ROAD SAFETY - THE ROLE OF RISK PERCEPTION: CURRENT KNOWLEDGE AND IMPACTS ON COMMUNICATION AND POLICY

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ABSTRACT

Risks exist in every field and situation, including the management of road infrastructures. But not all risks affect everyone and interest people generally: the attention focuses selectively on specific risks, leaving others to be completely neglected and just considered as unavoidable facts of life. However, these underestimated or neglected risks can suddenly be thrown into the lime-light – sometimes as a consequence of specific extreme events or media campaigns.
The perception of risk has two major consequences in the context of road safety management:

1. In the field of strategy: Road Authorities and Operators need to make choices and investments that are able to differentiate between hazards which have a reasonably high probability and those which carry other risks. The perception of risk and the social reaction appraisal to major events can have an impact on the assessment process, bringing the overall action to unpredictable results in terms of assessment or provisions or development of risk-plans.

2. In the field of human behaviour: This is all about the perception of risk by road users. Of course, without such insight it can be very easy for road users to underestimate the risks associated with driving – and poor insight inevitably tends to result in poor driving skills. But since risk perception and human behaviour may inevitably vary as between developed and developing countries, it is imperative that

we should take account of these differences in order to devise a coherent and meaningful approach to the development of road safety policy on a global scale.

This paper aims to provide a status of the research in the field of behavioural studies applied to the evaluation of risk in the framework of traffic operations, management and control and transport planning, policy and management. An overview of several issues and examples will be given, focusing also on the current action of PIARC (World Road Association) through international Technical Committee C3 in a specific WG animated by one of the authors (Arditi).

Keywords: Risk Perception, Road Safety, Human Behaviour

1. GENERALITIES ON RISK PERCEPTION

"*Man was born in labour, and birth itself means a risk of death*"[1]. This sentence is our English translation of a verse by Leopardi, maybe the most distinguished Italian poet. Risk exist in every field and every given situation, from the birth itself to the daily life, to the management of road infrastructures.

In considering the risk as the quantifiable likelihood of damage, danger or loss in a specific situation, it is clear that not all risks affect and interest most people, or at the same time.

But what makes the analysis, the preventive action and the response more cumbersome is the fact that the assessment of the risk and the related reaction, is linked to a very individual response, so that the attention is focused selectively on specific risks, while others are completely neglected, considered merely as unavoidable facts of life.

The worst possible outcome occurred exactly the underestimated or neglected risks turn into facts, and the unforeseen consequence are suddenly thrown into the limelight as a function of specific events and/or media campaigns.

The crux of this study is to focus on the role that risk perception, then the risk acceptance and individual reaction to risks play in influencing the road safety and how far mobility policies can have a role in this frame.

What is the acceptability of a risk? Mary Douglas [Risk acceptability according to the social sciences, 1985] [9] said this expression means "social" acceptability: there are in fact socially standardized conventions determining what risks are acceptable. In other words is the culture that leads to define some risks to be considered acceptable and other ones to be feared and therefore refused. It is impossible to design and report on the perception of risk without taking into account the overall reference context, moral, social and political. At the same time, press and lobbies often stress the unacceptability of certain risks. There is no question whether it is acceptable or not that a disaster with great probability could frequently occur. Specialists in risk perception attempted to systematically identify what makes one risk more acceptable than others and also address the issue of different thresholds of tolerance of relevant hazards.

[1] From the original "Nasce l'uomo a fatica, ed è rischio di morte il nascimento." Taken from "Canto Notturno di un Pastore Errante dell'Asia" (1829-1830) by Giacomo Leopardi, Italian poet.

Speaking of road risks, and in particular the risks related to traffic safety, we could easily consider that travelling by car brings a significantly higher risk in comparison to flying. People who don't feel comfortable with the above sentence, can quickly find a comfort in the statistics of casualties. Nevertheless, in spite of statistics, fear of flying is widespread and the risk implicit in flying is less tolerated. Conversely the fear of a short trip by car because of the potential risk, in urban areas for example, appears ridiculous to the vast majority of people. But indeed, the fatalities and crashes rates in urban areas are the most common causes of sudden death, especially for some categories of road users (bikers, young, pedestrians, elderly people), see [26].

Fear, therefore, is not always a good indicator of the hazard and vice versa: not all risks trigger the same range of interest and perception of people.

Authorities, Road Operators, and road safety policy makers when making their choices and investments, or targeting a strategy need to consider several factors to discriminate between risks (or better hazards) with a reasonably high probability (upon a solid scientific base) and other possible risks with a minor likelihood .

The experts, in general, offer peremptory answers, sometimes even in a noticeable contrast with one another.

