# 1st PROLOGUE Workshop Minutes

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Authors: Anita Eichhorn (KfV), Martin Winkelbauer (KfV)
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## Project Consortium

| | | | |
|---|---|---|---|
| 1 | | SWOV Institute for Road Safety Research (project co-ordinator) | NL |
| 2 | | CERTH/HIT Hellenic Institute of Transport | GR |
| 3 | | KfV Kuratorium für Verkehrssicherheit | A |
| 4 | | Loughborough University | UK |
| 5 | | Or Yarok | ISR |
| 6 | | Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek - TNO | NL |
| 7 | | TØI Institute of Transport Economics | NO |
| 8 | | Test and Training International Planning and Service GmbH | A |
| 9 | | Universitat de València | ES |

## Document Reference

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## Scope of the workshop

The workshop focused on the dissemination of ongoing and finished research, the experiences so far, the expected value of a European Naturalistic Driving study and dealt with considerations for the development of a pan-European naturalistic observation initiative.

In this regard two workshop groups were formed in order to discuss ND methodologies and technologies as well as to draw some attention to different topics for ND research.

# Minutes

### Welcome and agenda

Martin Winkelbauer opened the Workshop at 11:15, welcomed all participants and gave a brief overview of the workshop.

54 persons from international organisations interested in Naturalistic Driving (ND) were represented (see *Appendix 1*).

Jean Paul Repussard attended the workshop on behalf of the PROLOGUE project officer Mr. Ludger Rogge.

All presentations held can be downloaded at *http://www.prologue-eu.eu/*.

| 11:00 | Martin Winkelbauer | Introduction, Organisation |
|-------|--------------------|----------------------------|
| 11:10 | Rob Eenink | Overview about the PROLOGUE project |
| 11:30 | Ken Campbell | Naturalistic Driving in the USA |
| 12:00 | Adriaan Heino | Interests of the insurance industry |
| 12:20 | Tsippy Lotan | The Green Box - Concept & Potential |
| 12:35 | Michael Gatscha | P-drive system for data collection and processing |
| 12:50 | Lunch | |

| | Workshop 1: Methodology and Technology | |
|---|---|---|
| 13:50 | Andrew Morris | Methodology and Technology - Prologue WP2 |
| 14:20 | Moderator: Pedro Valero | Discussion |
| | Workshop 2: Topics for ND research | |
| 13:50 | Fridulv Sagberg | Topics for Naturalistic Driving Research - Prologue WP1 |
| 14:20 | Moderator: Martin Winkelbauer | Discussion |
| 15:20 | Coffee break | |
| 15:50 | Jean-Paul Repussard | Naturalistic Driving from the European Commission's point of view |
| 16:00 | P. Valero, M. Winkelbauer | Reports from the workshops |
| 16:20 | Rob Eenink | Wrap-Up |
| 16:30 | END | |

## Overview of PROLOGUE

Rob Eenink, principal investigator at SWOV and project coordinator, opened the plenary session with an overview of PROLOGUE. He pointed out what is understood by Naturalistic Observation and emphasised the added value of such a study for traditional research methods and potential user groups e.g. the effects of road design characteristics on the interaction between driver and vehicle, the identification of crash contributing factors and the relationship with particular behaviour patterns etc. Finally, the aims and the outline (partners, work packages & project organisation) of the project were presented.

## Naturalistic Driving in the USA

Ken Campbell, Chief Safety Program Officer of SHRP2, USA, presented the American ND programme and latest news from the project. At first, the participants were introduced to the project administration and organisation and it was explained how different organisations responsible for project coordination, project management, technical advice and research are linked. Beyond that, facts on the highway safety problem in the United States of America were demonstrated.

Mr. Campbell pointed out that the ND study will be conducted in order to collect more and better information regarding objective pre-crash data, accurate crash data, near misses & incident data as well as exposure data. Furthermore, SHRP2 shall help to determine relative crash risks for different factors and shall help to develop crash surrogates.

After a presentation of the project timeline and the project data collection sites (focus areas) Mr. Campbell described the sample design and the system components e.g. head unit with cameras.

