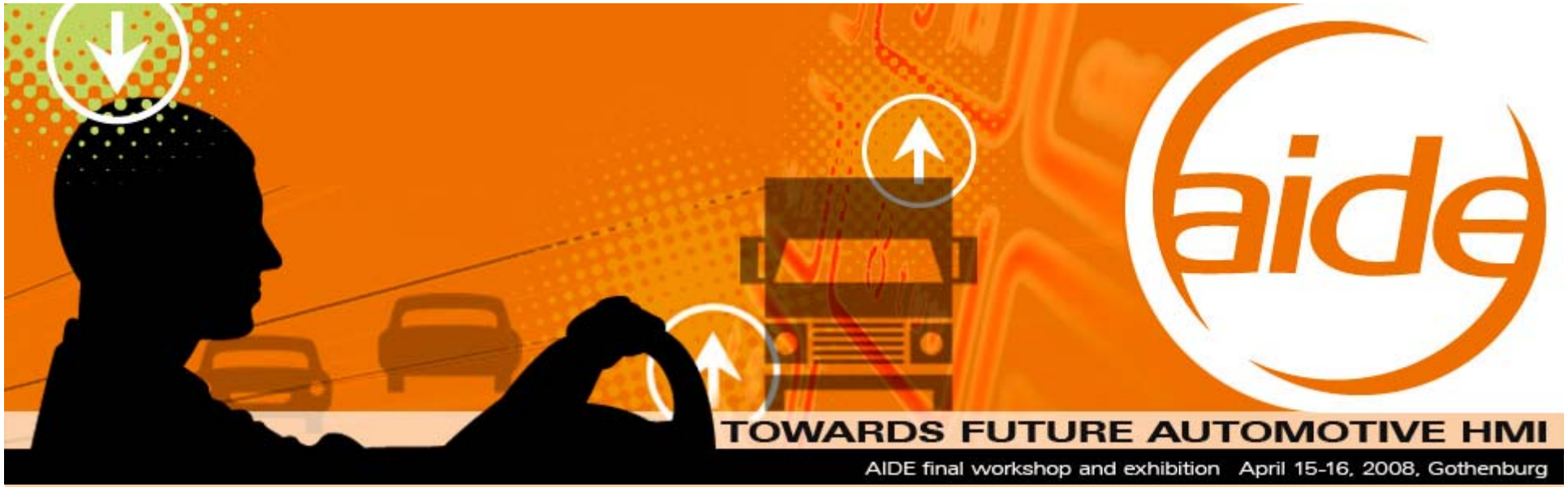
# Session outline

- Report from parallel sessions
- IP summary and final conclusions




# Report from parallel sessions SP1

Roberto Montanari, UNIMORE
Luciano Ojeda, PSA

# Report from parallel sessions – SP1

**Presentations on:**

- Behavioural effects of Driver Assistance Systems
  - Overview
  - Short term experimental results
  - Long term experimental results
- Driver - Vehicle Environment Modelling and Simulation
  - DVE description
  - SSDrive functionality
  - Modeling and integration of parameters related to distraction and driver intention

# Report from parallel sessions – SP1

## Discussions (1/2)

- Links between long term studies and FOT
  - A theoretical and methdological are the main issue
- How much exposure is needed for learning and for long term effects ?
  - 2 different process when learning a system
    - Discovering a taking in hands the system
    - Integrating the system in the driving task
- How long before behaviour stabilisation?
  - → No stabilisation observed, it changes all the time (ageing reasons, impairments growing etc)
- Does acceptance increase with learning ?
  - Not proved. Trust may increase other factors may intervene in acceptance (Cruise Control and Speed Limiter have a relevant acceptance and severity on Speed exceeding punishment in F)
  - 2 speed limiters studies made at 2 different times shows an increasing in acceptance probably due to social conditions (broadcast safety campaigns)

# Report from parallel sessions – SP1

## Discussions (2/2):

- **DVE model**
  - Discussion on 5 parameters characterising the driver's behaviour
  - The vision of an intelligent co-pilot has been proposed
- **SSDrive simulator**
  - Adaptability vs average value → adaptability to different driver's tipology and profiles
  - SSDrive exploitation: a design tool and the usage real-time parameters
- **From DIS to driver intentions**

