Introduction

This chapter aims to examine how changes in transport technology have influenced and altered the landscape for crime, criminal opportunity and the criminal justice system. The original intention at the outset of this chapter was to examine developments in transport and technology separately, and then to discuss a combined definition of what transport technology is. However, in doing this it quickly became apparent that this was a rather futile approach. The traditional definitions of technology were centred on the study of arts and crafts, but soon evolved to include an emphasis on purposeful invention and the strategic deployment of such invention (Rip and Kemp, 1998). In its narrowest sense technology can be thought of as a set of tools. However, more modern definitions of technology encompass a notion of something that works, thus often incorporates systems rather than just tools, and, therefore, in its widest sense, technology can also include skills and infrastructure. When considering advances in transport, from the development of the wheel, of boats and horse drawn carriages, from the first to more modern motorised vehicles, or considering other forms of travel such as bicycles and motorcycles, submarines, hovercraft, aeroplanes, and even spacecraft - it becomes apparent that disentangling developments in transport from developments in technology is rather difficult. When adopting the systems view of technology, this is particularly evident. Indeed, within the transport literature frequent reference is given to the notion of a 'transport system'. Examples include public transport systems, the growth of Intelligent Transport Systems (ITS), automated and smart transport systems, travel demand and forecasting systems, and fuel efficiency systems. Therefore, by virtue of the way modern transport has evolved, there is a defensible argument for considering transport systems and transport technologies as interchangeable terms.

There is not scope within a chapter such as this to consider all the key milestones and changes to transport technology that have occurred and then identify how these have impacted on crime opportunity, even when restricting this to more modern times. The exponential growth of transport technologies within land transport, water transport, rail transport, air transport and spaceflights, could each be written as individual monographs. Instead, this chapter will aim to do the following. It will firstly examine what insights theories of transport technology can offer for considering changes to criminal opportunity. As part of this, the drivers for transport are considered, and, therefore although indirectly, what underpins advances in transport technology. Following on from an examination of transport technology theories and drivers is a discussion of the constraints placed on transport technology development, such as the physical infrastructure, policy and legislation, and societal acceptance and structure, and how each of these might impact on changes to criminal opportunity. This discussion sets the scene for the key question to be addressed in this chapter; in what ways do transport technologies influence crime opportunities? Five mechanisms are identified for this and these are: transport technology dependent crimes; transport technology as an enabler of crime; transport technology as an enhancer of crime; transport technology as a preventer of crime; and, transport technology as an influence on perceptions of crime. Each of these is discussed in detail. The chapter concludes by examining potential future changes to transport technology and criminal opportunity.

A central theme examined throughout this chapter is how have changes to transport technology impacted on the landscape within which offenders commit crimes? The reader is encouraged throughout this chapter to therefore think of the following: who commits a crime; what type of

crime do they commit; when do they commit it; where is it committed; and, how and why it is committed? The key area for scrutiny is whether advances in transport technology have changed the answers to any of these questions.

Theoretical Considerations

Whilst a range of theoretical insights could be drawn upon in this chapter, a useful starting point is to consider McLuhan's (1966) notion of how technology is an 'extension' of the body. As a basic example, the wheel can be considered as an extension to the foot. Rothenberg (1993) breaks this down into two types of extensions, those of action, and those of extensions of thought. Three further types of extensions of action relevant to transport are identified. The first is hand driven tools that are direct extensions of the manual actions of the body, and a useful transport example is the bicycle. The second are motorised or piloted vehicles directly controlled by humans, which could include buses, trains, cars, and planes for example. The third are separate machines; generally relatively fixed structures such as roads and lighting that extend our 'restless need for movement'. Traffic management systems could also be considered as part of this grouping. It is debatable whether motorised but unmanned transport vehicles such as drones would fit into the second or third category here, or in the future were driverless cars would fit, or indeed if technology now demands a fourth category. Whilst better discussion of this is provided elsewhere in the literature (Brey, this volume) transport technology can be considered an extension to the body in terms of geographical distance covered and speed of travel. The question posed here is how this may alter the landscape for criminal opportunity.

