bear in mind that the analysis is based on offences data only. Our findings lend weight to principles of traditional urban criminology theory such as routine activity and social disorganisation, but also on the impact of environmental features on our behaviour. Future studies should consider how different types of people passing the stations (by crime propensity and by risk of being victimised) become affected by these environments. Situational Action Theory can help further the analysis of the role of the social environment in crime causation (Wikström *et al*, 2010, p. 56). More specific descriptions of these environmental attributes, particularly their temporal circumstances for both offenders and victims, will most likely identify which stations prove even more criminogenic for certain types of people. Environmental attributes of stations and surroundings can also be linked to passengers' levels of fear, during the trip, at transition nodes and on the way to/from them. The link between stations' surroundings and fear of crime must be better understood. We see this study as only an initial step to identifying what makes underground stations vulnerable to crime and disorder.

Acknowledgements

We thank the Swedish Transport Administration (Traffikverket), Stockholm Public Transport (SL) and Stockholm municipality for financing this research project. We also thank Ulla Wittrock (Police in Stockholm County), Stefan Liljevall (Stockholm Statistics), Mats Pergel (SL) and Peter Assor (Veolia) for providing data for the analysis.

Notes

1 In November 2010, stations were revisited on the evening/weekend to get a better idea of specific features, such as illumination.

2 Hot spots maps were produced using Kulldorff's scan test (SaTScan version 9.01; Kulldorff, 2010) and police-recorded data across Stockholm city. This technique has a rigorous inference theory for identifying statistically significant clusters (Kulldorff, 1997). The space–time scan statistics were used in a single retrospective analysis using data from 1 January 2006 to 31 December 2009. A 4-year data set was collapsed into 'one year'. All space and time dimensions of the data are kept (by day and location) except 'year'.

3 Statistical Package for the Social Sciences, Version 17.0 (2010), but virtually any other statistical package can be used for this purpose.

4 We employed Pearson's correlation for all independent variables in the five sets of covariates before Step 1 to identify variables that potentially contribute with similar information to the models. The histograms of the dependent variables showed skilled distribution. Thus, rates of crime and disorder were transformed into their natural logarithms.

5 This term was first suggested in urban criminology by Ratcliffe and McCullagh (2001), referring to mismatch between crime hot spots and police perception of high-crime areas.

6 Paraphrasing the known 'Eyes on the street' by Jane Jacobs (1961) in the book *The Death and Life of Great American Cities*, in which she suggested that people witnessing what happens in the streets reduces crime.

