Naturalistic study of rider's behaviour in initial training in France: Evidence of limitations in the educational content

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ABSTRACT

This paper analyses motorcycle educational content in a number of French motorcycle schools on the basis of a naturalistic study of riders' and trainers' behaviour. The aim is to specify the situations delivered in motorcycle schools and to study the rider's activity in these situations. The methodology includes ethnographic observation within the motorcycle schools and the longitudinal monitoring of 14 trainee motorcyclists during their initial training. The training situations were described by the combination of audio–visual recordings and interviews data (i.e. concomitant or interruptive verbalization, and self-confrontation data). The results permit to (1) compare the "real" and "official" durations of track and on-road training, (2) characterize the real training situations, (3) describe the preferred forms of instruction, and (4) conduct an in-depth analysis of the situations used during training in traffic. The discussion show, in first, the poverty of the training situations which are based on the repetition of the exercises in the test, and, in second, disparities between the riding situations encountered during training and the demands made by riding in natural traffic. The usefulness and the applications of this type of approach – based on the integration of the rider's point of view notably by self-confrontation interview – for understanding real riding behaviours and how such approaches could supplement vehicle-based data are discussed in a large conclusion.

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1. Introduction

The risks associated with motorcycling are a major public health issue in Europe (CARE, 2007). In France, motorcycles account for 1% of motorized traffic but 40% of injured road users and almost 20% of fatalities (ONISR, 2009). These figures are worrying, particularly in the case of novice riders (those who have held a licence for less than 2 years): one in five crash-involved motorcycles in France has been registered for under 1 year (ONISR, 2009). An improvement of the initial training of motorcyclists is thus clearly of potential value both with regard to research and public policies. This is why a large research programme is now conducted in France on this issue. This programme is divided into three stages: (1) the characterization of the educational content of initial training based on a naturalistic study of riders' and trainers' behaviour in several motorcycle schools, (2) the study of the real activity of novices just after licensing, (3) the identification of guidelines in order to improve the training and licensing system, and make novice riders safer. The

study presented in this paper relates to the first stage. It attempts to answer the following questions: what is really taught in initial training at motorcycle schools? What are the behaviours of riders in training situations? To what extent do the situations which are proposed during training match real riding situations?

1.1. Motorcycle training in the scientific literature

Studies involving motorcycle training can be divided into three types: (a) studies that test the effectiveness of post-test training, (b) studies that describe the educational content of training, (c) studies that attempt to identify new educational content for motorcycle training.

Most research into motorcycle training[1] tests the effectiveness of the curriculum on the basis of accident data. The results tend to show that trained and untrained motorcyclists have the same risk of being involved in an accident (Mortimer, 1984; Simpson and Mayhew, 1990; Christie, 2001; Mayhew et al., 2002; Elliot et al., 2003). Some research has attempted to demonstrate the

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[1] For a complete review see Haworth and Mulvihill (2005).

effectiveness of training on risk level (McDavid et al., 1989; Billheimer, 1998). However, in most cases, only serious injuries are included in the accident data. This is why, according to Haworth and Mulvihill (2005), research should focus more on the behaviours of motorcyclists and how these change once they have obtained their licence.

For a considerable number of authors (Chesham et al., 1993; Reeder et al., 1996; Haworth et al., 2000; IRT, 2007; Liu et al., 2009), the relative ineffectiveness of curricula is due to their training contents. Haworth et al. (2000) have shown that in the Australian state of Victoria three times more time in the training programme was given over to teaching the handling of the motorcycle than hazard perception skills. Haworth and Mulvihill (2005) have shown that most curricula focus on teaching control of the vehicle with a view to preparing for the final examination, to the detriment of skills such as the anticipation, detection and evaluation of risks. In addition, other researchers have shown that current contents favour the development of "overconfidence" (Crick and McKenna, 1991; Elliot et al., 2003). Rowden and Watson (2008) have also shown the existence of overconfidence among motorcyclists who, at the end of their initial training, have a tendency to expose themselves to risky situations in the misguided belief that they have the skills to cope with them.

The modernization of motorcycle training and licensing has recently become a topic of concern in Europe. Every country is considering a radical modification of its current training and licensing notably through scientific studies. For example, in Norway, the authorities have used accident data on novice riders and the *Goals for Driver Education* (GDE) matrix (Peräaho et al., 2003) in order to completely overhaul their training system. The GDE matrix determines driving education levels on the basis of a hierarchical car driving model (Keskinen, 1996), adapted to training by Siegrist (1999). The article of Lund (2006) details the new Norwegian motorcycle licensing system, organized around three main ideas: encouraging trainee self-evaluation, creating a balance between the teaching of cognitive and motor skills and, last, developing hazard perception rather than teaching emergency skills.

To sum up, the studies described above raise the issue of the effectiveness of training systems with regard to road safety. Following a curriculum and passing the test do not guarantee good safety. This situation seems partly linked to training systems. Many researchers have highlighted the lack of scientific work on training systems (Baldi et al., 2005; IRT, 2007; Rowden et al., 2007; Savolainen and Mannering, 2007), that is to say the knowledge and know-how that are really taught and the training situations which call on them, as well as how accurately they match the driving situations encountered once the rider has a licence (Hébrard, 1986; Marsenach and Mérand, 2003).

1.2. Conceptual framework

This study refers to the "French cognitive ergonomics approach" (Ombredane and Faverge, 1955; Theureau, 2003) which is at the crossroads between several disciplines (cognitive anthropology, psychology and microsociology). The aim is to explore the links between context, cognition and action in the real world environment. Instead of reducing riding to a task made up of a number of variables, the aim is to analyze it as a total entity. This approach has already been applied in a number of studies and is helpful when attempting to understand teaching and learning activities (Vion et al., 2000; Sève and Leblanc, 2003). One first postulate of this approach is that every activity is situated because it is closely linked to the context (Lave and Wenger, 1991). In our study, each participant interacts at every moment of the training session with his or her social environment (riders, instructors, etc.) and physical environment (motorcycle, infrastructure, etc.). These interactions lead

to behaviour that is specific to the time in question. It is therefore essential to analyze activities in the real world, i.e. taking account of social, cultural and technical conditions (Theureau, 2003). At a methodological level, this implies that the study must take place in "natural" riding settings. In spite of the widespread availability of low cost advanced methods of vehicle instrumentation and recording technologies, the number of on-road studies of motorcyclist behaviour is still limited. It can be noted that at European level in the pilot study conducted in the framework of the 2BESAFE project (2009–2011) several instrumented powered two-wheelers were used in four countries in the European Union in a measurement campaign conducted in natural traffic conditions.