A second key principle to consider is Harvey's (1989) notion of space-time compression, that is to say the idea of transport as a compressor of distance. This is concerned with the notion of a shrinking world, often measured in terms of reductions in the time or cost (or both) of travel. Transport technology has a crucial role to play here, although on a wider scale this idea of space-time compression was conceived to relate to wider society including; capitalism and changes to the economy brought about by a reduced time for turnover of capital; the growth of transnational companies and global cities; the international flow of pollution; and socio-technological changes to the structure of society (Giddens, 1984). There is a vast literature available on this subject (Warf, 2008; Oke, 2009) and perhaps the key message is how transport technology has compressed space and time. McGuire (2012) examined the impact of communication and transport technology on space-time compression and how this might influence crime. The difference identified between the two was that transport technology involves 'multi-range' extensions, whilst communication technologies offer 'distance extensions'. That is whilst communications extend interaction at a distance, or remotely as it where, transport technologies do the same, especially where they become faster and more efficient, but with the qualification that the body remains present and integral to the interaction. Again the question this raises is how this may result in changes to criminal opportunity. For transport systems, transport technology extends the opportunities for crimes committed in both physical and cyber space, whereas communication technologies only those committed in cyber space.

Combining both these ideas, of transport technology as an extension to the body, and, as a mechanism for space-time compression, and considering the view of those tasked with maintaining

safe and secure transport systems - there is a strong justification for considering transport technology as a double edged sword. The speed of change brought about by rapid developments in transport, combined with exponential advances of technology, result in a rapidly changing, dynamic and evolving landscape for transport related crime opportunities. There are a number of theories for technological advancement relevant to transport technology and changes in crime opportunity including: technology life cycles; economic path dependency; social construction of technology; market replacement approaches; evolutionary economics; and long-wave theory (Elzen, Geels and Green, 2004). However, there is not scope here to consider these in detail. Instead, this chapter focusses on the actual drivers for transport itself, and, by proxy the drivers of transport technology. It is argued that it is these drivers for change that impact most significantly on criminal opportunity.

Transport Technology and Drivers of Change

Transport is predominantly and in its simplest terms the outcome of derived demand for travel (Rodrigue, Comtois and Slack, 2013) and therefore transport technology is generally driven by the need to improve the delivery of a transport service to meet this demand. Examples include making transport quicker, or more cost effective, efficient, convenient, safe, or reliable. When considering transport technology it is acknowledged that changes have and will continue to vary by transport mode, for example car, rail and bus. Indeed, there are some unique crime opportunities across transport modes. Crimes such as trespass on the railway, and offences on board an aircraft have their own specific legal definition. However, perhaps a more useful split is to consider public transport and private transport separately. The reason for this distinction is that the drivers for each of these are slightly different, thus technological change will occur via different mechanisms. It is argued that it is these drivers which will influences crime opportunity most significantly, and, that the differences between the drivers of public and private transport are much greater than those of differing transport modes. For the purposes of this chapter, public transport, and in particular mass rapid transit in urban areas, is taken to include those aimed primarily at the service sector (for a fuller discussion of definitions of public transport see Ceccato and Newton, 2015); whereas private transport is taken to include those driven by industry, including private cars, commercial operations, and the movement of freight and goods.

Across the service sector innovation often relates to infrastructure (bus priority, new light rail systems); vehicles (environmentally friendly engines, low floor access, changes in size of vehicle ; and service operation (fares, timetables, frequency of service, ticketing and marketing). Across the private sector there are a range of industrial and socio-technical drivers (Geels, 2005) such as: changes to the road infrastructure; to vehicle manufacturers and suppliers; in market forces, driver preferences and mobility patterns; in maintenance and distribution networks (for example repair shops and dealerships); in the fuel infrastructure; in regulations and policies (parking fees, traffic regulations and enforcement, and road tax). When considering some of the more classical theories of technological change it is useful to draw on Schumpeter's (1939) ideas of invention, innovation and diffusion; as three components of technological advancement. Invention can be said to refer to the creation of a new concept or idea; innovation follows when this idea is developed into a new product and commercially transferred, and diffusion is the spreading out of this new product into existing or new markets. An interesting consideration here is how each stage of this process,

invention, innovation, and diffusion, may relate to the development of what are termed 'crime waves' (Laycock, 2005). These occur when early warning signs of new emerging crime trends, likely in the innovation phase and towards the start of diffusion are ignored or missed, resulting in substantial crime increases (crime waves), likely during the middle to latter stages of diffusion. This is discussed further below using the example of vehicle crime.

