The Influence of Perceived Safety and Security on Walking

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The ultimate security is your understanding of reality
H. Stanley Judd

Summary

In the current chapter we highlight two types of risk that are of importance for pedestrians: the risk of being involved in an accident and the risk of being victim of criminal offences, violence or threats. In most cases it is the latter type of risk that is of importance for pedestrians, and which influences their behaviour. From a theoretical perspective the perception of risk has traditionally been studied from a rational perspective, i.e. as a deliberate calculation of pros and cons in a given situation. Recently, theoretical developments have aimed at including feelings as an explanatory variable for risk perception. Due to methodological challenges, there is still little empirical support for the quite common-sense assumption that our feelings govern our way of making judgements of risk.

Although both anecdotal evidence and some single studies indicate so, the bulk of properly performed empirical research concludes that there is little relationship between perceived safety and security and the strategic decision to walk, in other words the modal choice situation. Apparently, there are other important elements of the perceived physical and social environment that essentially influence the decision to walk. Results also indicate that people express a higher degree of worry when they consider to walk than when they are actually on their way. Still, for some groups, and in some situations, feeling unsafe might be an influencing factor in people's decision to walk or not.

There seem to be considerable national and regional differences in how perceived safety influences children's opportunities for walking in everyday life. In some inner city areas, especially in large cities, fear of crime or fear of accidents might give considerable limitations to children's independent mobility. In more rural areas and especially in Northern Europe, this seems to be a more marginal explanation.

Once the pedestrian has made the strategic decision to walk, perceived safety plays a larger role. Multivariate analyses have shown that when everything else is controlled for, pedestrians who are afraid of crime and threats tend to adapt their behaviour more, like choosing another route, than pedestrians who do not experience fear.

1. Introduction

Safety is a fundamental and essential need for the human organism and as important as the need for social interaction and sex. As human beings we are always interested in maintaining our own safety and that of those around us. Still, feeling safe is only one of our fundamental needs. Often we find ourselves having to deal with conflicts of interest, and we have to trade off between the perceived benefits and risks of our actions.

In the current chapter we will look at pedestrians' perception of risk, in other words their assessment of safety and security. We distinguish between the influence of risk perception on the pedestrians' decision *prior to walking* and the influence it has *while walking*. In each of these two sections we will first outline some theories that are relevant to that specific topic. The second half of each section contains empirical evidence and will provide some answers to questions the reader might have. These findings may also, we hope, raise some new questions. Alongside the presented theories we see a good opportunity for the reader to pursue a further scholarly treatment of the topic outside of this handbook.

Strategic and tactical levels of decision making

In this handbook a distinction is made between behaviour at a strategic, tactical and operational level. Strategic decisions are made *prior* to conducting a trip, like what type of transport mode I should use, which airline I should choose, at what time of day I should go etc. Tactical decisions are made during travel and refer to decisions about which side of the road I should walk on, where I should cross this street etc. Operational decisions concern the microscopic, rather automated adjustments we make from moment to moment during travel, such as how I should walk to avoid stepping into that puddle, and on which side of that lamppost I should steer my path. Although the operational level of decisions is largely automated, it can easily shift to conscious monitoring. All three levels are closely interrelated, influencing each other reciprocally: a single threatening event or what is perceived as excessive workload might influence future decisions to walk as well as present behaviour (Summala, 1996). On the other hand, new information and knowledge offered by, e.g., media might modify strategic decisions leading, eventually but not necessarily, into changes in behaviour on tactical and operational levels (Summala, 1996). In the current chapter we look at how safety and security considerations can influence our decisions at the strategic level, for instance whether we should walk or not, and at the tactical level, for instance whether to cross the street here and now, or not. We do not deal in particular with the operational level, as there is not much research that has looked at this from a pedestrian point of view.

2. The influence of safety and security on the decision to walk

2.1. Theoretical background

There are several theoretical approaches that deal quite specifically with how people experience risk and feelings of unsafety. However, as the current section is about the strategic decisions people make related to the process of walking, more general theories and approaches about *decision making processes* are also relevant. In the following section we will therefore first give a short overview of some of the most relevant decision-making processes. At first glance, some of these theories might seem a bit unrelated to the topic of this chapter, but we can note that perceived safety potentially plays a role in all of these theoretical approaches. For example, the theory of planned behaviour deals with attitudes. Whether a certain mode of transport is considered as safe or not has often been included as one of the attitudes that might influence the behavioural intention to use it. Hence the theory might be said to implicitly take risk perception into consideration. We subsequently present

approaches considered to be more directly relevant to the concept of risk perception, the psychometric paradigm and the affective approaches to decision making. These should not be considered different theories, but rather reflections of different aspects of the concept of individual risk perception.

2.1.1. Planned behaviour

A perspective that is useful for describing the decision making process is the theory of planned behaviour (Ajzen, 1985, 1991). According to this theory, people's attitude, their subjective norm and their perceived behavioural control determine their behaviour indirectly via their intentions. When applied to the behaviour, e.g. walking, people's attitude is determined by beliefs about the likely consequences (health, injury) of walking weighted by the evaluation of how good or bad these outcomes would be. The subjective norm regarding walking is determined by beliefs about what important others think of walking weighted by the motivation to comply with these important others. Perceived behavioural control is determined by beliefs about factors which may facilitate or impede walking, weighted by the perceived power of these factors. According to Ajzen (2006) the more positive the attitude and subjective norm towards walking and the larger the facilitating factors are, the stronger the person's intention to walk will be. Given sufficient actual control of the behaviour, people are expected to walk as soon as an opportunity arises.

