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Practical Challenges and New Research Frontiers for Safety and Security in Transit Environments

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This chapter brings together this edited volume, and highlights and summarizes the main findings presented in the book, based on each of the preceding five sections. It examines the conceptual framework, and the main findings that arise from each section. These include safety and security at the transit node, the journey, links to the surrounding settings and the perspective of the user. It provides an overview of why safety and security is challenging and complex, and discusses the utility of the conceptual framework in tackling this. It then suggests new research frontiers for safety in transit environments, before concluding with some recommendations for future policy.

Research into transit safety and security contains a number of overlapping themes, and, as presented in this book, they have, to some extent, become united. The book illustrates a rich multidisciplinary field (for example, criminology, urban planning, transport planning, sociology, transportation engineering, psychology, geography, architecture, designing, security expertise), the areas of which, in practice, have each developed within their own professions, from different disciplines and theoretical principles. It is suggested this multi- or interdisciplinary approach is the way forward, as reality demands more integrated, holistic and cross-disciplinary research, particularly methods that are capable of guiding and dealing with an ever-increasing volume of space and time data, constituting the new frontier of research in urban safety, not least in transit environments.

The conceptual framework

This book was divided into six sections: the first provided an introduction to safety and security on transit environments. In Chapter 1, the book's scope, context and definitions of some key concepts were discussed. A conceptual framework for safety and security in transit environments was also identified, and this provided the basis for the structure of the book. The main sections of this book followed on from this: section two considered *the micro*

settings of transit environments; section three examined *the transport journey*; and section four investigated the *meso and macro settings of transit environments* and their links to the wider environment. Section five then examined transit settings from the point of *the user*, those persons who use the system for a variety of purposes.

In Chapter 1, some of the key concepts used by authors in the book were defined, namely, *safety and security; public transportation; transit environments/settings; transport nodes; and transit crime*. Whilst these may seem fairly simple to define, it was evident that the authors had a different understanding of, and offered a range of definitions for each of these. This suggests that there is a high level of complexity within public transit settings and that the safety and security of these systems must be addressed through a multidisciplinary perspective. The challenge is to draw out the best of these disciplines, both theoretically and practically, and merge them in a coherent and consistent approach.

Chapter 2 provided a discussion of the main theoretical perspectives that can be used to examine safety and security on public transit. It was evident that a number of salient theoretical perspectives could be used here, stemming from a range of fields. What was concluded in this chapter was that none of the current theories have been applied specifically to transit systems, and none offer an overarching explanation for safety and security in transit environments. The complexity of the transit system presents a series of challenges, born out of its complexity, as a rapidly changing setting, the diverse nature of its users and the complex level of interaction between the transit system and its wider environment. However, some important lessons can be learned by examining each aspect of the conceptual framework, which parts II to IV of the volume examine in considerable detail.

There were a number of fundamental reasons for the conceptual framework. Firstly, the transit setting is itself multifaceted. It contains fixed infrastructure such as stops and stations. Some of these may be large and highly complex, such as a sizeable interchange across several platforms. Some may be linked to integrated shopping centres, have several platforms and levels, and if multimodal, connect a number of transport modes. Some may be very simple such as a single post representing a bus stop. However, as was evident in the book, even the crime patterns around a single bus stop can be quite varied. These stops and stations have routes that connect them. This connection is made through a range of vehicle types, and travel may be on different modes such as bus, rail (over-ground and underground), ferry, tram, for example. However the extent of the transit system goes beyond these stations and routes.

When considering the passenger, it is necessary to take a whole-journey approach, door to door from start to end of the journey. Thus, transit environments consist of a walking environment, a waiting environment and an on-vehicle environment. Safety and security has been shown to vary across

each of these different components and settings. However, they are all integral and fundamental to the user. If one link is unsafe, the user may change their journey or switch to alternative modes of (non-public) transport. Thus, safety and security should be maintained for all users at all sections of the journey. However, perceptions and risk of victimization are not homogeneous, and the book explores this from the perspective of different passengers. For example, gender, age, income and disability are all factors that can influence the user, and these may all impact on their ability to travel, their reliance on, and their fear of travelling on public transport.

Transit settings have a further layer of complexity, and it is not just passengers who are at risk. There are a range of peripatetic staff who work on the system such as drivers, conductors, ticket officers, ticket inspectors, security staff, police and a range of other persons who may work within these settings. In addition, beyond the users (staff and passengers), the infrastructure itself may be at risk, so the target may be a platform, a bus shelter, a moving vehicle or a rail track, for example.

An additional layer of complexity is provided by the transient nature of the system. This may seem obvious, but users travel across this system for different purposes, for example, commuters, schoolchildren, retired persons, tourists, those working on the system, those who use the system for entertainment and leisure. Therefore as a function of usage the system will receive low and high volumes of passengers at different times of the day and different days of the week. Certain times are considered peak and others off-peak, and travel patterns reflect movement to specific places for particular activities. Moreover, stops and stations serve different functions within the urban environment. Some are on the periphery, transporting persons in an out of an area, some serve as central areas of convergence, and others are more specialized, such as an out-of-town shopping centre. The safety and security concerns related to each of these are different. Therefore, this is, in effect, a highly mobile system, and the risk and perceived risk from a safety and security perspective can change rapidly.