The speed and size of technological change is likely to vary considerably between private and public transport. Indeed, it is suggested the majority of invention will occur within the private sector; although transport technology may also be the result of spin off activity from military research and development. However, even when this is the case, early and greater adoption is likely to be driven first by the private sector. Innovation is also likely to be stronger in the private sector, particularly with greater levels of investment. Diffusion is generally at a more rapid pace and on a wider geographical scale on private transport systems. Indeed, changes to the public sector transport provision are likely occur with a delay or lag compared to private transport, and diffusion is likely on a smaller scale.

The key questions here to consider regarding crime opportunity are: how these private and public transport sector drivers may alter the criminal landscape; how quickly this landscape may change; what is the scale and extent at which this landscape may alter; and, as is often the case with technological innovation, what is the lag between new technology, new crime opportunity, and new design prevention solutions? Indeed, crime design is often an afterthought of new technology, and rarely built in at the outset of invention and or innovation of new technology (Ekblom, this volume) and here transport technology is no exception. To demonstrate this two contrasting examples relating to the speed and scale of innovation between public and private sector transport are now considered; changes to car vehicle security; and, automated ticket machines and the use of slugs on the London Underground.

In the UK, there was a considerable increase in the number of motor vehicle thefts that occurred from 1980 to 1990 (Morgan et al, 2016). This increase was considered as a second wave of car crime. From 1990 onwards, this trend reversed and there was a sustained reduction in the number of vehicles crimes. Note these trends have also been found internationally, particularly in the USA and Australia. Whilst several theoretical explanations of this crime drop can be found in the literature, perhaps the most reliable measure is provided by the security hypothesis (Farrell, Tseloni and Tilley, 2011; Farrell et al, 2011). Whilst there is not scope to review this work in detail, it is worth noting three technological security measures identified here as relevant to this crime drop. These include the introduction of central locking, car alarms, and immobilisers (mechanical and electronic). The growth in persons owning cars, and reduced costs in terms of affordability, can be seen as a key factor in the increased number of motor vehicle crimes. This is a clear if rather simple example of how a change to transport technology, perhaps viewed best as diffusion in the availability of the private car from 1950 onwards, resulted in widespread increases in crime opportunity. However, changes to car security through technology occurred at a much later stage. As is often the case, security design was an afterthought.

The research on the vehicle crime drop by Farrell and colleagues suggested that immobilizers were most likely to reduce theft of cars (but have less impact on theft from cars), alarms would influence theft from cars (alarms do not increase difficult in driving cars away), and that central locking may

affect both, but mainly change modus operandi (MO) as cars can be entered in other ways. What was evident in this research was that immobilizers did have the greatest impact on reducing theft of vehicle, and these reductions tended to occur as the prevalence of this security device increased. Thus as more cars had this technology fitted as standard, there were less stolen. Rates of decline in Australia happened much later than in the UK and the USA, but this is related to the delay in the prevalence and standardisation of these security devices here. Moreover, as this transport technology was driven by the private sector, the subsequent crime wave that developed was widespread, affecting large geographic areas, with increasing changes to crime opportunities, both in terms of the diffusion of new technology as a new target for crime (more people having private cars), and then a subsequent but lagged reduction in crime as security of this transport technology was improved (immobilisers, alarms and central locking).

