UDRIVE

European Naturalistic Driving Study

Thematic workshop research questions

Deliverable 63.3

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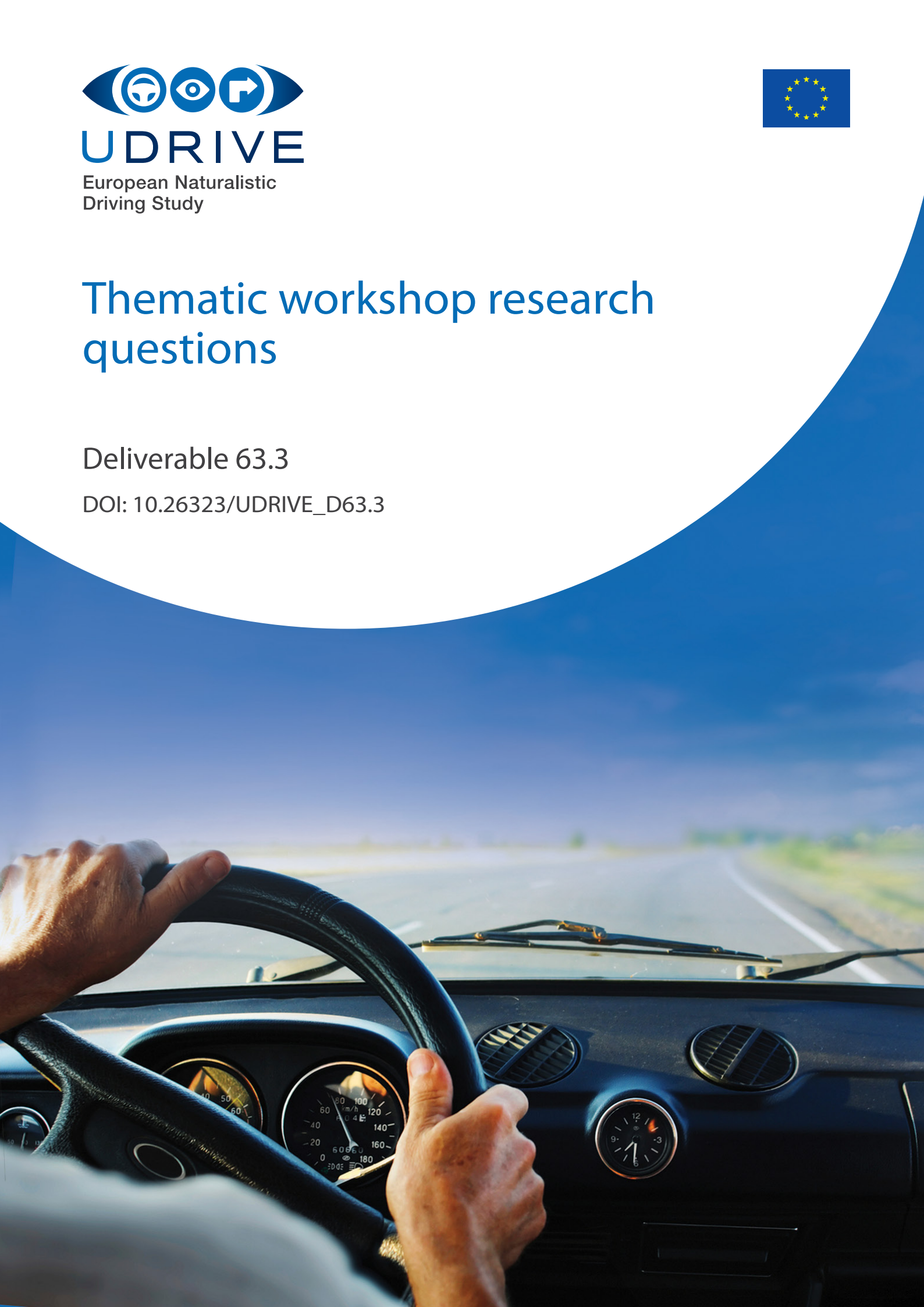

UDRIVE

European Naturalistic Driving Study

EUROPEAN COMMISSION

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Executive Summary

UDRIVE is a large-scale European Naturalistic Driving study that aims to collect in-depth knowledge about the behaviour of car drivers, truck drivers and motor riders in order to make road traffic safer and more environmentally friendly.