A final additional level of complexity is provided by the fact that the transit system is not isolated. Whilst it is unique, it also interacts with its surrounding environment. The boundaries of the transit system may become blurred when we consider the walking aspect of the whole-journey approach. Whilst many transit nodes have access controls, and defined boundaries with physical perimeters, there are differences in the extent of how and where access is restricted to the transit setting. Often there is a paid access control, although some parts of a station may be accessible to all. For some bus stops there may not be any physical separation from its surrounding environment. However, the movement of users ensures the transit system interacts with what is around it. For that reason alone, there is a need for safety and security of transit environments to consider both the places in the immediate vicinity of transit settings and the transit system as

a function of the wider urban (or rural) setting itself. A number of chapters in this book discuss this interaction or interplay between the transit system and the surrounding areas, which is, at present, only partially understood.

Therefore a focus on the layout of the transit environment, and the users of the system, is a structured and appropriate approach for examining safety and security in these environments. This allows an examination not only those at risk, the persons who use the system, but also, the system infrastructure itself. In turn, it is argued that responsibilities for minimizing such risk can be also examined within the same framework, by assigning responsibility to those who police, manage, regulate, design and maintain these settings.

Part 2: Safety and security at transit nodes

This section considered safety and security at the transit node, the micro setting. Three of the chapters examined a specific crime type that is often problematic at transit nodes, namely theft. Each chapter identified specific sets of risk factors that increased or reduced opportunities for theft at these transport nodes in three different countries. The fourth chapter examined safety and security at stations from the perspective of opportunities for 'guardianship' against crime, and the extent to which features of the station influence this. All the chapters identified that the transit node was not the only factor that influenced the extent of opportunity and risk (for both committing and preventing crime), and that the surrounding environments of transit stops and stations also influenced risk and opportunity.

The chapters by Ceccato and colleagues (Chapter 5) and Newton et al. (Chapter 6) investigated pickpocketing at bus stops and underground railways respectively. Both identified that crowded conditions can increase opportunities for stealth crimes at stops and stations and that levels of ridership were related to theft. Both identified there were concentrations of pickpocketing at particular stops and stations on the network. Both found micro concentrations of theft in 'hot spots'. The position of the stops and stations on the network was also deemed relevant, for example, those that served the periphery and likely the start and the end of the journey, those that were in the central business districts, and those that were an interchange. Levels of risk varied by station position within the transit network (periphery, central, interchange, entertainment centre), and, moreover, by the time of day at these station positions on the network. Ceccato et al. found that when a bus stop was present, levels of theft were higher when than not present, although not all bus stops were high risk. A question raised here is what combined with a bus stop increases the risk of crime. Similar issues were raised by Ward et al. (Chapter 10) and Hart and Miethe (Chapter 7).

Newton et al. and Gentry (Chapter 3) found evidence of an interaction in theft levels between a transit setting and its surrounding environment.

Indeed the Newton et al. chapter found that whilst both station characteristics and features of the nearby environment influence theft risk, the combined effects of both the station and its surrounding setting were more powerful. Gentry examined a specific type of theft, focussed not on act of the crime itself and more on the target stolen. Theft today is increasingly been driven by theft of mobile electronic devices such as smartphones, and in transit settings this is becoming particularly problematic. These electronic devises are highly desirable for offenders, and transit settings provide favourable conditions for offenders. Again, levels of ridership at stations influence these thefts, and levels of theft were found higher at interchanges

Uittenbogaard et al. (Chapter 4) examine how guardianship may play a role in reducing crime at transit nodes, and how levels of guardianship might be influenced by the layout and design of a node. Potential capable guardians include police, guards, ticket inspectors, shop owners and drivers. Guardianship may even be unintended, the result of a passenger whose presence simply deters an offender. From the research, it is evident that lower levels of familiarity with an environment can impact on guardianship, as willingness to intervene is reduced. Unfortunately at transit stations, levels of familiarity are often low. The authors discuss how particular characteristics of a station can also increase or reduce opportunities for guardianship, based on visibility and surveillance measures. They found the micro environment of a station particularly influential here, and suggested 50 per cent of guardianship was influenced by station characteristics and line of sight. Furthermore their study suggested levels of guardianship varied between the different settings within stations, including platforms, lounge areas, transition areas, and exits and entrances. Moreover, guardianship did not seem to be influenced by environmental conditions outside of a station. This suggests that micro-level prevention measures inside a station as measured by line of sight and visibility can all influence levels of effective guardianship, but that outside a station setting other factors may influence guardianship and crime prevention opportunities. La Vigne (Chapter 14) for example discussed the very different conditions of subway stations and subway station car parks, and the implications this had on levels of victimization and the effectiveness of prevention measures.

Part 3: The journey

This part of the book contained three chapters. Sedelmaier (Chapter 7) examined the potential impact of building a new station in an area and how that might influence the travel behaviour of offenders. Wiebe et al. (Chapter 8) investigated young people's transit journeys and how fears of violence on different transport modes impacted their travel behaviour. Solymosi et al.

(Chapter 9) explored a very specific part of the transit journey, the entrance onto the bus, in effect the gateway to the public transport vehicle.

Solymosi et al. investigated a very specific setting, the boarding of a bus. This was identified as a potential bottleneck resulting in crowding, close levels of contact between passengers and possible opportunities for pick-pocketing. Audio messages, reminding passengers that there may be pick-pockets in operation, were also tested. Three settings, waiting for a bus, boarding a bus and being on a bus, were all simulated through laboratory conditions. The authors identified boarding a bus as a bottleneck when persons came into very close contact with each other, more than in the waiting and on-vehicle setting. However, they also found that the duration of this close contact was reduced compared to the waiting and on-vehicle environment, and thus the length of time available for an offender to pick-pocket might be reduced. Finally, it was evident that the audio messages did appear to impact on the behaviour of participants.