In the fields of health, environment and technological progress, attitude and behavioural approaches appear increasingly diffused in terms of simplistic cause-effect relationship, often without an analysis of the overall context of the problems, in spite of the complexity and the huge number of factors involved. Results of statistical data processing, perhaps referring to non-representative samples, are sometimes wrongly considered as a conclusion and not as a precondition for further investigation. Moreover, on this basis, mass media may amplify ambiguous or misleading messages, often creating undue alarm, false expectations and frustration. In the long term this all leads to mistrust and confusion.

Covello research in psychological sciences has identified 47 known factors influencing the perception of risk; issues like **control, benefit**, and **whether a risk is voluntarily assumed**. The most important factor is **trust**. This can help to explain why citizens are concerned about food safety issues that scientists deem trivial. The actual risk does not change, but the perception can; and in the domain of public policy, perception is reality (Covello, and others; U.S. National Research Council). People also judge risk according to their perception of its controlling agents: if these controlling agents have a track record of secrecy, or they dominate supposedly independent regulatory bodies and the public policy process, then people magnify the perceived risks (Hamstra, 1992; Covello, 1992) [6], [7].

Other factors modulating risk perception, as cited by Covello and Merkhofer (1994) [8] include:

• **catastrophic potential** - people are more concerned with fatalities and injuries that are grouped in time and space (e.g. airplane crashes; outbreaks of foodborne illness) than about fatalities and injuries that are scattered or random in time and space (e.g. auto accidents; sporadic incidents of foodborne illness);

• **familiarity** - people are more concerned with unfamiliar risks (ozone depletion) than familiar risks (household accidents);

• **understanding** - people are more concerned with poorly understood activities (exposure to radiation) than those that may be understood (slipping on ice);

• **scientific uncertainty** - people are more concerned with risks that are scientifically unknown or uncertain (recombinant DNA) than risks well known to science (car crashes);
• **controllability** - people are more concerned with those risks not under personal control (pesticides on food) than those under personal control (driving a car);
• **voluntariness of exposure** - people are more concerned with risks that are imposed (residues in food) rather than voluntarily accepted (smoking cigarettes);
• **impact on children** - people are more concerned with risks perceived to disproportionally affect children;
• **dread** - people are more concerned with risks that have dreaded results (Creutzfeldt-Jakob disease is perceived as an undesirable way to die);
• **institutional trust** – trustworthy institutions are able to communicate vision of the risks and events modulating the perception of the risk itself more efficiently;
• **media attention** – the attention of media is a key element for the modulation and amplification of public opinion relating to risk perception;
• **attributability** – events that have a clearly attributable responsibility have a higher impact on public (car accidents consequent to the drug use of the driver).
• **clarity of benefits** – it is easier for people to accept risks when the benefit is clearer (nobody question the use of house heating even if contributing to environmental impact of urban areas and consequent possible diseases);
• **reversibility** - risks perceived to have potentially irreversible adverse effects are less readily accepted and perceived to be greater than risks posing no permanent, personal threat;
and other factors such as: accident history and personal stake.

2. IMPACT OF A MAJOR EVENT - MAGNITUDE AND SOCIAL AMPLIFICATION OF RISK - THE ROLE OF MEDIA

Perceptions of risk play as well a key role in a process labelled “social amplification of risk” (Kasperson et al., 1988) [12]. Social amplification is triggered by the occurrence of an adverse event, which could be a major or minor accident, a discovery of pollution, an outbreak of disease, an incident of sabotage, and so on, an event that falls into the either risk-unknown or risk-previously-ignored category and has potential consequences for a wide range of people.
Through the process of risk amplification, the adverse impacts of such an event sometimes extend far beyond the direct damages inflicted to victims and property and may result in massive collateral impacts such as litigation against a company or loss of sales, increased regulation of an industry and so on. In some cases, all companies within an industry are affected, regardless of which company was responsible for the mishap. Thus, metaphorically speaking, the triggering event can be thought of as a stone dropped in a pond.
The ripples spread outward, firstly encompassing victims directly affected, then the responsible company or agency, and, in the extreme, reaching other companies, agencies, or industries (See Figure 1). Media have a key role in the process of social amplification.