Different sources such as instrumented vehicles (continuous recording of video and sensor/parametric data), driver assessment tests for primary drivers, detailed crash investigations for selected crashes, roadway characteristics and features from mobile data collection vans and external sources are used in order to receive a broader data set. During the project 800 TB of video and 100 TB of vehicle sensor data & roadway data are collected (~1 petabyte of data!)

## Interests of the insurance industry

Adriaan Heino represented the Achmea Insurance Company and provided insight to the interests of the insurance industry concerning the ND methodology.

In a first step Mr. Heino provided the participants with facts and figures and explained why the Achmea Insurance Company is interested in accident prevention and traffic safety: Various statistics on accident frequency and costs are available e.g. the brand, value or age of cars involved in accidents as well as socio-economic factors of drivers. So, there are already a lot of answers to certain questions but a lot of questions still remain.

According to Mr. Heino, an analysis of different accidents showed that a majority of incidents take place just after leaving or just prior to the arrival. Mainly, drivers are not fully concentrated on driving at the very beginning or the end of the trip e.g. they are still busy with the setting of the navigation system, rear mirror or putting the seat belt on while driving.

With ND, finally, it is possible to evaluate crash or near crash risks as well as the impact of distraction. Mr. Heino showed a promotional video his company has produced in order to raise awareness about the particular risks at the beginning and end of a trip.

## The Green Box – Concept & Potential

Tsippy Lotan, chief scientist at OR YAROK, presented the concept and potential of the green box. With the green box profiles can be created by dynamic analysis of on-road manoeuvres such as accelerating, braking, turning, lane changing, overtaking, speed etc. Furthermore, driving patterns for certain groups of drivers e.g. young drivers can be analysed. Additionally, there is the possibility to use a pre-test-post-test design in order to evaluate whether the driving behaviour after certain interventions has changed or not. Mrs. Lotan highlighted that the green box technology is very simple: It is not expensive, easy to install and profiles can be generated fast.

## P-drive system for data collection and processing

Michael Gatscha, senior researcher at Test & Training International, introduced the participants to the P-drive system for data collection and processing. The system allows for capturing video and audio data as well as G forces (acceleration & braking, cornering). Using an additional module, time headway can be measured and recorded. Global position is recorded constantly.

Mr. Gatscha pointed out that P-drive includes a marking system for pre-defined events. In the framework of PROLOGUE the variables acceleration, braking, lateral forces, speed and GPS-position will be measured and Mr. Gatscha explained that for every recorded drive, different files such as raw data, summary statistics and video files (optional) are collected. Videos may be recorded for up to four cameras. They may record full time or using an event-based trigger function. In the latter case, a predefined sequence if video is recorded prior to and after an event, which also can be defined using the variables that are measured by the system.

At the end of the presentation further technical details and information on the data analysis software were given.

The plenary session was closed at 13:00 (Lunch).

## Workshop1: Methodology and Technology

Pedro Valero-Mora opened workshop 1 at 14:00, welcomed all participants and gave a brief overview of the contents.

Following this introduction, Andrew Morris and Steven Reed from Loughborough University referred to methodological, technical and organisational issues of PROLOGUE's Work Package 2. The field trials are carried out in order

- to evaluate natural driving behaviour,
- to study the relative crash/near crash risk for various types of drivers,
- to study the frequency and prevalence of driver inattention and distraction
- and, last but not least, to evaluate the impact of distraction on near-misses in particular and crash risks in general.

The main focus is on events such as crash (physical contact with another vehicle), near-crash situations (rapid & severe manoeuvre to avoid a crash) and incidents. Mr. Morris pointed out that ND studies are a relatively new concept within the EU and even at a pilot study level it is necessary to draw upon the experiences and lessons learnt from other studies. Therefore, in WP1 previous and ongoing international research studies, reports and activities relating to ND have been reviewed in order to collect all relevant information such as in-vehicle systems (100 cars study, VTTI USA), lane change behaviour (Naturalistic lane changes, VTTI USA), driver characteristics or eco-driving. WP2 builds upon these results.

Furthermore, PROLOGUE representatives visited Virginia Tech Transportation Institute in order to get first-hand information on this topic.

Thus, it was possible to gain relevant information regarding

- specific research designs and set ups,
- procedures for selection of vehicles and participants,
- metric measures,
- statistical methods,
- data collection,
- data storage and analysis methods
- and legal and ethical issues.