Sedelmaier examined arrest rates in an area in which a new rail station was introduced, to test whether this influenced levels of offending in an area, and, indirectly, whether offenders modified their travel behaviour as a result of a new station. Findings corroborated previous studies showing there was no evidence of an increase in crime. Thus, residents' fears of new offenders being brought into the area were not met. Potential explanations are that the infancy of the station had not yet impacted on travel behaviour; the system exported offenders out of the area rather than bringing them in; levels of reporting or recording were not reflective of changes to crime levels; or other. It could be argued too that this supports other studies in this volume and elsewhere, which find that it is the presence of a station as well as additional factors nearby, in combination, which increases or reduces crime risk, as opposed to the presence of a transit network or system.

Wiebe et al. examined in detail the movement of young people, a group who, in general, are often reliant on public transit. This chapter compared use of different modes of travel, subway, bus and also on foot and by car, the latter two possibly outside of the public transit system. Perceptions of fear by travel mode at different times of the day were compared with actual risk based on levels of victimization from recorded crime. Levels of fear increased after dark, and there was no difference by travel mode during daylight hours. However, young people felt safer in cars and buses, and less safe on the subway at night. This may be reflective of the particular study area, as many studies internationally have found levels of fear are higher on buses than on subways. Another interesting aspect of this study was that fear was not linked to the amount of time the young people actually spend in high-crime areas. Two possible explanations are that they were either unaware of risk, or were in familiar areas and thus did not feel risk was greater in these places.

Part 4: The meso and macro settings: the wider context

In this section, Ward and colleagues (Chapter 10) introduced the concept of malignant mixes and examined how transit settings and nearby features interact to influence safety and security. Hart and Miethe (Chapter 11) examined violence around bus stops and how the environment of a bus stop is related to victimization. La Vigne (Chapter 14) discussed crime at transit settings within and near the Washington, DC, Metro, both in the subway setting and in nearby car parking facilities. Yu and Smith (Chapter 12) examined the use of and fear of transport systems by different neighbourhood user groups based on a range of socio-economic and demographic factors. Smit and colleagues (Chapter 13) investigated the impact of a gated community in South Africa and how modification of the built environment can influence travel behaviour and patterns.

Ward et al. introduce malignant mixes, which they identify as combinations of facilities which together create more crime than would otherwise be present. Their chapter demonstrates these through two case studies, robbery in New York and violent assaults in Houston. They suggest that whilst some combination of facilities may increase crime, others may actually reduce it. This and the study by Hart and Miethe (Chapter 11) on violence at bus stops, using very different methodologies and data, both found evidence for particular configurations of places as more conducive to crime. This also supports findings in Parts 2 and 3 of the book, that it is the transport system in combination with the presence or absence of particular factors nearby that is more risky. Time of day was also shown to be a key factor in this, as malignant mixes were found to be both location and time specific.

Hart and Miethe found concentrations of violence clustered around a small number of bus stops, as did Ceccato et al. (Chapter 5). They profiled the configuration of land parcels in which violence occurred, and found that where a bus stop was present, violence was more likely. They examined the configuration of eight different land-use types, and found the majority of robberies occurred in only about 10 of the 256 possible land-use combinations under investigation. This is complementary to the Ward et al. chapter on malignant mixes, but suggests the mixes may be the result of more than two types of facilities..The overall configuration of the environment of which transit settings are part of also influences the safety and security at these places. Furthermore, whilst some configurations of bus stops and other nearby features increased the chances of robbery by seven times, other configurations next to bus stops actually reduced risk by three times.

La Vigne (Chapter 14) described safety and security at two connected but perhaps distinctly different transit settings, subway stations and subway car parks. The Washington, DC, metro was identified as an example of good practice in terms of designing out crime. A number of factors here included access control, surveillance, and place management and communication.

This was one of the few examples in this volume in which stations in high-risk areas were protected from surrounding crime levels, with the exception of larceny. Most other studies found a transmission of risk between stations and their surroundings. Many of the factors found by La Vigne as good practice for security by design are complementary with the guardianship work of Uittenbogaard et al. (Chapter 4). However, outside of the station, a very different picture emerged in station car parks. There were perhaps a number of implementation failures that restricted the impact of good design here, including problems with restricting access control, difficulties in the surveillance techniques used and less effective place management structures.

Yu and Smith (Chapter 12) and Smit et al. (Chapter 13) examine transit settings amongst wider communities, and how the transit system is an integral component of its wider environment. Yu and Smith analysed travel behaviour patterns of passengers whom they describe as transit captives, those unable to travel without public transport. Their analysis of journey-to-work patterns found two distinct vulnerable groups. The first were low income, below poverty Hispanic and foreign born immigrants who tended to work in jobs that required travel at non-conventional and more risky times of the day, and also tended to live in areas that overlapped with high-crime levels. The second were aged over 55, females, with no access to vehicles, who did not live in areas overlapping high-crime levels, but did experience more property crime in areas they lived. These two groups of transit captives accounted for a high levels of vulnerability amongst transit users measured by victimization, fear of crime and access to alternative forms of transport. Therefore these vulnerable groups lived in areas with high concentrations of public-transit-commuting residents with characteristics related to personal security vulnerability.

Smit et al. examined the influence of enclosed communities in South Africa and found that the gating of these communities had little impact on travel patterns of persons who resided within them, as they tended to be more affluent. Most of these persons travel by car, and this has not changed since the introduction of the enclosed areas. However, these perimeters did impact on the travel patterns of those with lower incomes who perhaps rely more on transit systems, as it increased their travel time considerably, and in some instances increased the walking component of their journey, which was perhaps the time at which they were most vulnerable. This is an example of the built environment impacting on a transit system.