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Appendix A

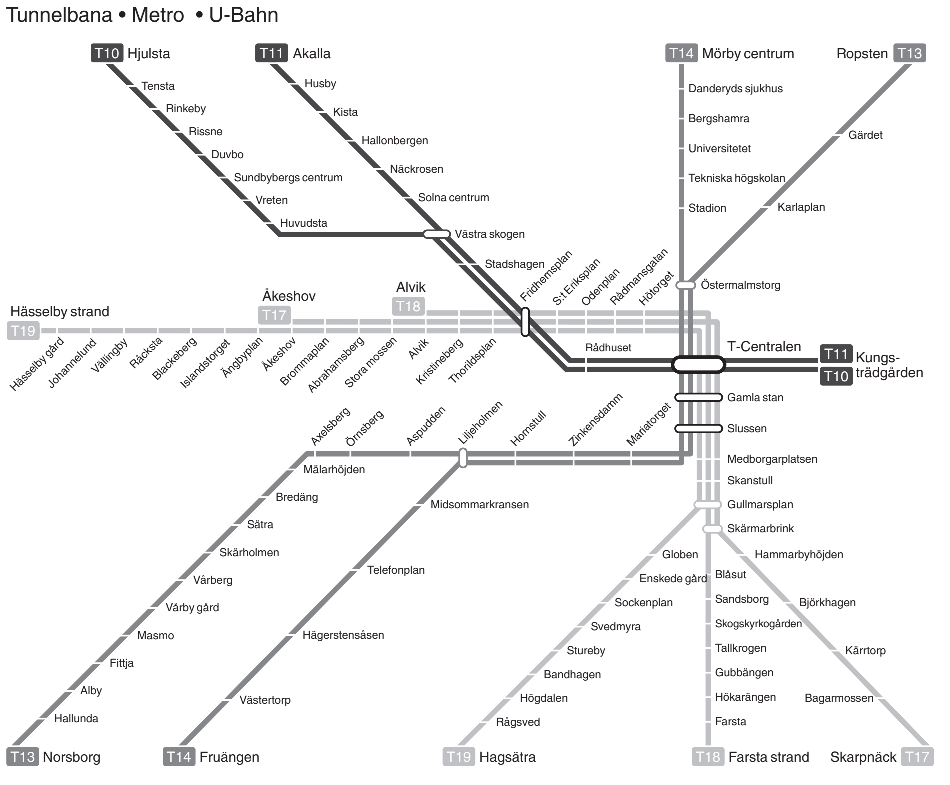

Figure A1: The Stockholm underground system. — Red; — Green; — Blue.
Source: AB Storstockholms Lokaltrafik, 2011.

Appendix B

Table B1: The data set of study: variables from fieldwork and surroundings

Variables				
Platform	*Lounge*	*Transition area*	*Exit*	*Surrounding area*
PBlock, PCorn, PCove, PCrow, PDetr, PDist, PDrnk, PFenc, PGuar, PHid, PIllu, PLevl, PLitt, PLoun, PMirr, PNice, PNum, POpen, PRoug, PSeat, PSecu, PSocd, PSun, PSur, PUndr, PVend, PView, PVis, PWait, PWall, WIllu, WCrow	LAtm, LCafe, LCorn, LCrow, LDetr, LDist, LDrnk, Lelvs, LGate, LGuar, LHid, LIllu, LLitt, LMirr, LNice, LOpen, LPhon, LPhot, LPlat, LRest, LRoug, LSeat, LSecu, LShop, LSocd, LStor, LSun, LSur, LTick, LUndr, LVend, LView, LVis, LWind, WSocd, WLitt	TCorn, TCross, TCrow, TDetr, TDist, TDrnk, TElv, TElvs, TEsdw, TEsup, TGuar, THid, TIllu, TLevl, TLitt, TMirr, TNice, TPram, TRroug, TSeat, TSecu, TSocd, TStep, TStor, TStrs, TSun, TSur, TView, TVis, TWalk	ECorn, ECrow, EDetr, EDist, EDrnk, EEsdw, EEsup, EGuar, EHid, EIllu, ELitt, EOpen, ERoug, ESeat, ESecu, ESocd, EStep, EStrs, ESun, ESur, EView, EVis, EWalk.	SAtm, SBar, SBike, SBuss, SClose, SComm, SConn, SDrnk, SEvnt, SFenc, SGraf, SGree, SGuar, SHome, SLitt, SMall, SMeet, SOpen, SOuts, SPeds, SPlay, SPoli, SRecr, SResi, SRest, SRoad, SShop, SSkol, SSoci, SStreet, SSysb, STtaxi, SToil, STrans, Swall AVInc, CityD, Forg, P in-Out, PopD, Villa, YMal, CAtm, CCTV, CExit

P=PLATFORM, L=LOUNGE, T=TRANSITION AREA, E=EXIT AREA, S=SURROUNDING AREA, W=WINTER (variable's situation in Winter).