Following these explanations Mr. Morris presented the Dutch VANPool FOT as an example of how an experimental design could go wrong and pointed out that detailed planning is crucial in order to receive a specifically adapted design. Considerations of data storage and management designs e.g. database creation, data quality and dealing with missing data, are essential as well. In this regard data reduction procedures that extract specific events of interest have to be designed.

Finally, the importance of obtaining legal advice already at the beginning of the project was indicated. All legal implications have to be taken into consideration, as PROLOGUE cross borders and European regulations (participation agreement, data protection) vary from country to country.

Subsequently, ND research methods and its use were discussed by the participants. A few prepared questions served as guideline moderated by Pedro Valero-Mora:

- Can and should ND be used to validate/calibrate other research methods (DBQ, in-strumented cars, simulations and simulators etc.)?

Nicole van Nes (SWOV) stated that ND could be useful for calibration of other research methods and could help to develop new behavioural models. She reported on a Dutch FOT (micro simulation) that looked at both approaches and found differences.

A participant pointed out that it is most likely that obtrusive and unobtrusive models will produce different results by comparison e.g. observer studies vs. simulator studies. This knowledge can be used in the future to validate other research methods. Furthermore, a combination of site based studies (speed, position) and vehicle measurements could create new information on driver behaviour.

- How could ND itself be validated?

There are still information gaps concerning driving behaviour and it is important to find a solution of how they can be shown in a better way. In this regards, self reports and questionnaires are still very common. It was pointed out that the project results could shed some light on real situations, and subsequently questionnaires as well as other research methods could be validated according to these outcomes.

The advantage of ND over simulator studies is that more detail information and variations on (near) crashes can be gathered, so by and by it will be possible to bridging these gaps.

During the discussion the question arose whether people do react in a naturalistic way if they know that they are monitored or not and Mr. Morris explained that it is not possible to change driving behaviour for a long period of time. This is why the subjects are monitored for at least 6 months. However, extreme behaviour may be underrepresented e.g. driving under the influence of alcohol but above all, it will be very beneficial to learn from the various trials in different countries.

- Concrete links have to be made to FOT's, SAFER etc.

First of all, it was stated that it is absolutely necessary to elaborate a better definition of what ND is. Actually, ND is mainly based on FOT programmes. There is an overlap that links FOT and ND studies but the difference is not clear. The two approaches are very similar and use common (acquisition) techniques. FOTs are interested in effects of systems while ND also provides exposure data. When ND explores the effect of technical impacts on driver behaviour, actually, it is a FOT study (focus on in-vehicle-systems).

Finally, it was suggested to form a ND-Net (similar to FOT-Net) and to rename 'Naturalistic driving' as 'Naturalistic observation'.

- What should be done in order to convince the EC to fund a large scale ND study and what should be recommended?

The participants agreed that ND is an important contribution to road safety. Changed vehicle behaviour requires changed driver behaviour. By showing the impact and effects of a ND study you are in the position to draw people's attention to specific risks e.g. it is 3 times riskier to text during driving than phoning. The participants agreed that by means of ND studies it will be al lot easier to get unwanted behaviour of drivers changed.

## Workshop2: Topics for ND research

Martin Winkelbauer opened workshop 2 at 14:00, welcomed all participants and gave the floor to Fridulv Sagberg.

Fridulv Sagberg, senior researcher at the Norwegian Institute for Transport Economics, gave an overview of ND driving research topics and presented the results of the questionnaire survey and state-of the art analysis in WP1.

In WP1 previous and current international research studies, reports and activities relating to ND (100 cars study, Naturalistic lane changes, VTTI USA) as well as different methodologies (EDR, instrumented cars) have been reviewed in order to collect all relevant information regarding actual and potential areas for the following pilot study. WP2, the small-scale field trials (WP3) as well as the final recommendations for a large-scale European ND study build upon these results.

Main areas that are currently investigated using ND methods are:

- Driver distraction and inattention
- Fatigue
- In-vehicle systems
- Lane change behaviour
- Driver characteristics

Following these explanations, Mr. Sagberg presented the results of the User Forum Member Survey. About 150 persons in 18 different countries (government, industry and research organisations) received the questionnaire. Thereof, 72 questionnaires were answered.