Part 5: The user

Section 5 of the book focussed on the transit system from the perspective of the user: those without whom the system could not operate. Shibata et al. (Chapter 15) considered perceptions of crime and disorder by riders in Tokyo. Loukaitou-Sideris (Chapter 16) and Levin (Chapter 17) both discussed

transit from a gender perspective, acknowledging the higher levels of fear perceived by female users. Uidici (Chapter 18) and Sochor (Chapter 19) considered another group who are suggested as highly vulnerable, those with disabilities, and discuss the experiences and perception of these groups when using transit systems.

Shibata et al. analysed expectations of how many crime and disorder incidents passengers may encounter at stations, levels of actual experiences and perceived levels of unpleasantness of each. They found a significant difference between perceived and expected unpleasantness of more serious rare events, and that the expected seriousness was a predictor of perceived unpleasantness. Thus, reducing the expected frequency of unpleasantness serious events is likely to have positive benefits even if they were to occur.

Loukaitou-Sideris and Levin both consider the perspective of the female user. The first author found that on transit systems, women's fears of crime were greater than those of men; that women have specific travel needs and are more fearful of the bus than the metro (contrary to Wiebe's findings for young people after dark); that some female user groups such as the elderly and those who are low income can be particularly fearful; that certain environments and settings such as poorly lit and unsupervised settings or remote areas are seen as particularly unsafe. More important, these fears of crime can translate into the altering of travel behaviour. Suggested measures to alleviate such fears included better design features, policing, security technology and some education and outreach activity. Many of these findings are echoed in the chapter by Levin. For example, higher levels of fear are evident amongst female transit passengers especially after dark. However, Levin argues that it is important not to overgeneralize between groups, and that a range of factors can influence fear of crime on transit systems including age, gender, ethnicity, economics, behaviour, culture and experience, for example. The author argues for a more holistic approach to safety, designing transit settings that are safe based on the needs of all users. This does not mean, however, that by not designing safety features specifically for women that they would be unsafe. The design should be specific to the setting and the user, and meet the needs of all users to be safe from harm when travelling.

Uidici and Sochor investigated the needs of a further vulnerable group, those with disabilities. Whilst both chapters used slightly different approaches, there were some consistent messages. Both authors identify that this group is considered as highly vulnerable. Both argue that transit systems should be designed to meet the needs of these users. Uicini advocates for the removal of a socially constructed barrier and says that the disabled person is viewed as having a characteristic or a personal attribute that disables them from using the system. They argue that if fear stops any person from travelling on this system, with or without any physical impairment per se, then that person is in effect then disabled by not being able to travel on public

transit. Thus, systems should meet the needs of all passengers so as not to exclude anyone. Solutions suggested include community research action, better legislation and training. Sochor discussed a specific disability, visual impairment, and investigated how ICT can be used to remove some barriers to travel for these users. However it is advised that a one-size-fits-all solution does not work and that the design of this solution must meet the needs of the user. Whilst pedestrian navigation systems could improve access to public transport for this user group, a number of possible interventions exist; they include developing long term projects, deal with privacy issues related to the new technology, and asses the overall design of the built transit environment for travellers with visual impairments. The system must be designed to meet the needs of all users for autonomous independent travel.

This section has summarized the main findings of this book. The next section now moves on to review some of the key possible areas identified for further research.

Future research questions

This section draws on previous research and lessons from studies contained in this book to put forward a number of research questions and to map current research frontiers in safety and security in transit environments. This volume has demonstrated how safety and security in transit environments is dependent on multidimensional conditions that act at various geographical scales in the urban environment. These conditions are determined by the *micro-environmental attributes* of a node (a bus stop or a station); the characteristics of the immediate environment (short walk distance from the node); and the type of neighbourhood in which the node is located as well as the relative position of both the station and the neighbourhood in the city – *the meso and macro transit settings*. Safety and security should be examined in the content of a *whole trip approach,* the door-to-door movement – *all aspects of the journey*, particularly from the perspective of those who use the system, *the users*. Future research questions are discussed based on these four distinct dimensions of safety and security in the public transportation system.

Micro transit environments

Transport nodes such as bus stops and train stations are examples of micro transit environments. Findings from chapters in Part 1 of the book found that these may be highly criminogenic places and that there were distinct patterns of crime associated with higher levels of ridership around certain nodes. For future research, Ceccato et al. (Chapter 5) suggest a key challenge is to elucidate the processes through which other land use and socio-economic variables interact and influence levels of pickpocketing in bus stop cells

using a long-term data series, perhaps broken down by time. Compared to other analytic approaches, the methods used by Ceccato and colleagues avoid the limitations imposed by using irregular arbitrary administrative zones, by applying small cells of 50-by-50 metres over the study area. Data permitting, future analysis should investigate the vulnerability of bus stops during peak and off-peak hours of the day. Although tests were performed in this study, the dataset was not appropriate for creating the same peak and off-peak time windows for both independent and dependent variables. The peak and off-peak hours should be examined, as changes in people's routine activities are expected to affect bus stops differently, for example, at different locations, at different hours of the day, the week and by season.

Newton and colleagues also identified that crime at transport nodes is influenced by ridership levels peak and off-peak travel hours, and a nodes relative position within the transit network. They also suggest that what happens at a node is symbiotic with its external surroundings. They advocate the importance of the interplay between a transit node and its environs. Moreover, the research by both Newton et al. and Gentry (Chapter 3) suggested that it is important for pickpocketing research to examine types of products stolen, as this might influence patterns of pickpocketing on transit networks. Gentry's findings from the United States indicate effects of guardianship opportunities, which were further studied in Uittenbogaard's chapter. The findings of both authors suggest the need for a more thorough investigation of the role of the environment on people's movement at transport nodes, as performed by Solymosi and colleagues in Part 2 of this book. An analysis of the movement of passengers at the stations can provide an idea for the best possible routes of guardians, where they should be present, and allow areas that have potential field of views.