Deliverable 63.3 is the report of the Thematic Workshop on Research Questions, held on 12 March 2013 in Brussels. All presentations of this workshop are available at the UDRIVE website at: http://www.udrive.eu/index.php/news/56-udrive-workshop-presentations-for-download

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1 Introduction

1.1 Background

Road transport is indispensable for the exchange of goods and persons, but at the same time has severe negative consequences, among others for road safety and environment. To meet the European road safety and emission targets, a next generation of measures is needed based on a far more in-depth understanding of road user behaviour.

1.2 The UDRIVE project

UDRIVE is the first large-scale Naturalistic Driving study in Europe and aims to provide a first step toward this in-depth knowledge in a number of areas, as well as data for further research. Cars, trucks and powered two-wheelers (motorcycles and scooters) will be equipped with sensors and cameras and will for more than a year and provide continuous and detailed information about the driver and the vehicle in interaction with other road users. This will result in a wealth of information about everyday trips on European roads in 6 different countries.

1.3 The Workshop and the audience

The UDRIVE integrated project started in October 2012, and after several preparatory activities, a workshop was organized on March 12, 2013 to discuss the UDRIVE research questons with the potential stakeholders. The workshop aimed for the future users of UDRIVE's knowledge, to get acquainted with the project, its aims and scope, to get involved and to bring in their ideas and needs. The workshop particularly aimed at potential stakeholders including road administrations, car industry, insurance companies, road transport operators, road user organisations, driver training and certification organisations, as well as knowledge and research organisations. 67 stakeholders and project members participated in this workshop.

2 Programme

The agenda of the workshop is given in Table 2.1.

Table 2.1: UDRIVE Thematic Workshop Programme

09:30	*Registration and coffee*	
10:15	**Why, what, who, when, where and how: UDRIVE in a nutshell**	Rob Eenink, SWOV
10:25	**UDRIVE in the European framework**	William Bird, EC DG for Research and Innovation; project officer
10:35	**Approaches to centralised data management for FOT and ND studies**	Karsten Heinig, VOLVO
10:45	**Overview of UDRIVE's main research areas**	Jonas Bärgman, SAFER
11:00	**The overall question: what can we learn about crash causation?**	Martin Baumann, DLR
11:15	Questions and discussion	
11:25	*Coffee break*	
11:55	**DISCUSSION SESSION I** **Passenger cars and trucks, with a focus on distraction** Introductions: Luca Pascotto (FIA) Johan Engström (VOLVO) Moderator: Marika Hoedemaeker (TNO)	**DISCUSSION SESSION II** **Safety of motor cyclists** Introductions: Veneta Vassileva (ACEM) Martin Winkelbauer (KFV) Moderator: Aline Delhaye (Federation of European Motorcyclists' Associations)
12:45	*Lunch*	
13:45	**DISCUSSION SESSION III** **Pedestrians and cyclists in interaction with cars** Introductions: Ceri Woolsgrove (European Cyclist Federation) Nicole van Nes (SWOV) Moderator: Prof. David Shinar (Ben Gurion University)	**DISCUSSION SESSION IV** **Enhancing eco-driving knowledge** Introductions: Tarek Nazzal (Allegium GmbH) Norbert Ligterink (TNO) Moderator: Oliver Carsten (ITS University of Leeds)
14:35	*Coffee break*	
15:00	**Priorities and expectations: the way forward** **Feedback from the sessions and closing plenary discussion**	
15:30	Wrap up and how to stay involved?	Rob Eenink, SWOV
15:45	*End of workshop*	

2.1 Plenary morning sessions

Rob Eenink (SWOV), who is the project coordinator of UDRIVE, presented the general overview of the project. UDRIVE aims to increase our understanding of road user behaviour and contribute to meeting the European road safety and environmental targets by conducting a large-scale Naturalistic Driving study in Europe.

