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Report on the effectiveness of simulators as educational tool

Deliverable G5 of Task Force G:
 Use of ITS to train and to educate drivers

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EXECUTIVE SUMMARY

The final task of HUMANIST Task Force G has consisted in synthesising the existing experience on the effectiveness of simulators as educational tool. Information on available research results on the effectiveness of simulators as educational tools within HUMANIST partners and on published sources was gathered by the Task Force. This report contains a synthesis of this information and the conclusions drawn from its analysis.

It was found that at present there is not enough knowledge on transfer and retention of the skills that are acquired during simulator training to assess its effects on the performance of the drivers after the training period. Nevertheless, research results provide indications of the potential efficiency of simulators and e-learning in improving some aspects of driver training.

Future research on the effectiveness of driving simulators for driver training should include the definition of a standardised set of safety-critical performance criteria against which performance and training effectiveness is measured, as well as the standardisation of evaluation procedures and criteria.

1 INTRODUCTION

HUMANIST Task Force G (TFG) seeks to identify the areas of training where simulation can be brought in to help provide the necessary skills to drivers. The objectives of the Task Force are:

- The application of new ITS technologies for the driving education of novice drivers to facilitate the development of safe behaviour and awareness of risky situations
- The application of new ITS technologies for the training of elderly and disabled people in the aim of functional awareness.
- To explore the potential of applying e-learning techniques to driver training and to conduct an analytical review of driver training and education to be used in formulating guidelines and goals for future development of learning tools.

Previous HUMANIST TFG work resulted in the assessment of the state of the art in the application of driver simulators to driver training, the identification of additional research effort that is needed to achieve the potential effectiveness in using simulators to improve the driver training process, and the elaboration of Guidelines for the development of European driver training and education tools [Pardillo et al., 2005 and 2006].

The Guidelines contain a series of recommendations that are intended to provide guidance in the development of driver training and education tools, and background information that supports these recommendations.

The final task of TFG has consisted in synthesising the existing experience on the effectiveness of simulators as educational tool. Information on available research results on the effectiveness of simulators as educational tools within HUMANIST partners and on published sources was gathered by the Task Force. Contributions were received from Karel Schmeidel (CDV), Anke Mogilka and Nina Bär CUT, Yvonne Barnard (EURISCO), Christine Turetschek (FACTUM), Max Duraz (INRETS), Willem Vlakveld (SWOV), Alan Stevens (TRL) and José Pardillo (UPM). This report contains a synthesis of this information.

2 THE USE OF SIMULATORS AND E-LEARNING IN DRIVERS EDUCATION

It is generally accepted that driver training needs to encompass a theoretical and a practical component, which ideally should enable the student to both acquire abilities to master the driver task by means of a more abstract approach and through practical training by driving in a real vehicle in real traffic.

Driver training curricula are based on theoretical assumptions about driver behaviour and the driving task. A common premise is that driver behaviour is organised in four hierarchical levels described by Keskinen [1996], building on previous work by Michon [1985 and 1989]. This hierarchical approach assumes that abilities and preconditions in a higher level influence the demand and preconditions on a lower level. It was applied in the EU project GADGET [Hattaka et al, 1999], in which a matrix was developed to provide a theoretical framework for defining the competences of a safe driver and the goals of driver education and training. The GADGET matrix includes three hierarchical levels: strategic, tactical and operational. A fourth level concerning goals for life and skills for living was added. Traditional driver training is focused in the first two levels whereas the other two are seldom part of the training. The GADGET project provided the basis for developing the Goals for Driver Education (GDE) framework. It was proposed that the driver training curriculum should address safety relevant issues:

- Knowledge and skills that a driver needs for driving under different circumstances.
- Risk-increasing factors: aspects of driving or traffic that can increase the risk, such as worn out tyres, perception of the traffic situation, speed adjustment, risk acceptance.
- Self-evaluation of the driver's performance on the four levels. This points to critical self-adjustments of all from skills in vehicle handling to reflection of individual risk attitudes. Overestimation of the abilities after having taken a specialised training course is a threat of such courses.

Simulators and e-learning applications can be used to complement driver training in these aspects.