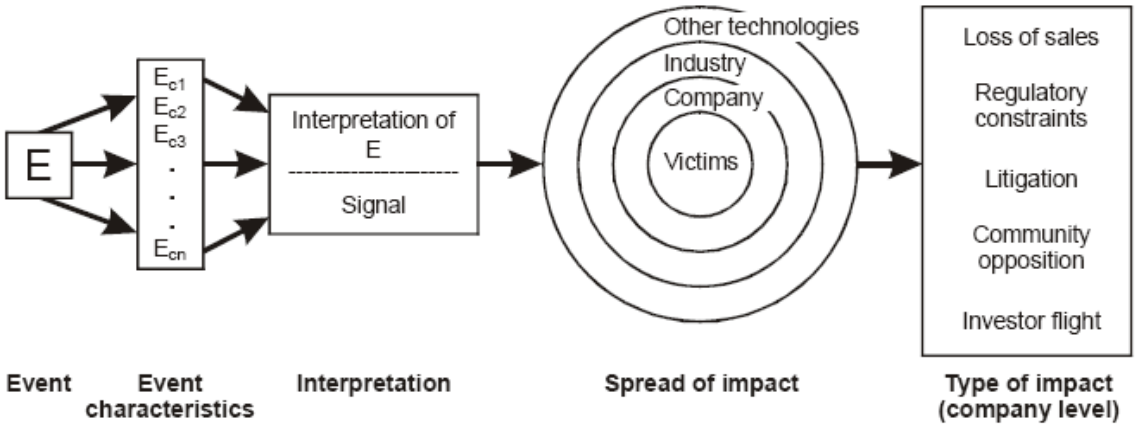

Figure 1. A model of impact for unfortunate events[2]

3. RISK PERCEPTION IN THE FIELD OF ROADS

The present chapter develop the generalities on risk perception and social amplification of risk, trying to see how some phenomena are applicable to the field of road transport. Two typical kind of accidental events are analyzed, both of them highly impacting in terms of perception on the general public and highly amplified by media.
The two chosen cases are accidents in tunnel and multiple pile-up in the event of fog.

The case of road tunnels

In the field of roads we can make use of examples to assess the consequences on public perception risk relating the media impact following the road accidents.
Let us start with the case of accident within road tunnels.
Accidents which occurred on the European road network (Mont Blanc – France/Italy, March 1999, Tauern – Austria, May 1999, St. Gotthard – Switzerland, November 2001). All these accidents have the common point that fire spread from heavy goods vehicles in a confined space. All three cases had a strong impact on the mass media and public and it can be seen that most of the features of risk amplification described above applied.
It is worth noting that fire accidents in tunnels have a strong emotional impact on the public and media. A shocking recoiling effect that often goes well beyond the effective registered damage. Fires in tunnels shake souls and fill in the pages of international newspapers for the nature, the rareness and maybe the exceptional dimension on the impact of the facts. On the other hand, the news of the road tribute in terms human life with maybe twice, maybe three times, maybe ten times or even more victims', although diluted on the road network, is weekly reported on the national press in a shape of a short paragraph of chronicle.
The quoted events were kept for such a very long time under the spotlight of media and the European Institutions decided to establish new provisions for the “minimum requirement of

[2] Taken from [19] Slovic Weber “Perception of Risk Posed by Extreme Events” – Risk Management strategies in an Uncertain World,” Palisades, New York, April 12-13, 2002

safety" for all European tunnels. According to the preliminary budget of the European Commission, the total cost coming from the Directive was in the range of 2.6 billion Euros to 6.3 billion Euros of 2002 [10]. The refurbishment cost of the Mont Blanc tunnel was in the range of 300 million Euros, but even higher are the costs for the overall Italian and French economy because of the 3 years closing of the tunnel (estimated in 3-400 million Euros for each year[3]).

Considering the events in tunnels regarding the "47 known factors that influence the perception of risk" (see above - chapter 1) it can be observed that in the case of tunnel fires:

• **catastrophic potential** – The fires in the Mont Blanc tunnel (1999), Tauern Tunnel (1999) and St Gotthard tunnel (2001) showed the potential for significant loss of life, bodily injury, property damage and business interruption compared to standard road accidents. On the other hand no relevance on the perception of people has the fact that very few fire accidents in the history of worldwide transportation [15] resulted in fatalities and only the three above listed accidents resulted in more than 10 fatalities each;

Figure 2. Accidents in tunnels trigger the attention of media. A pre-war vintage example: March 1929 New York rail tunnel fire made the front-page on a newspaper of Naples (Italy) "il Mattino illustrato"

[3]Source [18]: Valutazione degli effetti economici sui sistemi regionali e nazionali della chiusura del traforo del Monte Bianco, Prometeia, maggio 1999.