More than 90% of the respondents considered road safety and about 60% considered eco-driving or environmental effects of road traffic to be interesting to investigate by means of a large-scale European ND experiment. Prioritised topics in this regard are risk taking behaviour, pre-crash behaviour, crash avoidance behaviour, driver conditions and in-vehicle safety support systems.

Subsequently, a matrix for defining research topics and questions including a classification of behavioural dimension (fatigue, decision-making, errors, driving style, lane change, speed) and situational dimensions (trip characteristics, road system, vehicle design, traffic composition) was developed. Each cell of this matrix should indicate a global research topic.

| SITUATION<br><br>BEHAVIOUR | Driver background, trip characteristics | Road system/ environment, ambient condtions | etc. |
|---|---|---|---|
| **Distraction and inattention** | Young drivers and engagement in distractive activities | Distraction under different environmental conditions | ------- |
| **Fatigue, sleepiness, other impairment** | How often and under what circumstances do drivers drive while fatigued? | Is falling asleep while driving more likely on monotonous roads? | ------- |

| Decision making, driving errors/ style/performance | What is the role of inattention in intersection errors/conflicts? | Are drivers less likely to pass with centreline rumble strips? | ------- |
|---|---|---|---|
| etc. | ------- | ------ | ------- |

Mr. Sagberg pointed out that non-safety related research topics such as eco-driving or traffic management can be included easily in the presented matrix as well. Though, it is necessary to keep the matrix simple - only a limited number of categories is preferable.

Additional results of the user survey:

- Countries with high mortality rates seem to be less interested in environmental effects and driver training.

- There is no significant difference between types of organisations (only governments tend to be more interested in traffic flow issues and environmental issues).

- A strong interest in a future contribution regarding a large-scale European study was stated.

Following this presentation, the outcomes of WP1 and ND research topics in general were discussed by the participants. A few prepared questions served as guideline moderated by Martin Winkelbauer:

- Is the matrix a good framework?

- Which cells are most interesting?

- Are the categories of behaviour and the condition categories complete or should some categories be joined?

- What is the added value for VRU, driver training, accidentology...?

- Are there specific topics for eco-driving/environmental issues and traffic management?

- If you have this desired knowledge from the large scale ND study, what would you do with it? (new products, different policies ...)

- Please provide some examples!

- What should we (the consortium) do to convince the EC to fund a large scale ND study?

- What must we include in the recommendations (one issue per person)?

During the discussion Mr. Sagberg pointed out that it was also important to study the validity of ND studies and David Shinar confirmed that point. The important question, if drivers of equipped cars behave the same way as drivers in "normal" cars could be investigated by, for example, combining site-based studies and ND-equipped cars.

David Shinar further emphasised that it was absolutely required to have a good definition of various events, such as crash and aggressive driving.

Furthermore, various participants were of the opinion that ND studies could be very useful for evaluating and improving (advanced) driver training methods, not only for car drivers but also for PTW (powered two-wheeler) riders. In this regard, ND data could also be used as input

for the curriculum of driver & rider trainings e.g. which situations are difficult for novice riders and which situations do they consider to be dangerous. This would be possible e.g. by asking drivers or riders to push a button when they experience a dangerous situation. Data thus obtained could also be used to give feedback and tips to the road user. In particular, ND could help to answer the questions, why ¾ of collisions between passenger cars and PTW are to blame to passenger car drivers and what is the reason, why they fail to perceive PTW riders.

With respect to eco-driving, the participants agreed that we already know much about the relationship between driving style and eco-driving. Though, ND data presumably could improve that existing knowledge. But, prior to that it is necessary to define what we want to know and what issues require further investigation.

After this discussion Mr. Winkelbauer asked all participants to write down one research question that they considered being very useful for further investigations by means of the ND approach. Following research questions were written down:

- How can observed driving behaviour to the driver's cognitive processes (e.g. attention) and interactions be related? => Example: If the driver collides with a motorcycle, is it a problem of attention, visibility or conspicuity?