Driver training covers the training of novice drivers, professional drivers or experienced drivers, elderly drivers, and disabled drivers. Though an overlap occurs, it is useful to distinguish between the target groups. A novice driver needs to acquire both theoretical and practical skills and knowledge at all levels of the GDE framework, whereas training of experienced or professional drivers typically is directed at more specific areas of the driving task. Similarly, training groups of elderly or disabled drivers would have to implement different approaches such as the obtainment of functional awareness of their abilities and limitations and to adapt their driving behaviour accordingly without being exposed to the risks of real traffic.

2.1 Driving simulators

The use of driving simulators in driver education and training is increasing both in Europe and worldwide. The advantages of using simulators are numerous. They offer the possibility to control and standardise training environment and conditions, to practice in abnormal and hazardous conditions and to deliver objective on-line performance feedback. These advantages can make simulators more effective training media than the operational systems (Flexman and Stark, 1987). Additionally, training in simulators can reduce training costs.

Nevertheless, driving instruction is a complex process, requiring an extensive analysis on the selection, timing and form of instruction and feedback. In order to be able to learn something from a simulator, its technical quality must be adequate. The quality of the simulator lessons is also important, as is the way in which these lessons are imbedded in the total learning course. It also requires insight in the state and the mental processes of a student. Human instructors are able to evaluate such processes while virtual driving instructors are currently not.

Driving simulation can be considered as a form of Scenario Based Training (SBT). An SBT is focused on controlled and systematically constructed scenarios that have been specifically created for training a certain (sub) task. For each scenario (and the underlying training activities and learning goals) performance measures are defined. After completion of the scenario, the performance of the student is graded relative to a set of standards. Based on a task analysis, learning goals are derived. From these learning goals, training activities are derived that are modelled in scenarios. These scenarios are presented to the student in the simulator.

Automatic Traffic Generation and Autonomous Driver models reproduce the circumstances in real traffic in driving simulation, and enable the users to repeat and therefore train certain tasks in changing environments, with varying risk, and different road users, with variable behaviour. With these devices it is possible to train anticipatory skills, like risk or hazard perception, which are highlighted by recent research as very important for safe driving.

Through the combination of opportunity to practice and obtaining feedback on those skills trainees can come to their own understandings of how cues in traffic and a possible outcome are related. Moreover, trainees can experience the results of their own risky choices. However, risky driving behaviour results not only from poor perception, but also from overestimation of own skills.

A problem that in some instances has created problems in simulator based training is the appearance of simulator induced sickness, which can affect users of all ages, but to a larger extent to older persons.

2.2 E-learning

E-learning or multimedia learning can be defined as the combination of text, graphics, animations, pictures, video or sound to present information (Najjar, 1995). Since these

media can readily be integrated by means of computers, e-learning is becoming a more and more widespread tool for training and education within many spheres of society.

E-learning techniques can employ strategies, which range from theoretical knowledge of traffic rules and regulation to training of certain skills or techniques or improvements in awareness of special subjects. Finally e-learning might be integrated as tools for influencing the attitudes of drivers and as tools for self-assessment.

In addition it is technically possible, e.g. through the internet, to provide immediate access to learning materials and interaction with experts or/and fellow learners. Finally the advancement of computers' capacities makes it possible to illustrate real life driving situations and animated scenarios thus making the experience quite realistic.

3 KEY FACTORS IN THE ASSESSMENT OF SIMULATOR TRAINING EFFECTIVENESS

3.1 Transfer of training

To assess training effectiveness, it is essential to consider the degree to which trainees are able to apply the knowledge, skills, and attitudes gained in a training context to the real context. In other words, training is effective when transfer of training is achieved (Gielen, 1995) and the value of a training device is determined by the degree of learning and transfer that occurs.

Transfer of training relates to a variety of aspects. In the literature different types of transfer are distinguished (Baldwin and Ford, 1988; Gick and Holyoak, 1987; Patrick, 1992; Salomons and Perkins, 1990; Tannenbaum and Yukl, 1992). Barnard et al. (2001) defined the following forms of transfer:

1. Positive transfer: Extent to which trainees have acquired knowledge, skills and attitudes, which can be applied effectively in work practice. Previously acquired knowledge, skills and attitudes facilitate the learning of new knowledge, skills and attitudes
2. Negative transfer: Extent to which an undesired effect occurs after following a course. Previously acquired knowledge, skills and attitudes hinder the acquisition of new knowledge, skills and attitudes
3. Far transfer: Transfer when the initial learning task and the subsequent tasks to be learned differ substantially
4. Near transfer: Transfer when the initial learning task and the subsequent tasks to be learned differ only slightly or not at all
5. General transfer: The trainee acquired certain working methods, knowledge and skills which can be used in tasks other than the original learning task
6. Specific transfer: The learning task is so specific that no transfer can be expected to other tasks, but only to the same task