2.1.2. Decision making from a maximising perspective

Traditionally, researchers have used a rational approach to decision making. According to the maximising perspective people integrate in a deliberate manner as much information as possible with information already present. Then they weigh carefully the pros and cons of every alternative, and finally they come to the appropriate decision. When the decision of which travel mode to use is very important, people evaluate each travel mode carefully. They try to collect information about for example costs, time, ease of use, but also about safety or security-risks related to particular travel modes. The evaluating is often done by considering the qualities of one travel mode at the time and seeing how each travel mode's qualities shape up to some set of desired characteristics. Although people sometimes take all these steps to come to a decision, this extensive process does not give an accurate view of the decision making process in real life.

2.1.3. Decision making from a satisficing perspective

Simon (1955) pointed out that people simply do not extensively go through the phases for making decisions because human decision making is limited by available information, available time, and the information processing ability of the mind. People are assumed to have neither the wish nor the capability to perform extensive search processes and thoroughly asses the alternatives found with every decision regarding travel mode choice. According to the satisficing strategy people search for the first alternative that is 'good enough'. This alternative has to meet certain levels for relevant qualities of alternatives. One such quality can be the perceived safety or security related to a travel mode, for example walking, cycling, driving, and using public transport.

2.1.4. Habitual behaviour

In contrast to the perspectives of planned behaviour and the maximising and satisfying strategies, which view decision making as a rather conscious process, the perspective of habit execution argues that many of the choices people make, for example travel mode choices, are a consequence of the execution of a habit (Aarts & Dijksterhuis, 2000). This perspective asserts that people are often found to base their choices for travel modes not so

much on a deliberate evaluation of alternatives and their qualities, but rather on the execution of their habit (e.g. Aarts, Verplanken & Van Knippenberg, 1997; Verplanken, Aarts & Van Knippenberg, 1997; Hannes, 2009).

Habits such as using the car when one could also walk, are created when the behaviour led to valued outcomes in the past but does not do so anymore. Some habits can also be actions, which are rewarding in the short term, but do not align with longer term goals. Breaking habits is difficult. People who always use the car to go to work only seem to be willing to think about other options, such as cycling or using public transport, when radical changes in their situation (e.g. new job in new city) force them to reconsider their automatic choice of the car.

2.1.5. The psychometric paradigm and risk perception

In 1978, Fischoff, Slovic, Lichtenstein, Read and Combs published a study where risk perception and attitudes towards risks were measured by means of psychological scaling (Fischoff et al., 2000).This approach and the encompassing theoretical framework has later been named *the psychometric paradigm.* The main aim of the study was to examine the usefulness of psychological questionnaire techniques for studying perceived risks. By this, the study lays the foundation for a theoretical assumption that risk is a quantifiable psychological construct, which is influenced by a wide array of social, cultural and individual factors. Perceived risks and benefits of a wide array of hazards were measured in two separate samples. In addition, all respondents rated each hazard on nine 7-point scales reflecting characteristics of the hazards hypothesised to influence the perception of risk:

- was the risk *voluntary*,
- was the effect of the risk *immediate*,
- was the risk *known to science*,
- was the risk known to those exposed,
- was the risk *controllable*,
- was it a *new* risk,
- was the risk *chronic* or *catastrophic*,
- was it common or dreaded,
- to what degree were the *consequences severe*.

By means of principal component analysis (factor analysis), the nine risk characteristics were reduced to two factors. Factor one is termed ‘technological risk,’ which includes voluntariness, immediacy of effect, knowledge about risk, control, and newness. The second factor is termed ‘severity’, which includes chronic-catastrophic, common-dread, and severity of consequences. These two factors were later renamed ‘unknown risk’ and ‘dread’. Moreover, based on this factor analysis, all risks were placed in a factor space: a mental map of all the hazards was created based on their score on the two factor dimensions (e.g., nuclear power had a high score on the items ‘certain to be fatal, ‘dread’ and ‘catastrophic’, and was also rated to be high on ‘involuntariness’, ‘delayed effect’, ‘unknown’, ‘uncontrollable’, and ‘new’).

2.1.6. The optimism bias

A common feature in most of the approaches mentioned above is the more or less implicit assumption that the individual is rational and makes deliberate decisions concerning risk activity and responses to risky situations. However, in psychology it is common knowledge that people’s decisions often are subject to various cognitive biases. One such cognitive bias that has particular relevance for risk perception is the *optimism bias*. Research has indicated

that people tend to underestimate their own risk of being involved in a hazardous situation compared to others (Slovic, 2000). Further, this tendency for optimism bias is greatest for hazards where the individual believes he or she has substantial personal control over the outcome, such as lifestyle risks. Thus, in the situation where people have to choose between walking and taking the car to their job, they might underestimate the health risk of a sedentary lifestyle, and overestimate the risk of becoming involved in a traffic accident while walking.

2.1.7. Affective decision making theories

Research in the decision-making field has increasingly moved its attention from cognition to the role of affect. The Dual Process Theories have suggested the existence of two fundamentally different ways of approaching reality: one is rational, logical and analytical; the other is more intuitive, automatic, fast, narrative and nonverbal, and works through images and representations. Although some decisions are made by accurately assessing logical arguments, it is believed that the majority of behavioural choices depends on an affective basis (the experiential system). This is particularly evident in dangerous situations, when emotional reactions such as worry, anxiety, fear or dread are generated, thus orienting people's decisions and behaviour. Such an automatic and fast system has ensured survival for the human species over the long period of evolution and also today, it remains a natural and common way to respond to risk (Slovic et. al, 2006).