• **familiarity** - people is more concerned about unfamiliar risks: people are not frequently exposed to fires in tunnels, while almost every week when driving in a major town, it is lifely to encounter a car or motorcyclist accident;
• **controllability** - people are more concerned about risks not under personal control. When a major fire ignites in a tunnel, the physics of the phenomena could be out of human control;
• **voluntariness of exposure** – people are more concerned about risks that are imposed rather than voluntarily accepted; we can consider that speed related accidents are, to some extent, the consequence of a voluntary action, which is not the case in the event of a tunnel fire;
• **dread** - people are more concerned about risks that have dreaded results. It is not a perceived, accepted or imagined outcome to be burnt or to die from suffocation as a result of a tunnel fire;
• **media attention –** the attention of media is a key element for the modulation and amplification of the risk perception on the public opinion; even a minor event related to fire triggers the attention and quickly reach forefront of media worldwide. In picture 2 there is a pre-war vintage example: in March 1929 a New York rail fire in tunnel (9 fatalities) made the front-page on "il Mattino illustrato", newspaper of Naples (Italy).
• **impact on children** - people are more concerned about risks perceived to disproportionally affect children; referring again to figure 2 we can observe that the painter of last century Ugo Matania, emphasized the event by putting several children in the illustration, one in the central position.

The case of fog accidents

Pile-up of cars in the event of extreme weather conditions such as "fog" (e.g. fig. 3[4]), is an additional example of those events that, independent of frequency, are clearly perceived by the public and highly amplified by the media.
In figure 4, snapshots of news of BBC [20] and VOA [21] are reported. These two articles present a multiple crash in Italy (2003) subsequent to a sudden, thick fog.
The event of 2003 was extremely severe resulting in several fatalities. However "extremely severe consequences to human life" are not the only triggers for media attention. For instance, a pile-up collision resulting in a single fatality in Austria garnered media broad attention (e.g. [22] on Spiegel). A similar interest from media wouldn't have occurred for a single fatality related to "ordinary" road accidents.

[4] A video of the event consequences is available on http://it.youtube.com/watch?v=OfL5x_SFGZ4

Figure 3. Resulting pile-up from crash happened on A21[5] motorway, February 22nd 2008

It can be observed that the media attention and exposure is not necessarily related to statistics and the attention not necessarily addressed to events similar in happening but sometimes the attention is driven to events similar in media impact. See figure 4, where a media impacting event for fog bring the journalist to link to fire in tunnel events (the BBC news on fog crash of March 13th, 2003 links to some news of October 24th, 2001 related to the fire accident on the Swiss tunnel of St . Gotthard).

[5] Image from [25] http://www.ilgiornale.it/a.pic1?ID=243192

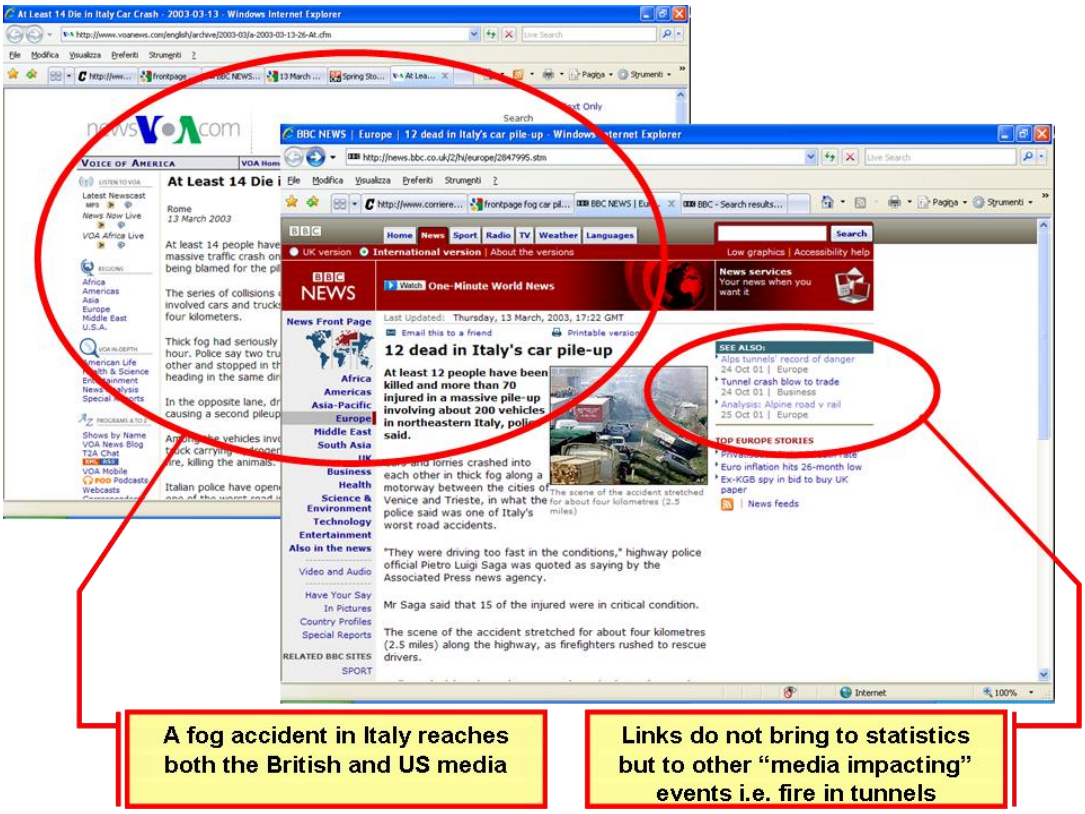

Figure 4. Crashes with car pile-up are events shaking media.

