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Risk and threat factors in prior representations of driving situations among powered two-wheeler riders and car drivers

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ABSTRACT

Our research objective is to contribute to gaining a better understanding of the difficulties inherent to managing interactions between power two-wheeler riders and car drivers. 132 power two-wheeler riders and 94 car drivers have been asked what they perceive as being riskiest in driving situations for the representatives of their generic reference group. From all the answers produced, only those which provide information on risk factors related to the other and the occurrence of interferences due to the dynamic situation have been retained and analysed. The results provide a partial explanation of the difficulties related to the two types of users' taking each other into account. On the one hand, the frequency with which the other is mentioned as a source of risk is linked to the concept of conspicuity. This interpretation is related to the relative frequency of the interactions and the difference of real and perceived vulnerability between the users. On the other hand, the specific risk factors attributed to the other illustrates a mutual misunderstanding or ignorance of the driving situation's determinants. These include various practices among users which can be related to the physical and dynamic characteristics of their vehicle and their level of familiarity with other users. The potential road safety consequences of prior representations of risk factors among users are presented and suggestions for improving road user safety are proposed.

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1. Introduction

On French roads, power two-wheeler (PTW) users still account for less than 2% of all road traffic in terms of kilometres driven. And yet, the road safety results for this category of vulnerable users[1] is highly negative compared with other road users, notably car drivers. This characteristic justifies improving our understanding of the factors that could explain their accident involvement. Road safety challenges and, more generally, public health challenges are increasingly important because PTW traffic has been growing constantly over the past 20 years, notably related to traffic congestion in large urban areas (Haworth, in press). The crash rate for PTWs includes a large number of accidents also involving a car driver (ONISR, 2005). Our research objective is to contribute to understanding the difficulties inherent to the interactions between these two types of users. For this, we sought to gather their knowledge and beliefs as to what they perceive as being riskiest in driving situations. Their prior knowledge and beliefs determine part of their awareness of the situation and thus orient their risk perception in the situation (Smith and Hancock, 1995).

PTWs are rare in traffic, but they bring a differential to the traffic system through the vehicle's very design and the type of driving they entail. In the most commonly observed accident scenarios involving a motorcycle and a car, it can be noted that problems often relate to taking others into account (ONISR, 2007a). The weak conspicuity of PTWs has been identified as a major risk factor in interactions between PTW riders and car drivers (Williams and Hoffmann, 1979; Thomson, 1980). Conspicuity usually refers to an object's capacity to draw attention and be easily located thanks to its physical properties (Wulf et al., 1989). This concerns the object's visual salience, i.e. the degree to which it can be distinguished from its environment (Hancock et al., 1990). The physical characteristics of PTWs riding in a complex environment constitute an explanatory element for their weak conspicuity in view of perceptual constraints and information processing of other road users (Hole et al., 1996; Horswill et al., 2005; Crundall et al., 2008).

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[1] The motorcyclists account for more than 10% of the drivers involved in an injury accident and 18% of the persons killed. The risk of being killed during an accident is 23 times more raised for a motorcyclist than for a car driver (ONISR, 2007b).

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PTW riders are also subject to the effects of another form of conspicuity: cognitive conspicuity. Beyond their sensory or visual conspicuity, the cognitive conspicuity of objects can be defined by their capacity to draw the attention of observers in a given situation. In other words, when an individual performs a particular task, an object that is subjectively considered irrelevant to the task at hand, i.e. having weak cognitive conspicuity, will have a lower probability of being detected *and taken into account* by this individual than an object with strong conspicuity. An object's cognitive conspicuity is based on several dimensions relative to the observers and which are changeable. This refers to their short-term intentions or existing goals (Hancock et al., 1990). In other words, an object's cognitive conspicuity varies from one individual to another, but also, for a given individual, from one moment to another and/or from one situation to another. In the literature on PTWs' traffic accident involvement and its underlying causes, the notion of cognitive conspicuity has not yet been much explored. It is dealt with from two angles of approach which are nonetheless closely linked. On the one hand, the weak cognitive conspicuity of PTWs is evoked as depending on the car drivers' personal and social interest and/or the significance of the PTWs in terms of affect, valence, experience, etc. (Hancock et al., 1990). On the second hand, the weak cognitive conspicuity of PTWs can be explained by the low expectations they provoke among other users due to their relative rarity in traffic and therefore the low probability of encountering them on the road (Van Elslande et al., 2008).