In most situations we do not have the time to carefully consider the risks and benefits of a given action. Thus our decisions usually take place in an automated and fast manner, as *heuristics*. The term *affect heuristic* has been employed to characterize situations where people use such readily available representations, rather than making rationally calculated decisions (Finucane et al., 2000; Slovic et al., 2004; Slovic et al., 2005a; Slovic et al., 2005b; Slovic & Peters, 2006; Slovic et al., 2007). Several studies have shown that perceived risk and perceived benefit are negatively correlated, and that this correlation is stronger the less time we have available to make careful rational considerations (Slovic et al., 1991; McDaniels et al., 1997; in Finucane et al., 2000). This has been suggested as an argument that people's judgement of risk and benefit are guided by their general affective evaluation of a given situation or activity.

However, it should be noted that the affect heuristic is only one of many possible shortcuts that we can make, and that it does not work all the time. In the original experiment by Finucane et al (2000), the affect model *did not work* for most of the subjects (Backer-Grøndahl & Fyhri, 2008). 31% did not change their mind on the non-manipulated dimension, and 23% changed in their risk assessment in the opposite direction than predicted.

Taking the more rational theories on decision making, such as utility maximising behaviour, as well as the affective theories into account may lead to a better understanding of how people make choices (e.g. driving instead of walking). Habitually jumping into the car even for short rides, may lead to skipping a deliberate evaluation of alternative travel modes, activating simply the acquired habit that emotionally represents the most effective, easiest and most appealing solution (Hannes, 2007). Perpetuation of a habit can be particularly strong when people have no motivation (in terms of desire) to change their existing habits. In that case, people also tend to justify their choice (e.g. to use a car) with any available argument denying negative consequences of car use (e.g., costs). The purpose of such a negation is to avoid cognitive dissonance accompanied by unpleasant feelings and discomfort. Considering the principles of risk perception mentioned above, it can be expected that people who like and want to use a car, might perceive walking and using public transport as more risky and less beneficial, thus less attractive.

On the other hand, a positive change of attitudes towards walking does not imply that people start walking automatically. In line with motivation theories (Prochaska & DiClemente, 1986), changes in behaviour occur when the desire to adopt a new behaviour is strong enough to contrast the discomfort associated with the renouncement of immediate awards of the original habits. Again, the affective balance (desire-discomfort) will play a decisive role in these trade-offs. Similarly, those situations perceived as clearly risky, will generate strong negative emotions and will have an imperative effect on one's behaviour and thoughts, thus leading one to avoid those feelings by avoiding the situation.

2.2. Empirical findings

People's behaviour emerges through interaction between the person and the environment. The decision to walk or not to walk is influenced by individual factors as well as by the perception of the physical and social environment. This section summarises some of the findings concerning how perceived safety and security influence people's strategic decisions related to walking. Very few studies have actually attempted to apply risk-related theories, such as the psychometric paradigm, to the field of transport in general and to walking in particular. Other more general theories of behavioural change, such as the theory of planned behaviour, have been applied to the field of transport a number of times, but not in relation to perceived risk or feeling unsafe. In general, empirical research in this field is rarely theory-driven; it is more often driven by the nature of the application. Hence, the empirical findings presented in this section can only be loosely related to the previous theoretical section.

2.2.1. Risk perception at the strategic versus tactical levels

It has been argued that the distinction between strategic and tactical levels is important in relation to risk perception, as it has been hypothesized that people's fears and anxieties are much stronger when they sit at home imagining what can happen on a certain journey, than when they are actually conducting that specific trip. However, there have been few attempts to actually test this difference empirically. One reason for this is that the comparison of risk perception at strategic and tactical levels is quite difficult to actually carry out from a methodological point of view. Some questions concerning risk perception, which are meaningful in a strategic situation, are without meaning in the operational situation and vice versa (e.g. 'how risky would it be to walk from your home to the nearest railway station?'; 'how afraid do you feel right now when you are walking in this street?'). One notable exception was a study aimed at comparing these two situations (strategic and tactical level) for bicyclists and metro users. Respondents were asked about risk perception and feelings of safety while they were at home and while they were travelling (Backer-Grøndahl et al., 2007). The results indicate that people express a higher degree of worry when at home (strategic situation) than when they are using a certain mode of transport (operational situation). Even if this study did have some methodological challenges, and concerned other transport users, it confirms the proposed difference between the two levels, and it also functions as a justification of the separate treatment of these two types of decision situations.

2.2.2. Risk perception, security and safety

Feelings of unsafety can be related to fear of accidents (safety-related risk perception) as well as to fear of crime, violence and strangers (security-related risk perception).

Backer-Grøndahl et al. (2009) used an internet based survey in Norway to investigate the subjective perception of risk in relation to different transport modes. They measured risk perception both in relation to safety issues, i.e., perceived risk for being involved in an accident, and security issues, i.e., perceived risk for unpleasant experiences such as violence and threats. Perceived risk was operationalised as 'feeling of safety'. They asked

each respondent about his/her perception of ten different modes of transport. For walking, people reported higher perceived risk for security issues than for safety issues. That is, people appear to be more afraid of situations where they think they are likely to be exposed to threats, violence, and other unpleasant situations, than of being involved in an accident as a pedestrian. Looking at all transport modes on this safety-security dimension, pedestrians actually turned out to be the 'exception'; the general tendency was for private means of travelling to be related to high perceived risk of accidents, whereas public means of transport was related to high perceived risk for unpleasant situations, see Figure 1. Strictly speaking walking is a private transport mode, as there are no professional operators in charge. The pedestrians themselves are responsible for 'the performance' of the transport system. However, from a risk perception perspective walking is placed together with the public modes of transport, i.e. people being more concerned with security than with safety. This makes sense, as pedestrians, to a larger extent than bicyclists and car drivers are exposed to the public scene of a typical urban environment. Statistically, they also run a far greater risk of being exposed to violence than bicyclists, car drivers and motorcyclists (Amundsen, 2008).