- Many of the categories for research questions are very much driver or behaviour oriented – human centered. The categories seem to be defined in order to better interpret the human-centred questions. An additional spatially oriented point of view was proposed that somehow overlaps with traffic planning & management: Data should be aggregated to study spatial – local situations, where attention may be different/change. This allows identifying particular situations and locations. Also results could be published complementary to EURORAP and locations can be matched with areas with accidents.

- What is the difference between different characteristics of drivers regarding the number and type of passengers in connection to risky behaviour? => Do young drivers really drive more risky (speeding ...) than older drivers if they drive in accompany of teens or children?

- Eco-driving application during a trip: % of trips?

- Difference between sexes/gender and age groups?

- What is the effect of 'new' car features (e.g. cruise control, shift gear indicator ...) on applying a safe and economical driving style?
    o What keeps people from using these features optimally
    o Implications for driver training

- A driving test is in the most European countries only a 25 minutes driving. The training is mostly completely free. => How (what indicators) predict that someone will be a safe driver in his first stage of driving (alone)?

- To understand the "typical but failed to see" accidents in terms of
    o driver characteristics
    o driving characteristics
    o road design characteristics
    o any interaction between these factors

- What are the indicators for risky driving behaviour?

- How do you validate the crash surrogate to make it useful to use this research?

- What are typical near accident situations and how do riders/drivers react to avoid them?

- What is normal driving and how often are drivers involved in collisions, while driving 'normally'?

- What are the indicators for dangerous driving?
- What are the behaviours that are most likely to enable a driver to recover from an unexpected event that leads to a near-miss?
- Do elderly drivers have different strategies to avoid car crashes than young drivers? => Which characteristics should elderly have/or how should they behave while driving to assure safe driving?
- How can naturalistic driving take fully into account the specific context of driving and incidents in urban areas?
- What factors cause the same type of distraction (passengers etc.) that cause an incident (or accident) or not?

**Final speeches (plenary)**

Jean-Paul Repussard, on behalf of PROLOGUE's project officer at the European Commission, Ludger Rogge, commented on Naturalistic driving from the European Commission's perspective.

Before Mr. Repussard moved on to ND in particular, he informed the participants that the department DG TREN was renamed as DG MOVE (Mobility and Transport). That followed he pointed out that the European Commission in order to improve road safety in Europe wants and needs more data because police data don't give sufficient information on injuries. The CARE database (Community database on Accidents on the Roads in Europe) exists already for 50 years but ND now opens a new field of research possibilities: near misses situations, enormous potential to understand driver behaviour and how data can and should be interpreted best.

Mr. Repussard's main concern regards the resources and high investment necessity needed for a main data collection.

Pedro Valero-Mora and Martin Winkelbauer summarised the contents of each workshop discussion and Rob Eenink gave a brief résumé of the day.

**Closure**

Martin Winkelbauer closed the workshop at 16:30.

**Conclusions:**

a.  There is strong interest in Naturalistic Driving as a new research methodology. Compared to other events of this kind, a total of 60 registrations with participants from 16 countries including USA and Canada can be considered a success. Moreover, 95% (i.e. 54) of the registered people showing up is quite uncommon for events without registration fee and another indication for commitment to the topic.

b.  There was a vital discussion, which could have been continued for much longer (and was continued during the breaks). Feedback clearly indicated that there is high interest in the new methodology.

c.  The core behind most of the messages received during the discussion: Research on the field of road safety is still vital, for a lot of the questions asked, researchers and those who pay them do not have the data available to execute this kind of research. In particular, it is exposure data that is not available to a reasonable extent.

d.  It is general phenomenon in road safety work, that the "simple things" are widely exploited (such as seat belts, ABS) and more sophisticated measures need to be developed to address the problems, which now more and more float into the focus of crash prevention. For many of these activities it not sufficient just running a couple of queries in an accident database. It gets more necessary to know what people are doing and thinking and what kind of behaviour put them at risk. Hence, naturalistic driving comes at the right time as a source which is very likely to provide this kind of information.

e.  As a summary of the previous paragraphs, the workshop showed strong interest in ND in the research world. Beyond that, it seemed that the potential customers, e.g. the insurance industry, expect researchers to apply and exploit ND in order to answer questions, which they have so far not been able to answer.

f.  There seems to be strong interest on the field of powered two wheelers. Representatives from this group attended the workshop in considerable number. There seem to be particular problems in this area, where naturalistic driving is considered a method to research behaviour and accident causation.