# Report from parallel sessions SP2

Rino Brouwer, TNO
Klaus Bengler, BMW

# Report from parallel sessions – SP2

**SP2 conclusions 1/2: feedback on evaluation methodology**

- Successfully applied the cookbook and further recommendations
  - How to select use cases (structured process)
  - Specification relevant scenarios (detail)
  - Relation type of use case and metrics could be clarified
  - How to deal with differences in task lengths
  - System status logging needed for detailed analysis
  - Current risk estimation is a good first step but needs to be taken further

- Tools/Metrics developed were useful, but
  - (Workload) questionnaires need to be clarified/improved
  - SRR useful but not applicable to crossings
  - Recommendations for number of subjects is based on complete data
  - SDT is strongly recommended
  - Gaze metrics highly recommended
  - Useful metrics for crossings/roundabouts missing

# Report from parallel sessions – SP2

**SP2 conclusions 2/2: Feedback to demonstrator developers**

- Feedback (drivers' and test leaders' comments) have been provided to the developers
- In general – drivers are positive to the AIDE concept
- We tested demonstrators
  - DVE modules works - further development should focus fine tuning (trade-off between sensitivity and efficiency)
  - Enhance transparency for the user of AIDE for some use cases
  - Specific design solutions need improvement (e.g., PTT-button should be on the steering wheel; move displays further up)
  - Interaction between developers and evaluators turned out to be essential and should be extended (message to both developer and evaluators)

# Report from parallel sessions – SP2

**Discussions:**

- Why is it difficult to come to significant differences in the area of objective data?
  - There are some signifcant results (e.g. SRR, DT)
    We investigated a set of AIDE features in a field setting in non-critical situations.

- Did You select appropriate tools and metrics for the final evaluation?
  - Yes – definitely. Sensitivity Analysis was done beforehand. No interactions between measurement and HMI realisations.

- Did usecases and scenarios reflect appropriate levels of workload for this kind of evaluation?
  - Only partially. The final evaluation avoided the ”hot WL area” due to ethical issues.

- Does AIDE define a ”Golden Line” in sense of a criterion?
  - No, was not in the scope, but is important – future work

# Report from parallel sessions SP3

Angelos Amditis, ICCS
Luisa Andreone, CRF

# Report from parallel sessions – SP3

During the SP3 session the following aspects of the AIDE system were presented:

- AIDE Use cases and scenarios.
- Input/output devices in AIDE.
- AIDE system architecture.
- Driver-vehicle-environment monitoring modules.
- Interaction and communication assistant module.
- AIDE prototype vehicles.

- Discussion followed the presentation of AIDE SP3 results.

# Report from parallel sessions – SP3

**Discussions (1/2):**

- Architecture and timing issues; how are these handled in AIDE?
  - The architecture solution is modular and flexible.
  - Different solutions can be implemented taking into account timing constraints.
- Differences between SAVE-IT and the AIDE architecture.
  - SAVE-IT doesn't take into account Nomadic devices.
  - AIDE provides the adaptivity and personalisation element.
  - Interactions between AIDE and other initiatives – not just project oriented solution.
- Methodology to derive the AIDE solution.
  - UCD approach. VP prototypes, expert workshops.
- Flexibility against consistency - user is used in specific modalities.
  - User tests show that the change of modalities do not create confusion
  - Flexibility should stay at the minimum level.
  - Good study for the secondary modalities needed.

# Report from parallel sessions – SP3

**Discussions (2/2)**

- Possibility of plug and play functionality for ICA.
  - ICA is modular with open architecture. It is possible that new applications can be integrated without changing ICA's structure.
- I/O devices future and trends.
  - AIDE activities pointed out clearly the need to take advantage of future technology development
  - Depends on the type of the vehicle (different configuration approach for a truck and for a car).
  - Integration and adaptation: key issue.
  - Novel look and feel, speech interfaces are of special interest.
- Exploitation potential.
  - Immediate exploitation potential of specific elements (e.g. architecture)
  - Continuous exploitation both in mid and long time term of multiple AIDE concepts.