As could be expected, pedestrians felt more afraid at night than during the day. 'Unpleasant people' and 'bad lighting conditions' were reported as being the factors contributing most to feeling unsafe at night, whereas 'other road-users not being considerate' was the equivalent factor during the day. This may indicate that pedestrians are more afraid of being involved in an accident during the day, while at night perceived risk of unpleasant situations is more salient.

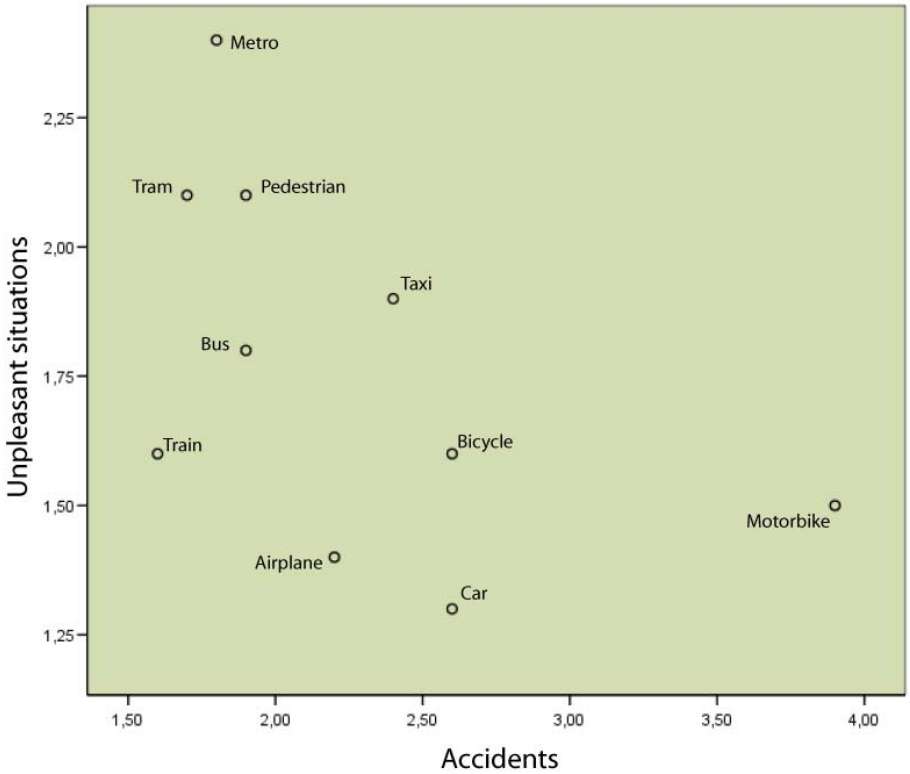

Figure 1 'Risk profile' of ten modes of transport. Respondents' perception of worry for accidents and for being involved in an unpleasant situation (crime, violence, harassment). Mean scores from 1 to 5. From Backer-Grøndahl et. al. (2007).

2.2.3. Associations between perception of the physical and social environment and walking

In general, unsafe roads are often considered one of the main factors hindering cycling and walking (Elvik, 2000). If people could choose their mode of transport based on their own preference, in a situation where cars do not cause unsafe or unpleasant situations, the

volume of walking and cycling would most probably increase substantially. Sælensminde (2004) calls this the 'natural volume' of transport modes.

Below, we describe results of several studies that have examined the relationship between perceived safety and security and walking. In most cases, the data concerning perceived safety and security have been collected as part of larger data collections. Most studies investigated individual and environmental correlates of walking in general, for recreation or transport, or as a component of physical activity. The studies used self-reported walking behaviour as a dependent variable and obtained people's perceptions of the environment through a survey. The perceptions of the environment included, for example, unattended dogs, crime and safety concerns associated with recreational facilities, traffic volume and speed, street lights, and strangers. In the studies, regression models were used to show associations between the variables. Different groups were the subject of study: adults, elderly, children and children's parents.

Results of these studies show that the relationship between perceived safety and security and walking seems not to be very strong. Addy et al. (2004) found that traffic volume, unattended dogs, crime and safety concerns associated with recreation facilities were not associated with walking. Giles-Corti & Donovan (2002), however, found that people who perceived their neighbourhood as safe were more likely to walk. Humpel, Owen, Iverson, Leslie & Bauman (2004) examined associations of perceived environmental attributes (weather, aesthetics, accessibility, and location) with walking for different purposes. They found no evidence of a relationship between safety and neighbourhood walking, walking for pleasure or walking to get to and from places. Duncan & Mummery (2005) also found no associations between safety and recreational walking and physical activity. Suminski, Poston, Petosa, Stevens & Katzenmoyer (2005) examined the relationships between features of the neighbourhood environment (functional, safety, aesthetics, destinations) and walking for transportation, walking a dog, and walking for exercise by U.S. adults. The feature 'safety' described neighbourhood traffic volume and speed, lighting, and crime. They found that women who perceived their neighbourhood as safe walked more often for exercise and walking a dog than women who perceived their neighbourhood as unsafe. Troped, Saunders, Pate, Reininger & Addy (2003), however, found no associations between unattended dogs, streetlights, and heavy traffic on one hand, and recreational and transportation-realated physical activity on the other. Booth et al. (2000) attempted to identify perceived environmental influences associated with physical activity participation in older populations. They assessed self-reported physical activity and a range of perceived environmental factors in a randomly selected sample of 449 Australian adults age 60 and older. Perceiving the footpaths safe for walking (i.e. no uneven paths or dogs) was associated with the elderly being physically active.