The second postulate is that the point of view of the actors with regard to their activity is essential to study what has meaning for them (Bannon, 1991). It is the participant who is in the best position to describe the difficulties he encounters (Grize, 1995). The naturalistic riding studies, based only on the recording of the riders' actions and the dynamics of the vehicle are laden with huge amount of data. For example, these data do not allow to automatically detect the potential risky situations because almost all of them are anticipated by the rider. For us, it is thus necessary to record not only the actions of the riders but also his point of view. This approach suggests to collect and to combine subjective data (about the rider's experience) and objective data (on the rider's actions). While the production of objective data is of value, the idea that lies behind this approach is that we can only successfully describe the activity of the participants if we link these objective data with the rider's subjective opinions. In other words, external data must be filtered through the participant's point of view. This can be possible because the rider acquires significant experience during training which can be "reactivated" and may provide useful research material (Theureau, 2003).

The third postulate concerns the sample of population. The decision to study the riding activity in such a systematic and detailed manner and the complexity of the data collection procedure meant the recruitment of a relative reduced sample. It is postulated that activity and difficulties faced by studied riders can be, in part, the same as other riders in similar situations (Leblanc et al., 2008). We believe that a number of experiences of the participants are shared by others. In addition, the benefit of studying more individuals in a superficial manner rather than a single individual in depth depends on the context of the study (Clot, 1999). If the aim is to carry out a very detailed investigation of the subjective experience of an actor in a given situation, then an individual may be a valid object of study. This kind of study that focuses on the details of individual experience can bring out some results which are difficult to detect with more quantitative approaches. The consideration of a small number of participants permits to determine some perspectives of research that can systematically analyzed with a larger population. There is a complementarity between these two approaches. But it is clear that increasing the number of subjects would help to achieve validation and wider applicability.

1.3. The official training curriculum and the motorcycle riding test in France

Across the EU, initial rider training programmes vary enormously from Member State to Member State: from virtually nonexistent to extensive, compulsory to voluntary, and cheap to expensive. The cost of training ranges from 400 to 3600 Euros (IRT, 2007). Elsewhere in the world, there are major differences in training contents and the riding tests that validate them, and variations even exist within the same country, e.g. the United States and Australia (Haworth and Mulvihill, 2005).

In France, almost all the candidates who take the motorcycle riding test have undergone an initial training in a motorcycle school.

Fig. 1. Example of a low speed handling exercise for the test.

The French National Training Programme proposes a number of skills and know-how that are necessary to ride in safety conditions and highlights the importance to teach hazard perception skills. This programme lays down that the minimum duration of this training is 20 h which much include at least 8 h of track training and 12 h of training in traffic. The practical examination is in two stages, one on a track and the other in traffic. Candidates must carry out three types of vehicle handling exercise on the track: "with the engine off", "at slow speed" (Fig. 1), "at normal speed" (Fig. 2), which are followed by oral questions. The examiner rates the motorcyclist's performance in each exercise. The possible ratings are "A" (no error), "B" (non-disqualifying error) and "C" (two non-disqualifying errors or one "disqualifying" error). In order to pass the test, the candidate must obtain at least one "A" and no "C" rating. There are two exercises for each part of the examination, and it is the best rating that counts. During the test in traffic, the examiner checks that the candidate has acquired the skills and know-how that are necessary to ride safely, during a 30 min journey on roads. The candidate, on a motorcycle, is followed by the examiner who is in a car and who gives instructions by radio to the trainee who is wearing an ear-piece.

2. Methods

This field study consisted of two stages: ethnographic observations of the situations delivered by instructors and a longitudinal study of the 14 trainee motorcyclists during their initial training.

2.1. Stage 1: ethnographic observations of the training situations

This stage set out to describe the training situations proposed by the instructors, achieve mutual familiarization between the participant and the researcher, and set up the audio and video recording systems.

2.1.1. Population

The studied sample consisted of 10 salaried instructors working at two motorcycling schools in the provinces and one in Paris. Their

Fig. 2. Example of a normal speed handling exercise for the test.

average age was 41 years and their average professional experience was 12 years (see Table 1).

2.1.2. Procedure

The 10 instructors were monitored during their working days. 36 lessons were observed in detail (72 h) in the case of the first motorcycling school, 48 lessons (96 h) for the second and 28 lessons (84 h) for the third.

2.1.3. Data collected and material

The naturalistic observations related to the situations created by the instructors (goals, instructions, material organization, duration were noted in words and with a diagram for each situation) and the activity of the trainee motorcyclists in these situations (behaviour, performance, verbalization extracts). These data were recorded in

Table 1
Place of work, age and experience of the 10 instructors studied in Stage 1.

Name	Motorcycle school	Age	Experience as instructor
Instructor 1	Provinces	38 years	13 years
Instructor 2	Provinces	44 years	10 years
Instructor 3	Provinces	37 years	1 year
Instructor 4	Provinces	55 years	29 years
Instructor 5	Provinces	36 years	10 years
Instructor 6	Provinces	35 years	8 years
Instructor 7	Provinces	39 years	9 years
Instructor 8	Paris	35 years	11 years
Instructor 9	Paris	44 years	17 years
Instructor 10	Paris	47 years	14 years

Table 2
Gender, age and driving experience of the 14 trainees studied in Stage 2.

Name	Gender	Age	Driving experience
Rider 1	M	18 years	Driving licence, rides a 125cc motorcycle, competitive motocross riding
Rider 2	M	21 years	Driving licence,[a] rides a 125cc motorcycle every day
Rider 3	M	22 years	Driving licence, competitive motocross riding
Rider 4	M	25 years	Driving licence
Rider 5	M	26 years	Driving licence
Rider 6	M	27 years	Driving licence, a little experience of riding a scooter
Rider 7	M	27 years	Driving licence, experience of riding a scooter
Rider 8	F	27 years	Driving licence, a little experience of riding a scooter
Rider 9	M	28 years	Driving licence
Rider 10	M	30 years	Driving licence, some experience of riding a 125cc motorcycle
Rider 11	F	32 years	Driving licence
Rider 12	F	36 years	Driving licence
Rider 13	M	45 years	Driving licence, rides a 125cc motorcycle every day
Rider 14	M	52 years	Driving licence

[a] In France, holders of a car driving licence are allowed to ride a powered two-wheeler (PTW) with an engine capacity of 125cc or less.

a field notebook. The data are left unchanged to support the results of the in-depth study.

2.2. Stage 2: longitudinal study of the activity of 14 motorcyclists undergoing initial training

The aim was to study all the riding situations encountered by the motorcyclists during their initial training course and their behaviour in these situations.

2.2.1. Population

14 trainee motorcyclists taking a course in a provincial motorcycling school were recruited (3 women and 11 men,[2] with an average age of 31 years), with varied driving experience (Table 2).