William Bird (EC DG for Research and Innovation), who is the project officer for UDRIVE, explained the role of UDRIVE in the European framework, especially in relation to the EU road-safety action plan, and Horizon 2020. He emphasised that more effort is needed in road safety research and innovation. Next to safety, sustainability is of course an important focus for Europe.

Karsten Heinig (VOLVO) provided an overview of approaches to centralised data management for Field Operational Tests and Naturalistic Driving studies. He focussed on the lessons-learned from the euroFOT project. The data management chain and the process for data collection in UDRIVE were presented.

Jonas Bärgman (SAFER) presented an overview of UDRIVE's main research areas. He concluded that UDRIVE deals with a set of complex research areas. The main research areas are: crash causation and risk, normal/everyday driving, inattention and distraction, driving style and eco-driving, and vulnerable road-users. A difference between euroFOT and UDRIVE is that in euroFOT all test-sites had different approaches; in UDRIVE a centralised data management will be used.

Martin Baumann (DLR) addressed the overall question: what can we learn about crash causation? The challenge is to reduce fatalities on the European roads, approaching zero in 2050. UDRIVE will provide detailed data on naturalistic driving necessary for deepen knowledge about factors contributing to crash causation. In the discussion, driving (and especially motor-riding) behaviour at night times was discussed. It may not be easy to acquire good quality video data. Eye-tracking is not foreseen in the project due to being immature in a naturalistic setting.

2.2 Morning discussion sessions on passenger cars and trucks, and on motor cyclists

2.2.1 Discussion session 1 Passenger cars and trucks, with a focus on distraction

Luca Pascotto (FIA) and Johan Engström (VOLVO) gave presentations on distraction of drivers of cars and trucks. The session was moderated by Marika Hoedemaeker (TNO).

Luca Pascotta explained that attention can be improved by keeping the "Drivers In-the-Loop", preventing disruption of driver attention by the product's content, function, or operation and actively supporting driver attention. He stressed that we should aim to improve the behaviour of the driver, aiming for "5 star" drivers.

Useful instruments are: regulation, awareness campaigns and education, research and sharing best practices.

Johan Engström went deeper into the question of what inattention and distraction actually are. He presented work from the US-EU Driver Distraction and Human Machine Interaction working group, the Inattention Taxonomy Project. He emphasised the importance of naturalistic driving studies because drivers behave differently in the real world compared to controlled experiments.

In the discussion many questions was raised about the characteristics of the participants to be recruited. For example, there are differences in their attention and distraction between experienced and novice drivers. Several points were raised on these issues. Knowledge about these differences could lead to recommendations for training. Selection of participants should also take into account age, and the relation with experience. What about older drivers, are their medical history taken into account? UDRIVE will screen drivers, and exclude those who are not fit to drive. The age of driver can be related to what happens during the drive. Personality, like sensation seeking, also plays a role.

Familiarity with routes also relates to distraction and attention issues. For example, more familiarity might cause more incidents, because drivers will develop expectations. Expectations are one of the key-issues in

proactive attention. As wrong expectations about traffic situations may lead to misdirected attention, how do we collect data about expectations? The main data collected will be on behaviour, e.g. where the driver looks, and on the situation, e.g. where are the other cars. We would like to ask drivers directly, but how to do that in ND is unclear. You can ask them afterwards, e.g. in an interview, show the driver the video. The question was raised how precise can you tell if the driver did not see something (inattentional blindness)? You can see where he/she looked, and infer that he/she did not see if he/she did not react.

Also the conspicuousness of objects is relevant, some conditions may lead to invisibility of objects, it is possible to look at this by using the outside video cameras. But it is difficult to measure, you would need image processing, which is probably not going to be used. In UDRIVE video fragments will be annotated and classified. Annotation needs to be objective, which is a major challenge. However, several partners, such as SAFER, have experience. The criteria need to be defined properly, and annotation needs to be done iteratively by several researchers.

Is it possible to make a choice of support systems drivers may have available in the car, and check whether they turn it on or off? The car models selected will be a representative sample of contemporary cars, many of them will have systems onboard. We will measure whether they are on or off if this is made available to us from the vehicle manufacturers. In-vehicle systems can also have an influence on attention, or the design of the dash-board etc, but this is no priority in the research questions.