To sum up, the results of these studies show that the relationship between the perception of the physical and social environment and walking seems to depend on the attributes taken into account. A positive perception of the safety in the neighbourhood seems to lead to more walking. However, from the literature mentioned above, it is not clear which elements of the physical environment contribute to a safe feeling. Characteristics like high traffic volume are associated more with increased security than with decreased safety, even though it might be less safe from a traffic safety perspective. Apparently, there are other important elements of the perceived physical and social environment that essentially influence the decision to walk.

2.2.4. Reduced mobility due to fear of crime

'Fear' can have a very direct impact on the decision to walk as it can lead to the exclusion of certain transport modes, because of for example anxiety, fear for crime or traffic (un)safety or fear of participating in traffic. Fear of crime is often related to being outside and having the perception of being vulnerable, as was illustrated in the study by Backer-Grøndahl et al

(2007) mentioned above. Especially vulnerable road users like pedestrians may have a fear of becoming a victim of criminal acts, such as being pushed, threatened with violence, robbery, physical attacks, being stared at or people making remarks. Also, handicapped people have a fear of crime when using public transport (Crime reduction website; Department for Transport website; Stafford & Pettersson, 2002 and 2004; Stafford, Pettersson, Young & Mather, 1999b).

One of the consequences of fear of crime is that people travelling with public transport take precautionary measures like avoiding travelling alone, avoiding certain routes or stops and choosing a seat close to the driver. Some people may also avoid public transport completely, especially at night. It has been suggested that possible alternatives like the car are preferred and individuals without alternatives stay at home (Green, 2006; Stafford & Pettersson, 2002). Research has shown that the decision whether to use public transport or not is based on the whole trip, including walking to and from the bus stop or train station (Alm & Lindberg, 2004). Research in 1996 and 2002 in the UK reveals that the introduction of additional safety measures like the presence of personnel, proper lightning and CCTV can account for an increase in train travellers of 11% (Committee of Public Accounts, 2006). In Stockton (UK) 40% of the questioned citizens stated using public transport more often if they feel safer (Stafford & Pettersson, 2002).

As we can learn from the different studies discussed above, being a pedestrian plays an important role in the negative feelings and the final decision whether or not to use public transport (Stafford & Pettersson, 2002; Stafford et al. 1999a). Groups who are put off most from travelling because of fear are mainly women, elderly, ethnic minorities and the underprivileged. For those groups using public transport and walking is an important way of staying mobile and taking part in society, as they often don't have alternatives (Colliard, 2003; Gwilliam, 2002; Crime reduction website; EU Equal Opportunities Unit, 1995). However, Hoehner et al. (2005) examined perceived and objective environmental measures and physical activity among urban adults. No associations were found between feeling safe from crime and perceiving active neighbours and recreation-based or transportation-based activity.

2.2.5. Reduced mobility due to fear of (new) accidents

Having been involved in an accident oneself often causes a reduction or change in mobility. Some people do not want to drive their cars anymore, or do not want to be passenger. In some case parents or partners are extremely concerned about family members travelling. Research in the UK (Ellis, Stores & Mayou, 1998) reveals that 18 of 43 questioned parents introduced new mobility rules after an accident in which their children were involved. Sometimes the limitations where very drastic and the children were not allowed to bike or walk alone anymore. This means a serious restriction of independent mobility.

2.2.6. Reduced mobility in children due to parents' fear

Although the importance of children's independent mobility for their general development has been generally acknowledged, children are more and more restricted in travelling alone. This is often based on parents' feelings of fear. Zwerts (2008) researched the travel mode of school of children between the ages of 10 and 13. Fear for accidents and fear for crime were the most important reasons for parents to bring their children to school by car, even if walking was an alternative. Also, children reported traffic safety and fear for crime as less attractive aspects of cycling and walking, as well as poorly maintained public spaces.

For a lot of children, walking and cycling is their preferred mode of transport because of the freedom and independency it brings (Mitchell et al. 2007; Zwerts, 2008). The children

reported that the most important reason they do not come to school with their preferred mode of transport is the fact that they 'are not allowed'. The reasons parents give their children most often are safety reasons: road safety and fear for crime.

A questionnaire in Oxfordshire (UK) (Hurdle, 1999) reveals that fear of strangers is a reason for 85% of all parents to accompany their children to school. Unsafe traffic was the reason in 50% of the cases. In the United States (CDCP, 2002; Falb, Kanny, Powell & Giarrusso, 2007) the reasons for not allowing children to walk have been reported as, in descending order: distance (62%), traffic safety (30%), weather (19%), crime (12%), school policy (6%), other (15%).

Whether parents have more fear of traffic or more fear of crime depends partly on the location where they live and where their children have to go (Tranter & Pawson, 2001). In rural areas road safety plays an important role while in urban areas fear of crime is more important (Stafford et al., 1999a; Klöckner, 1998). Researchers in the inner city of London (DiGuiseppi, Roberts, Li & Allen, 1998) found that 90% of parents were very or rather afraid that their children would become a victim of crime (kidnapping, being attacked) and 89% was very or rather afraid of road accidents. Characteristics of the surrounding environment also play an important role in the intensity of the fear and if it results in the rejection of children's independent mobility (Björklid, 1996; Klöckner, 1998; Lam, 2001). Research from other countries find far lower figures for what is often called 'stranger danger'. In Norway, for instance only 11% of parents reported this as a reason for accompanying their children to school (Fyhri & Hjorthol, 2009b). Similar low scores regarding 'stranger danger' have also been reported in Finland (Kyttä, 2004)

Italian research (Prezza et al. 2005) states that the fear of crime against children often consists of fear of petty crime like drugs and theft, and fear of certain groups to which people may prejudiced like gypsies, immigrants, and the homeless. Parents' fear is often not related to events, which have actually happened to themselves or their children. Parents recognise that they are influenced by media campaigns about criminal acts against children. These results indicate that the perception of social danger in the area of residence has been correlated on the one hand to the level of mothers' personal fear of crime and on the other hand to the size of urban context; mothers who live in smaller cities and have a stronger sense of community perceive their environment as safer for their children than those mothers who have high levels of fear and live in large cities. Parents state that their fear for their children (and for themselves) is probably the consequence of amplified media campaigns on criminal acts against children. A sense of community, connections with neighbours and availability of green spaces was considered beneficial for children's development and can be considered a protective factor against feeling unsafe. As expected, heavy traffic represented a risk factor for both parents and children.