The journey

The decision that an individual takes to be on the move may result in a reduction of their safety, depending on where and how they travel. Some crimes happen whilst a passenger is on the move, such as on a bus. Knowing the nature of people's interactions while they are on a bus can be helpful in preventing transit crime on board. Solymosi and colleagues' chapter uses data collected from laboratory experiments to address differences in interpersonal distances and crowding behaviour inside a vehicle, such as a bus. They showed that crowding peaks happen when passengers board the bus, creating opportunities for pickpocketing. Results also indicate that people are capable of modifying and willing to modify their behaviour within the crowded environment in light of audible warning messages. The authors suggest that further research should look into a time threshold for pickpocketing, and determine whether increased time spent close to one another during the waiting phase increases exposure to potential pickpockets, and

also whether the time spent very close to one another while boarding is long enough for a contact crime to occur.

Some researchers believe that the implementation of new transportation systems introduces crime by facilitating access between crime-prone areas and relatively low-crime areas. Similar to previous research in other areas, Sedelmaier found little evidence for this and suggests a follow-up study, as the system has expanded to include more municipalities. It could be that the system's ability to influence offender awareness spaces or the opportunity structure had simply not reached maturity in the year-and-a-half following its introduction. Therefore, the author suggests that it would be instructive to determine how ridership patterns – and exposure to potential targets – have changed with the system's growth. Regardless of actual victimization risk, the perceived risk experienced by public transport users is a real component of trips, which was exactly what Wiebe and colleagues analysed by mode of transportation also in the United States.

Wiebe and colleagues' study produced novel insights into the perspectives of young people and their perceived safety from violence as they travelled in different transportation environments during their daily activities. The authors remind us that, whereas the study shows what factors appear to impact perceptions of safety, the analysis does not lend itself to understanding why they have such perceptions, which should be a focus for future studies. Wiebe and colleagues suggest findings from their study should motivate future mixed-methods research, using both qualitative and quantitative approaches to better understand the mechanisms by which transportation environments impact on young people's perceptions of safety and to find ways to make them actually feel safer.

The meso and macro settings

This part of the book considers the relationship between transit systems and safety across the wider neighbourhood and city context. It is in these environments, according to Ward and colleagues, that malignant mixes may be found. They suggest that certain combinations of activities adjacent to each other may serve to increase or reduce crime risk, of which the transit setting may play a key role. Their preliminary findings suggest further research into the malignant mixing of facilities is worthwhile and can be extended beyond the current study to include any number of facilities, such as malls and parking garages. Accordingly, Ward and colleagues suggest that future research consider not just one land use or activity, nor one hot spot pattern for the year under study. Rather, the authors suggest studying combined activities and land uses. They especially advise future research on crime and security in terms of both public and private transportation, both vehicle and pedestrian movement. As suggested in LaVigne's chapter, parking facilities associated with these transit hubs may serve more as attractors than as

generators of crime. Parking facilities in general have been documented as crime attractors due to the wide array of available targets, a lack of surveillance and proximity to major thoroughfares for easy escape. The Hart and Miethe chapter also examines these configurations of land use and finds evidence to support future research here.

LaVigne suggests that future studies should consider the notion that transit crime prevention interventions cannot be evaluated in isolation; rather, they should be multifaceted. As her study found, successful interventions at transit stations were not replicated at transit car parks. The task, however, is not a simple one. Such an undertaking presents challenges from an evaluation component, in that it is difficult to untangle what component (or collection of components) of the comprehensive crime control measure is yielding a beneficial impact.

Hart and Miethe identified mixes of facilities that are highly criminogenic near bus stops. They suggest that once 'dangerous' bus stops have been identified, further research at these nodes should focus on what in particular are their risk-enhancing properties. They suggest future studies should identify the particular mechanisms that contribute to these differential risks for similar types of environments, some vulnerable to variations in time and people's routine activity. Some routine activities are hindered by geographical barriers in urban space that limit accessibility. Smit and colleagues analysed exactly that in South Africa and assessed the impacts of neighbourhood enclosure on travel behaviour, congestion and walking access of various interest groups inside and outside the neighbourhood. They suggest that future research should be context specific and investigate the particular crimes that occur around enclosed areas and the patterns of victimization, including how this specific context influences different people and transport users, such as woman, children or the elderly, who may be more vulnerable to crime. In addition, future studies should also investigate the impact of extended travel times on increased vulnerability during other phases of the journey. Smit and colleagues' findings raise equity and gender concerns around the fairness of neighbourhood enclosure practices on non-residents, and point to the need to rethink the conditions under which enclosures are allowed. Some of these issues are dealt with in the chapter by Yu and Smith, as well as in Part 5 of this book.

Yu and Smith identified two distinct types of transit commuters who were clustered in different parts of New York. They suggest that findings from their study can be used to build guardianship and assist place management in areas with high concentrations of what they call vulnerable transit commuters. As they assessed these groups in New York only, they suggest future similar studies should be performed in other cities. Yu and Smith also propose future studies look at ways to understand the heterogeneous population that constitutes vulnerable transit commuters and address their concerns in the most useful way.

The user's perspective

Mobility should be considered as an individual right, and as such this book explains why one should care about transit safety from the perspective of those who use the public transportation system. The book includes studies that examine safety and security in transit environments from the perspectives of gender, age and disability. As indicated by Ceccato (2013b), safety and security possesses a dimension of reflexivity, which means that they depend on those who observe and produce them. Thus, a better understanding of safety and security by different groups of society, especially those with special needs (such as the elderly, disabled individuals) is of particular importance for researchers. These groups themselves are the best sources of information about their own fears, needs and mobility barriers. Their opinions were taken into consideration especially in the last chapters of this book (Loukaitou-Sideris, Sochor, Levin, Shibata and Iudici), but they need to continue to be included in future studies and, more importantly, in planning interventions aimed at safety in transport settings.

