

VULNERABLE USERS: MOBILITY AND SAFETY

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SUMMARY

Beyond the inquiries often undertaken among the population, the analysis of insecurity and its determinants can be used to place the reality of risks in a larger context of technical debates on layouts.

In Depth Accident Investigations (EDA Etudes Détaillées d'Accidents), which are based on a technical collection gathered at the accident location, provide an in-depth understanding of the behaviours, activities, representations and attitudes of those involved. This knowledge constitutes an indispensable aid to analysing the current blocks to developing "soft" traffic.

Current concerns for ecomobility are expressed in the scenes of public actions where various decision-making actors confront each other (for example, the PDUs in France, as well as LTPs in the UK and PUTs in Italy). Conflicts of observable objectives and values, the strategies implemented notably involving the role of the feeling of safety, are the subject of research whose results can be made clearer in light of what DASs show us.

1. INTRODUCTION

The objective of road safety policy is to reduce the number of traffic fatalities. This motivates action and constitutes the measure of effectiveness. Most policies which set a measurable objective seek to decrease the number of fatalities in 5 or 10 years, which is notably the case in the European Union and in many European countries.

Some policies, however, stress the safety of vulnerable users, as they travel at lower speeds, apparently have much less external aggressiveness and are the privileged victims of collisions with vehicles, since they have no protection to attenuate the seriousness of an accident. The need for sustainable development in our societies also requires that we call into question our habitual methods of motorised travel and promote "soft" modes. Such promotion necessarily entails securing these methods of travel which are all too often sacrificed in layout projects for transportation networks.

This text looks into the safety of vulnerable users, who include pedestrians and bicycle riders. It starts with an accident case to raise several questions on the causality of collisions, on their consequences in terms of actions and on layout practices as they can be observed today. It is not a question here of describing technical systems or of reviewing policy programmes which have been widely discussed throughout the literature. Rather, it is a question of shedding light on the current difficulties that can be observed in layout practices and to look into how the safety of vulnerable users can be integrated better.

2. WHAT CAN WE LEARN FROM AN ACCIDENT CASE INVOLVING A VULNERABLE USER?

2.1. Detailed Accident Studies

For many years, INRETS has been drawing up In Depth Accident Investigations (EDA) thanks to the mobilisation of multidisciplinary teams of safety specialists.

When the first aid services are notified of an accident, the alarm is transmitted in real time to the EDA team. A technician and a psychologist go immediately to the site and gather information, focusing on the most transient elements which could contribute to understanding how the phenomenon came about.

Physical traces – such as debris, tyre tracks, the positions of the levers and safety systems, any traces of collision left on the body by the collision with a pedestrian or cyclist – are pinpointed and photographed as quickly as possible. These traces will disappear very quickly even though they are of great interest for understanding what happened.

At the same time, the interview with the people involved is carried out on the site as close as possible to the event, before a mental reconstitution can be made and helping – in a way – in the memorisation work. The advantage of such a quick intervention is to be able to access raw material unmodified by the integration of the various justifications used to get oneself “off the hook” from any penal responsibility or so as not to damage one’s self-image.

Then, more permanent information is gathered on the roads and vehicles as well as among the persons involved concerning their socioeconomic characteristics, their physical condition, their relationship with the vehicle, with driving, with traffic law infringements, etc. The research thus continues by gathering secondary information at the scene of the accident, in a garage or junkyard and among those involved at home or in hospital.

The analysis of such material is based on two types of modelling. A functional analysis looks into the processes at work, notably mechanisms which could explain how the accident happened.

Another formalism stresses the phases of how the accident occurred, which makes it possible to look into all of its complexity by working back toward determinants long before the collision. We can thus look into living conditions and working conditions in a phase prior to driving. Driving is then studied from various angles, choice of mode transportation and itinerary, particularities of the road sections taken, speed and attention levels, attitudes and expectations coming up to the accident point. The accident situation indicates the type of breakdown in progression, notably the interactions between those involved. The emergency situation requires making decisions under heavy time constraints involving strong dynamic strain. Lastly, analysis of the collision is the affair of the physicians, biomechanics and specialists of automobile structures.

To illustrate the questions raised by the safety of vulnerable users, we will start with an accident case involving a pedestrian. Many of the accidents studied involve a vehicle driving at speeds greater than or equal to 50 km/h, causing severe injury or even death to a pedestrian. The reader obviously expects this type of accident. The choice made here is that of a very minor accident, without major bodily consequences, which will enable us to illustrate the conflicts confronting the users of urban public spaces.