In summary, the received feedback was very positive - the workshop was perceived as good networking event.

The results of the workshop as well as the knowledge collected in the other WPs are the basis for developing material for one-day dissemination workshops at national or regional level where the focus will be on user's interests and how they would implement the knowledge they are looking for. Target groups will be those involved in naturalistic studies and the potential users in the respective country of region.

## Appendix 1: List of participants of the PROLOGUE Workshop, 18 February 2010, Brussels

| Name | Organisation |
| --- | --- |
| 1.   Agathe BACKER- GRØNDAHL | Institute of Transport Economics |
| 2.   Niccolò BALDANZINI | University of Florence |
| 3.   Edwin BASTIAENSEN | Tele Atlas |
| 4.   Mohamed BENMIMOUN | Institut für Kraftfahrzeuge, RWTH Aachen University |
| 5.   Tamás BERTA | KT Ltd. |
| 6.   Cees BOUTENS | RAI Association |
| 7.   Christian BRANDSTÄTTER | Kuratorium für Verkehrssicherheit |
| 8.   Tom BRIJS | Transportation Research Institute (IMOB) – Hasselt University |
| 9.   Peter BURNS | Transport Canada |
| 10. Kenneth CAMPBELL | TRB (SHRP2) |
| 11. Joao CARDOSO | LNEC |
| 12. Rein CASTERS | DrivOlution |
| 13. John CHATTERTON-ROSS | FIM |
| 14. Rob EENINK | SWOV |
| 15. Anita EICHHORN | Kuratorium für Verkehrssicherheit |
| 16. Philippus FEENSTRA | TNO |
| 17. Mark FOWKES | MIRA Ltd |
| 18. Michael GATSCHA | Test & Training International |
| 19. Adriaan HEINO | Achmea |
| 20. Marc HINDRIJCKX | BRRC |
| 21. Graziella JOST | ETSC |

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|---|---|
| 22. Oliver JUNG | Polis |
| 23. Laurianne KRID | FIA |
| 24. Tsippy LOTAN | OR YAROK |
| 25. Dimitris MARGARITIS | CERTH-HIT |
| 26. Uta MEESMANN | IBSR |
| 27. Vivien MELCHER | Fraunhofer IAO |
| 28. Andrew MORRIS | Loughborough University |
| 29. Jean-Francois PACE | UVEG |
| 30. Peter PEETERS | Achmea |
| 31. Monika PILGERSTORFER | Kuratorium für Verkehrssicherheit |
| 32. Francesca PODDA | ETSC |
| 33. Jürgen PRIPFL | Kuratorium für Verkehrssicherheit |
| 34. Angel REBOLLEDA | Electronic Traffic |
| 35. STEVEN REED | Loughborough University |
| 36. Michael REGAN | INRETS |
| 37. Agnes REIKL | CIECA |
| 38. Jean-Paul REPUSSARD | European Commission, DG MOVE |
| 39. Han RIETMAN | CBR |
| 40. José Manuel RODRIGUEZ ASCARIZ | Alcalá University – Department of Electronics |
| 41. Hugo ROEBROECK | FEMA |
| 42. Fridulv SAGBERG | Institute of Transport Economics |
| 43. Peter SALEH | Austrian Institute of Technology AIT |
| 44. David SHINAR | Ben Gurion University of the Negev |
| 45. Irina SILVA | ERTICO – ITS Europe |

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|---|---|
| 46. Miguel Ángel SOTELO | Alcalá University – Department of Electronics |
| 47. Rachel TALBOT | Loughborough University |
| 48. Pedro VALERO-MORA | UVEG |
| 49. Nicole VAN NES | SWOV |
| 50. Ingrid VAN SCHAGEN | SWOV |
| 51. Trent VICTOR | Volvo Technology |
| 52. Peter WILBERS | SenterNovem |
| 53. Martin WINKELBAUER | Kuratorium für Verkehrssicherheit |
| 54. Bojan ZLENDER | DRSC |