# IP summary and final conclusions

Gustav Markkula, VTEC

# Outline

- Summary of AIDE achievements and their expected use
- Expected impact of AIDE
- Future work
- Final conclusions

# Summary of AIDE achievements and expected use



AIDE has produced a large number of highly relevant results

Simplifying, the following main achievements may be identified:

1. Experimental results on behavioural effects of ADAS
2. Theoretical DVE model
3. DVE simulation (SSDrive)
4. Tools and methods for evaluation of HMI
5. AIDE methodology for evaluation of HMI
6. AIDE HMI architecture and logic
7. Nomadic device integration gateway
8. The Nomadic Device Forum
9. DVE monitoring modules
10. Prototype vehicles and HMI
11. Prototype evaluation results
12. Input to standards and guidelines

The project has included an activity on exploitation planning

# 1. Experimental results on behavioural effects of ADAS

Highlights:

- Simple ”additive” integration of multiple ADAS may cancel beneficial effects of individual ADAS
- Learning multiple ADAS at the same time increases duration of learning phase considerably
- Adaptation of ADAS to driving style improved acceptance considerably

Will be used by OEMs/suppliers in development of next generation ADAS

- Functionality/HMI
- Instruction manuals

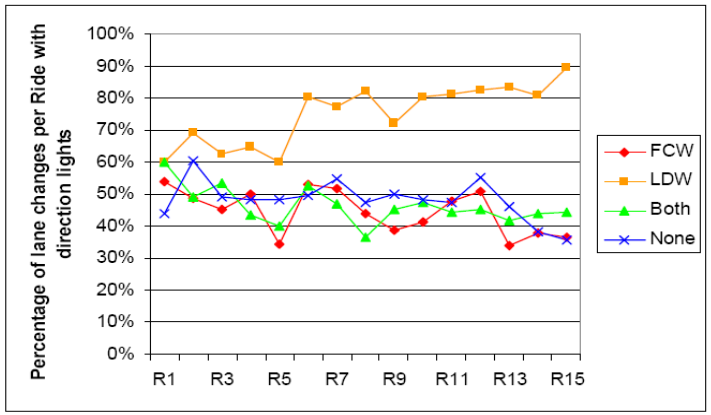


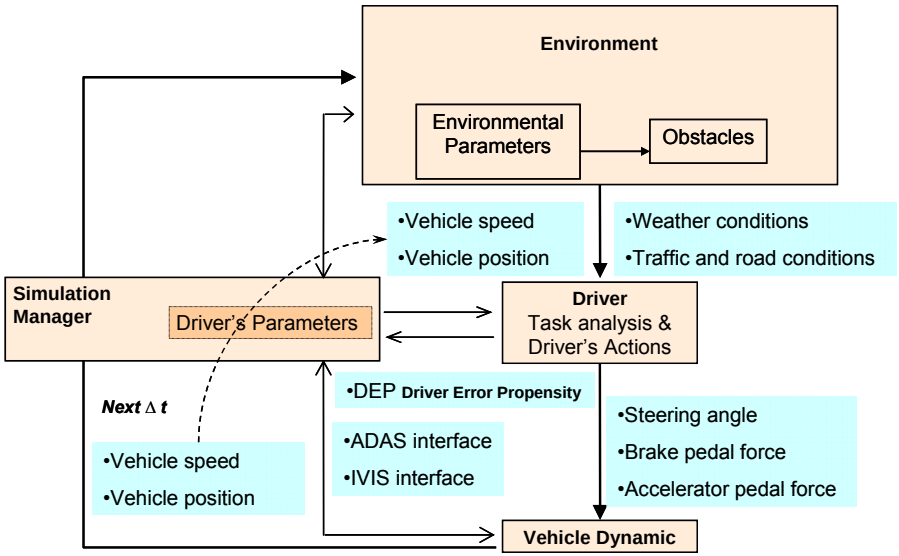

Figure 43: Percentage of lane changes per ride with the use of direction lights

# 2. Theoretical DVE model

Definition of DVE parameters and the correlations between parameters