2.2. Extract from an accident summary

"Friday ... January, approximately 9.15 am, Mrs X was walking along the wide side-alleys of the Cours M., in Aix-en-Provence, heading toward La Rotonde square. She decided to cross the road toward Avenue Victor Hugo, walking onto the pedestrian crossing without looking to her left. She was immediately struck by the rear-view mirror of an Iveco van, falling onto the carriageway and losing consciousness. Although she was only slightly injured, Mrs X was taken to the emergency room for observation. Mrs X is nearly 66 years old. Divorced since 1965, she raised her son alone... No higher education, she had held various jobs... she is now retired. Mrs X appears to be a fragile person in terms of her nerves... These events and this information may help to understand a bit better that she is suffering from depression... Today she is in good health... she is only being monitored for a slight thyroid and cholesterol problem. ... Living in the city centre of Aix-en-Provence..., Mrs X has never learnt to drive. But she does go out every day and seems to know the city like the back of her hand.

The day of the accident, around 9.00 am... She walked down the Cours M. This road is about 400 m long and has a 6-m wide carriageway, with 2 lanes of two-way traffic. ... wide, 17-m walkways line the carriageway... The carriageway is now 40-cm lower than the pedestrian walkway.... The pedestrian crossings are laid out as humps... bringing the carriageway to pavement level. There are no marking on the ground to identify the pedestrian crossings, except for the fact that it rises. ... the pedestrian flow is nearly constant and drivers almost have to force their way through...

This is where Mrs X decided to cross. ... She could have continued and crossed in front of the Casino... but she does not like this itinerary; she feels it is more dangerous... Two people were already crossing on the pedestrian crossing toward Avenue Victor Hugo. Mrs X headed across as well, but did not look to her left. ... But Mrs X had barely started to cross on the pedestrian crossing when she was hit (or rather "jostled") by the rear-view mirror of a lorry, at head height. This collision made her lose her balance and she fell onto the pedestrian crossing, losing consciousness.

The driver of the van... Mr Y, is 55 years and 6 months old. He is married and has two children... he finds his delivery job to be... tiring... he always has many customers waiting for their deliveries, "you have to move fast".

Having left Marseille around 8.00 am for exceptional "rounds", Mr Y came to make deliveries to his customers in the city centre of Aix first. He preferred to start his rounds here because, like many deliverymen, he does not like to make deliveries in the city centre given the parking problems... Moreover, he finds the new layout of the Cours M absurd, he says that driving is even worse than before... Concerning pedestrians, he says that "since they did their thing with the paving stones, people cross wherever they want"...

Mr Y was already late for his next delivery, but that was not very important to him... all drivers have a 1 to 1½ hour margin for deliveries on their route card, customers and transporters are all aware of this. So he was not particularly in a hurry... "There were people on the pavements, as usual" Mr Y ... did not hit his brakes until he heard a dull thud on the right-hand side of his lorry, far from imagining that he had just hit a pedestrian."

2.3. Some conclusions

At this stage, several observations may be made in the form of reflections on the appropriation of public spaces and their layout. These reflections will be used to organise

the rest of this text, which will try to point out certain essential points of the issues surrounding the safety of vulnerable users.

1) The first point to be observed is the banality of accident situation presented: the accident involves an ordinary user, at a habitual place, carrying out a routine task.

It does not involve an atypical event. The search for abnormalities, unusual or abnormal events is obviously a method that may have been fruitful at the dawn of road safety research. It was very helpful in improving situations, notably in clearing up black spots and improving vehicle design. But today, accident prevention entails changing viewpoints and changing paradigms. It is no longer a question of eliminating residual dysfunctional situations, but rather of designing a travel system with a better level of safety for all users, under all circumstances and notably for the most vulnerable users, which creates a range of multiple constraints.

In such a system, users do not have stereotypical, standardised behaviours, but these are average individuals whose “deficiencies” must be accepted, travelling with unsustained attention, usually thinking of something other than driving or walking. As [1] wrote, it is a question of “a normally downgraded user”. The challenge of design that will achieve a better level of safety is then the integration of such a travelling user, with the diversity of his physical states, his motivations and his methods of transportation.

2) While safety today entails taking such complexity into account, it is nonetheless true that certain types of action have unquestionable effectiveness. Speed reduction is obviously of this type. In the case under study, it appears that low vehicle speed gives a better chance of improving reciprocal perception among users, enabling users to avoid collision and notably considerably reducing its seriousness.