7. Horizontal transfer: Transfer from one task to another
8. Vertical transfer: Transfer within a certain task, with growing expertise

In addition to this, Salomons and Perkins (1990) considered two categories:

- “Low-road” transfer: Transfer based on intensive and varied training, and occurring by means of automatic use of acquired knowledge and skills in a new context .
- “High-road” transfer: Transfer based on consciously abstracting of already acquired knowledge and skills from one context to another

In order to establish the effectiveness of driver training with a simulator, it is necessary to perform a good learning goal analysis, to establish what knowledge, skills and attitudes should be acquired in the simulator and to determine what kind of transfer is expected.

In all cases we want to acquire positive transfer, the things learned in the simulator should be transferred to the real-life driving task. It is important to avoid negative transfer. With simulators this risk exists, as the technical driving task is certainly not the same as in a real car, especially with relatively simple simulators. But also perceptive tasks are different. For example speed and distance is not perceived the same.

Specific transfer is not a problem in itself; the trainee needs only to transfer the learned driving task to a driving task in the real environment. However, general transfer is desired when it concerns traffic insight. The traffic situations encountered in the simulator should be generalized to other traffic situations. Because in simulators many more potentially dangerous and complex situations may be presented than would have been encountered in driving lessons on the road, and simulators offer the possibility to replay them if not understood, we may expect a better transfer on this aspect.

Vertical transfer usually takes a long period and will take place after the training, when the driver becomes more experienced. Horizontal transfer in driving will be more or less the same as general transfer.

Low and high road transfer is an interesting topic in simulator training. Usually simulator training is seen as a means for practicing and automating the driving task, thus promoting low road transfer. However, when it comes to traffic insight, high road transfer is desirable. In order for trainees to be able to consciously abstracting from one situation to another, more explicit instruction and feedback is needed than just simulator practice.

3.2 Simulator fidelity

A simulator is an abstraction of reality, and many aspects cannot be reproduced with sufficient detail or realism. The term fidelity refers to how closely the simulation imitates reality. Limited fidelity restricts the range of tasks or task aspects that can be trained in the simulator.

Some research results indicate that more fidelity does not always improve the training results (Alessi, 1988; Lintern & Garrison, 1992).

Alessi and Trollip (2001) suggest that there is also a relationship between fidelity and the place in the training trajectory: beginning trainees could be overwhelmed by the complexity of the real system and environment and may, therefore, sometimes be better served by a simplified, lower fidelity simulation. More experienced trainees, however, would learn more from a high-fidelity simulation (Verstegen, 2003 and Verstegen et al. 2002).

Furthermore, there seem to be different kinds of fidelity that influence the training value in different ways. Stanton (1996) makes a difference between the degree to which the simulator looks like (physical fidelity) and acts like (functional fidelity) the operational system. Positive transfer will occur when the stimulus and response elements are the same in the simulated and real environments, i.e. when the trainees' behaviour in the simulated task is the same as the operational task under similar conditions (Korteling, Van den Bosch, and Van Emmerik, 1997). Defined in this way, functional fidelity is vital for the transfer of the learned skills to the operational environment, whereas perfect physical fidelity may not always be required when it concerns aspects that are not important for task execution.

Some authors use the term psychological fidelity to refer to the degree to which transfer occurs, despite the lack of other aspects of fidelity (Stanton, 1996).

From an educational point of view the learning goals determine the required level of fidelity: for those tasks and task aspects that should be covered in the training simulator, at least functional fidelity should be guaranteed. Slick et al. (2006) found that transfer of training from simulated environments to the real world was maximized when training is characterized by a high degree of both physical and psychological fidelity. The purpose of their study was to establish the psychological fidelity of a particular training simulator. This was accomplished by creating a methodology using physiological measurements to compare participant responses in both real and simulated-driving environments. Twenty-two participants were measured in both real-world driving (RWD) as part of a driver's education course and simulated-world driving (SWD) completed in a driving simulator. For both the RWD and SWD conditions, overall measurements and task specific-measurements in four high-risk driving tasks were obtained. Results indicated no significant differences between RWD and SWD for any of the four driving tasks. Thus, the evidence collected suggested psychological fidelity of the SWD.