Will be used especially by research institutes

- Future work on DVE modelling



# 3. DVE simulation (SSDrive)

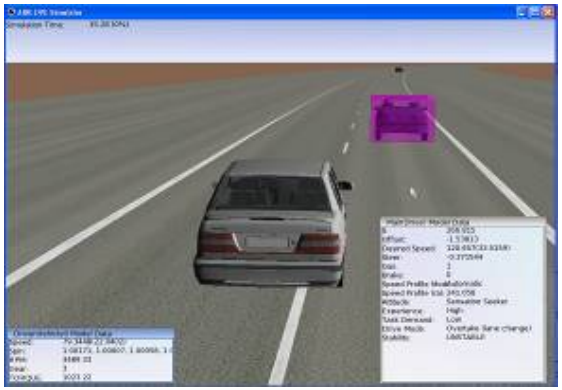


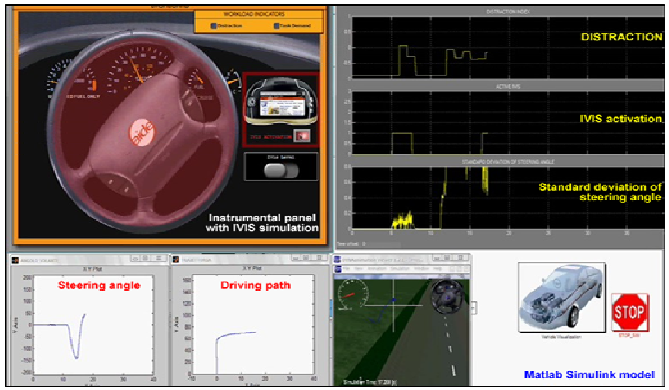
Tool for simulating driver-vehicle-environment interaction scenarios

- Current version achieves fairly good match with human driving data

Envisioned use of SSDrive in present or further developed form, by industry and academia:

- Replacing user testing of ADAS/IVIS in early development phases
- Identifying critical traffic scenarios to guide development of new ADAS
- Simulated drivers for traffic in driving simulators or traffic micro simulations





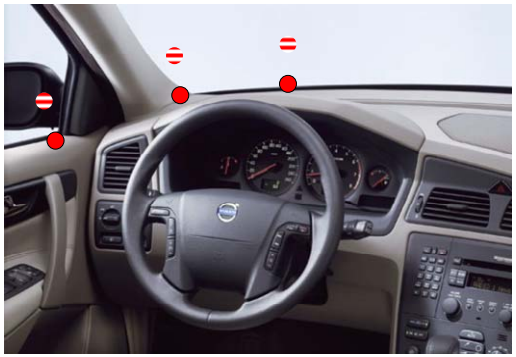
# 4. Tools and methods for HMI evaluation

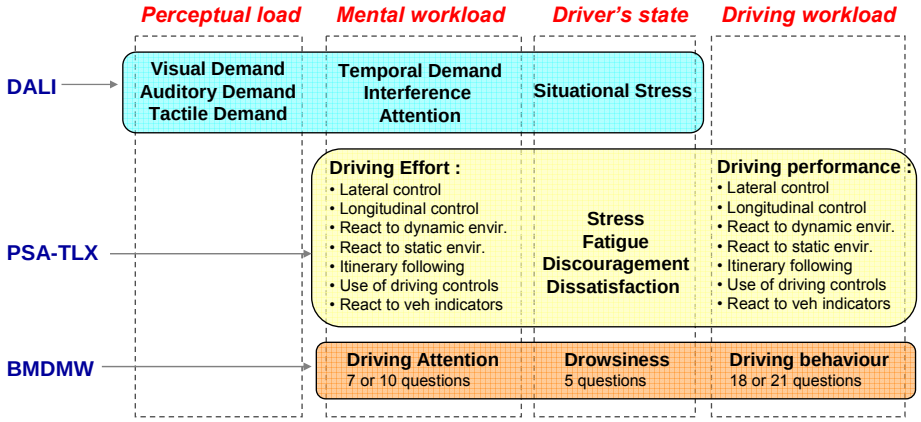
Development / improvement / validation of a large number of tools/methods

- Subjective (DALI, NASA-TLX, PSA-TLX, BMDMW, CRF questionnaire)
- Objective (SDT, VDM Tool, EOT, vehicle control metrics)

Use is planned within both industry and academia

- Integration of tools/methods in HMI development/evaluation processes within AIDE partner companies
- Potential commercialisation of some tools
- Standardisation of some methods (ISO WG8)





# 5. AIDE methodology for HMI evaluation

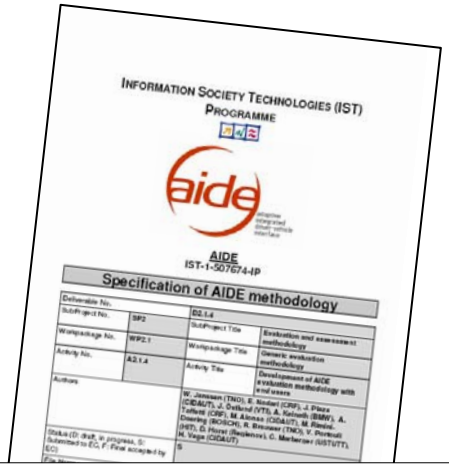


”Cook book” describing step by step method for evaluation of HMI

- Evaluation scenarios
- Level of developed system to be tested
- Experimental design
- Subjective and objective parameters to measure