For truck drivers, information from the company where they work may be a major source of distraction. Information coming from the company may be recorded, but recording audio is giving rise to serious privacy issues. However, messages from the company are important, you will get additional information about what is going on, if something happens the company will ask what is was. We will have difficulties getting to this information. There are a lot of incidents with trucks, especially in a city area where they drive for distribution purposes. Trucks that turn right have a blind spot, there are doubts about the mirrors, and they may cause a visual overload. We have not thought about this specific issue yet, it would require special cameras to investigate this, which is a matter of whether it is a priority. However, we could check how often drivers look at the mirrors.

Another question was how to detect incidents without hard braking? This can be done for example by measuring the distance to objects, such as pedestrians. However, it will require automated detection and tracking that we hope we will be able to include in the data acquisition.

Drivers could make the same mistakes every day. The question was asked whether UDRIVE will do something about this, warn the driver when these mistakes are detected? The answer is that UDRIVE is not testing counter-measures, but just observing driving behaviour.

There was a question whether the research questions are endorsed by the stakeholders. We do appreciate input from stakeholders, but there are also scientific considerations. Workshops like this are meant to gather input. Given the budget it will only be possible to analyse a few research questions, but the data will be available for analysis later, after the project. There may be a lot of possible research questions, but we have to take into account that we cannot cut up the driver population into too small chunks (young, old, experienced etc.), else the sample size will become too small for any significant findings.

2.2.2 Discussion session 2: Safety of motor cyclists

Veneta Vassileva (ACEM) and Martin Winkelbauer (KFV) gave presentations on the safety of motor cyclists. The session was moderated by Aline Delhaye (Federation of European Motorcyclists' Associations).

Veneta Vassileva posed the question why there is a need of a naturalistic riding study, from the point of view of the industry. Safety of motor cyclist is a serious issue; human factors are predominant in accident causations: perception failures from other vehicle drivers and decision and perception failures from PTW riders. The industry expects from a ND study that it contributes to identifying the main factors contributing to safety critical events, understanding riding behaviour, and provides more knowledge about visibility, perception, and conspicuity. However, the involvement of PTW in UDRIVE is limited (only 2 countries and 2

models). The conclusions of this study could be hardly considered as representative. So there is a need for a European large-scale naturalistic **riding** study.

Martin Winkelbauer presented the 2BeSafe study. This pilot study was recently finished. Some results: a motorcycle needs a particular design to be well perceived by other road users. Accidents with motorcycles have declined, but number of vehicles registered has increased. However the reduction is not as much as for passenger cars – 20% of persons of fatalities on EU roads concern motorcyclists. Important research questions for getting a better understanding of safety related issues of motor cyclists are: the distribution and circumstances of safety critical events, conspicuity issues, "normal" behaviour compared to cars, speed choice, and perception.

UDRIVE could address three types of research questions relevant for the safety of PTW riders:

- Why do drivers fail to perceive PTW?
- What do motorcycle riders do when they get into trouble? Is there a problem in everyday behaviour which leads to safety problems?
- How to detect safety critical events? This may be difficult to identify because, for example, sometimes riders tend to brake harshly just for fun, and different manoeuvres for braking.

He would like to compare safety critical events with accidents statistics: we could see to which extent we could learn from accidents, and we could see what the differences and common factors are.

In the discussion questions were raised about how to detect scenes of driver-rider interactions; there is no automatic way to detect whether there is a rider in the field of view of the driver. The MobilEye system of VOLVO is able to identify a pedestrian from a bicyclist. If automatic detection is not possible, you have to look at the video data manually. Based on the MobilEye software we could identify when PTW is present and then we can possibly study from the eye movement if it was detected by the driver.

There are two types of data for investigating the interaction between PTW and cars/trucks: data from vehicles that are instrumented while the PTW is not, and vice versa. For detection interaction a high quality front view video camera is needed. If we have safety critical events from cars we can look at which ones involve PTW and investigate those. From the everyday riding behaviour we can learn what is normal speed behaviour and how is it linked to safety critical events. From previous research we concluded we lack info on the normal riding info; in-depth understanding of what road behaviour for motorcyclists is essential. The number of safety critical events for PTW is higher than for cars – it will be interesting to be able to compare between novice and advanced riders (for example advanced riders will be able to avoid the near-miss).