Fear for crime and road accidents may lead to an increase in children being brought to school by car and thus to a more unsafe route to school (Tranter & Pawson, 2001; National Center for Safe Routes to School; Ker & Tranter, 1997). This vicious circle may also have an impact on feelings of crime (Mullan, 2003). As a reaction to a (perceived) unsafe road environment, fewer youngsters cycle and walk or play outside. This leads to a decrease in social activities and social contact, again leading to an increased fear of strangers. And this fear might lead more parents to think that their children cannot go to school alone. Protection of children against threats that certain modes of transportation bring with them might lead to a generation with an acquired fear for those modes of transportation resulting in more people being dependent on their car (Department for Transport, website).

Timperio et al. (2004) also examined associations between perceived aspects of the local neighbourhood (e.g. traffic density, road safety, strangers, traffic lights/ crossings) and walking and cycling among children as a means of transport. Parents reported their child's

(five and six-year-olds and ten to twelve-year-olds) usual walking or cycling to local destinations and their perceptions of their neighbourhood. Ten to twelve-year-olds were also asked about their perceptions of traffic, strangers, road safety and sporting venues, and their perceptions of their parents' views on these issues. For 10 to 12-year-old children, analyses showed that boys, whose parents believed there were no lights or crossings for their child to use, were 60% less likely to walk or cycle. Also girls, whose parents believed that their child needed to cross several roads to reach play areas, were less likely to walk or cycle. Perceptions of heavy traffic and road safety concerns, however, were not associated with walking and cycling among children. Also, no associations were found between parents' concerns about strangers and children's walking or cycling in the neighbourhood.

Another study, looking at factors influencing independent mobility for children using multivariate analysis, found that distance to school and child age are the most influential variables (Fyhri & Hjorthol, 2009a). 'Objective' descriptors (subjectively assessed) of the traffic environment explained independent mobility indirectly though the parents' experience of how safe the road to school is. Another study conducted by Maria Johansson (2006) in Sweden, found that an objective descriptor of the traffic environment explained independent mobility, whereas subjective expressions of trust did not. These results might seem contradictory, but they do in fact point together to an important implication: any measure aimed at increasing walking and cycling for children via improved traffic safety will only be effective if parents' experience of traffic safety is improved. Thus, any physical measures improving traffic safety need to be supplemented by information or campaigns in order to be effective for increased independent mobility.

All in all, there seem to be considerable national and regional differences in how perceived safety influences children's opportunities for walking in everyday life. In some inner city areas, especially in large cities, fear of crime or fear of accidents might give considerable limitations to children's independent mobility. In more rural areas and especially in Northern Europe, this seems to be a more marginal explanation.

3. The influence of safety and security on mobility decisions <u>while</u> walking

3.1. Some theoretical considerations of risk perception while walking

In the current section we are interested in looking at how risk perception may influence people's behaviour while walking, at a tactical level. The theories covered in the section about the strategic decision to walk, tend to be concerned with trying to explain the components of risk perception, or to describe how it is shaped – the purpose can be said to be one of *taxonomy*. However, few studies have actually attempted to *predict behaviour* based on these approaches. To find theories with behaviour prediction as an aim we should change, or maybe narrow, the perspective from general transport users to *car drivers.* There exists a whole body of literature describing different *driver behaviour models,* i.e. at the tactical/operational level. One important common feature of these models is the central role of *motivation* as a key element in the model description. The most prominent of these is Wilde's (Wilde, 1994) *target risk theory*, more commonly known as risk homeostasis theory. All of these models predict that the driver's behaviour is motivated by the goal of achieving a certain outcome related to risk level.

For Wilde's model this outcome is a targeted risk level that differs between individuals, but that is fairly static within society as a whole. By weighting potential risk benefits, risk costs, safety benefits and safety costs the individual seeks to achieve risk homeostasis at a level that by definition > 0. In another well established model, Näätänen and Summala's *zero risk*

theory (Summala, 1988), the desired outcome is zero risk, i.e., drivers monitor risks, adapt their behaviour and pace their driving speeds according to a perception for which the level of experienced risk of an accident is zero.

It is quite intriguing that there is so little common ground between transport-related risk perception research and driver behaviour models, as both areas of research deal with experienced risk. An important difference between the driver behaviour models and the risk perception models, and a potential explanation, has to do with *methodology*: risk perception models are mostly based on survey methods and people's self-expressed behaviour (if any behaviour measures at all), whereas driver behaviour models first and foremost are theoretical models based on direct behavioural measures or indirect measures (accident rates).

One thing that is apparent both in the risk perception field of research and the driver behaviour field of research is the growing attention to the importance of involving the concept of affect (or emotions) into the explanations, as mentioned in the previous section. Within risk perception research this can be said to date from the introduction of the affect heuristic in 2000 (Finucane et al., 2000). In some of the driver behaviour models, emotional aspects have been a naturally inherent part of the described mechanisms, but only recently has there been any attempt made to include emotions as a guiding principle for actions in such a model, through the introduction of the Risk Monitoring Model (Vaa, 2003). At present this model is of a rather theoretical nature, and is yet to be tested empirically.