In contrast the London Underground presents an example of transport technology increasing crime and a new crime target on public transport, the case of using slugs for fare evasion (Clarke, Cody, and Natarajan, 1994). In the 1980s the London Underground introduced automated ticket vending machines. However, they introduced a new criminal opportunity for fare evasion, and theft. The slugs were made by simply wrapping a 10p coin inside foil in the shape of a 50p piece. Not only did this allow the user to travel for a significantly lower price (technically fare evasion/fraud), it also was possible that by inserting a slug and then pressing the reject button, an actual 50p coin was ejected by the machine (theft). The use of these slugs greatly increased from 1987 and became more widespread, and in 1991 a technological change was made and machines were modified to reject the 50p slug (at great expense). However, this then resulted in the appearance of a new £1 slug. Again a number of stages can be identified here, including invention of automated ticket machines, innovation of ticket vending machines to be used on the London Underground, and diffusion across the entire Underground system. As an interesting parallel, the crime can also be classed under this invention, innovation and discussion umbrella. This occurred at a lag or delayed from the transport technology, from the invention of slugs, to the innovation of the slugs (from using for travel and fare evasion, to using for theft), to the diffusion as usage became more widespread across the transport system. The speed and scale of change in the diffusion of the crime occurred at a much more rapid pace than that of the installation of the ticket machines. Indeed, the security measure, changing the ticket machine, was an afterthought to the development of the technology. However, in this example the pace, scale and extent of the crime wave was less widespread than the first discussion of the growth of vehicle crime. This is primarily due to the localised nature of the public transport system, compared with the industry driven advances of the private transport system (car). Both these examples are cases were the transport technology and transport system were the direct targets of the crime (transport dependent crimes).

Some additional components of transport systems to consider that also influence crime opportunities are to compare; the movement of people with transport of goods; the different types of land use associated with transport systems, for example roads and rail tracks, stations and interchanges, sea and air ports, parking facilities, and those with mixed facilities such as combined retail and transport; by transportation mode including bus, rail, tram, plane, boat and ferry, car, and bicycle; the temporal components of transport journeys such as by weekday and weekends, or peak and off peak times; and to consider individual traveller's needs. Journey needs vary, for example those of the elderly, young persons, those with disabilities, tourists, commuters, movement of goods, movement of fuel and other supply services, and those travelling for leisure and recreation.

Whilst this chapter does not examine each of these in detail, elements of each of these are apparent in the five way transport technology influences crime opportunity as discussed later in this chapter.

Transport Constraints

Both the private public sector transport systems require two further functions, transportation nodes and transportation networks. These may be constrained by the physical environment or urban places (for land and sea), and by the socio-spatial structures of places. Advances in transport technology will also be influenced not only by technological development (as discussed above), but also societal development, and both of these should be taken together as they are symbiotic. Thus society's acceptance and use of transport technology, and the constraints of the physical infrastructure will also impact on the extent to which transport technology is adopted, and therefore the extent to which it may create new opportunities for criminal activity. More recently in urban centres, there is now the twinned pressure; of reducing land space for development; and from increased travel congestion over an ever growing peak travel period (Wilson, 1997). This has implications for transport technology, travel demand, and also may impact on the landscape for criminal opportunity. As more and more places are busy, does this increase the chances of pick-pocketing at large urban transport interchanges at rush hour, and what is the impact for the security of roads and goods during rush hour, or indeed how will this impact on future air travel?

Therefore optimisation of transport, through technological change, is driven by demand for service, but this must be seen as embedded within sociological processes, legal frameworks, and physical environments. Transport technology can be useful for maximising capacity, optimising operations, and improving safety and confidence in travel, but, and this is highly relevant, these may not always align and may even conflict. Several examples of changing transport technologies that could impact on crime opportunity can be identified. A non-exhaustive list to demonstrate the diverse and widespread nature of this includes: access control, surveillance and monitoring; physical design; operational deployment of staff; automated and smart transport systems; communication and information; risk assessment; environmental improvements; the growth of intelligent transport systems; holistic transport planning and management; travel demand modelling; transport journey planning; traffic management; automation; increasing fuel efficiencies; smartcards and passes; journey planners; real time information systems; and road traffic management. Social media and transport technology may also increase mobility and the speed of mass gatherings. To make some sense of this diverse list, this chapter attempts to classify transport technology by the mechanisms through which it may influence crime opportunity and as a starting point five classifications are suggested here. This is not a definitive list, but the author is not aware of other work that previously attempts this. Each will now be explored in more detail.

Transport Technology and Crime Opportunity

In order to devise these five categories of how transport technology may influence crime opportunity, this work draws on two previous findings. The first relates to studies into the development of cyber-crime, and this work heavily borrows from the concepts of cyber-crime as

being: cyber-dependent, those which can only occur with Information Communication Technology (ICT) and computer technology; and those which are cyber-enabled, whereby the speed and scope of criminal activity is increased through the use of ICT (McGuire and Dowling, 2013). These ideas were identified as relevant to public transport during a panel discussion at the International Crime Science Conference, in 2014 at a roundtable session[1] which considered crimes that were transport dependent and transport enabled. These key ideas have been developed into the five new groupings for the purposes of this chapter, to try and make some sense of the ways transport technology may influence criminal opportunity.