2.2.2. Procedure

Data collection was spread over 5 months. 98 training sessions on a track (i.e. 196 h) and 73 sessions on a road (i.e. 146 h) were studied, making a total of 171 sessions (342 h). 11 of the motorcyclists were monitored systematically throughout their driver training and three others were studied less comprehensively. Measures were taken to reduce the disruption caused by the presence of the researcher in order to ensure there was as little interference as possible with the activity. The measures in question related to three points: ensuring the observation devices and their operators were not too obtrusive, integrating the observation techniques gradually, and providing guarantees for the participants (anonymity, confidentiality) which were set out in the participation contracts.

2.2.3. Data collected and material

Two types of data were collected: (1) observations and audio–visual recordings of the behaviour of the participants and the riding situations and (2) participant's verbal data during and after their riding activity.

The audio–visual data were recorded continuously using an "external" camera operated by the researcher on the track or in the "following" car in the case of on-road training. The sound sources (communications with the instructor, discussion with other trainees, the "noises" of the motorcycle, etc.) were collected using an HF microphone connected to the camera whose emitter was placed on the motorcyclist's jacket. These recordings related to the training situations and the activity of the participants in these (trainee/instructor). They also provided the basis for the a posteriori interviews. In all, 342 h of recordings were made.

The verbal data were collected before and after the riding activity. The verbalizations elicited by the researcher during riding were of the "interruptive" type (Theureau and Jeffroy, 1994). The participants were asked to explain their actions by questions which referred strictly to what had happened and which did not lead to generalizations, for example: what do you think about the design of this slalom? What did you feel during the last exercise? These questions were asked during the break between two runs or while the training track was being re-organized in order to modify "normal" behaviour in the situation as little as possible.

The a posteriori verbal data were collected during self-confrontation interviews (Theureau, 2003). This technique made it possible to document in detail the motorcyclist's subjective experience. The interview consisted of asking the rider to describe his entire activity during the previous riding session, when confronted with the continuous audio–visual recording of his/her behaviour. The researcher asked questions which were "focused" on action in order for the motorcyclists to be able to place themselves in the dynamic context of the experienced situation and intervened to place the motorcyclist once again within this context if the motorcyclist started to talks in an excessively general way (see Fig. 3). This interview was made to understand the behaviour and the feelings of the trainees towards the training situations proposed by the instructors. Two 90 min interviews dealing with track and on-road training episodes were conducted for each person, making a total of 30 h.

2.2.4. Formatting and analysis of the data

All the audiovisual data were formatted in tables. The following information was provided in the case of track training: the effective
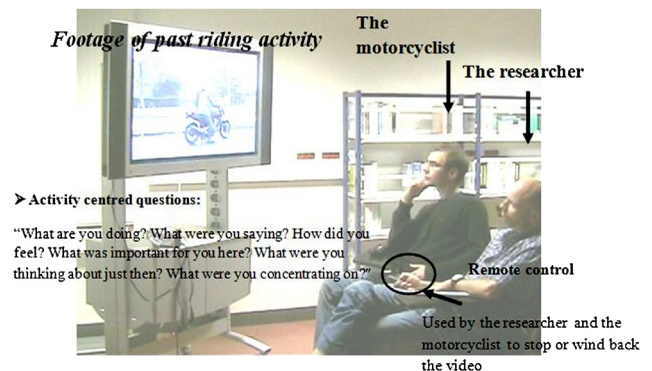

Fig. 3. Example of a self-confrontation interview situation showing the positioning of the participants (motorcyclist/researcher) and the equipment. Some examples of questions asked by the researcher during the interview have been shown.

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[2] According to available data, there are about 20% of motorcyclists in France who are women. We take these data into account to recruit our participants.

length of the observed lesson, the specific actions of the motorcyclists, the type of training situation and the verbalizations, which were retranscribed *verbatim*. The following information was available for the on-road training: the actual duration of the observed lesson, the route taken by the motorcyclist, the motorcyclist's specific actions and the verbal data retranscribed *verbatim*. The data from the a posteriori interview were placed in processing grids which contained two sections (Theureau, 2003). The first section ("self-confrontation data") contained the effective duration of the interview situation and the verbalizations. The second section explained the action that was taking place and the "record of the activity", which were used as a basis by the participants for commenting on their previous actions. The aim was to combine the different levels of data in order to obtain the most detailed description possible of the situation and the reaction of the rider towards the training situation proposed by the trainer.

The analysis categories for the corpus of data were based on the "*top-down*" ("classical" deductive reasoning) model and the "*bottom-up*" (inductive reasoning) model. They were produced by a combination of research questions (describing the educational situation proposed by trainers) and an initial analysis of the collected data. Immersion in the empirical data provides a starting point for the development of analysis categories and a way of conserving an evidential link with the field data (Glaser and Strauss, 1967). The analysis of video recorded during "track training" consists in coding of the exercises performed by the trainee by two researchers working independently of each other (coding of the type of exercise, the number of repetition, and its length). The analysis of video recorded during "on-road training" consists in coding of the routes taken by the trainee and the verbal communications made by the trainer. This was made also by the two researchers working independently. For both recorded data, a comparison of the results of the two coding operations was achieved in order to take of a joint decision where there were differences of opinion. The analysis of the self-confrontation data consists for the two researchers in several stages: (1) construction of a first version of the analysis categories: identification of the recurrences in the trainees' opinions regarding the proposed training situations based on an initial examination of the data and the research issues, (2) discussion and decisions about the validity of several of the categories, (3) drawing up of the final version of the classification, (4) coding of the corpus of data using the analysis categories by the two researchers working independently, (5) comparison of the results of the two coding operations. These data are used to be combined with the video recordings and enrich it. The presented results come from the convergence of the analysis made with all the levels of recorded data.

3. Results and analysis

The collected data permit to specify the educational content delivered in motorcycle schools by (1) comparing "real" and "official" durations of track and on-road training, (2) characterizing the real training situations, (3) describing the preferred forms of instruction, and (4) conducting an in-depth analysis of the situations during training in traffic.

3.1. Comparison between the "real" and "official" durations of track and on-road training

The observations conducted in the three motorcycle schools show that most of the training time was spent on track training – on average 25 out of the 30 h of training (Table 3), so, on average, 5 h were spent on on-road training. This result highlights a major disparity between the official and real durations.

Table 3
Duration of initial training in the three studied motorcycling schools.