Reducing speeds in dense urban areas is an essential objective, all the more necessary since the number of elderly people is increasing in European cities. But with age, the seriousness of collisions is growing all the way to situations which can be fatal, even following collisions with vehicles driving at just a few kilometres/hour.

3) The previous considerations then require taking safety into account at a strategic level of urban planning and notably in the organisation of traffic in urban public spaces. It is indeed at this level that essential objectives such as accessibility and safety need to be thought out.

Safety is often conceived of as the ability to make the various users in the city to cohabit at lower speeds, while mobility and users must be segregated when high travel speeds are authorised. But the plurality of situations encountered cannot be limited to this dichotomy of road spaces, it requires a fine consideration of the diversity of spatial configurations and the safety challenges that each may represent. This obviously involves the organisation of traffic in contrasting urban environments.

4) Lastly, when the best know-how is used, the results in terms of victims may be excellent. This does not, however, mean that accidents may not occur in places where layouts comply with the state of the art. Zero risk is impossible.

A person in the city centre moving about without paying attention to traffic, crossing while following the pavement across a raised pedestrian crossing, may thus enter into conflict with a van required for its work to enter into such places where priority is given to pedestrians. Luckily, these physical constraints require vehicles to limit their speeds, thus

reducing the seriousness of collisions. We must therefore admit the complex character of urban situations, the difficulty of defining the actions to be undertaken and the relativity of the results obtained [2, 3]. We should insist on the importance of the diversity of public spaces, the methods of analysis and the fine comprehension of situations and the criteria for action and evaluation. The success of action is directly linked to the organisation of decision-making scenes, the motivation of the actors, their technical level and their implementation ability.

3. APPROPRIATING PUBLIC SPACES

Layout actions for spaces in which users travel should not be simply responsive and limited to interventions when dysfunctional situations are observed. These responses are, of course, necessary, but their impact remains limited. A proactive system should integrate safety into design. To do so, it should take into account the ability of drivers and pedestrians to move about in urban spaces and the specificity of the physiological functions at work in this type of travel. It should notably take a look at all levels of mental representations of urban and road spaces, the consistency of their articulations, and their links when these representations are involved in travel.

Ergonomics, cognitive psychology and accidentology insist today on the importance of an analysis of the context in the understanding of this human activity. Such activity is only made possible by our ability to foresee and forecast events which may interfere with our travel, as well as, thanks to our skills, to react in situations of interaction.

The theoretical frameworks dealing with this are based on representations of human understanding as catalogues for classifying the world or categorising it in more up-to-date perspectives [4] [5]. Other authors have looked into modelling in terms of diagrams or scripts able to show the dynamics of actions undertaken in various forms of human activity.

Rasmussen [6] pointed out the importance of an overall representation of situations in user expectations, in what the user can foresee as future interactions and what he can envisage as possibilities for action. Notably, this representation conditions the information-gathering strategy and the meaning attached to the information gathered. This overall meaning of the situations encountered helps to explain how and why certain events and certain signals can be neither seen nor understood, depending on the nature of the environment.

In the case in question, it is indeed the overall representation of the travel situation and of the public space "at hand" that leads users to pay no more than diffuse attention to the presence of a vehicle. While the protagonists in an accident are visible, the cues, although present, make little "sense" in such a context. This would certainly not be the case on a wide road in the city periphery where the problems encountered more commonly involve a lack of visibility, vehicles overtaking or a "follow-the-leader" effect when a pedestrian trustfully follows other people.

While driving, the user recognises the type of road he is travelling on, foresees the evolution of situations, seeks information that he feels is relevant, uses this information and processes it with reference to his previous practice (*a priori* expectations) and particular characteristics involved in his itinerary (*ad hoc* expectations). These two types of expectations [7] will make it possible to make refined driving adjustments based on permanent knowledge, but adjusted to particular conditions.

This has major consequences on the urban environment. This should first of all be recognisable to travelling users, which entails the possibility of quickly attaching meaning, because of the heavy time constraints. Thus, the more it looks like a “habitual” situation, the faster it is recognised. To this environmental category are associated expectations which correspond to situations which are more easily recognised. “Surprising” elements will have to be highly perceptible in order to be taken into account. Setting up signalisation often appears to be a necessary response, but it is only effective if it is congruent with the overall signification of the scene before the travelling user’s eyes. In all other circumstances, it will be totally ignored as it does not make any “sense” in this context.