Walking close to heavy or busy traffic is an unpleasant experience for pedestrians, but those places that are generally recognized as dangerous do not necessarily have to be dangerous in terms of the actual number of accidents (Elvik et al., 1999). A typical explanation for this is that individuals tend to behave in a more cautious manner in situations they perceive to be dangerous. The flipside of this is that people will behave less cautiously in situations where they feel safer or more protected. The notion of *risk compensation* is typically an expression of the latter phenomenon. Risk compensation refers to people's tendency to adjust their behaviour in response to perceived changes in risk levels, and is often used as an explanation when measures aimed at improving safety do not work as effectively as intended or when they have a negative effect on accident rates. An important feature of walking, as opposed to car driving and other motorised modes of transport, is the lack of physical protection. As a result, it can be hypothesised that soft transport modes might be involved in rather different processes of risk compensation than for example motorists. For motorists, the effect of a safety measure aimed at reducing accidents (e.g. ABS-system) may be reduced by risk compensation by the drivers, whereas a safety measure aimed at reducing injury from accidents (e.g. airbags) are not (Bjørnskau 1994). For pedestrians, it can be proposed that this distinction between accident-reducing and injury-reducing measures is not as apparent, since most accidents will eventually lead to an injury for an unprotected soft-mobility user.

3.2. Empirical findings

3.2.1. Route choice

Walking in general and use of public transport are the two modes of transport with the highest fear of crime. In both cases physical contact with strangers is possible but there is often no quick escape. Walking alone is often perceived as more dangerous than in a group (Van Vlierden, 2008).

A study conducted in Sweden aimed at investigating worry and feelings of being unsafe in various 'travel-related' places, for instance railway stations and parking lots (Alm & Lindberg, 2000). The point of this study was to investigate how people perceive the 'whole journey'. This is perhaps particularly important in relation to risk of violence or of being threatened.

The results showed that people reported experiencing worry and feelings of being unsafe most frequently when *walking*, followed by being at a *bus stop*. Airports and ferry terminals were the least frightening transport related places. The Department for Transport (2004) confirms that the walking parts of a public transport trip (e.g. during the access and egress trip or during a transfer), are often considered the least safe part of the trip and even less safe than the time spent in the vehicle or at the station or stop. Especially pedestrian underpasses are frightening and often avoided due to feelings of enclosure and poor quality (graffiti, litter and other signs of disorder). Also streets in the vicinity of stations and parking garages often cause feelings of fear.

Stafford and Petterson (2004) found that women who use public transport after dark feel unsafe in parking garages and other enclosed places like stations, in the train, underground and while walking in the vicinity of the station. Generally speaking the underground has the highest scores (62% of the women) of feeling unsafe, followed by the train and bus (40%). Men's scores were substantially lower: between 18 and 32%. The perceived risk of becoming a victim of crime seems to be higher after dark and in enclosed spaces (Crime reduction website; Stafford & Pettersson, 2002 and 2004; CROW, 2007; Social Exclusion Unit, 2003). This corresponds with research by Greene (2003), who found two basic characteristics of the built environment, which play an important role in the perception of risk: the visual field (how much can I see?) and the visual control (can I be seen?). People feel the safest if they have a good overview of the space in which they are moving and if they have the feeling that they are supported by other users.

In a previous COST-action, a study was conducted looking at *comfort* among pedestrians in six European cities. Eight different factors were identified. In a subsequent survey pedestrians who stated that they could have chosen different routes were asked for their main reason(s) for the choice on the current trip. Among the most common answers were time use (38%) and walking distance (33%), while as many as 15% mentioned the surroundings. However, the most important factor to explain comfort when walking was to feel *safe* and *secure* (Øvstedal & Ryeng, 2002).

In addition to asking about factors contributing to perceived risk, Backer Grøndahl et al. (2009) asked their participants about five different behavioural adaptations, some strategic and some tactical, related to 10 different transport modes. Behavioural adaptations in this context can be seen as safety precautions. Of all the adaptations for all transport modes 'choosing another route while walking' was the behavioural adaptation most reported. 67% of respondents said they would 'sometimes' or 'often' do this as a consequence of feeling unsafe while walking. Support for the previously mentioned distinction between worry about accidents and unpleasant incidents, such as crime and threats, were also found when investigating behavioural adaptations. Thus, for pedestrians most behavioural adaptations would occur as a result of worry about unpleasant incidents, rather than as a result of worry about accidents. In this respect walking is more akin to public than private modes of transport, which are typically associated with fear of accidents.

Being close to motorized traffic exceeding the speed limit fills cyclists and pedestrians with dread (Vlassenroot & De Mol, 2007). But, as mentioned earlier, perceived and objective safety are not necessarily related. A typical example of this is the finding that ordinary marked pedestrian crossings seem to increase accident risk for pedestrians (Elvik et al., 2009). This has been attributed to the fact that pedestrians behave less carefully when crossing the street at marked intersections than they would do if just crossing the street where it is not allowed. In other words, they reduce the potential positive effect of the risk reducing measure by risk compensation. However, a theoretical discussion of safety measures aimed at improving safety for pedestrians and bicyclists, indicated that compensation was not normally the case. 78 out of 125 submeasures were assessed to have a positive effect on both objective and subjective safety, while 25 have negative effects

on objective and subjective safety. This is taken as an interpretation that in most cases risk compensation *does not occur for pedestrians' safety measures* (Sørensen & Mosslemi, 2009).

Thus, there is not always a clear relationship between feeling unsafe and the objective risk in a situation. This should not be interpreted as people not being able to accurately judge risk. In most situations people are actually quite good at assessing risk levels. Research shows that in big American cities there is a relation between locations perceived as risky and locations that are objectively high risk areas (Pucher & Dijkstra, 2003).