4. HUMAN BEHAVIOUR - FROM COMMON PERCEPTION TO THE ASSESSMENT OF EXPERTS – THE CASE OF ROAD SAFETY

The case of road safety appears to be a good example of road related risks where there is a fair difference between the perception of common citizen and the way of thinking of experts.
For instance it is commonly recognized by experts that the highest standards of safety are possible on motorways as compared to other roads. Moreover motorways are capable of better progress in terms of improving safety and reducing traffic accidents (e.g. Simone - Bonini, 2003). Despite facts recognized by experts, the clichéd perception of safety on this type of road continues to be diffused. Answers to questions of this nature needs to be investigated within the field of studies concerning the modalities of risk perception and consequent behaviour, more than on safety statistics.

Figure 5. Austrian media campaign on the use of safety belts in rear seats [44]

Again, as an example, the analysis of different accidents in motorways shows that on one hand users do not always have a correct perception of the risks to which they are exposed and that some features of the individual character and some personal specific situations could lead users to underestimate or overstate the risk (Brunel, 2002).
The same studies show how an incorrect perception of risk can be consolidated, even from erroneous beliefs, e.g. from clichés or from incorrect and contradictory communication on safety and levels of risk.
In Italy, the laws on wearing helmets were changed in 2000, reaching all moped and motorcycles riders, irrespective of age. There were press campaigns, media involvement, and severe enforcement.
It has been very difficult, nevertheless, and still is, to impose these rules mainly because youngsters undervalue risk and their attitude to drive recklessly is also fostered by thinking that rules are made just to create a further burden, maybe a purposeless constraint to the incredible freedom that instead youth should have by default.
Evaluation showed that the highest uptake (66% decrease in traumatic head injury hospital admission, and a 31% decrease in admission to neurosurgical units [27]) was achieved in the regions where strong educational campaigns involving schools, families, clubs were carried out, combined with strong enforcement.
Indeed the action on the risk perception in young people is one of the most challenging commitment both for the scientific medical world and for road safety policy makers.
In fact, understanding and assessment of the feeling of exposure and vulnerability change over the course of life.

The problem of disproportionate high rate of accidents among young drivers shows the fact that indeed youngsters are addict risk–takers, almost often considering (for lack of direct experience, familiar are still young, or poor scholar training and acknowledgement) the death, the permanent impairment, rehabilitation as well as illnesses in general, hospital care, and medicaments as extremely remote events or very out of touch situations.
This is indeed due to risk perception, hazard attitude, judgements, behaviour and motivation well embedded in the cultural environment [28].
Indeed rewarding actions could be carried out considering school customized also pre driving education programmes, constant updated campaigns and the permanent involvement also of families and social actors.
Again, for instance, it appears to be quite a widespread opinion that in the event of an accident, the rear seats are safer and subsequently somebody deems it not essential to fasten safety belts. A recent statistical evaluation of the number of children killed in road accidents in Austria showed that half of them died whilst travelling as passengers in cars, usually their parents' cars. Most of them were either not belted in at all or were wearing incorrectly fitted belts [44]. To this purpose Austrian Authorities launched a specific communication campaign on the subject (see figure 5 and video available on [24]) Another example of false belief concerning the safety: it is widespread the opinion that when driving over porous asphalt the speed can be increased in full safety. Pavements using porous asphalts prevent the aquaplaning effect and reduce splash and spray, but the road surface is still wet and, even if not clearly perceived by drivers, speed should be reduced. According to 2005 statistics of the Italian operator ASPI [24] 50% of accidents on wet pavement occurred despite the porous surface.
Again, somebody believes that in straight motorways with low traffic, the only risk in exceeding the speed limit is to get a fine (false perception of risk coming from the holding of a reduced attention) and the perception that in tunnels and in mountain highways the risk of accidents is higher (false perception of the true risk level).

Action of EU in the field of road safety related risk and their perception

The EU VI and VII Research Framework Programme have considerably stressed the importance to study and assess human behaviour and response in hazardous or critical situation. In particular, just recently a new project [29] tests have been carried out in order to generate an empirical basis for the driver model in a vehicle, in the frame of road environment (Joint Driver-Vehicle-Environment Simulation Platform) in order to enable closed-loop simulation of driver behaviour.