In a concern for prevention, action on public spaces must therefore include these capacities for foreseeing and forecasting to achieve a good adaptation among drivers and pedestrians to the situations that they encounter in urban environments. Operationalising this notion today takes the form of road legibility. This notion is not new, insofar as Kevin Lynch, in his "Image of the City" [8] defined the *legibility of the city* as "facilitated apparent clarity... with which urban elements can be recognised and organised in a consistent scheme". He thus studied travel in cities, the cues for finding one’s way around and the resulting structuring of interactions between man and his environment.

The layout of urban public spaces for automobile driving will, through the notion of legibility, look into the overall meaning of the visual scene. Research has shown, first of all, the importance of the holistic treatment of these scenes, thus attributing them overall meaning. The structuring of knowledge sheds light on the importance of cues related to the carriageway (width, coating, marking, pedestrian crossings), then those related to characteristics proper to the direct and more distant road environments. Some research has looked into the role of learning in the structuring of knowledge, thus showing that novices more willingly use closer, "here and now" cues, whereas experienced users refer much more often to the nature of the urban fabric by aggregating many cues related to form, materials, height/right-of-way ratio, etc. These experiments also show that certain layout characteristics are more easily recognised such as paved streets in city centres or ranked networks in neighbourhoods of large urban areas.

Lastly, it should be pointed out that the situations of interaction which could be used, being related to this knowledge, are not homogenous. Pedestrians may be closely linked to the urban environment, but other modes of travel, notably two-wheeled vehicles, are not spontaneously associated with it [9].

More recently, a field of research has looked into the driving context at the same sites depending on the time of day, in the daytime, in the evening and at night. This type of experimentation [10] adds a time dimension to the work already carried out and demonstrates the ability of subjects to link times of day with induced activities depending on environments and potentials for encountering pedestrians and cyclists.

4. SPEED AS A VALUE FOR DIMENSIONING LAYOUTS

Road safety research has been going on for quite some time. A few main effective principles for action are well known today. We shall not mention the effects of alcohol or age-related disparities. But we should point out that, concerning space design, there have been very few definitive results in terms of prevention. The main, universally recognised effect is the importance of speed calming for safety [11]. In a same environment, reducing the driving speed among vehicles leads to much higher proportional gains in the number of victims. This result can be seen in the setting of speed limits and the obligation for

following them, notably through automated controls and sanctions, which have been expanding with a certain degree of success, for example in France.

Reducing speed has a twofold effect on safety, notably for vulnerable users. First of all, it gives the driver and pedestrian time to avoid having a given conflict degenerate into an accident. An older study of in Depth Accident Investigations data has shown that collision avoidance could be expected from such a reduction in speed [12] [13]. Moreover, all biomechanical research has shown the importance of impact speed in the seriousness of accidents involving an automobile and a vulnerable user. A meta-analysis of the literature (Figure 1) has shown stability in the results of research measuring the correlation between the seriousness of injuries and collision speed exceeding 30-35 km/h.

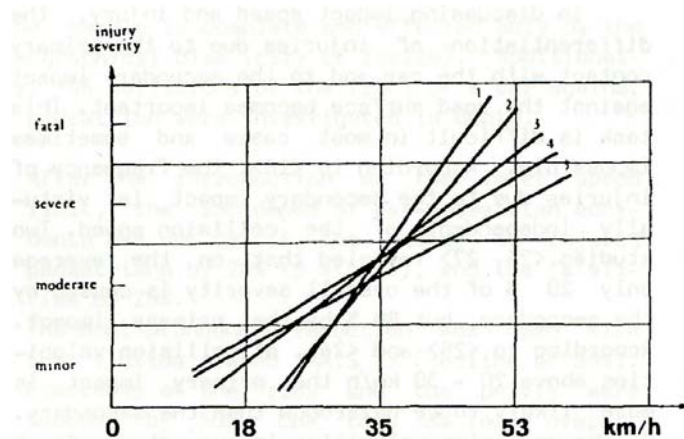


Figure 1 – Classification of the seriousness of injuries according to impact speed – Comparative research results [14].

Based on these certainties, layout has integrated speed reduction to protect vulnerable users. This was done empirically in the 1970s with the woonerf concept (pedestrian priority area) in Holland, and then with traffic calming experiments [15] [16] which have led to the technical principles widely shared around Europe today.