Using railway stations in Tokyo as a unit of study, Shibata and colleagues assessed the expectation and perception of crime and disorder events using data collected from questionnaires. The findings showed that keeping incivility of the environment to a minimum is important when it comes to improving people's comfort level in their use of railway facilities. However, the event list used in this study was originally from a European study and did not include events specific to Tokyo such as too much crowding experienced on a train; thus, as suggested by the authors, future research is needed to clarify the importance of the local context of Japanese railway station on expectation and perception of crime and disorder events.

The study by Loukaitou-Sideris into women's safety in transit environments found that women have distinct safety/security needs, are often fearful of certain transit modes and frequently adjust their behaviour and travel patterns to avoid them. The author concludes that gender mainstreaming policies have encountered important challenges in their implementation all over the world. Gender-neutral safety policies in transportation environments are often gender blind. Therefore, a way forward is to decrease the current lack of knowledge in this area and promote a systematic strategy for gender equality in transit environments. Levin also agrees that it is important to consider gender equality from an intersectional perspective. This means that the complexity of gender and safety in the public space requires paying attention not just to a person's being a woman or a man, but, in addition, to the intersections between gender and, for instance, age, ethnicity, financial resources, individual experiences and culture. Future studies should consider the context needs in relation to gender and safety, for example, the relation between a particular place, a mode of transport and ideas about the function and use of this transport

mode. For future work on this, Levin suggests that more interdisciplinary research and increased cooperation between professionals from planning, security, social and health services are needed.

Similar conclusions are put forward by Iudici in his study about the experiences faced by people with disabilities, in particular harassment. The author found that individuals with disabilities are much more at risk to be harassed than those without disabilities, however, the extent of the phenomenon and the ways in which the offences are committed are not yet clear or studied. Future research should shed light on the types of preventive activities that can be implemented and the way in which disability is viewed in society. As the author suggests, actions must be inclusive, and disability should not be seen as merely the impairment of which the person is a carrier, but it is also a social product resulting from the way in which society deals with individual differences.

Sochor goes a step further and looks at the case of visually impaired persons and the possible effects of a tailored pedestrian navigation system on their mobility. Interview results with Swedish respondents indicate that with information provision about the built environment and public transportation, positive potential effects include a greater degree of perceived safety, an increased ability to travel alone and in unplanned or unfamiliar situations, and the prioritizing of public transportation over special transportation services. The motivations behind these privacy- and trust-related ratings were not explicitly explored in the interviews, but are of interest in future studies to further understand consumer expectations. The use of ICT to enhance mobility and safety opens up a number of new research questions. For a detailed discussion, see Ceccato (2013a). For instance, data on individuals' detailed movement could help in understanding the link between transportation nodes' surroundings and fear of crime. Chapters by Wiebe and Sochor in this book are examples of this potentiality. Some of these future research questions are of a technical nature, while others trigger ethics questions surrounding the positioning and the tracking of individuals over space and time. As mobile technology advances and the demand for WiFi and phone coverage increases, the electronic device is becoming a target for theft in metropolitan public transportation systems. Future studies should expand on the research presented Gentry in this book, with specific detail concerning where electronic device thefts occur on moving subway cars and the addition of more subway characteristics.

Cross-cutting themes

Throughout the book several themes reoccurred. Some of these are now highlighted as they represent some of the complexities and challenges present in improving safety and security in transit environments, and

provide a useful overview in the development of a holistic and theoretical framework to achieve this,

- A range of concepts were identified, many of which without a common definition, for example, safety and security; public transportation; transit environments/settings; transport nodes; and transit crime. This is unsurprising given the multidisciplinary nature of authors contributing to this volume
- The scope of the challenge on public transit is wide and diverse, across a range of crime types and offences, which is further broadened by disorder, and security-related serious incidents
- The complexity of the transit system, including nodes, routes and the walking setting makes this a difficult environment to examine. Whilst this seems simple, it is highly multifaceted. For example, a node may be a single bus stop, or a large interchange, and each one is very different. Stations may have a perimeter, several entrances and exits, lifts, waiting areas, shops, transition areas, ticket offices, information areas, escalators and platforms.
- Transit settings can potentially limit the potential positive influence of capable guardianship, due to issues such as unfamiliarity poor design may also restrict this.
- The transit system serves multiple functions (for example, a station at the periphery, one serving the CBD, a large interchange, one serving an out-of-town shopping centre).
- The interaction between the transit system and its surrounding environments adds a further layer of complexity, which goes beyond for example a comparison between two bus stops, to two bus stops and the areas surrounding two bus stops. The configuration of the built environment is also related to the transit settings. The relative position of a node on the transit network is relevant to safety and security, such as end stops, interchanges, those in the central business district and night-time economy, and those at specialized services such as out-of-town shops.
- Transit systems are influenced by the range of users of the system, and the particular vulnerabilities associated with different groups, for example, categories which are not mutually exclusive include transit captives: those on a low income, the young, the elderly, females, those with disabilities, schoolchildren; commuters, tourists, late-night NTE users, and leisure and entertainment passengers
- The dynamic and transient nature of the transportation system and the rapidly changing nature of its use makes it complex to understand
- A range of organizations have responsibility for the safety and security of the system, especially at large multimodal interchanges, thus there is a multi-ownership and management issue which adds to the complexity of the system.