Transport as a target of crime (transport dependent crimes)

The first set of crimes identified as influenced by transport technology are those were transport systems are the target of crime, and perhaps most importantly, ones that could have not occurred without the transport system. It is the transport system itself that creates these new opportunities for crime. For rail, sea and air transport there are legal definitions of crimes that all fit into this category[2]. These include

i) Rail specific crimes
    - railway trespass
    - damaging trains and endangering the safety of rail users including: criminal damage; throwing missiles at rolling stock or static railway equipment; offences against the person on railways , intent to endanger the safety of any person travelling on the railway, or any unlawful act or wilful neglect endangering public safety; malicious damage including penalises the placing of wood, etc, on a railway, taking up rails, turning points, or showing or hiding signals, an intent to obstruct, upset, overthrow, injure or destroy any engine, tender, carriage or truck; obstructing engines, or carriages, or railways
    - intoxication of employees
    - fare evasion
    - assault on transport staff
ii) Criminal conduct at sea and in the air
iii) Offences on-board aircraft including
    - hijacking
    - damaging or endangering the safety of aircraft
    - dangerous articles on aircraft and in aerodromes
    - offences relating to security at aerodromes and on aircraft
    - drunkenness
    - aerodrome trespass
iv) Vehicle offences

[1] Roundtable session organised by Reka Solymosi; Transport for London (TfL) and University College London (UCL): 'What is the most important current problem in transport crime?'. This was held at the International Crime Science Conference, London. 16th July 2014. It was chaired by Mr Steve Burton (TfL) with panel discussants Dr Barak Ariel, University of Cambridge; Inspector Varley, Metropolitan Police, Operation Menas; Dr Vania Ceccato, KTH Royal Institute of Technology, Sweden, and Dr Andrew Newton, the University of Huddersfield

[2] Guidance available via the Crown Prosecution Service (CPS): Road Traffic Offences - Transport Offences

- aggravated vehicle taking
- theft from a motor vehicle
- theft or unauthorised taking of a motor vehicle
- interfering with a motor vehicle

It can be argued that some of the above railway and sea and air offences such as criminal damage, assault against persons, and drunkenness do not neatly fit within the 'transport dependent category' as they could occur outside of transport systems. Indeed, many of these activities occurred before the advent of transport and continue to occur outside of this arena. However, they have been included here as they can be prosecuted[2] under the Regulation of Railways Acts 1840-1873; the British Transport Commission Act 1949; the Railways and Transport Safety Act 2003; the Aviation Security Act 1982; the Civil Aviation Act 1982; the Aviation and Maritime Security Act 1990 and the Air Navigation Order 2005. It is important to note that criminal damage could be prosecuted under the Criminal Damage Act 1971; or the Offences against the Person Act 1861 – if the condition 'intent to injure or endanger the safety of persons on railways' is absent. In such situations, these crimes may fall better under the second category identified below, as transport technology enablers.

The important issue for criminal justice is that the advent of these transport technologies (in the 1800s for the railway) required new laws to be written under which offences could be prosecuted. It is argued that it is this feature that makes these offences transport dependent as without such a law and a transport target, these crimes could not occur. It is the speed and extent of innovation and diffusion of these products onto the market, often in the absence of strong security measures (as was the case with the growth in vehicle theft and the subsequent crime waves that ensued) that governs the extent to which new crime opportunities are present. When considering new technologies today and their rapid evolution, it is often the criminal justice system that struggles to keep pace with the speed of change. This is discussed further at the end of this chapter. Indeed, if there is no law in place to govern this, then some of these offences may be difficult to prosecute.

Interestingly bus and tram systems unlike air, sea and rail systems do not have transport specific crime acts. Offences on these systems are subject to general laws as would be applied outside of the bus and tram system. Therefore, any of the above crimes that occurred on a bus or tram network including assault of passengers and staff would be considered under transport technology enabled crime (and not transport dependent as is the case on the rail when endangering the safety of rail users).