	Track training	Training in traffic	All training
Motorcycle school 1 (provinces)	23 h	8 h	31 h
Motorcycle school 2 (provinces)	26 h	2 h	28 h
Motorcycle school 3 (Paris)	27 h	6 h	33 h
Average	25 h	5 h	30 h

While the official directives state that there should be a balance between track and on-road instruction (respectively a minimum of 8 and 12 h), the motorcycling schools we observed include the journey between the school and the track in the hours in traffic ($1/3$ of the duration of the session in the case we are considering). However, our analyses have shown that the activity of the motorcyclist during his journeys is very different from in a "real" lesson in traffic. With regard to the route that is used, this journey to the track is "sanitized": what is sought is an uninterrupted journey with the fewest difficulties in order to reach the track without wasting time and as safely as possible:

> "*I always take this route to join the track because it is safe!*"(Instructor 2)
> "*The main purpose for me is to not waist time to go to the track. This is why I take this route.*" (Instructor 3)
> "*I cannot waist time on the road to join the track. My only advice is to ride as safely as possible.*" (Instructor 6)

The driving school that was observed in Stage 2 was the only one that provided 12 h of riding in traffic as laid down in the French National Training Programme. The hours of training on the road and on the track for the 14 motorcyclists who were monitored during this stage are set out in Fig. 4.

We noted that the duration of track training for these motorcyclists was on average more than twice the minimum laid down in the regulations, and greater than the duration of training in traffic (18 h of track training compared with 12 h of training in traffic). Only a few young motorcyclists, with previous experience of riding a powered two-wheeler, took the test after only 8 h of track training (Riders 1, 2, 3). Others, like Rider 14, had greater difficulties, with 36 h of track training, or Rider 11, with 28, and Rider 12 with 30 h. The real duration of track training therefore increased the
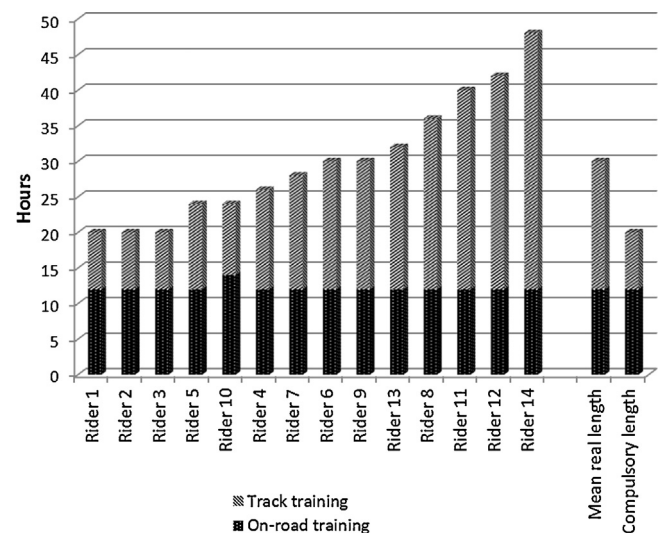

Fig. 4. Real duration of track and on-road training from videos analysis of the motorcyclists studied during Stage 2.
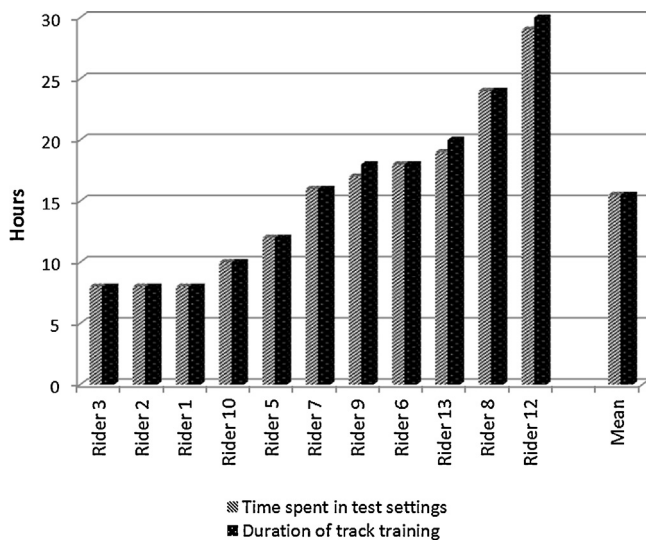
Fig. 5. Time spent on the track in settings used during the test compared to the duration of track training for the videos analysis of riders studied in Stage 2.

duration of the curriculum, which increased from the minimum of 20 h laid down in the French National Training Programme to 30 h. The interviews made with the different instructors can bring elements of understanding of that gap between "official" and "real" curriculum. For some of them, the complexity of the manoeuvrability requires to spend more time than expected on track. Trainees usually subscribe 20 h of training package which is almost entirely devoted to the training on track. Given the high price of a supplementary session, the motorcycle schools cannot force the trainees to take 12 h of traffic training after the on-track period.

> "I cannot oblige a motorcyclist to take 12 hours outside the package; overtime is too expensive for most trainees, especially for young students!" (Instructor 5)
> "If we force riders to do 12 hours of on-road training, for sure we will lose customers. People will know that we are more expensive than over motorcycle schools who do not respect the 12 hours!" (Instructor 7)

For other instructors, riding a motorcycle is almost identical to driving a car. As almost all the trainees hold a driving license, it is not necessary, for several trainers, to spend a lot of time on the training in traffic:

> "I do not know why it is compulsory to make 12 hours of on-road training! My trainees know how to master a motorbike because they have made the training on track!" (Instructor 8)
> "All the trainees have their driving license so riding a motorcycle is not a problem; it is the same task! 12 hours of training in traffic are two much!" (Instructor 9)
> "Riding a motorcycle is like driving a car, except the two wheels! Two hours of on-road training would be enough!" (Instructor 10)

3.2. Characterization of the track and on-road training situations

3.2.1. The track training situations

The quantitative data extracted from the videos show that almost all the track training situations reproduce situations that feature in the track test: the four normal speed motorcycle handling exercises that are included in the test are used as training situations, and the same applies to the low speed handling exercises. Fig. 5 shows the time spent by all the trainee motorcyclists in the test situations during training (for the trainees who were

followed throughout their entire course, i.e. 11 of the 14 riders).