SYNTHESIS OF RESEARCH RESULTS ON THE EFFECTIVENESS OF DRIVING SIMULATORS FOR DRIVER TRAINING

Information on available research results on the effectiveness of simulators as educational tools within HUMANIST partners and on published sources was gathered by the Task Force. Contributions were received from Karel Schmeidel (CDV), Anke Mogilka and Nina Bär (CUT), Yvonne Barnard (EURISCO), Christine Turetschek (FACTUM), Max Duraz (INRETS), Willem Vlakveld (SWOV), Alan Stevens (TRL) and José Pardillo (UPM). The results are synthesised for each target group and discussed in the following paragraphs.

3.3 Novice drivers

In many European countries, driving simulators are being used for initial driver training. Novice drivers need to learn basic skills, like vehicle operation, steering, manoeuvring and interaction with other traffic. These skills may be learnt in a virtual environment in which the complexity of real driving environment can be simplified. Low-cost driving simulators can offer such an environment, with traffic in a detailed road environment, providing virtual instruction and feedback on errors. These simulators focus on the didactical aspects, and are integrated with normal driver training. They can be used for training the first steps of vehicle handling.

Research indicates that drivers who have their learner's permit or are just newly licensed have particular difficulties identifying areas of a scenario from which hidden risks could emerge. Standard driver education programs do not appear to address these difficulties adequately. This suggests that some alternative form of driver training could reduce the crashes, either in the classroom or on the road. Driving simulators can provide novice teen drivers with experimental learning in situations that typify teen crash involvement which would be difficult, if not impossible, to rehearse in the real world precisely because of their inherent danger.

The Dutch research organization TNO estimates that in late 2005 100 simulators were used in the Netherlands in the driver training for a car driving licence (Kappé & Van Emmerik, 2005). According to Vlakveld (2005), the road safety effect of simulator training is unknown.

An experiment was carried out in Sweden (Falkmer & Gregersen, 2003), in which, in addition to their driving lessons, driving school learners also were given computer based training and then simulator training focussed on hazard perception and risk acceptance. For these subjects, in comparison with those who only had driving lessons, it was sometimes useful to have had the simulator training, but generally it was not. This modest effect could be seen when using a simulator with a screen angle of view of 120° and simple movement feedback. When a very simple simulator (40° and no feedback) was used, the simulator training had absolutely no effect on the hazard perception and risk acceptance of these driving school learners.

In the US, Fisher, Pollatsek, and Pradhan (2006) examined the effectiveness of a PC-based risk awareness and perception training programme (RAPT) for novice drivers.

Results demonstrated a performance improvement of RAPT-trained drivers compared to untrained drivers in both near and far transfer scenarios.

Ivanvic and Hesketh (2000) studied the effects of making errors during training (error training) versus learning from examples of errors (guided error training) on adaptive driving skills and driver self-confidence. In error training, participants drove through a training run in a driving simulator themselves, whereas in guided error training, participants watched a video of a driver making errors. Transfer was measured after training in a simulator run including analogical transfer and adaptive transfer scenarios. Guided error training was found to be less effective than active error training in promoting analogical transfer compared to errorless learning. Moreover, active error training promoted adaptive transfer and led to significantly lower self-confidence, whereas guided error training did not. Further research would be needed to assess whether the advantages of error training translate from simulated to real driving, and whether exposure to simulated accidents can lead to long-term changes in drivers' attitudes and actual driving behaviour.

Montgomery et al (2006) developed a personal computer (PC) based virtual reality driving simulator that included a simulation of the effects of driving while drunk at the University of Missouri-Rolla (UMR). An evaluation study was conducted by the University of Michigan Transportation Institute to establish the internal validity of the drunk driving simulation by comparing participants' performances under a "sober" condition to a "driving drunk" condition; and to assess the external validity of the simulator by asking subjects about their future likelihood of engaging in drinking and driving and their general expectancies regarding the use of alcohol. The study showed that virtual reality simulator could be a safe, ethical and effective approach to educating young people about the dangers of drinking and driving. With regard to the initial attempt to assess the external validity of the VR driving simulator, the results were disappointing as no significant differences were found with regard to the likelihood of students engaging in future drinking and driving behaviour, or for any changes in their expectancies regarding the use of alcohol.