Although we talk about Powered Two Wheelers, we mean both motorcycles and scooters, but they are very different, it might be a good idea to try and categorise them separately. In UDRIVE different types will be used, we know that the vehicles and people riding are very different, for example scooters ride more in urban areas, giving rise to completely different types of accidents and incidents.

Motivational elements are important; these need to be included in the questionnaires that will be used.

2.3 Morning discussion sessions on pedestrians and cyclists, and on eco-driving

2.3.1 Discussion session 3: Pedestrians and cyclists in interaction with cars

Ceri Woolsgrove (European Cyclist Federation) and Nicole van Nes (SWOV) gave presentations on Pedestrians and cyclists in interaction with cars. The session was moderated by David Shinar (Ben Gurion University).

Ceri Woolsgrove focussed on the topics of crash Causation factors with cyclists, the role of naturalistic driving studies and the relation between eco-driving and vulnerable road-user safety.

A Naturalistic Driving Study can bring more knowledge about car driver's behaviour, but also about accident causes. "Failed to see" is so far classified as a major factor in accidents between cars and cyclists, but hard to

investigate and difficult to get to based non-naturalistic data. Other issues that ND studies might provide knowledge about are risk compensation, HGV - Blind Spots, the Safety in Numbers phenomenon (more cyclists means more safety per individual, for which the underlying cause is not known), and maybe even modal share. An example of risk compensation is that cyclists with gear (helmets, fluorescent jackets etc,) seem to run more risk because cars drive close to them.

However, there are limits, it is difficult or impossible to investigate attitudes of cyclists and drug/drink driving. To understand what is happening in an incident both the behaviour of the driver and the cyclist need to be taken into account.

In the discussion it was stressed that most data in transport research come from the perspective of the driver, not from the cyclist.

Critical incidents are defined as a situation in which a potential collision may take place if one of the involved parties does not change course or speed. Yielding behaviour often differs according to the local circumstances. We expect to get new insight into crash causation, but we will not understand it all and the amount of critical situations will be limited. ND is the study of “normal” behaviour. What a safety critical event is differs according to the perspective of the driver or motor-rider.

It would be interesting to know what happens during night time, also knowing what pedestrians are doing. It was remarked that equipment of pedestrian or cyclist detection does not work as reliable in the dark. We will rely on the type of camera. There will be a focus on the day-time interaction with pedestrians. We could investigate whether it is possible to study interactions with cyclists during night time, but that may be difficult. Another question was about what happens in one-way streets that allow cyclists to use both sides.

It might be an idea to ask drivers whether they are also cyclists, their perspectives may differ. Motor riders who are car drivers and vice versa, may also have a different riding/driving style. There are differences in riding culture and in safety awareness amongst riders.

Another question was raised about the involvement of cheaper and older cars in the study. In the US they have focussed on newer cars because these are the cars of the future, and we need answers for the future. But cheaper cars have a different type of driver. And safety systems can be retrofitted. There are also issues with installation, warranties and access to e.g. CAN for older cars.

On the question what kind of knowledge and answers stakeholders would like to get from UDRIVE, some ideas were:

- Countermeasures to improve safety
- Differences between types of cyclist, pedestrian, cycles etc.
- National conditions, riding styles differ in countries
- Aggressive behaviour/riding style of VRU (but we cannot measure personality style of cyclists)
- Cultural factors

2.3.2 Discussion session 4: Enhancing eco-driving knowledge

Tarek Nazzal (Allegium GmbH) and Norbert Ligterink (TNO) gave presentations on enhancing eco-driving knowledge. The session was moderated by Oliver Carsten (ITS University of Leeds).