The next two categories identified for transport technology as a mechanism for changing crime opportunities are as an enabler of crime and as an enhancer of crime. For the purpose of this chapter transport technology enablers are those systems that extend current or traditional forms of crime (that can occur outside of transport) onto the transport network. Transport technology enhancers also may extend traditional crimes onto the transport network, but are considered to increase the speed or extent of these crimes, or change the MO, or provide new tools to facilitate the crime. This is slightly different to McGuire's definition of cyber enabled crime (McGuire, 2012; McGuire and Dowling, 2013) which suggests cyber enabled crimes increase the scale and reach of offending through the use of ICT. Here, crime opportunities created by transport technology are separated into those that extend the arena where crimes are carried out (an enabler), and those that increase the scale and reach or provide new tools with which to do this (an enhancer). When

considering the use of vehicles for ram raids or as getaway cars, the vehicle is a tool used to facilitate the crime, part of the method and or pathway to and from crime (an enhancer); whereas pickpocketing on the transport network is a traditional crime extended by a new place to commit it, a new transport station (an enabler).

Transport technology as an enabler of crime

As stated above these can be considered as an extension of traditional or existing crimes onto the transport network, which are effectively a new arena as a result of developments in transport technology. The transport system provides a new setting to carry out traditional crimes and thus unlike transport dependent crimes do not rely on transport systems to occur. Some examples of these include:

- assault of passengers and staff (not covered under transport specific legislation);
- criminal damage (including arson and graffiti);
- disorder;
- robbery;
- theft from person, including pickpocketing at stations and on vehicles, for example of mobile phones);
- violence against the person; and,
- sexual offences.

There are some important theoretical concepts into how crime opportunity manifests as relevant to transport. These include routine activities theory (Cohen and Felson, 1979) and crime pattern theory (Brantingham and Brantingham, 1993). A fuller discussion of how these apply to transport systems is provided by Newton (2014) and Newton and Ceccato (2015). In brief, transport networks rely on key nodes (interchanges and stations), and the routes between these. They are also constrained by the extent of the transportation network and infrastructure. These are neatly represented in crime pattern theory as nodes, paths, and edges, and it is known criminal opportunity often occurs near to key activity nodes. These nodes are governed by notions of people's routine activities, for work, leisure, shopping, and recreation for example, and it is at and near to these nodes (activity spaces) were crime is more likely, were offenders and victims come together in the absence of capable guardians. The question this poses is how transport technology may alter the settings of transportation nodes or transportation paths, and what possible new crime opportunities may arise as a result of these changes. In the case of transport enabled crimes, it is these transport systems themselves that become a new setting to carry out traditional forms of criminal activity.

A further useful perspective to consider here are crime generators and crime attractors (Brantingham and Brantingham, 1995). Crime generators are places whereby crime opportunity arises due to the presence of large volumes of persons being present, but are not pre-planned. Crime attractors are places offenders visit with known opportunities for crime, indeed such places often have a reputation for crime to occur. On transport systems both are present but the drivers of transport technology which have created these situations are rarely considered. For example, the demands of modern rapid urban transit systems have resulted in very large interchanges, with multi-modal transport systems, and indeed retail and even leisure all combined within a single location.

Clearly this may generate several new crime opportunities for offending that arise as part of persons every day routines but are not necessarily pre-planned. Transport systems also are attractive to potential pick-pockets. At peak times platforms are crowded, passengers are tired, and there is an acceptance of jostling and bumping. This and a range of additional factors (Newton, Partridge and Gill, 2014a, 2014b) make transport stops and stations attractive to pick-pockets. Thus new transport systems enable pick-pocketing to occur in a new arena.