This form of education appears to be economic from a psychological stand point for the instructors to design training content. Developing original and adapted training situations to the peculiarities and difficulties of each rider requires a greater effort than only reproduce licensing situations:

> "I am not bothering to create original situations; I usually take the exam situations!" (Instructor 6)
> "The test situations are normally the best situations to learn to ride a motorcycle! This is why I use it for the whole training." (Instructor 4)
> "If I had to develop a specific situation for each trainee I do not stop! In my session, all the riders are in the same situation!" (Instructor 3)

However, this criticism must be weighted by the constraints of the trainers. On the one hand, the observed instructors are dependent on other instructors and situations they have implemented on shared tracks,

> "Most motorcycle schools share the track with other motorcycle schools and therefore we cannot design the specific situation we want!" (Instructor 6)
> "If other instructors use the test situations on the shared track, I must also use these situations!" (Instructor 2)

and secondly, the number of riders per instructor often does not allow to design adapted and specific situations:

> "I have to manage six riders at the same time; it is not possible for me to make six different situations!" (Instructor 4)
> "At each session, the trainees are not at the same level. I know it would be benefit for them to design specific situations, but I'm all alone for six or eight riders, so it is impossible!" (Instructor 7)

3.2.2. The on-road training situations

With regard to on-road training, the trainees rode almost exclusively on routes the examiners use during the test:

> "I went into the country with the examiner last week. He doesn't stay in town. I'll try to remember so we can follow exactly the same route!" (Instructor 5)
> "I basically use the same route as the examiners. Sometimes, I change them slightly, I go in the other direction or I combine two routes. Sometimes I leave the route for a few hundred metres, but I soon go back to it." (Instructor 6)

Naturalistic observations permit to specify the proportion of the journeys proposed by trainers during on-road training which are the journeys usually used by the inspectors during the test. In Stage 2, these data indicate that trainees have ridden 93% of their training in traffic on the test routes (i.e. on average 11h15 out of the 12 h training period for each trainee). The instructors' aim to put the motorcyclists in the situations which they will have to deal with during the test, thereby improving their chances of passing:

> "I always go on a road the trainees may use during the test. Our aim is to prepare them to pass the exam." (Instructor 5)
> "I prepare the trainees for the road that they might use on the exam. I know where the examiners take the motorcyclists." (Instructor 2)
> "I am not going to work on anything specific on this road with the trainees. It is a route that the examiners take regularly and that the trainees will have to travel during the test, so I go there too." (Instructor 4)

In summary, the trainees therefore encounter situations of an equivalent complexity to that of the test right from the start of their "track" or "on-road" training.
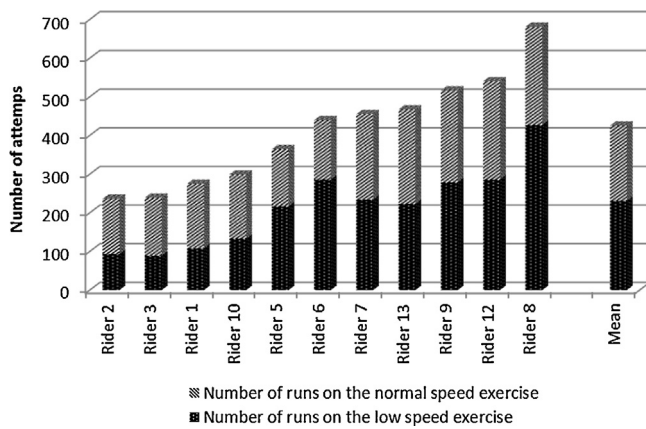
Fig. 6. Number of runs on the normal and low speed handling exercises from videos analysis of the riders studied during Stage 2.

3.3. The training methods favoured by the observed instructors

3.3.1. For track-training

The systematic analysis of the videos of the motorcyclists' activity during track training (Stage 2) meant we could quantify the number of times they did each exercise (Fig. 6).

On average, each trainee performed the training exercises, which are the same as those in the test, 425 times (231 times for the slow speed exercise, 194 the normal speed exercise). A "typical" training session included 28 runs on the slow exercise and 24 runs on the normal speed exercise. In more detail, Rider 12 and Rider 8 performed the exercise respectively 540 and 681 times during their relatively long times of training (24 and 30 h on the track). Significantly, Riders 2, 3 and 1 did the exercise many fewer times, respectively 236, 239 and 275 times during their 8 h of training. It is also noteworthy that all the trainees did not spend the same proportion of their time on the two types of exercise. In some cases, they performed the low speed exercise more frequently (Rider 5, 6, 8 and 12), in others it was the other way round (Rider 1, 2, 3 and 10) or there was a balance between the two (Rider 7, 12 and 13). The fact that the trainees who underwent the shortest duration of training had more runs on the normal speed exercise more often than that at low speed is not surprising. It is simply that because they learnt how to do the slow exercise rapidly, they needed very few practice in order to obtain the required level of performance. For these four young motorcyclists who already had the most experience of riding a powered two-wheeler, training therefore consisted of conducting exercises at normal speed. The analysis of feelings of actors towards the delivered training situations during and after the sessions show that this form of teaching by repetition causes weariness among motorcyclists,

> **"Instructor: What happens Rider 2?**
> *Rider 2: I'm tired. Here I keep doing the same thing. What do I do now?*
> **Instructor: Do not worry goes on!**
> *Rider 2: What! I continue that?*
> **Instructor: Yes again and again!"** *(Rider 2)*

> *"This exercise is too long! To repeat all the time the same exercise, I'm bored. I start getting tired this is why I miss the doors!" (Rider 7)*
> *"It pisses me off! I succeed every time the exercise for fifteen minutes and I continue again! I have already said to the instructor that I wanted to make another exercise!"(Rider 8)*

> *"I think we will do the same exercise as always! We will make low speed exercise for one hour and after the normal speed exercise for one hour also. I would like a more diversified course!" (Rider 6)*

and trainers:

> *"Teaching during track training is boring! All the time you have to repeat the same thing!" (Instructor 1)*
> *"I am happy when I can make an on-road session; it is more diversified. The track sessions are annoying: the trainees ride on the low speed and after the normal speed exercise." (Instructor 3)*
> *"You know it is not easy to see riders on the same exercises all day long! I am happy at the end of my business day when it stops!" (Instructor 8)*

3.3.2. On-road training

The analysis of collected videos permits to quantify the limited number of routes used in on-road training. The motorcyclists were restricted to riding in the same environments. The monitoring conducted in Stage 2 allows us to characterize the routes. These made very great use of roads with low traffic levels, mainly county roads, and mainly roads where a 90 km/h speed limit applies with a few visits to small towns round the main city. In Rider 10's case, this repetition of routes during his course is striking: he rode exactly the same route in three sessions (lessons 1, 2 and 5) and rode on the same roads in two other sessions (lessons 4 and 6). The verbal data show the general weariness of the studied motorcyclists with regard to this:

> *"We get bored in traffic training! I think that I have been on this road at least four times since the first lesson, we do the same thing each time!" (Rider 9)*

> *"I know the road we take during the lesson in traffic well! We have been into the country twice. I almost know where to turn before the instructor tells me!" (Rider 2)*

> **"Researcher: What happened here - we can see that you strayed onto the other lane on a bend?**
> *Rider 3: I almost fell asleep! I am really fed up, I cannot wait for the training to end. We always go on the same roads. I strayed onto the left-hand lane in the bend on purpose. I know this section of road very well and I looked to make sure there was nobody before going. I did it to wake myself up a bit, to tilt a little on the bend. These lessons are really boring!" (Rider 3)*

These extracts highlight the fact that these motorcyclists are aware that the same routes are being repeated and this is considered to be boring because it is monotonous and makes few demands on them with regard to the riding activity.