Tarek Nazzal addressed the question how eco-driving may contribute to Road Safety. Eco-driving is safer driving because smoother and more anticipatory driving may lead to more attentive and co-operative behaviour, which is good for avoiding distraction and paying more attention to vulnerable road-users, as well as reducing stress. He presented the European ECOWILL project on eco-driving. The role of coaching and training people to drive eco-friendly was emphasised, the most important being the coaching on-road. Challenges for the future are: interesting people in ’Eco-Training’, gathering further evidence of the benefits, and changing behaviour long-term

Norbert Ligterink gave a presentation on the driver aspects of fuel consumption. The consumption of fuel varies greatly over drivers of the same type of vehicle. It is especially the braking, not the acceleration, that determines the fuel consumption. Research questions he proposed for eco-driving are: why do drivers brake, what is the cruising velocity, what is the engine power used, do eco-driving awareness/training/tools help, what delays the gear shift, how is improvement possible, and what improvements are effective? It should be noted that UDRIVE studies Naturalistic Driving and will not perform interventions such as eco-driving training, but a better understanding of driver behaviour, such as braking and acceleration behaviour may lead to recommendations to improve this behaviour.

In the discussion it was noticed that although braking is a bad thing in eco-driving, for safety we need to break – there might be some contradiction there. Of course we are talking about unnecessary braking because there was unnecessary acceleration before, but we have to be careful that the system doesn't give improper advice, i.e. to continue cruising when a pedestrian is crossing. Unnecessary braking means the driver is not observing the driver in a good way and anticipating – one advice is to follow the traffic flow.

Participants could be asked in a questionnaire if they had training, if they use tools, etc. for eco-driving. A lot of the truck drivers will have had the training.

Indicators for eco-driving raise the question on the impact of on on-board devices, distraction is one of the questions we have to consider.

What can be learned from UDRIVE is the real personal behaviour of drivers, and the identification of the biggest problems in fuel consumption, and hence where are the largest savings to be made.

2.4 Wrap-up session

In the wrap-up session, the moderators of the discussion sessions summarised the outcomes (see also the description of the session above, and the wrap-up presentations available at the website). The plenary discussion focussed on priorities and expectations, and the way forward in UDRIVE.

Expected benefits of UDRIVE will include a better understanding of everyday driving and riding, and of saftey critical events. The interaction between cars/trucks and vulnerable road-users, including PTW, is a focus. Because of seven countries being involved in data collection, we will be able to make a comparison between risk and exposure between countries. Note however that the distribution across the different counteries is very different for different road users, e.g. trucks only based on Netherlands, PTW of one type in one country and another in another. Cars will be the road user type that is spread the most across different countries.

Note that the analysis in UDrive is just scratching the surface of safety and eco-driving research the UDrive dataset can be a basis for. The project is covering many different areas and thus only few research questions will be possible to address within each area. We encourage people to start thinking already now about future complementary research based on the UDrive dataset.

In this workshop we did not address the infrastructure and road design research questions since this part is not included in the study for budgetary reasons..

Rob Eenink (SWOV) closed the workshop and urged everyone to stay involved.

More information on our website: www.udrive.eu

Appendix A List of participants

Last Name	First Name	Job Title	Organisation	Work Country
Augros	Xavier		Volvo Group Trucks Technology	
Baeyens	Peter	Editor	Mobimix.be	BE
Baird	Trevor	Director	Right To Ride Ltd	GB
Balli	Giovanni	Director	AGBN	GB
Bärgman	Jonas	Research Area Manager - Accident Prevention	Chalmers University of Technology	SE
Barnard	Yvonne	Project Manager	ERTICO - ITS Europe	BE
Baumann	Martin	Team Leader	German Aerospace Center	DE
Bird	William	Programme Officer	European Commission	BE
Buday	Andrej	project manager	ZAS - the driving school association	SK
Carsten	Oliver	Professor of Transport Safety	Institute for Transport Studies, University of Leeds	GB
Cocu	Xavier	Researcher	Belgian Road Research Centre (BRRC)	BE
Coupillie	Roel	engineer in incident management	AWV	BE
Damiani	Alessandro	Head of Unit, Transport Research / horizontal aspe	European Commission	BE
Delhaye	Aline Delhaye	General Secretary	Federation of European Motorcyclists Associations (FEMA)	BE
Druart	Axel	European Project Director	Responsible Young Drivers	BE
Eenink	Rob	head of department	SWOV	NL
Engel	Henri	Ceo	SUMOcar Group	NL
Engström	Johan	Technology Specialist, Driver behaviour and safety	Volvo Group Trucks Technology	SE
Fernandez	Laetitia	Project Assistant	ERTICO - ITS Europe	BE
Flament	Maxime	Head of Sector	ERTICO-ITS Europe	BE
Garcia	Manuel	r&d director	Puntech	ES
Giromini	Elisabetta	Trainee	Responsible Young Drivers	BE
Hagleitner	Walter	CEO	ADAS_Management Consulting	AT
Happee	Riender	Assistant Professor	TU Delft	NL
Hardy	Elaine	Director of Research	Right To Ride Ltd	GB
Heinig	Karsten	Leader Accident Research Team	Volvo Group Trucks Technology	BE