Mobile technology may also enhance pick-pocketing, and when considering theft of mobile phones it is difficult to distinguish between this as a transport technology enabler or enhancer of crime. As Wi-Fi increases on transport systems, more passengers use their phones - but by doing so they are not concealed, and potential victims readily use these devices on transport systems connected by Wi-Fi. When there is no signal or no Wi-Fi less users would have hold of their devices out in the open. These devices are then on display to would be offenders, who can simply identify the model of phone they wish to acquire, and then pursue targets who carry the desired phone model. When satellite navigation systems were introduced to vehicles, many were left on display in cars and became a target for theft. Whilst both offences can occur outside of transport systems (they can be stolen elsewhere) and are thus not transport dependent, it is debatable if the transport technology enabled traditional crime in a new setting, or enhanced the opportunities for offenders to commit this crime, or both. This demonstrates the difficulties in separating transport technology enablers of crime and enhancers of crime, thus it could be argued these should be merged as a single grouping. However, at present for this chapter they have been left as separate classifications.

Transport technology as an enhancer of crime

Whilst it may be difficult to always draw a distinction, for this chapter a transport technology enhancer of crime is considered a situation whereby transport technology has increased the scale and extent of crime, or has advanced the tools to facilitate crime (for example altering the MO or assisting in the methods), or is part of the pathway to and from a crime. Here transport technology assists or increases the ability of criminals to achieve their goals. Examples of such crimes may include:

- The use of vehicles to commit theft (Ram raids of ATM machines/cash points, shops fronts and banks)
- Where transport is part of the pathway to and from crime (using a car as a getaway from a bank robbery or other offence)
- Theft of personal data using transport systems (for example wifi on transport networks)
- Sexual harassment, cyber stalking and abuse (using the transport network to target individuals; this may include taking pictures of such as sexual photos taken when victims are unaware this is happening during crowded journeys)
- Use of false travel documents
- Theft of personal data, oyster cards, theft of data from electronic mobile pay and travel devices
- The use of transport as part of trafficking, smuggling , child sexual exploitation and even modern slavery

- Use of electronic jammers to thwart tacking devices on stolen vehicles
- The use of unmanned drones to commit criminal offences

A difference between these transport technology enhancers of crime and the previous enablers is the scale of change is likely to be quicker and more widespread for crime enhancers, thus the criminal legislation may struggle to keep apace of this change. This puts pressure on the criminal justice system to legislate against what could be described as entrepreneurial offenders using transport technology to increase their criminal activity.

However, there are limitations to using these categories for transport technology, of crime dependent, crime enabled, and crime enhanced. Consider the case of vehicle hijackings ('carjackings') that have occurred in Sao Paulo, and other major cities in Brazil. Transport technology, namely pedestrian traffic lights are used by offenders to create new crime opportunities. Pedestrianised lights are turned to red when cars approached, and cars are taken at gunpoint. Indeed, it is common and even encouraged that car drivers slow after dark when approaching lights in particular areas of Sao Paulo, but pass through without stopping if no persons are crossing. These pedestrianised lights settings can be considered as a crime attractors. The target of crime is the vehicle, so this crime could be considered as transport technology dependent. However, the MO is to use the lights; which is cyber enabled. It should be remembered the offender will not be restricted by these definitions and is likely to use all means at their disposal to be successful. To complicate matters, if the target was a person inside the car, and the crime then became a kidnapping, this could be classed as a transport technology enhanced crime. The question for the criminal justice system is irrespective of whether it is transport technology dependent, enabled, or enhanced, can it be prosecuted under current legislation (likely with enabled crimes); does new legislation need to be written or adapted (more likely with transport dependent and enhanced crimes); and can the criminal justice system keep pace with the rapid changes in the technology.

Transport technology as a preventer of crime

In addition to transport technology increasing crime opportunities, there are several examples of how it can reduce such opportunity. The use of immobilizers on vehicles has already been discussed, and cashless ticket machines reduce the risk of robbery for bus, train, and tram drivers. Several other examples here can be identified including:

- Closed-circuit television (CCTV) being wirelessly transmitted from moving vehicles to control rooms
- Monitors on board vehicles displaying CCTV images so passengers and potential offenders are aware the systems are working and they are being monitored.
- The use of technology to analyse crime and mobile data to assist front line staff
- Communication and information dissemination
- DNA and smart water technology
- Automatic Number Plate Recognition (ANPR) camera technology to enforce bus lane and traffic offences
- Use of oyster and cashless travel to avoid theft of cash from drivers
- Use of text messages to encourage anonymous and live reporting of crime and disorder