Notes: *Atm*=Presence of ATM inside the station; *AVInc*=Average Income (SEK/year) in 2006; *Bar*=Presence of bar(s); *Bike*=Bike lanes; *Block*=Many structures (objects) blocking view; *Buss*= Station is close to bus stops; *Cafe*=Presence of cafes; *CAtm*=Number of ATMs within 100 m; *CCTV*=Number of CCTVs placed at a station; *CExit*=Number of exits; *Close*= Station is a closed type (enclosed station); *CityD*=Distance from city centre; *Comm*=Station is connected with commercial area; *Conn*=Connection to other trains; *Corn*=Presence of dark corners; *Cove*=The place is covered by (rain) shield; *Cross*=Presence of cross-sections/junctions/disruptions of one station by another station; *Crow*=Overall crowded at the station (low (0–5), med (6–10), high (+=11)); *Detr*=Any other physical deterioration at the place; *Dist*=Presence of social disturbance (loud speech/kids fooling around); *Drnk*=Presence of drunk or homeless; *Drnk*=People drinking in public (only for surrounding area); *Elve*=Presence of any elevator; *Elvs*=Elevator smells/has lot of graffiti; *Esdw*=Escalator(s) going down; *Esup*=Escalator(s) going up; *Evnt*=Presence of event location/cinema/sports arena; *Fenc*=Use of fencing; *Fenc*=Surroundings of station is fenced off (only for surrounding area); *Forg*=Population with foreign background in 2007 within 100 m; *Gate*=Type of gates available at lounges (old=1, new=2, mix=3); *Graf*=Presence of any graffiti in surroundings (only for surrounding area); *Gree*=Station is surrounded by closed green area (low visibility); *Guar*=Presence of private guards; *Hid*=Hiding places; *Home*=Presence of homeless; *Illu*=Sufficient/effective illumination; *Levl*=Number of levels of station; *Litt*=Presence of any litter; *Loun*=Lounge is easily visible; *Mall*=Presence of shopping mall; *Meet*=Station is connected with square/meeting place (many people); *Mirr*=Presence of mirrors; *Nice*=The place has nice/pleasant atmosphere; *Num*=Number of platforms at station; *Open*=The place layout is open type without walls and roof; *Open*=Open layout of station in surroundings (only for surrounding area); *Outs*=Presence of pawn/eating out shops; *Peds*=Pedestrian paths; *Phon*=Presence of any phone; *Phot*=Presence of photo booth; *P in-out*=Net population (difference between population moving in and moving out from the area in 2007); *Plat*=Platform is easily visible; *Play*=Presence of recreational parks within a visible range; *Polis*=Number of police stations within 100 m; *PopD*=Population density; *Pram*=Track available for pram; *Recr*=Presence of car parks; *Resi*=Station is connected with residential area; *Rest*=Presence of rest room; *Rest*=Presence of restaurant (only for surrounding area); *Road*=Close to motorways/big roads (low surveillance); *Roug*=The area (partly) built of rough material; *Seat*=Presence of seats/benches; *Secu*=CCTVs are placed and visible; *Shop*=Presence of shops; *Shop*=Shops/cafes(only for surrounding area); *Skol*=Number of school within 100 m; *Socd*=Presence of social disorder; *Soci*=Presence of 'social help care'; *Step*=Size of stairs; *Stor*=Space used as storage for stuff; *Street*=On-street parking; *Strs*=Presence of any stairs; *Sun*=Sunlight easily illuminates the covered places; *Sur*=Possibility of surveillance by others; *Sysb*=Number of alcohol-selling premises within 100 m; *Taxi*=Close to taxi stops; *Tick*=Presence of more than one operated ticket booth (per lounge); *Toil*=Public toilet; *Trans*=Station is connected with transition area/low flow of people; *Undr*=Located underground; *Vend*=Vending machines; *View*=Clear view from outside; *Villa*=Housing is Villas (owned housing); *Vis*=Everything is visible at the place; *Wait*=Presence of waiting room; *Walk*=Long walking distance; *Wall*=Walls between two areas; *Wall*=Station is walled off (only for surrounding area); *Wind*=Open windows; *YMal*=Population comprises young men (aged 15–30 years).