This revolution in methods led to the concept of 30 km/h zones, 20 miles area, tempo 30, etc., which allow the safe appropriation of public spaces by pedestrians and cyclists. This concept is usually based on a retistic model of traffic and of major thoroughways providing access to reduced speed areas located in the mesh of this network structuring urban spaces.

This is not self-evident, however. The “Safer Cities, Accident-Free Neighbourhoods” operation showed the importance of reducing speeds when rearranging heavy traffic thoroughways [17]. A PIARC report, furthermore, showed that the best candidate for a 30 km/h zone was the Avenue des Champs Elysées, which is one of the most heavily used streets in Paris! [18].

Going beyond the framework of retistic models of speed management, the idea of cities in which speed is reduced to 30 km/h has made progress, whether by referendum in Switzerland, by the principle of “car free cities” joining up with current ecological concerns, 30 km/h cities, generalised 30 km/h zones, etc.

In 1992, Holland implemented its vision for sustainable safety. Today, this vision has been amended for Advanced Sustainable Safety (2005-2020). For this, speed management has been rethought to avoid collisions’ having excessively serious consequences (Table 2).

Table 1 – Proposals for safe speeds, given possibility conflicts between road users [19]

Road type combined with allowed road users	Safe speed (km/h)
Roads with possible conflicts between cars and unprotected road users	30
Intersections with possible transverse conflicts between cars	50
Roads with possible frontal conflicts between cars	70
Roads with no possible frontal or transverse conflicts between road users	100

In Sweden, road safety policy is part of vision zero for layout. This means that “The road transport system is not adapted to the fact that people sometimes make mistakes. There is no perfect human being. In road traffic it is all too often a case of simple mistake being punished by death (p.5)... A speed of 30 km/h in built-up areas is nothing new, but the work on turning Vision Zero into reality has emphasised that this must be the limit pedestrians and cyclists are to survive a collision (p. 10)” [20].

Even if some people are working for this idea, France has not developed such a vision of systematic speed reduction to protect vulnerable users. In our country, layout practices are part of the unresolved tension between rational speed management and maintaining an optimal level of accessibility for local life. We can observe the actors focusing, on the one hand, on the hypercentre where local life predominates and, on the other, on expressways ensuring accessibility. Intermediate zones often have a more ambiguous status. The most common representation of urban spaces based on such a type of traffic organisation model then goes back to the question of travel speeds. It is part of the framework of reflections on the “speed and slowness” topic.

5. FORMAL MODELS, IMPLICIT MODELS

5.1. Integration of uses and segregation of modes

To simplify, it is possible to see layout as resulting from this twofold constraint of safety for vulnerable users on the one hand and accessibility on the other.

European cities are very vigilant in encouraging highly valorised local life. The objectives pursued by technicians and elected officials for this do not all appear to be the same and differ from one country to another. Great Britain stresses safety as an essential value which notably receives special financing. But other values drive this process. The preservation of historic heritage (in Italy), the importance of tourism, the quest for architectural quality in public spaces (recently in France), the need to integrate occasional festivities which bring together large audiences, taking the handicapped into account and spatial equity are among those which can be observed as having been put forward in layout in Europe. Add to this process the development of tramways and the promotion of cycling, and this dynamic is now part of a firm desire for sustainable development.

Overall, this dynamic is profitable to the safety of vulnerable users who can see a space being developed in which slower travel is privileged.

In other places, faster travel is favoured. The layout is based on a segregation model. This consists in creating networks that are differentiated by modes of travel, specific in their

layout, with no connection between them. It creates homogenous flows and thus safer traffic. Its strict application is, in practice, effective, and motorways and pedestrian streets are good examples of this. This notion of segregation ensures a good level of safety, a good level of comfort and a good commercial speed for public transportation. For these reasons, those who defend two-wheelers demand that veritable cycling networks be built. The condition for their success is a thorough application of such a model. Cycling networks must be disconnected from the roads used by other vehicles, while the space reserved to pedestrians must be isolated from that reserved to traffic.

From a strict safety point of view, however, this type of model has twisted effects when segregation is not complete, when there are same-level intersections between different networks. Moreover, many layouts are of poor quality because the political will stresses displaying the number of kilometres of cycling paths and their quality, and because there is limited space, because drivers or deliverymen use them to travel or park. In older urban fabrics, these layouts are rarely set up satisfactorily. On urban roads with heavy traffic, the safety of vulnerable users is harder to ensure.