Studies have often considered either the risk of crime in transit environments or perceived safety/fear of crime, separately. Future studies should instead combine both of these dimensions of safety and security. As Ceccato (2013b) shows in the Stockholm study, the most risky stations may not necessarily be perceived as the most unsafe ones. This assessment should include a multiple number of users (e.g. daily users, sporadic users, different ages, gender and income levels) as well as personnel who work in and around transportation nodes and in the transportation system itself.

Chapters of this book show examples of the need to take the whole trip into account both in terms of the risk of victimization and perceived safety. More studies, perhaps in other country contexts than the ones presented in this book, should shed light on issues of perceived safety beyond nodes and transportation system itself. Data permitting, future studies should also assess the quality of public transportation systems in relation to safety and security in countries of the Global South, specifically, where and for whom public transportation is the only way to have access to schools, jobs and leisure. Safety is a vital part in the provision of public transportation of the so-called 'transit captives'.

There is a need to investigate the varying degrees of responsibility of individuals for discouraging crime in the transit system (Clarke, 1992; Felson, 1986; Eck, 1994). For instance, by investigating the role include investigating the role of *guardians* who keep an eye on targets, *handlers* who can positively influence potential offenders, and *managers* who monitor places.

A relevant issue in any future research is data accessibility and quality. Current research is limited by the police and other public authority recording procedures. A typical problem is that recorded data does not identify whether an offence happened inside the vehicle (when the bus was parked at the bus stop), at the bus stop, or on the way to/from the bus stop (a few metres from the bus stop). This uncertainty in the exact location of crime calls for a revision and a refining of recording practices. This imprecision limits both the advances that can be made in research and, more importantly, affects the scope of crime prevention and safety interventions.

The analytical challenges for research should be further investigated as a wide range qualitative and quantitative methods, as well as spatial techniques were employed in this book. They include analysis from interviews, focus groups, observations, quantitative analysis of crime data, transit system characteristics, socio-economic and crime data of surrounding environments, and experimental laboratory simulations and travel demand modelling. Quantitative techniques included range of regression methodologies, PCA, CCA, stratified sampling, statistical dispersion measures and other statistical tests, and analyses derived from Geographical Information Systems. Equally important is the selection of the appropriate method of analysis in relation to the research application's goals, which, of course, is related to the choice of a theoretical framework guiding the analysis. This

book provides a useful guide on 'what works' and 'what does not' in terms of methods applied to transit safety and security.

A key issue highlighted by Ekblom (2014) is the challenge of communicating these complexities to appropriate audiences, researchers and experts, including the relevant organizations responsible for safety and security on transit settings. Figure 20.1 attempts to visualize and provide a schematic of the complex interactions that occur at the transit system.

Figure 20.1 suggests the complex interactions that occur along the whole door-to-door transit journey. Whilst passengers are on board a moving vehicle, the vehicle will make several stops at which further interactions occur, but they are not locations at which the passengers board or exit. Here, other users and possible offenders may get onto the bus, thus changing the setting. At each point of interaction on the transit system, a range of possible factors may influence levels of safety and security, including

- passenger density – peak versus off-peak, low and high levels of ridership;
- offender proximity and familiarity with a setting/area;
- guardianship (passengers and peripatetic staff, including police, guards, ticket inspectors, shop owners and drivers);
- design and management (access control and surveillability, help points and information access, visibility and lighting);
- user proximity, familiarity and feelings of safety (transit captives; low-income people; the young, the elderly, females, people with disabilities, commuters, tourists, late-night economy users, people seeking leisure and entertainment, schoolchildren);
- the relative position within the network (peripheral, central business district, interchange, end of line, entertainment district)
- type of safety and security concern (violence, theft, disorder, criminal damage)
- time of day, day of week and season.

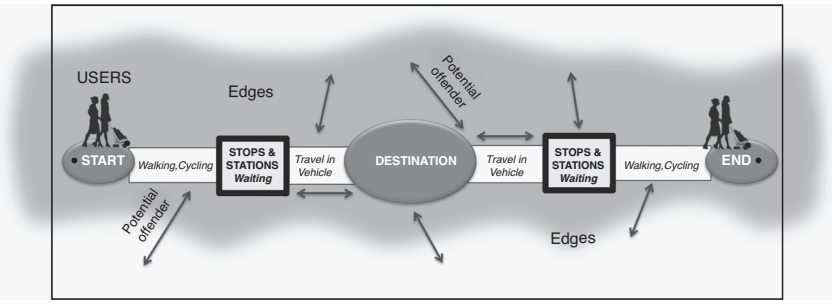

Figure 20.1 Transit settings and their environs: interactions between the settings, the user and the potential offender

Limitations of the book's conceptual model

The conceptual model used in this book (Figure 20.1) is, as suggested above, helpful in providing a framework for systematically relating transit environments to crime and perceived safety. However, it is not free of problems . One of the limitations is that it does not consider differences in the wider contexts (region, country) within which these transit systems are embedded. Economic, technical and institutional characteristics specific to each country are likely to affect the way in which both transportation and safety services are delivered and assessed. The implication of this in practice is that there is no such thing as a 'one-size-fits-all' solution for issues of crime and safety in transit systems.

Another limitation is that the idea of 'immediate context' is not theoretically well developed in the model. Whatever the approach adopted towards the 'immediate context', it is dependent on the inherent characteristics of the transportation system (bus vs. railway), the citywide context (morphology, size), the object of study (offender, target/victim or the environment in itself), and the types of crime (property vs. violent offences); therefore, a 'whole-journey approach' to safety is required. This complexity imposes a united but interdisciplinary theoretical framework that is, for the time being, lacking or is underdeveloped.