3.4. In-depth analysis of the road situations encountered by the riders during traffic training

The organization of the group of trainee motorcyclists, the type of communication they have with the instructor and the routes favoured by the instructors allow us to gain a better understanding about the real situations that are encountered during training.

3.4.1. The organization of the group of trainee motorcyclists during the lessons

Our systematic observations of the on-road training situations show the protective role played by the "group" that consists of two or three motorcyclists and the following vehicle:

> *"It is reassuring to have the instructor behind us in the car, because it stops anyone from coming up behind us!" (A motorcyclist, ethnographic survey)*
> *"It is OK when we are not the first, all we have to do is to follow the riders in front of us so we do not take any risks at all!" (Rider 14)*

"The instructor stops his car in the intersection which halts the traffic for the time we need to negotiate it, so we have nothing to worry about!" (Rider 1).

The trainees agreed that the organization of the training sessions makes riding reassuring and safe. They do not need to worry about what is happening behind them, so they do not watch this zone which is occupied by the instructor. The "unit" formed by the motorcyclists and the instructor seems to form a protective "cocoon" around the trainees, meaning that few demands are placed on them with regard to interpreting the environment.

3.4.2. The communications between the instructors and the trainees

Our systematic recording and analysis of the communications shows the large number of warnings given by the instructors to riders:

"Be very careful at the next intersection, you have to give way to the right!" (Instructor 1)
"Watch out! Be careful! There are loose chippings on the next bend, so slow down!" (Instructor 5)
"All the intersections on this avenue are dangerous, be careful and slow down!" (Instructor 7)
"Be careful there's a car that's going to overtake you on the left!" (Instructor 2)
"We are going onto a road which may be slippery and the bends are tight as well! I'll say it again, the road may be slippery and the bends are dangerous. Be very careful!" (Instructor 10)

Thanks to videos processing, this type of communications on the warnings represents nearly 20% of the whole communications made by the instructors to trainees. This communication directs the attention of the motorcyclists and reassures them as it means they can foresee potential difficulties, but ultimately it takes away that part of the riding activity which involves identifying risks.

3.4.3. The typical routes that are chosen by the instructors

The observations and interviews highlight the fact that the majority of the routes selected by the instructors avoid complex inner city zones, which are precisely those which mobilize the motorcyclists' perceptive activity the most. It is the environments with dense traffic which all the motorcyclists we studied considered to be the most difficult situations. Using naturalistic observations carried out in Stage 2, we can estimate the riding time in the city centre closed to the motorcycle school at 2h52 out of the 146 h of observed on-road training (i.e. about 2%). The majority of the lessons in traffic concentrate on riding on county roads or main roads with 90 km/h speed limits, where riding is considered to be easier by all the persons we interviewed. It is very easy to maintain one's balance at these speeds, the carriageway is large, and there are few road users when the lessons take place. For example, Rider 9's training (12 h) did not include any experience in a built-up area, or on roads where it was possible to travel at more than 90 km/h. This means that his first experience of riding in these situations will take place after he has passed his riding test. The same applies to all the motorcyclists we followed in Stage 2 and almost all of those we observed in Stage 1. The motorcyclists are very aware of this state of affairs,

"Rider 3: During the last lesson, we went into the city centre with the instructor just for part of the session because we had to drive through part of the city.
Researcher: Just through?
Rider 3: Yes we must have spent about 15 minutes in the city centre that time, and it was the only time! I have ridden for 12 hours in traffic in all. Fifteen minutes in the city is not much!" (Rider 3)

"I never rode in the city centre during the sessions in traffic. It is strange because the most difficult situation for me is traffic in the city, so surely they should prepare us for that!" (Rider 9)
"I went very briefly once into the city centre, it was to go and get petrol and we left quickly afterwards as though the instructor wanted to get away from the traffic!" (Rider 7)

and others exhibited a considerable degree of demotivation:

"Rider 3: I'm in a hurry to pass the test, I'm really fed up with the lessons in traffic. It's awful!
Researcher: What is awful?
Rider 3: In traffic, we just go on country roads or into small villages. I'm fed up! It's not interesting!" (Rider 3)
"I hope the on-road training stops soon. It's really boring! I can't wait to pass my test so that I can see something apart from country roads. That's all we do in the training. I didn't know these areas before the lessons, now I know them really well (laugh)!" (Rider 13)

The data show that the motorcyclists were worried with regard to their future riding by the fact that their perceptive skills were not elicited:

"I didn't go into the city centre during a single in-traffic lesson. But that does not bother me because I know the centre very well and I know where the difficult parts are, I know how to recognize them. But I'm afraid that people who do not know these situations will be caught out after licensing!" (Rider 10)
"What we do in traffic is very pretty, we discover new landscapes but as far as training is concerned, it's useless! Everybody knows how to ride a motorbike on a straight road at 90 km/h. We don't learn how to react in urban traffic, what we have to watch, what we have to be careful about..." (Rider 2)
"It's not right that we don't do more in town than that! There's no point in just riding on county roads, we don't learn anything new. It's true that we learn how to take bends, but there's more to riding a motorbike than that. We will all be using our bikes mainly to go into the city centre and I don't know if I will be able to ride in the centre with the training I'm getting!" (Rider 8)

We can therefore wonder why the instructors, who are well aware of the difficulties of riding in built up areas, prefer to stay out of them. The explanation given by several instructors is as follows:

"What I think is that the only thing the motorcyclists gain from the lessons in traffic is experience! They have to ride for the whole session! If we go into the city centre, we will be held up by traffic jams, traffic lights and we'll be stopping all the time. They won't ride enough, which is why I take them almost only onto country roads!" (Instructor 4)
"Training in the city is boring for me and the learner motorcyclists. We go too slowly. The countryside is better; they can ride for two hours without stopping." (Instructor 2)
"For training, I only go on roads outside built-up areas, so that the trainees encounter a maximum number of situations. In town, we don't have time to see anything in two hours, the motorcyclists don't ride enough." (Instructor 6)

In these extracts, we can once again perceive the idea that driving a car and riding a motorcycle are similar: motorcyclists do not need to learn specific skills in traffic, as they already hold a car driving licence. Other instructors think that riding in the city centre is dangerous for the trainees. They therefore prefer to stay outside built-up areas as this is safer dangerous. Another possible explanation is simplicity and the high level of success in the on-road motorcycling test (only two failures for the instructor followed in Stage 2 in his last 6 months of work, out of 120 candidates). As the test is objectively easy to pass, the

instructors spend little time on the lessons in traffic and the skills it requires.