5.2. Several types of spaces

These constraints lead to several distinct types of spaces which can easily be mapped.

The first is located in city centres or in spaces whose density and low level of traffic encourage better consideration of vulnerable users. Their safety is fully taken into account; or rather the state of our understanding enables us to take it into account when the political will is there.

The second network is made up of expressways forbidding pedestrian and cycling traffic. Insofar as they do not go there, the number of accidents involving them is low but, when they occur, they are obviously very serious.

Lastly, the network structuring the city forms an urban framework structuring traffic flow. This is usually a spider web made up of ring roads and radial roads. This network is designed for accessibility, but it presents an obvious challenge in terms of the safety of vulnerable users. The spaces reserved to these users are limited, pavements, pedestrian crossings, cycling lanes, sometimes bicycle priority systems on pavements. This division of spaces appears to be obligatory, yet it does not ensure satisfactory safety.

Moreover, road safety problems emerge in the “holes” in the model when it is not complete from the point of view of automobile traffic [21]. The interstices are the spaces that pose the greatest safety problems. This dichotomy can be seen in the panel of technical tools for road safety: motorways “work” well in terms of safety, pedestrian streets as well, but the intermediary spaces, such as urban boulevards, have more problems. Much road safety research has been carried out on areas with heavy local life stressing the development of principles such as traffic calming or the separation of traffics. On the other hand, many questions remain concerning interfaces: between express networks and local networks, notably on urban boulevards. Our know-how is limited on these expressways, where most traffic drives; these roads are also the centre of local life and have an intense presence of vulnerable users.

5.3. "Island strategies"

While the aforementioned models are representations of spaces that can be used to analyse the organisation of traffic, it is important to consider the dynamic of the spatial strategies at work in European cities today.

In many European fields, we can see the use of forms of urban networks and spaces that appear to be the result of "island strategies" [22]. It is as if, under pressure from motorised transportation and the explosion of the resulting urban task, the pedestrian city had tried to defend itself in places where the density of population and urban quality allow such a reaction for preservation. The apparent urban evolution thus appears to be the result of an "island strategy" in which certain zones manage better than others to defend themselves against the invasion of the automobile. The result is the appearance of islands of urban quality, but which in the end represent just a small percentage of the urban space.

This tension between the network design of travel systems and the treatment of urban space reinforces a rated, zoned vision of urban space; transportation (notably mass transit) structures it by crisscrossing the city space, thus reinforcing the island layout strategy.

Layout can be read at all levels, from the basic crossroads to spaces covering several communities. At a micro-local scale, it is a question of having many uses cohabit, even if this entails shifting traffic toward a dedicated lane "a bit further on". On a large scale, it is a road network that both links and avoids dense centres with a view to allowing exchanges, including in automobiles, while developing islands of sociability for pedestrians. A ranked model is thus set up through the rejection of traffic from zones in which urban functions are privileged, and by the design, in the periphery, of major infrastructures to meet the demand for mobility according to a more road-based model.

In everyday practice, action takes into account territorial differences, which involves adaptation to local contexts, finely specialised objectives, progressiveness in treatment from one type of fabric to another. This is not a fragmented vision, but rather an obligation to include, as early on as possible, the specificity of design objectives and principles, and notably progressiveness of transitions. The challenge today is indeed to design public spaces according to a vision that privileges the spatial dynamics of transitions, and therefore the dynamics of use, to improve the safety of vulnerable users, especially through consistent speed management.

6. LOCAL MANAGEMENT PRACTICES

6.1. Understanding for action

The appropriation of public spaces and traffic networks by the population and users does not follow simple rules. The processes at work may be interpreted in many ways and several disciplines call upon different models to present it.

This complexity of the activity deployed on public spaces is obviously the result of the capacity for adapting to those who use them. The results of layout actions, notably for the safety of vulnerable users, are never those expected. Each modification produces many "perverse effects" which must be taken into account.

We should certainly not think that all action is useless, but rather that, in all individual or social intervention, it is good to give up all deterministic references and, on the contrary, to understand how at all times to adapt the action to complexity, for which behaviours are revealing.

Leonard Evans [3] briefly sums up the representation that layout experts sometimes have of what a user is. He uses a "naïve, non-interactive model, without feedback, of the "engineering" type. This model postulates that users do not change their behaviour in

response to changes in the perception of safety. Generally, it overestimates safety gains and sometimes gets the sign wrong". This caricaturised warning is useful given that practice all too often stresses "nice layouts" or the number of kilometres of cycling paths rather than that which is really useful and safe for vulnerable users.