In Finland, where they have problems of driving in dark training condition due to the fact that the majority of driving licences are completed during the lighter summer season and during this time it is difficult to offer appropriate dark training condition without extending the working days, a working group was created to set up and conduct an experiment to compare a driving in the dark training program in a traditional manner and on a driving simulator. A total of 102 students from driving schools in the Vaasa region took part in the experiment, they were divided into A and B groups and everyone received simulator instruction and traditional driving in the dark instruction, but in a different sequence. The results of the two groups were compared by means of two self-evaluations of the skills learned (subjective learning outcomes) and two performance measures (a knowledge test and the instructor's evaluation of the driving in the dark demonstration). New teaching arrangements based on the simulator could provide significant pedagogical benefits, such as the implementation of a more comprehensive curriculum, control of learning outcomes and uniform learning feedback for everyone. The experiment shows that switching to a simulator would not involve a significant risk of worsening driving in the dark skills. Although the research that has been summarized provides indications of the potential efficiency of simulators and e-learning in improving

some aspects of driver training, at present there is not enough knowledge on transfer and retention of the skills that are acquired during simulator training to assess its effects on the performance of the drivers after the training period.

3.4 Professional drivers

Professional drivers typically undergo training at the skill and manoeuvring level (i.e. in handling difficult driving manoeuvres, driving special vehicles or goods vehicles). Simulators have been developed both for research and training for professional drivers. At present, several European countries employ truck driving simulators as part of in-service training.

In the UK, a programme of research focused on simulation as a training delivery tool for skills development in qualified truck drivers TRUCKSIM has been developed by TRL. Parkes and Reed (2005) reported on results from a longitudinal cohort study that sought to provide an analysis of the benefits of synthetic training in the area of fuel efficiency improvement. 36 drivers attended the truck simulator on three separate occasions and received training designed to improve driving style in a range of traffic situations. Apparent fuel consumption figures were recorded during each simulator visit, and compared to real world fuel consumption records for the same drivers. In addition, fuel consumption data were obtained for a matched cohort of drivers over the same period who did not attend the training. The results revealed a picture of improvement in the simulator of several aspects of driving performance. Drivers made an 11% increase in their fuel efficiency over the three visits to the simulator, with the biggest gain being made during the first visit. It was also clear that drivers retained what they had learned from one visit to another as fuel efficiency did not deteriorate between visits. The simulator data showed that drivers were handling the vehicle in a much more efficient manner. Average RPM observed during periods of acceleration dropped by 22% resulting in the engine operating in a more efficient region and generating 45% higher torque. There were also 29% fewer gear changes over the course of the drives. All measures indicated an asymptotic pattern, with little to suggest much potential for improvement after the third visit. The pattern of improvement in the real world fuel consumption figures was different and did not appear to be approaching asymptote, so further work would be needed to determine the potential ceiling level of performance. Further work would also be needed to determine if similar transfer of training effects, and relative benefit in comparison to on-road training, could be achieved for other aspects, such as licence acquisition or advanced specialist training.

Strayer and Drews (2003) conducted another study to quantify the transfer of acquired skills during a fuel efficiency simulator training for truck drivers to the real world. The study was based in a two-hour fuel efficiency simulator training for truck drivers comprising 19% lecture, 24% computer-based training and 57% simulator training and focused on optimizing shifting to maximise fuel efficiency. Forty drivers were selected from a local commercial trucking company that maintained precise records on drivers' history, fuel efficiency, type of vehicles driven, and trucking routes. These drivers participated in a two-hour training program that focused on ways to optimize shifting to maximize fuel efficiency (e.g., progressive shifting, double clutching, timing, and appropriate gear selection). Transfer of training was assessed over a six-month interval

using measures of fuel consumption obtained by drivers in their own vehicles driving their normal route. Training transfer and retention (fuel consumption) was measured on-road monthly over a 6-month interval. Results indicated a positive transfer of fuel efficiency skills over a 6-month period, especially for those drivers with the poorest pre-training performance. This study provides strong validation for the fuel efficiency simulator training. Drivers' age and job tenure did not affect the efficiency of the training.