4. Discussion

The results of the analysis of the training situations that are proposed and the behaviours of the motorcyclists highlight (1) the relative "poverty" of the observed training with regard to learning how to ride a motorcycle and (2) the major disparities that exist between the training situations and real riding after the trainee has passed the test.

4.1. The "poverty" of the observed training situations

4.1.1. Riding test situations are used for track and on-road training situations

Our results show that track and on-road test situations are used for training purposes. Very few "original" situations are used. The training systems we observed therefore tend more to prepare the motorcyclists for the final exam than to teach them how to ride in traffic. These findings are consistent with those of Haworth and Mulvihill (2005). Putting learners from the start of their course in complex situations with no progression as the course goes on is not the most effective training method, according to experts on learning (Famose and Durand, 1988). The data highlight that teaching contents do not take account of the progression of the motorcyclists, the trainees perform exercises of the same difficulty throughout their training. However, Maxwell (1985) has shown that training situations are improved if contents are more progressive.

4.1.2. Repetition as the only strategy

Our observations of the behaviours of trainees highlighted the repetition of training situations, both in terms of the repetition of the paths the motorcyclists take on the track and the repetition of the communication on the part of the instructors. Our observations highlight the fact that the trainees had to repeat the requested exercises on the track several hundred times. It is as though skills can only be acquired by excessive repetition of these exercises. Even if repetition is a necessary condition for learning (Famose and Durand, 1988), requiring excessive repetition of actions has limitations (Meltzer, 1990). This is because repetition has a number of disadvantages when it becomes the only form learning takes. The motorcyclists become bored and annoyed which appears to discourage learning and reduce their commitment to training. It also makes it difficult to improve the occupational status of instructors. Also, limiting the number of repetitions could release time to teach other skills (e.g. hazard perception skills) while maintaining the same duration of training.

4.2. Marked disparities between the situations encountered during training and after the test

4.2.1. Training is focused on the control of the motorcycle to the detriment of the perceptive and cognitive dimensions required for riding after the test

Our analyses show the importance given to track training and controlling the motorcycle. The concentration on track training can be analyzed from the point of view of the types of skills it develops. Work on motor learning has, since Poulton (1957), identified two types of skills. The first, known as "closed" skills, are developed in predictable environments, where there is no uncertainty and where there is a high degree of spatial and temporal stability. Actions are not affected by variations in the context. Track training is a good example of this type of environment. The "track" is a relatively closed environment (the paths do not change, the obstacles have a usual position, there are no other road users…)

and learning consists of developing and stabilizing the motor skills which are required to control the machine (regularity in speed, use of the controls, positioning on the motorcycle, etc.). On the other hand, other skills are required in "changing" or "dynamic" environments where actions must be continually modified in response to the precise nature of the situation. This is the case for riding in real traffic, where the motorcyclist must cope with changing situations (the presence of other road users, unfamiliar roads, the weather, the density of traffic, etc.). These skills are referred to as "open" and make greater demands on perceptual mechanisms (awareness of the situation, anticipation, decision-taking), which are barely required in the case of closed skills. Based on this distinction, we can clearly conclude that motorcycle training places too much emphasis on the teaching of "closed" skills and therefore the construction of motor skills in a stable environment to the detriment of teaching "open" skills. Our results confirm the conclusion reached by a number of studies (Simpson and Mayhew, 1990; Crick and McKenna, 1991; Chesham et al., 1993; Reeder et al., 1996; Haworth and Smith, 1999; Haworth et al., 2000; IRT, 2007), with regard to the focusing of educational content on the control of the machine during training. The problem is that most of the accidents that involve several road users which are blamed on the motorcyclist are not the result of a lack of technique but a perceptual failure (Lester, 1987; Rothe and Cooper, 1987; Schulz et al., 1990). The conclusions of the MAIDS report (2003) clearly highlight perceptual failures among motorcyclists in accidents, with the most frequent errors being poor perception of danger (in 36.6% of cases) and poor analysis of the traffic (27.7%).

4.2.2. Little importance is given to the teaching of perceptual skills which nevertheless play an important role in road traffic accidents involving motorcyclists

The study of real riding behaviours highlights the fact that motorcyclists make little use of perceptual skills during track training. On-road training situations which should, according to the National Training Programme, focus on this type of skill fail to do so. Little time is spent on on-road training and almost none of the trainees feel they will be ready to ride on their own once they have obtained their licence, particularly in urban areas. These findings agree with those of Maxwell (1985) and Haworth et al. (2000). Real riding situations require the motorcyclist to react in dynamic environments (situations change), which are uncertain (the rider does not know what is going to happen, where it is going to happen or when it is going to happen), and in unknown environments (unfamiliar road environments) with complex goals (which are not limited to successfully negotiating a path on a track or 15 min of riding). These post-test riding situations are demanding with regard to perceptual discrimination (cues are unclear, there is a large number of stimuli), and with regard to perception and decision-making (uncertainty with regard to spatial and temporal factors and events). These contexts, which are central to riding a motorcycle and which make it a complex activity with regard to interpretation, are "glossed over" in the current training road system. These findings confirm, in particular, those of Rothe and Cooper (1987), Crick and McKenna (1991) and Allardice (2002) who consider that initial training situations are incapable of teaching perceptual skills. These results show also that the gap between the compulsory training system (i.e. the skills and know-how promoted in the French Training Programme) and its application.