Thus, for practices truly in favour of vulnerable users, we should:

1. Keep in mind that technical systems are just tools to be used with discernment.
2. Draw up a diagnosis, remember to adapt the action to the local context, to the architecture and to the "spirit of the location"; design scenarios that will then be used as references for observing the effects of the action.
3. Perform follow-up on the layout. If pedestrians cross elsewhere or if drivers park on the cycling path, it is not a problem of a human factor disrespectful of laws, it is first and foremost a question of poor layout.
4. Perform a quantitative evaluation which can be used to measure the effects of the layout based on several criteria. The international bibliography is available to compare experiments implemented around the world.

6.2. Strategies for action

Certain systems at work in different countries are rich in useful lessons for protecting vulnerable users. These "good technical practices", while useful, nonetheless require taking a close look at the decision itself and at the organisation of the process of defining the action.

Most countries today have understood the need to design complete cycling networks to ensure the promotion of this mode of travel, and notably its safety. At this stage, we should point out the importance of the quality of layout to avoid accidents. While this concern in favour of bicycles can be observed in many countries, it is not as widespread in favour of walking, except perhaps in Switzerland, where the obligation to set up pedestrian networks is included in the law.

In several countries, promoting and protecting vulnerable users is now included in the travel plans, whether the British Local Transport Plan (LTP), the Italian Piano Urbano del Traffico (PUT) or the French Plan de Déplacement Urbain (PDU). That is why it was interesting to take a look at the process of drawing up PDUs to understand how and according to what criteria strategic decisions are made.

Thanks to an in-depth analysis of the drafting of the PDU in Marseille, Frederique Hernandez [23] looked into the relationships between projects. She was able to put forward the thesis of the construction of a "reference project" by aggregating "operational projects" and not by drawing up actions formalising common objectives, as indicated in the CERTU file on the design of PDUs [24]. Some of these operational projects are decided upon outside the field of PDU design, such as the tramway. Other operational projects emerge based on shared notions and tools, notably used to reduce the place of cars in city centres.

Several scenarios thus appear to be the result of aggregated "elementary projects" when brought up together, placed side-by-side, discussed in terms of their implications, and thus evolve during the meetings. On the other hand, it is when the components of a scenario do not mesh with those of another scenario during discussions in working groups that we can

see the existence of several spatialised mental models with relatively autonomous existences.

These models fit together in a generic “island strategy”. Firstly, the hypercentre model provides increased protection from automobiles by privileging pedestrians. For this to work, it is necessary to lay out bypasses which can drain off the demand for motorised travel.

A polycentric model appears at a smaller scale in a wider urban territory. Networks of connections by public transportation and “soft” travel modes, but also bypass roads for automobiles, are then designed consistently.

At a totally different scale, connections between cities are stressed through railroad links.

The process of constructing a decision is thus based on bringing together layout tools that can be used on different levels, producing observable consistency which is implicit throughout the model proposed. This type of system is only possible with the participation of a wide range of actors with different interests.

6.3. Decision-making actors

Of course, action in favour of vulnerable users is part of a general system of multidisciplinary construction of the action and of participation by citizens in the decision-making process. An analysis of the participation of actors, their institutional relationships, their qualification and their expertise is essential to understanding the nature of the decisions made.

To go beyond meeting immediate needs, a few effective practices have been put into place. The one that consists in having dual oversight over projects is certainly the most effective. This requires formal procedures, however, so as not to fall back into minimal routines. Audit procedures are set up in some local communities. They are all the more effective, however, insofar as they are carried out within the context of hierarchical institutional relations and especially when they are accompanied by specific financing. They can be observed in communities such as Lille, Grenoble, London and many others. This higher institutional level (intercommunal in France, Greater London) labels and finances local projects after verifying their usefulness in improving safety.

Taking social demands into account is still more complicated to implement. Technicians express reticence toward considering things which, in the end, are just one-off demands when the general interest is in question. Thus, in public inquiries, few comments on safety are considered as being valid [25].

Another form of reticence concerns the NIMBY-type reactions that are regularly expressed. Some researchers, however, find legitimate interest in this type of reaction and thus call into question the corporatist self-defence found in the technical world [26].