This will provide data and several feedbacks to predict emergent behaviour including the prediction of driver errors in realistic traffic scenarios and to reach , through a Human Error Risk Analysis, a risk based design process for vehicles (Partially Autonomous Driver Assistance System - PADAS). Jointly, other EU initiatives, such as the European Road Safety Charter [30] (based on the 2001 White Paper on European transport policy for 2010, setting practical measures to bring about significant improvements in the quality and efficiency of transport in Europe) have also proposed methodology to study behavioural impact in different circumstances so to target road safety campaign, and improve vehicle safety, and road infrastructure granting a safer mobility. Moreover, last but not least, another appreciable consequence is that calmer controlled driving could also bring a significant reduction in fuel consumption and exhaust emissions. [31] The behavioural approach is also going to be the

crux of the new strategic paper the EU Commission (Towards a European road safety area: strategic guidelines for road safety up to 2020) is about to launch as a follow up of the Road Safety action Plan 2003-2010. Medium and long term targets will be set to hit the objective of halving the casualties by combining vehicle technology, enforcement with education and risk-awareness campaigns for road users. In this framework of references, the technological innovation relating to vehicles and control equipment will also help to secure better application of safety rules.

5. ROAD SAFETY RISK PERCEPTION: DEEPENING THE IMPACT OF DIFFERENT CULTURES (DEVELOPING AND DEVELOPED COUNTRIES)

The perception of risk plays a prominent role in the decisions that people make, in the sense that differences in risk perception lie at the heart of disagreements about the best course of action between technical experts and members of the general public. Culture is a key factor for the perception of the risk. The culture could significantly shift the attention from a risk to others or to induce to completely drop the attention from some specific risks.
Citizens in developing and developed countries devote to some risk (e.g. to risk related to road safety) an attention that could be assessed as highly different.

This difference is reflected also in the road accident fatality rates from 1989 to 1993, where developed countries have maintained the ratio of deaths per 10.000 vehicles to less than 2, while developing countries were at least 3 times higher [2] and [11]. The discussion of the gap can begin by listing the differences between developing and developed countries: facts related to demography, education, income and enforcement underpin these differences. How do these factors influence road risk acceptance? Is a higher level always better? Let's take a look at each one of them.

Demography

Developing countries have the largest rate of population in the youngest and productive age. This means that they also have the largest rate of young motorists. In addition, this age group is mainly single, meaning they do not worry about the safety of family passengers such as their own children. Being new on the road, young motorists still lack important skills such as maintaining attention, making split-second decisions, estimating speed and distance, recognizing potential risks etc, all factors which can be improved with experience. At the same time, they are more prone to speed, tailgate and substance abuse to win peer approval, as displayed in the "*mat rempit"* phenomenon in Malaysia, where gangs of young motorcyclists perform dangerous stunts with fellow gang members on city streets.
It is evident that , since the number of these young motorists is higher, and so the related casualties, the percentage of population with high risk acceptance could also be judged high. Indeed young motorists in developed countries may also have the same "spirit" and behavioural characteristics, but being the young population a minority in the ageing social context of the other drivers, therefore the perception of road related risk in driving is dominated by the majority of more experienced drivers.

Education

For the purpose of this paper, we shall concentrate on informal education for drivers. Without a doubt, education is a powerful tool in shaping good drivers. A driver's earliest education starts at the driving school. With the large numbers of accidents in developing countries, authorities have now realized that basic how-to-drive education only is not enough to reduce losses. Unfortunately in developing countries, driver's education is just one of the many programs that compete for the same, limited public funding. In Malaysia for example, in recent years there has been a lot of debate regarding the introduction of defensive driving, but its implementation is only compulsory for traffic offenders at the orders of the court. Thankfully, various short-term road safety campaigns have been conducted to increase public awareness. Safety messages in the form of electronic advertisement, printed media and exhibitions are regularly promoted during festive seasons and school breaks, when mass traffic flow to and from hometowns can be seen throughout the country. Yet the shortage of funding prevents such education to be inculcated in a long-term, more aggressive, perhaps in-the-face manner. Consequently, risk acceptance in developing countries very likely for lack of knowledge of the potential hazards remains high.