5. Conclusion

5.1. Main results and next stages of the research programme

The findings of this study highlight the fact that initial training has a number of shortcomings: the limited nature of the training

situations, the rudimentary nature of the underlying theories of learning and the poverty of the courses which are exclusively focused on excessive repetition of the situations used in the test. Our study highlights the disparities between the contents that are taught in motorcycling schools and certain riding requirements in real situations. An important aspect of the perceptual and cognitive dimensions that come into play when riding a powered two-wheeler in a natural situation is almost absent from the regulatory initial training which qualifies people to ride on the road. In our view, the profile of a novice driver produced by current training is someone who has developed skills that are focused on mastering the machine (balance, control of steering, braking and acceleration) in "aseptic" environments: the riders are seriously short of capacities with regard to perception, the interpretation of situations, and decision-making in the dynamic and complex environments that are generated by traffic situations. This has impacts on road safety. On the one hand, by focusing on the control of the motorcycle and confirming the acquisition of the skills in question by success in the test, we make the hypothesis that this system fosters overconfidence among beginner motorcyclists which makes them potentially dangerous for themselves and other road users. On the other hand, by leaving a major part of what provides the basis for safe riding skills in the background, we are relying on personal realization and the individual responsibility of each motorcyclist for the development of these "hidden" skills after the test (we are referring here to Perrenoud's concept of a "hidden curriculum" developed in 1995). These hypotheses need more thorough investigations that will be carried out in the next stages of the research programme. The study presented in this paper is the first stage of a large French research programme aiming at improving the training and licensing system. After the characterization of the real educational content, the objectives of the on-going SIM2CO+ project (2011–2013) are (1) to conduct a naturalistic study of novices' behaviour and (2) to specify training and licensing guidelines. The approach that is applied in the naturalistic riding study is to carry out systematic monitoring of all the trips made by eight motorcyclists for more than 2 months after passing the test. Three methods are applied: diaries (where the riders are asked to note down the situations they experience during their journeys which are or can be problematic), an instrumentation in sensors, GPS system and four cameras implemented on the riders' own vehicle, and self-confrontation interviews. All these data will be combined to set out the problems encounter by novices after passing the test and identify how the limitations of the existing training and licensing system are link with these problems.

5.2. Applications for licensing system improvement

The results presented in this article are used by the French authorities to design new motorcycle licensing tests in the framework of the Third European Directive. The new tests call into question the weight of teaching motor and control skills to the detriment of hazard perception skills. Our study gives empirical proofs of this phenomenon. It seems necessary for the authorities to promote the development of hazard perception skills as they are traditionally undervalued in observed motorcycle schools and yet involved in lots of accidents. It appears to them essential to balance the teaching of control and perceptual dimensions: these two dimensions are required in real traffic conditions at each moment but in different proportions depending traffic situations. French government has well understood the significance of changing the situations used at the licensing test because these situations largely dictate the nature of the delivered training as we have pointed out. The observed instructors only prepare trainees to get the license. One of the challenges for the authorities is to reduce the gap between the training/licensing situations, the French National Training Programme and the real riding situations. The goal is to ensure that the riders' activity in training and licensing settings seeking similar mechanisms to those used in traffic conditions.

5.3. Methodological issues: the utility of conducting self-confrontation method and combining verbal data with vehicle-based data to analyze the rider's behaviour

With regard to methodological aspects, it is worthwhile to re-examine the levels of analysis that have been applied in order to describe driving behaviours in the case of powered two-wheelers in a real context. Naturalistic studies of motorcycle riding behaviour which are gaining in prevalence (see this special issue) and use a methodology which is largely quantitative (taking account of observable data on driver behaviour, riding context and vehicle dynamics). The study presented in this paper placed the emphasis on the collection and exploitation of interview data. The use of questionnaires, which provide a first level of access to the subjective opinions of drivers, does not allow us to observe fully individuals' subjective experience. With the self-confrontation method, a partial understanding of participants' activity can be gained when they describe, show and comment on what is significant for them in a particular situation. Therefore, the training programme in France analyzed in this paper becomes the context for examining the benefits of the self-confrontation method. The use of verbalizations as a source of observable data for the study of cognitive functioning has given rise to a considerable amount of discussion and experimental work (see the review by Caverni, 1988). The use of such data has prompted a whole series of criticisms, one of the main ones being that the demands of verbalization stimulate the development of activities of introspection which may lead to reconstructions that are alien to the performance of the target activity and learning processes which modify the observed task (Nisbett and Wilson, 1977). However, these criticisms do not cast doubt on the gains mentioned previously, but lead us to deploy strategies of vigilance with regard to the collection of verbal data and the construction of processing and analysis protocols for them. A "co-construction" strategy was implemented when collecting and analysing the data for the present study in order to check the validity of the verbal data in relation to the activity considered and counter some of the criticisms.

The methodological tools proposed in this paper (concomitant or interruptive verbalization, self-confrontation) provide a high density of subjective data. With these continuous or nearly continuous data, researchers can capture not only states but processes of change, development and learning (Granott and Parziale, 2002). An in-depth study of the subjectivity dynamic of powered two-wheeler riders can improve our knowledge of several aspects of their riding behaviour: (a) by providing access to dimensions of the riding activity which are difficult to capture with other approaches – emotions and feelings, (b) by making it possible to identify and document difficulties, even if they are minor and/or non-observable which, if they do not have severe outcomes are significant for the riders, (c) by identifying elements in the environment which are taken into account by the rider and which determine his/her modalities of decision-making and action, (d) by allowing us to investigate the processes of riding on different time scales. Furthermore, considering the subjectivity of the motorcyclists seems to be of interest with regard to the ergonomic goal of changing and improving existing situations. We take the view that, in relation to motorcyclists, the design, testing and improvement of prevention measures, training curricula and infrastructure necessarily involve the identification of the problems riders encounter in real world. This dimension cannot be investigated without the use of systematic qualitative methodologies that allow us to perceive the concerns of the individuals in question. In many domains,

self-confrontation interviews have demonstrated their potential for identifying the problems encountered by actors in existing situations and helping ergonomists make valid recommendations for future situations (Theureau, 2003). The processes of design need to be reconsidered giving more importance to the opinions and difficulties of actors, from the proposal of design hypotheses to the appraisal of the modified situations (Haines and Wilson, 1998).

In addition, these data are of obvious value in another way which does not apply to the subjective data normally collected by questionnaires. Like "vehicle based data" they provide a density and continuity of data which facilitates their combination with data that relate to other levels. Our study provides an example of possible connections by mixing audiovisual data on the behaviour of the participants and ethnographic observations of training situations which we have described by using the term "intermediate level data" (Aupetit et al., 2011), and "high level data" (Aupetit et al., 2011) such as data from self-confrontation interviews or verbalizations collected during the situation. The specific protocols for formatting and analyzing these data that were developed in this study allow us to attain a very detailed understanding of the behaviours of the riders and the processes at work. They provide us with a comprehensive overview of the riders' activity in a natural context, which is then analyzed with reference to specific research issues. The data on the dynamics of the vehicle, which were not collected in this study and which provide a third level of data ("low level data"), may also be integrated with these processing protocols and combined with the other data (Aupetit et al., 2011). Mixing methodologies in this way thus strikes us as being a valuable approach both with regard to measuring and understanding riding performance by means of "vehicle based data", and also in order to improve the quality of the "naturalistic study" by exploiting the complementarity between different levels of analysis. These methodological decisions – integrating the subjective point of view of the motorcyclist and combining different levels of data – are a continuation of two European projects, SAFERIDER (2008–2010) and 2BESAFE (2009–2011).

Acknowledgements

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