Besides problems caused by visual and cognitive conspicuity, car drivers may also have difficulty in understanding PTWs' manoeuvres. This may have some incidences on how they take PTW riders into account and how they foresee their behaviour. Foresight is the result of the combination of *circumstantial data* and *permanent knowledge* and *beliefs* (Mundutéguy, 2001). While the former are dependent upon and concomitant to the interaction, the latter are prior to it. Knowledge and beliefs include categories of affiliation corresponding to vehicle characteristics (Trucks, PTWs, etc.) or stereotypes referring to prototypical behaviours associated with these objects (PTW riders are speeders, PTWs couriers are foolhardy riders, taxis' drivers drive aggressively, etc.). In situations of uncertainty in which behaviour by one user leads to predictive difficulties, Mundutéguy and Darses (2007) pointed out that foreseen behaviour is determined by the behaviour that the subject would expect to be confronted with from the group's prototype. Along with the conspicuity factors indicated above, it is relevant to add that PTW riders often adopt behaviours that are specific to them and which do not correspond to car drivers' behavioural standards. These behaviours do not make it easy for other users to foresee them. These behaviours could, in fact, surprise car drivers and keep them from reacting effectively in critical situations (Obenski, 1994; Van Elslande, 2002).

Different levels of analysis are used to study the difficulties inherent to interactions between PTW riders and car drivers. Using In-depth Accident Studies and Police Reports, Jaffard and Van Elslande (in press) has studied failures affecting PTW riders and car drivers in critical interactions' situations. They have shown the differences between dysfunctional processes that characterise the formers and those of the latters. As a complementary approach at an earlier stage, the present research's ambition is to look into what comes before these processes, such as drivers' knowledge and beliefs about risk. In general, this knowledge and these beliefs prior to driving situations shape the overall social representation of the risk in the road environment. As for all social representations (Abric, 1993), they structure thoughts that orient understanding of one's own behaviour and that of others. More specifically, knowledge and beliefs orient expectations, perception, information gathering and, *a fortiori*, decisions for action (Smith and Hancock, 1995).

The literature gives a few clues as to this way of functioning marked by the drivers' practices. This notably concerns the impact of dual use of a PTW and a car on drivers' performances when acting as car drivers. For example, by concatenating data from car drivers concerning their hazard perception, Armsby et al. (1989) put forward the idea that car drivers who also ride a PTW (or have ridden one) are able to identify specific road features and specific actions by other users as risk factors for motorcyclists, whereas car drivers who do not have any experience with PTWs focus on other drivers' behaviours. In other words, experience with the specific risks run when driving a particular vehicle orients prior representations of risk factors. Very recent studies have shown that dual drivers, compared with car drivers who have no experience with PTWs, have better skills and performances in their visual search for information and behaviours toward PTWs that are better suited (Crundall et al., in press; Shahar et al., in press). Dual drivers, for example, use their rear-view and right-side mirrors more and adopt an information-gathering strategy that is better suited to PTWs coming from the right (Shahar et al., in press). The effects in driving situations are backed up by several analyses of accident involvement, which show that car drivers who have or have had dual driving experience are less represented in accidents involving PTWs than those who do not have such experience (Comelli et al., 2008; Magazzù et al., 2006; Weber and Otte, 1980). This phenomenon also exists when they themselves do not ride a PTW, but a member of their family or a close friend does (Brooks and Guppy, 1990). According to Crundall et al. (2008), experience with and exposure to PTWs supplies schemata for managing or dealing with a variety of driving situations. A schema represents the know-how accumulated by an individual concerning a situation and provides directives, guidelines for action and self-imposed rules on the behaviours to be adopted in these situations.

Exclusive driving of one vehicle or dual use of another type of vehicle stands out as an influential characteristic in developing knowledge and beliefs prior to driving situations concerning road risk factors. Other parameters are also useful in understanding these prior representations. The type and category of PTW ridden constitute two of these parameters because they largely determine the use made of this vehicle. In fact, the use made of a small scooter is not the same as that of a high-powered motorcycle. The use made of a vehicle leads to overexposure to certain particular driving situations (familiar situations) and underexposure to others.

Knowledge and beliefs prior to interaction situations are elaborated or adopted during driving and therefore are largely shaped by practices (Mundutéguy and Ragot-Court, in press). Most studies usually do not take into account the very wide diversity of PTWs, generically mentioning "PTW riders" or "motorcyclists" in their comments and put forward conclusions that are often generalised to cover all PTW riders, as is also the case for crash data in many jurisdictions (Haworth, in press).

Furthermore, knowledge and beliefs about risks may depend on the threat constituted by other road users. The representation of this threat related to the presence of other road users and the occurrence of interferences linked to their movement is not insignificant in the context of road interactions between PTW riders and car drivers. Threatening situations "can be characterised in general by the presence of a perceived danger in a subject's (or group's) environment. This danger may be real or imaginary, and may have a nociceptive or stressful action or influence on the subject (or subjects) in question" (Mannoni, 2004). The threat that PTWs or cars represent can be linked to their frequency in traffic and to the corresponding expectations of encountering them. This situation can be combined with the design of the vehicles themselves. This leads to different driving behaviours which can increase their drivers' accident risks. It also leads to a variation in real and perceived vulnerability between the different users.

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