Income

Income level is probably the most obvious difference between a developing and a developed country. However, for many people in a developing nation, financial freedom is a dream, even m more so, in this time of economic turmoil. For some breadwinners, having two jobs is essential. Even then, the household budget is mainly used for purchasing food, school necessities and utilities, resulting in a smaller share of the leftover income- pie for other 'unnecessary' items Although government road safety campaigns reach out to every level of society, family savings and extra income would rather be spent on leisure activities and not in safety related fittings such as child car seats, or for installing rear seatbelts, getting insurance policies or pay for taking up defensive driving courses.
The poor, if not null, legislation to impose those items contribute to the total disinterest of the public and consequent promotion of willingness to tolerate risk.
In a study by Nor Ghani et al. [14], results of a questionnaire showed that the respondents were not sensitive to different risk reductions by different bus companies which charge according to their safety records. In another example, many motorcyclists in Malaysia provide oversized adult helmets or game helmets to their children instead of buying proper helmets. These examples may provide insight regarding the fact that in 2002, head injuries accounted 55.3% of all injuries and in 2003, 60% of traffic deaths were made up by motorcyclists.
Developing countries show a clear example of how conscience alone is not enough. Safety is the last item on their shopping list. There must be sufficient resources to cover their priorities before they are willing to execute the knowledge.
Is it only a question of risk, or cultural habit to face life unpredicted events, or this tendency could be driven and cast in a different more risk sensitive mould…..

Enforcement

Enforcement could also be considered one of the tool to make the risk of breaking the law and of the pending danger considered and " felt" in everyday life. Developed countries

traffic laws are imposed, not without difficulties, through stricter enforcement; there are many officers to monitor the drivers, and road users in general , even in small towns.
That makes the sense of the importance of the behavioural boundaries, and points out the risk the infringement of rules brings, from the legal point of view, but also from the health-life threatening consequences.
In developing countries there are also many laws to protect people on the road.
Malaysia has mandatory seat belt law since the seventies and recently, it has been made compulsory for rear seat passengers to wear seat belts as well. Violation of this law will result in a fine of Malaysian Ringgit (RM) 300.00 (about 62 €). In spite of that, the actual amount of fine imposed can be negotiated with the police officer and in most cases it is reduced to RM 100.00 [13]. Often in rural areas, violators are only given oral warning and advice from the police (Kulanthayan et al., 2003). This sort of public knowledge somewhat gives relief to motorist instead of fear of getting caught by the law.
Undeniably, most of motorists are aware of the traffic laws in their country. However, enforcement is sometimes necessary to impose the right amount of "fear" and will indirectly build risk perception to drivers. A fearless driver is someone accepting a high amount of risk.

Remarks on driver behaviour and attitude to risk

The combination and degree of the factors determine what sort of culture a motorist is living in. Even more important, it also determines the level of motivation of a driver: it is not self-evident that drivers decide to perform in the best way they are able to, if not properly motivated. Knowledge of how to control a car is not as critical to safety as individual motivation: strong motivation makes up for weak skills better than strong skills make up for weak motivation. Without strong motivation to reduce risk, advanced skill training can lead to more crashes, not fewer (Lonaro et al, 1997).

6. CONCLUSIONS

Risk perception, the direct or unintended acceptance of the likelihood of a dire event, should be considered as one of the pivoting element when planning road safety strategies or road infrastructure management. In particular, communication and prevention strategies, could result significantly more or less effective in consideration of threshold of the risk acknowledgement and felt acceptance by the final users. Moreover, the risk perception evaluation should also be put in context with other factors, such as the socio economic and anthropological background, being these potential keys to the full understanding of an attitude or demeanour which brings to a specific behaviour that could be a very important key for governing the process of road safety. The study and analysis of the related "external dimension of road safety", namely the perception of 'risk factors', and the significance and weight of these factors (e.g.: speed, use of the helmets, drink and drugs abuse, hazardous driving, and tiredness) need to be the driving forces of nowadays mobility policies, since are exactly these factors which are so often underestimated by young drivers in particular, and yet they are often the cause of casualties or lifetime injuries.

The management of complex infrastructure in an emergency situation, given sudden extreme events, could receive a reliable source for an effective an deficient planning by the evaluation

of the attitude towards the risk and of the capacity of dealing with the stressful unexpected situation. The study of the risk attitude and the governing of the individual response to a certain degree of commitment is certainly a winning component of all media communication strategies and also driver boosting the perception of the enforcement and promoting the social acceptance of the legislation aiming to cast different behavioural patterns in road users.