3.2.2. Mobility of the elderly

For elderly, walking is a way to maintain their mobility and overall health situation. Their walking behaviour though, is different from other pedestrians because of age-related individual characteristics like walking speed, need for assistance, limited mobility and fear of falling (Borst et al., 2008). The main goal of the research of Borst et al. (2008) was to investigate the influence of street characteristics on the attractiveness of streets preferred by elderly. They selected different factors, which may potentially influence walking behaviour for elderly: pedestrian infrastructure, traffic volume, public transport, shops and businesses, green areas, reported crime and information about what neighbourhood looks like (tidiness, blind walls) and asked respondents to mark the streets they liked and disliked. Elements related to presence of other people were positively associated with the perceived attractiveness (shops, catering establishments, businesses, bus and tram stops). Also safety measures (zebra crossings) and traffic volume had a positive score on walking conditions. A possible explanation could be that higher traffic volume also indicates wider streets and more activity.

Bernthoft et al. (2008) investigated the risk perception and behaviour of pedestrians and cyclists aged 40-49 and people older than 70. One of the topics on the questionnaire was route choice when walking in their hometown. Both groups appreciated pedestrian crossings and signalized intersections, but the older people tended to find it more dangerous to cross a street without those facilities and when there are cyclists and roller skaters on the sidewalk. The younger group though, preferred street lighting more than the older group, perhaps because they go out more in the evening. It is also interesting to note that reduction of travel time (fast, direct) was an important issue for the younger group. Sidewalks are important for both groups. When questioned how the two groups behave in certain risky situations, the older group seems to be more cautious, choosing pedestrian crossings, not walking against red and returning after having started crossing a signalized intersection when the light turns red. Both groups cross the street sometimes in other places, but only if there is a clear view and light traffic. The most important reason for older people to cross where they are (not using a special pedestrian crossing) is because it is inconvenient or difficult to make a detour. The younger group though, crossed the street often where they were because there was no reason not to do it.

In a random sample of elderly between 65 and 80 years old in the United States, 9% reported a serious fear of falling. Although more women than men reported fear, for both groups the fear of falling increased with age. As a result they seldom left the building where they lived (Arfken et al. 1994). Research shows that among women between 54 and 77 years of age in the UK, 10% were afraid of falling (Martin et al. 2005). One third had already fallen on the street. Australian research of women between 70 and 85 shows that fear of falling was larger than fear of being robbed on the street (Bruce, Devine & Prince, 2002). Fear of falling has an impact on the amount of outdoor walking elderly engage in and their activity pattern (Lachman and Howland, 1998 – cited in Jørstad, Hauer, Becker & Lamb, 2005).

4. Conclusion

Research on risk perception has increasingly moved its attention from cognition to the role of affect. These days it is generally recognized that both aspects play an important role in decision making processes. Due to methodological challenges, there is still research that actually manages to handle both these issues and prove their relative contributions.

From an empirical perspective it is just as important to make the distinction between two types of risk that are important for pedestrians: the risk of being involved in an accident and the risk of falling victim to a criminal offence, violence or threats. It is the latter that is most important for walking behavior.

Some studies report quite high numbers of self-reported mobility restrictions due to unsafe environments. However, general surveys using well-controlled designs and proper sampling methods tend to find quite low relationships between perceived risk or feeling unsafe and strategic decisions about walking.

There seems to be considerable national and regional differences in how perceived safety influences children's opportunities for walking in everyday life. In some inner city areas, especially in large cities, fear of crime or fear of accidents might give considerable limitations to children's independent mobility. In more rural areas and especially in Northern Europe, this seems to be a more marginal explanation.

Once the pedestrian has made the strategic decision to walk, perceived safety plays a larger role. Pedestrians who are afraid of *crime and threats* tend to exhibit more behavioral adaptations, like choosing another route, than pedestrians who are not afraid. Perceived risk of *accidents* tends to have less of a direct impact on behavior. An important and often cited exception to this is the rather rare occasion when traffic safety measures lead to increased risk due to the risk compensation phenomenon.

5. Recommendations

Surveys using well-controlled designs and proper sampling methods tend to find quite low relationships between perceived risk or feeling unsafe and the strategic decisions about walking. From this, one could draw the erroneous conclusion that this aspect should be disregarded in the planning and design of pedestrian facilities. There are quite strong regional or geographical differences, and research has shown that people are rather good at judging risk. Thus, these findings should act more as a reminder that feeling safe is a fundamental need for human beings, and that the provision of safe and secure transport systems is a fundamental prerequisite for attracting more people to walk. In other words making walking safe is a necessary, but not sufficient, condition for increased walking.

Normally, measures directed towards providing safe and secure transport are seen strictly from a transportation perspective. However, we have learned that there are considerable differences among groups of the population. Typically, young females feel more unsafe than middle aged men. This means that we also have to consider such measures from a welfare and equity point of view. In other words, even if such initiatives may not shift large quantities of people from motorised to non-motorised transport, they might increase the mobility and independence of groups of the population who now feel restricted in their everyday travel.

Finally, the relationships between behaviour and perceived safety are stronger for the decisions made at the tactical level than at the strategic level. Most safety measures for soft mobility transport tend to increase both perceived and objective safety. The general rule is

therefore that any safety measure for pedestrians will have a positive influence on both safety and mobility. However, there are some quite notable exceptions to this rule, such as ordinary pedestrian crossings (unsignalised, not raised). To avoid the negative trade-off between increased mobility and safety, designers should therefore make sure to consult good quality literature on the effect of both these parameters when planning new constructions.

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