From the varied experiences that we have observed, we can see that the involvement of the population is easier when dealing with a concrete street layout project than when asked to react to a more large-scale project, such as a city or urban area. Thus, in Lille, the public will not react as easily to the PDU, on the CUDL urban community level, as to a micro PDU on the neighbourhood level, for which the population will feel more directly concerned.

6.4. Citizen forums

During the British experiment of the Gloucester "Safer City Project" – an experiment on a city-wide scale carried out by the British government – it very quickly appeared that the population's involvement was a major factor in the project's success. Mobilisation of the population is massively sought out through press articles, exhibits, the distribution of information documents, opinion polls or setting up an internet site. A representative panel of citizens is set up when drawing up each layout project. The Safer City Forum, on the other hand, has a more strategic ambition. It is made up of 46 residents of Gloucester, representing the economic world, associations, transport operators, emergency services, magistrates, the handicapped, ethnic minorities and others. Its role is to react to general technical proposals before the elected officials make a decision. While the role of the forum was supposed to be that of an authority representing the population's opinion, in practice it has become a channel of transmission to the public and plays a concrete animation role in implementing decisions [27].

In London, a "Pan London Road Safety Forum" was organised, with the task of encouraging the implementation of the Mayor's objectives and national objectives, the technical job of gathering data and good practices in actions, and the development of action campaigns. This forum is made up of elected officials, technicians, the police, transportation professionals, solicitors and jurists, insurers, ambulance operators, physicians, specialists in education and the media and associations of drivers, cyclists, pedestrians, some specialised in road safety, academics and researchers, as well as the PACTS (Parliamentary Advisory Council for Transport Safety) [28].

The Dutch sustainable transportation plan is also based on setting up regional forums to integrate local road safety actors. This brings into debate the highly standardised character of the Dutch system in a general process of decentralisation and mobilises actors for better integration of road safety into the field of transportation and urban planning [19].

Sweden's vision zero has also managed to develop thanks to the government's implementation in 2002 of a national assembly for road safety which brings together a wide range of actors.

Given the complexity of decision-making processes, it is thus necessary to elaborate a dynamic of procedures and projects providing consistent constructions. Participation by everyone in making decision is an obligation today to find ways of integrating different objectives. This dynamic implies balances of forces in which everyone plays a role. This holds true for the different professions, but also for representatives of social demands who have sometimes divergent interests. Those who want to promote "soft" modes and to contribute to improving safety play a major role in this process. To avoid coming into systematic conflict with those who have technical expertise in road layouts, it is important that they be allowed to contribute their expertise, and notably to provide strategic vision for layout and not just to demand details. This is indeed the challenge of procedures such as forums which are sure to grow in the future of city management practices.

7. CONCLUSION: SAFETY OF VULNERABLE USERS, A RESPONSIBILITY AT THE HIGHEST LEVEL

Locally, two conflicting points of view confront each other in road safety questions. Some only take into consideration the driver's responsibility and basically call for actions on people through controls and sanctions, training and information. Others consider that prevention *also* entails action on the road system, notably on public spaces. Thus, while

the driver's responsibility seems obvious, it should not overshadow the favourable effects that road layouts can have. It is hardly acceptable just to blame the driver when the victim is a vulnerable user: has everything been done so that a collision does not turn into a fatal accident? Along these lines, the layout manager is largely responsible for safety.

While this point of view is scarcely put forward in France, it is in other countries among the most advanced in terms of traffic accident prevention, for example Holland and Sweden. In this last country, the highways administration considers the designer of the road system as the first person responsible for safety. The value behind dimensioning travel networks is no longer the level of traffic but indeed the safety of vulnerable users.

It appears necessary today for network managers to take responsibility for integrating safety into the criteria and values that define their designs.

A comparison could be made with the taking of safety into account in the workplace. Today, it is when the company management takes on this responsibility and is mobilised to reduce work-related accidents, notably by integrating safety into the design of industrial processes, that progress has been made. If road safety wants to make equally spectacular progress, it is indeed through responsibility at the highest levels that mobilisation can be achieved.

Thus, Ken Livingstone has positioned himself on the safety level in London: "This is the first Road Safety Plan under the new governance arrangements for London. These give the Mayor responsibility for developing and implementing safe transport facilities throughout London. ... Boroughs will continue to be responsible for traffic management and safety issues on their roads..... The Mayor's Transport Strategy sets out his priorities including road safety and this allows the promotion of road safety in ways not possible before". And the figures have proved him right [28].

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