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BIBLIOGRAPHY

[1.] ARDITI R., BELDA ESPLUGUES E., CECCHINI B.M., FERNANDEZ ALONSO F. – Gestion des risques d'exploitation routière: acceptation sociale et perception des risques, Routes Toads, n. 344, 4° trimester 2009, 4th Quarter, pp. 52-61
[2.] BAGULEY C.J. and JACOBS G.D. 1999 - Traffic safety issues for the next millennium
[3.] BONINI A. - SIMONE A., Il Comportamento dell'utenza in galleria, Atti del Convegno AIPCR - Grandi Progetti Stradali Italiani, Tunnel & Perforazioni: World of tunnel drilling technology, Ferrara, 10-13 maggio 2001
[4.] BRUNEL F., AZAR P., GREGAN-PAXTON J., D. HIBBARD J. D., So that's what that is?: Examining the impact of analogy on consumers' knowledge development for really new products, in «Psychology and Marketing», 19 (2002), 533-550
[5.] COVELLO V.T.- SANDMAN P.M., Risk Communication: Evolution and Revolution, in WOLBARST A. (ed.), Solutions to an Environment in Peril, Baltimore, 2001
[6.] COVELLO, V.T. 1992. Risk communication: An emerging area of health communication research in Communication Yearbook 15 ed. by S. Deetz. Newbury Park and London, Sage Publications. pp. 359-373
[7.] COVELLO, V.T. 1992. Trust and credibility in risk communication. Health Environ. Digest 6: 1-5
[8.] COVELLO, V.T. and MERKHOFER, M.W. 1994. Risk Assessment Methods. Plenum Press, New York. 319 pp.
[9.] DOUGLAS M. - 1985. - Risk acceptability according to the social sciences - New York: Russell Sage Foundation, cop. 1985
[10.] EUROPEAN COMMISSION Explanatory memorandum of the Proposal of European Directive 2004/54/EC - COM(2002) 769 final of 30.12.2002
[11.] JACOBS, G.D., KIRK S. (1996) - Safety problems in developing countries - International Conference on Asian Road Safety, Beyjing,28 – 3rd October 1996 PA 3192/96.
[12.] KASPERSON, R. E., RENN, O., SLOVIC, P., BROWN, H. S., EMEL, J., GOBLE, R., KASPERSON, J. X., & RATICK, S. (1988). The social amplification of risk: A conceptual framework. Risk Analysis, 8, 177-187.
[13.] KULANTHAYAN S., RAHA A.R., LAW T.H. RADIN UMAR R.S. - Seat belt use among car users in Malaysia - IATSS RESEARCH Vol.28 No.1, 2004 – paper dated December 2003
[14.] NOR GHANI MD. N., MOHD FAUDZI M. Y., ABU SUFIAN A. B., AHMAD ZAFARULLAH A. J., AZRAE Z., JAMAL A., RIZAUDIN S. - Placing dollar value (on

life) for a better quality of life: a contingent valuation study of Malaysian motorists - SEAGA 6, 2001, International Conference, UKM, Bangi, 12 – 15 November 2001

[15.] PIARC, Committee of tunnel operation - Systems and equipment for fire and smoke control in road tunnels, 2007

[16.] PIARC, Committee *Managing the operational risk of roads*, preliminary works – Contribution of Benekos I. and Toniolos P. (to be published)

[17.] PIARC, Committee *Managing the operational risk of roads*, preliminary works – Contribution of Ashaari Bin Mohamad (to be published)

[18.] PROMETEIA, Valutazione degli effetti economici sui sistemi regionali e nazionali della chiusura del traforo del Monte Bianco, maggio 1999.

[19.] SLOVIC P., Introduction and Overview, in Slovic P. (ed), The perception of risk, Earthscan Publications, UK, 2000.

[20.] http://news.bbc.co.uk/2/hi/europe/2847995.stm - BBC news: 12 dead in Italy's car pile-up

[21.] http://www.voanews.com/english/archive/2003-03/a-2003-03-13-26-At.cfm - VOA news: At Least 14 Die in Italy Car Crash

[22.] https://www.spiegel.de/international/europe/0,1518,543351,00.html Spiegel news: One Dead in 60-Car Pileup in Austria

[23.] http://www.bmvit.gv.at/en/verkehr/roads/safety/index.html - Campaign "Belts save lives" sponsored by the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT) in conjunction with Austrian Social Insurance for Occupational Risks (AUVA)

[24.] www.autostrade.it/pdf/Sicurezza_WEB_Mid_Res.pdf - Autostrade per l'Italia – Buon Viaggio – Obiettivo sicurezza (a leaflet of safety information for road users).

[25.] http://www.ilgiornale.it/a.pic1?ID=243192 Il giornale News: Tamponamenti per nebbia sull'A21: 6 morti

[26.] United Nations Economic Commission for Europe, Road traffic injuries statistical database, 2003

[27.] Youth and Road Safety In Europe, Sethi, Raccioppi, Mitis, WHO pubblications, 2007

[28.] Risk Attitudes and behaviour Among Norvegian Adolescents, Inversen, Hildo, Rundm, 2005

[29.] VII FP - ISI PADAS Integrated Human Modelling and Simulation to support Human Error Risk Analysis of Partially Autonomous Driver Assistance Systems.

[30.] EU road safety charter saving 20.000 lives on our roads, European Commission, a shared responsibility

[31.] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, com(2010) 135 final vol. I, Brussels, 31.3.2010