Use is expected both by industry and academia

- Some partners are integrating methodology in company processes for HMI development/evaluation
- Report publicly available



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Specification of AIDE methodology

*7.3 Steps for the evaluation*

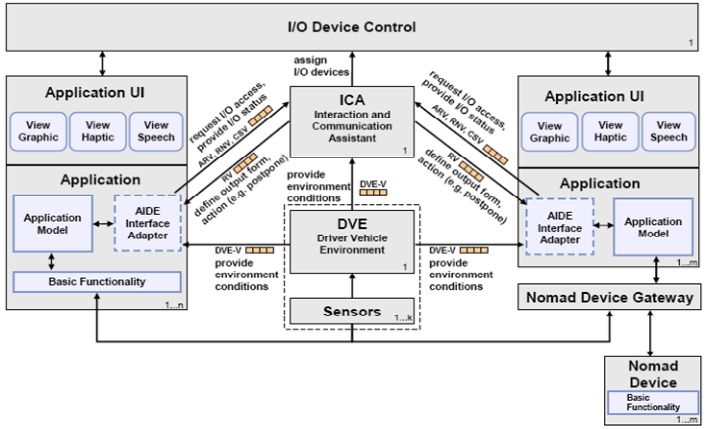
In this chapter the different steps to design an evaluation methodology with end-users are listed. Eleven points have to be taken into consideration.

1. To define the aims of the evaluation.
2. To describe the system to be evaluated.
3. To define a scenario.
4. To define the subject sample.
5. To define subjective and objective parameters and instruments to collect them.
6. To define the experimental design.
7. To develop experimental instruction both for participants and for experimenters.
8. To finalize the experimental set-up.
9. To carry out the experiment.
10. To analyse the collected data.
11. To produce summary indications about the system.

# 6. AIDE HMI architecture and logic

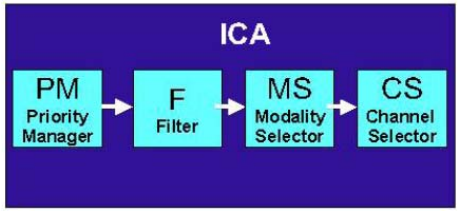
Logical / functional architecture, including the Interaction and Communication Assistant (ICA) module

- Generic and modular solution for adaptive/integrated HMI
- Logic for HMI prioritization and adaptivity (ICA)
- Communication protocols




Use expected mainly by automotive OEMs and suppliers

- Modularity brings potential for reduction in HMI development time and cost
  - Adding new functions with minimal impact on existing implementations
  - Well defined interfaces simplify cooperation
- Standardisation could reduce development time and cost even further



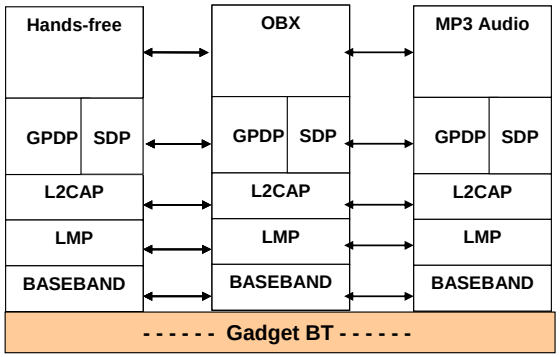
# 7. Nomadic device integration gateway

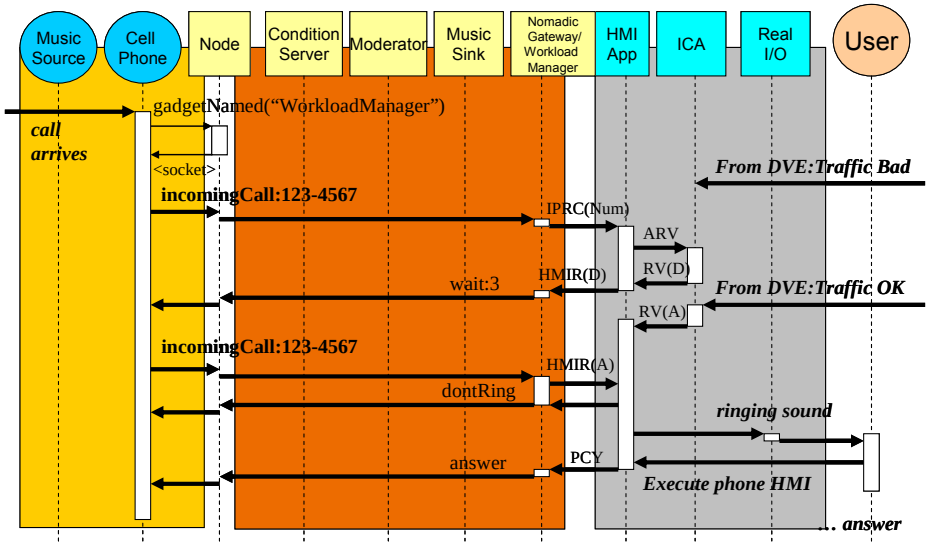
Technology for integration of nomadic devices in an adaptive HMI