- Use of breathalysers built into cars to prevent drink drivers
- Scanning and access control systems
- Use of forensic evidence in investigation
- Facial recognition technology, explosive device detection, and even unusual behaviour/suspicions package identification (when bags left on platform, passengers remain on platforms and don't board)

There are two important factors that should be addressed here. The first is there is a need to balance the use of technology for crime prevention with that of the presence of staff for reassurance. It is known that technology does not always increase perceptions of safety as is discussed in the next part of this chapter. Additionally, many of these transport technologies for crime prevention occur after a crime wave had occurred, as a response to a growing crime trend or problem. It would preferable for these technologies to include crime prevention as part of the invention/design phase, or at least the innovation phase, as opposed to part of the diffusion process as transport technology spreads (and often increases crime opportunity). However there are several difficulties in achieving this as summarised usefully by Ekblom (2014) including: aesthetics; legal and ethical issues; environmental considerations; safety; cost; convenience; and, a general lack of horizon scanning/awareness of potential crime opportunities that may emerge from new product design.

Transport technology and perceptions of crime

Whilst transport technology may increase crime opportunity, or even be used to prevent crime, it is important to consider that is can also have a substantial impact on passenger's perceptions of travel and fear of crime. For example, surveys have shown reliability and convenience are two of the key barriers to the uptake of public transport. Personal security or fear of safety from crime is the next biggest obstacle (Ceccato and Newton, 2015). Transport technology is a key mechanism for advancing transport journeys, for example by increasing speed, reliability, safety, and convenience. There are a number of opportunities for such technology to increase perceptions of safety, after all if persons do not feel safe they may choose not to travel despite even if the transport system has very low levels of crime. This issue sits within the socio-technological constraints of transport technology development, particularly focussing on societal acceptance. Examples where transport technology can be used to increase perceptions of safety include:

- Real time passenger information
- Help points and passenger reassurance messages
- Secure by design and movement control
- On-board live streaming of CCTV on moving public transport vehicles
- Advanced information on traffic and weather conditions on roads

However, it is critical that transport technology here is not used to replace people, for example CCTV should not be viewed as an alternative to the presence of staff on public transport systems. Indeed, the physical presence of staff at stations has shown in several surveys to be the most likely to reassure travellers. This is more effective for reassurance than CCTV, environmental improvements

such as better line of sight and good lighting, and other technological innovations (Ceccato and Newton, 2015).

Conclusions and future direction

Whilst this chapter has been critical of the lack of thought into security and crime prevention placed in the invention and innovation of new transport technology products, it is also acknowledged that it is not a simple task to horizon scan and to identify possible future changes to transport technology and crime opportunity. Therefore, this is written with some apprehension as future changes and their possible impact on crime are in many ways unpredictable. However, this chapter will conclude by highlighting some possible future transport technology trends, and reflecting upon their potential impact on transport related crime.

Some transport technologies that are already beyond the invention stage and in the innovation or early phases of diffusion can be grouped within the wider lens of Intelligent Transport Systems (ITS). More specific examples include: driverless cars; autonomous and connected vehicles; electric vehicles that may be able to charge wirelessly; better travel data for road optimisation; and the growth of smart cities. Data will be a key commodity as part of this, and therefore its security should be a key prioritisation. If electric vehicles increase and can be charged wirelessly how can this technology be secured against possible misuse. Transport data, electric chargers, and vehicle batteries may all be valuable commodities to the future offender. Autonomous cars presents a different challenge, as will it be possible for remote users to hack into these, or for such vehicles to be used to commit crimes with no driver, in effect anonymising the offender's identify. How will social media and mobile platforms evolve on transport systems and what are the possible crime opportunities from this? Thus, as transport becomes more intelligent and digitally driven, some elements of transport crime should perhaps be considered as part of a branch of cybercrime or indeed critical infrastructure protection. However, the extent to which this will increase (as a proportion of all transport crimes) is difficult to envisage. It is perceived transport dependent crimes will still form a large proportion of transport crime, particularly on public transit systems, as these environments are less well policed than other semi-private spaces, especially the bus and tram environments. The two greatest challenges however, are perhaps for the criminal justice system to keep pace with the changes in transport technology, and, the lack of investment in building crime prevention design into the invention and innovation phases of transport technology developments.

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