Brock et al. (2007) synthesised US experiences of those training programs that are using some combination of simulators and computer-based instruction (CBI). In those cases where advanced technologies are being applied, early data indicate that well-designed CBI, including simulation, can improve student performance and also realize efficiencies in the instructional process. Distance learning shows great promise for post-licensing training. Nevertheless they found that there is a lack of standards for measuring the effectiveness of commercial driver training

Turpin and Welles (2006) analyzed field data derived from driver performance measurements collected during real application training in Utah. 355 drivers were trained using a simulator based program in the course of eight months . The simulators collected objective performance data on each trainee. Those data have enabled statistical analyses on the effectiveness of their training. Conclusions derived from that analysis indicate that critical driving errors in intersections can be defined, measured and reduced by at least 67%.

The Finnish Vehicle Administration (AKE) and the Adult Education Centre of the Work Efficiency Institute (TTS) have set up an experiment to assess the suitability of a bus simulator as a training tool. A total of 50 novice driver students completed the driving examination; 27 of them used an average of 9 per cent (6.33 hours / 70 hours) of the total driving practice on the simulator and 23 belonged to the reference group. The key finding was that no differences appeared between the simulator-user group and the reference group in terms of course completion, learning during the course, economical driving skills or success at the driving examination or work practice.

3.5 Elderly and disabled drivers

Elderly drivers, impaired drivers or drivers with special needs are very rarely targeted in simulator and e-learning driver training applications though many of these driver groups could potentially benefit from certain elements of these applications.

Roemaker et al. (2003) designed a study to examine if a speed-of-processing training can improve at-risk older adults' driving performance. Training transfer and retention were assessed in an on-road driving evaluation immediately after training and again 18 months after training. Driving performance was evaluated against a traditional driver training in a non-interactive driving simulator, and a low-risk reference group. Results indicated that both speed-of-processing training and driving simulator training can enhance driving performance. Speed-of-processing training resulted in improved performance in untrained tasks that relied on visual attention and higher-order processing speed, and those training effects were persistent at the 18-month follow-up. Simulator training resulted in an improvement in the specific driving manoeuvre skills

that were expressively practiced during training. However, those effects were mostly temporary (dissipating by the 18-month follow-up).

Disabled drivers are typically trained for the purposes of identifying functional weaknesses thus not for the purposes of training per se but rather to identify which conditions of driving they would encounter difficulties with.

In the only reported study that was found as a result of the TF effort, Akinwuntan et al (2005) studied the effectiveness of simulator training in heart stroke patients. Eighty-three first-ever sub acute stroke patients entered a 5-week 15-hour training program in which they were randomly allocated to either an experimental (simulator-based training) or control (driving-related cognitive tasks) group. Performance in off-road evaluations and an on-road test were used to assess the driving ability of subjects pre- and post-training. Outcome of an official pre-driving assessment administered 6 to 9 months post-stroke was also considered. Both groups significantly improved in a visual and many neuropsychological evaluations and in the on-road test after training. There were no significant differences between both groups in improvements from pre- to post-training except in the "road sign recognition test" in which the experimental subjects improved more. Significant improvements in the three-class decision ("fit to drive," "temporarily unfit to drive," and "unfit to drive") were found in favor of the experimental group post-training. Academic qualification and overall disability together determined subjects that benefited most from the simulator-based driving training. Significantly more experimental subjects (73%) than control subjects (42%) passed the follow-up official pre-driving assessment and were legally allowed to resume driving.

Simulator-based driving training improved driving ability, especially for well educated and less disabled stroke patients. However, the findings of the study may have been modified as a result of the large number of dropouts and the possibility of some neurological recovery unrelated to training.

4 CONCLUSIONS

Despite their prevalent use, there is still a lack of evaluation studies to provide evidence on the effectiveness of driving simulators in driver training. At present there is not enough knowledge on transfer and retention of the skills that are acquired during simulator training to assess its effects on the performance of the drivers after the training period. Safety performance of drivers trained in this way compared to that of traditionally trained drivers has not been fully assessed yet.

Nevertheless, existing research provides indications of the potential efficiency of simulators and e-learning in improving some aspects of driver training.

Future research on the effectiveness of driving simulators for driver training should include the definition of a standardised set of safety-critical performance criteria against which performance and training effectiveness is measured; as well as the standardisation of evaluation procedures and criteria.

A potential new use of driving simulators, may be to let people get used to all kind of new ITS devices in the car, either for driving support systems and dealing with complex informative systems.

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