Finally, equally important is the need to position the conceptual framework adopted in this book within a wider effort that aims at creating sustainable environments. Public transportation is recognized as an important part of the solution to achieving a more sustainable future. In order to be sustainable, public transportation has to be reliable and safe. Recent statistics show evidence that ridership in public transportation has increased steadily in many countries over the last decade (UITP, 2012). Yet, across the world public transportation is not attained by all. Many still face constraints that impair their mobility and make full use of public transportation – an individual right and a basic requirement for any modern, efficient and sustainable city.

The next section identifies the key recommendations for policy that arise as a result of the research presented in this volume.

Policy recommendations

The policy recommendations put forward here take distance from the detailed suggestions made in each chapter of the book. This section disregards, for instance, potential crime differences that require a tailored, more specific look at each case study. Moreover, although this book includes examples from transportation systems around the world (the United Kingdom, the United States, Japan, Scandinavia, Italy and South Africa), this section attempts to highlight policy recommendations that go beyond

these national contexts. This does not mean that they can be considered as a 'one-size-fits-all' solution for safety and security in transit environments. They are, however, expected to be of relevance for professionals worldwide.

The design of a transportation node (stop and or station) can affect safety and security. Certain design features are shown to be effective – for example, access control, line of sight and visibility, staffing – and should be considered when dealing with existing nodes or when building new ones.

Measures put in place should also increase guardianship and surveillance opportunities as they help reduce opportunities for criminal activity. These design issues to increase guardianship opportunities are particularly important at stops and stations. Staffing has been shown to be especially effective for providing reassurance to passengers and in reducing certain offences.

Interventions directed only at transit nodes have less chance of succeeding in reducing safety and security concerns at transit stations than those which also consider the nodes' nearby environments. Research has shown signs of interactions between a station and its surrounding environment and vice versa. Of particular importance, configurations of certain land types around stations have been shown to increase and or to reduce levels of risk.

These findings demand the cooperation of a range of actors who have responsibility for the transportation system itself and those who deal with safety and security issues in and around transportation nodes and the overall city. These actors include, for instance, those who run buses and trains, and those responsible for maintenance, management, planning and regulation of areas around the transit setting. However, this needs to go beyond joint planning and design, and requires joint implementation. It is argued in this book that safety and mobility require an understating of the barriers that lead to poor cooperation between actors within and across sectors and organizational scales. They demand more than a *quick fix* of the physical environment at transportation nodes (Ceccato, 2013b). The quality of joint collaborative work between actors involved in the provision of safety and transportation services would be worth investigation.

In practice, the whole-journey approach to safety demands the addressing of safety problems found by commuters, especially 'transit captives' during any part of a journey, whether walking, waiting in a station or travelling by bus. In countries in which urban spaces are disrupted by streets closures (e.g. gated communities), safety is compromised, as those who are dependent on public transportation have to walk further and pay more to use buses or trains. The South African case has illustrated the challenges of coordinating urban and transport planning to ensure an affordable and safe public transportation.

Any safety and security intervention should consider the spatial and temporal contexts of the transit node, for example, whether it is an interchange or a peripheral station, whether it serves the CDB, or whether it is an entertainment district which is highly used by tourists or schoolchildren.

The context is also important, as interventions need to be both place and time specific. What is effective at peak times might not be at off-peak times. Drawing conclusions using a number of events should be avoided because large transport nodes are bound to show a greater number of events than small ones. What is needed instead for properly defining interventions is to consider both the flow and the density of passengers by transportation node over time and by crime type. Moreover, the flow and density of passengers in transit nodes affect opportunities for surveillance and passengers' own perceived safety. Previous studies have indicated that the environmental features of transportation nodes are perceived as more risky by offenders (and less vulnerable by passengers) when active guardians are around, during the day, for instance. In contrast, nodes with hidden corners and low visibility at night often tend to be crime targets, or at least raise perceptions of vulnerability. Such space-time assessments of the environmental conditions of nodes contribute to making more informed decisions regarding safety interventions and allocation of resources.

The type of transit mode, such as bus, underground or train, is also linked to safety and security concerns along a trip and at transportation nodes. Evidence shows that certain users feel safer on certain types of systems. Additionally, levels of safety on these vehicles vary by day and by night. Indeed, subway systems are generally considered safer than buses, although this was not apparent for young people after dark in the Wiebe et al. chapter.

There is a need to place *users* at the centre of safety and security interventions in transit environments. Knowledge about the needs of different groups of users is relevant, as well as the obvious benefits of investigating why they might be fearful or at risk. The engagement of these groups in local safety issues might be an effective remedy for the lack of perceived safety. The effectiveness of various types of local participatory schemes for dealing with poor perceived safety on the way to transport nodes is also worth exploring in future safety interventions.

Overall, gender, age, disability and socio-economic exclusion are co-identified as contributing to a lack of safety while a passenger is on the move. Future actions must go beyond this preliminary diagnostic and support plans of action that consider the *intersectionality* of these individual dimensions when approaching those who are victimized or in fear when using public transportation (e.g. being a woman, old, disabled, with low income). The adoption of the concept of 'universal design' (often called 'inclusive design' in Europe) is expected to provide just that, environments that are fit for all (Mace et al. 1991), and at the same time can be tailored to the needs of particular subgroups. The use of ICT technologies can potentially be a resource as well, particularly for groups with special needs. ICT that supports safe mobility for groups with special needs is expected to move from prototypes into products on the market, in which anyone who feels

the need for such aids would be able to access them. Some of them can be adapted to existing electronic products, such mobile phones.

This book, despite its limitations, makes an effort to provide examples of an integrated and holistic approach to transit safety from an international perspective. The task is far from complete, but as the examples illustrated in this book show, steps in such a direction have been taken.

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