Last Name	First Name	Job Title	Organisation	Work Country
Heino	Adriaan	Traffic Psychologist	Achmea	NL
Hoadley	Suzanne	Coordinator, Mobility & Traffic Efficiency	Polis	BE
Hoedemaeker	Marika	Project Manager	TNO	NL
Janssens	Bart	Engineer	Agency for Roads and Traffic	BE
Josseaume	Françoise	Chargée d'étude Facteur Humain de la conduite	LAB PSA Peugeot Citroën / Renault	FR
Kloker	Sarah	Research Assistant	DEKRA e.V. Representation to the EU	BE
Krems	Josef	Professor	Chemnitz University of Technology	DE
Krid	Laurianne	POlicy Director	FIA Region I	BE
Kryuchkov	Vladimir	Head of R&D Department	Ingosstrakh (insurance company)	RU
Lee	Ji Un	Policy Analyst	Umicore	BE
Ligterink	Norbert	Reasearch Scientist	TNO	NL
Luettgens	Gunnar	Head of Application Center	Philips Automotive Lighting	DE
Lumiaho	Aki	Head of Mobility & Innovation	RAMBOLL	FI
Malasek	Jacek	research coordinator	Road and Bridge Research Institute	PL
Manz	Karl	Head of the Test House LTIK	Karlsruhe Institut for Technology (KIT)	DE
Marolda	Cristina	Policy Officer	European Commission DG MOVE	BE
Meyer	Hermann	CEO	ERTICO - ITS Europe	BE
Miki	Yoshikuni	Engineering Coordinator	Fujitsu Ten (Europe) GmbH	DE
Nakai	Toshio	R&D ENGINEER	FUJITSU TEN(EUROPE) GmbH.	BE
Nazzal	Tarek	Managing Director	Allegium GmbH	DE
Pascotto	Luca	Director Mobility	FIA	BE
Pereira	Marta	Researcher	Chemnitz University of Technology	DE
Petzoldt	Tibor	Researcher	Chemnitz University of Technology	DE
Pugh	Shirley	Director	SPMJ	GB
Rodriguez Portugues	Sara	Project Manager	FIA	BE
Schepers	Paul	Road safety advisor	Rijkswaterstaat	NL
Schulte	Kay	Expert Novice Drivers/Experience Drivers	German Road Safety Council	DE

Last Name	First Name	Job Title	Organisation	Work Country
Shala	Kumbim	CTO-R&D	Kosovo Vehicle Center	XK
Shinar	David	Professor Emeritus	Ben Gurion University of the Negev	IL
Simcic	Gabriel	Senior Project Manager	FIA	BE
Szeligowska	Dorota	project officer	European Commission	BE
Van der Valk	Klaas	Editor	Motorcycle Safety Academy	NL
Van Nes	Nicole	Senior Researcher	SWOV	NL
Vancuyck	Stijn	Advisor Road Safety and PTW's	FEBIAC	BE
Vassileva	Veneta	Safety coordinator	ACEM	BE
Verhoeve	Wim	Advisor Road Transport	AWAC - Walloon Agency for Air and Climat	BE
Vits	Andre	Director	AV Consult	BE
Vogli	Drita	Project Analyst	B-ET	BE
Volckaert	An	Researcher	Belgian Road Research Centre (BRRC)	BE
Winkelbauer	Martin	Senior Researcher	Kuratorium fuer Verkehrssicherheit	AT
Woolsgrove	Ceri	Policy Officer	ECF	BE