- Use cases and requirements
- Communication protocols (incl. Gadget BlueTooth)
- ND software library (Windows Mobile 5.0)

Can be used by both industry and academia

- Results to be considered in ongoing work on common gateways



# 8. The Nomadic Device Forum



Cross-sector platform, improving understanding and agreement on a number of issues related to NDs and their integration in vehicles

- Use cases and business models
- Requirements on a vehicle-device gateway
- HMI and safety (e.g. in relation to ESoP)

ND Forum can continue to serve industry and academia

- Continued discussions to keep up with trends and developments
- Current hot topic: MoU on ESoP
- Identification of research needs

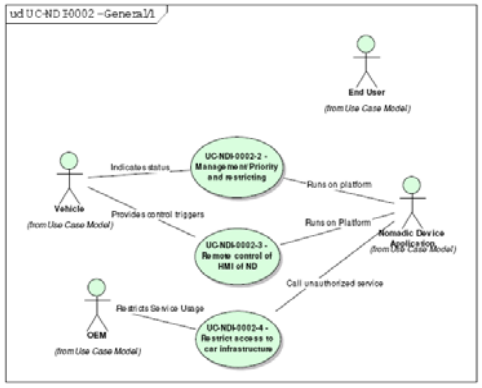
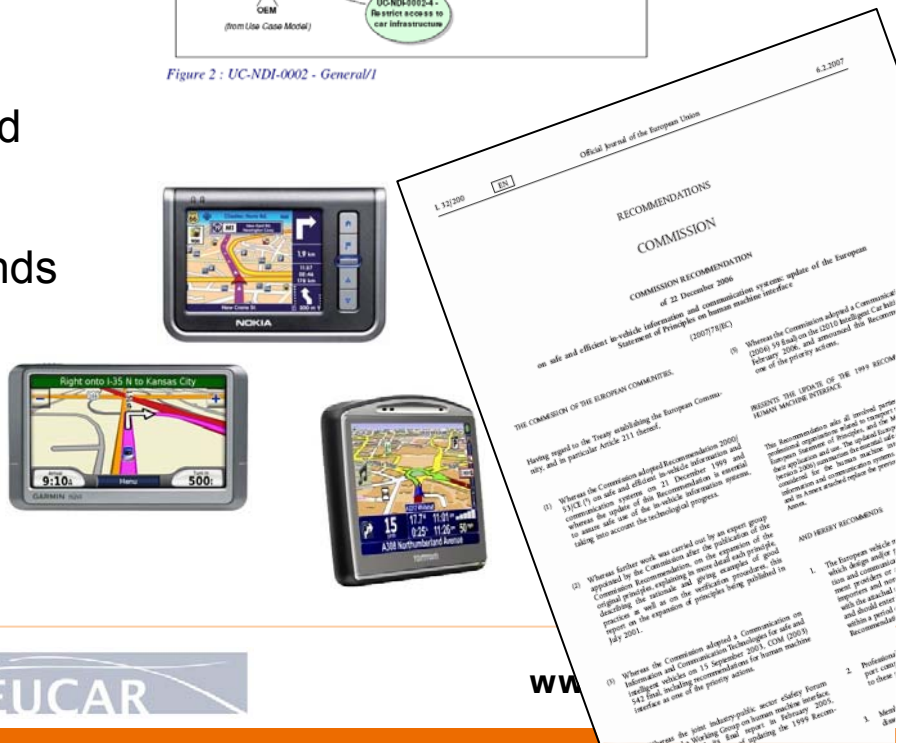



Figure 2 : UC-NDI-0002 - General/1



# 9. DVE monitoring modules



Five SW modules monitoring driver-vehicle-environment state in real-time

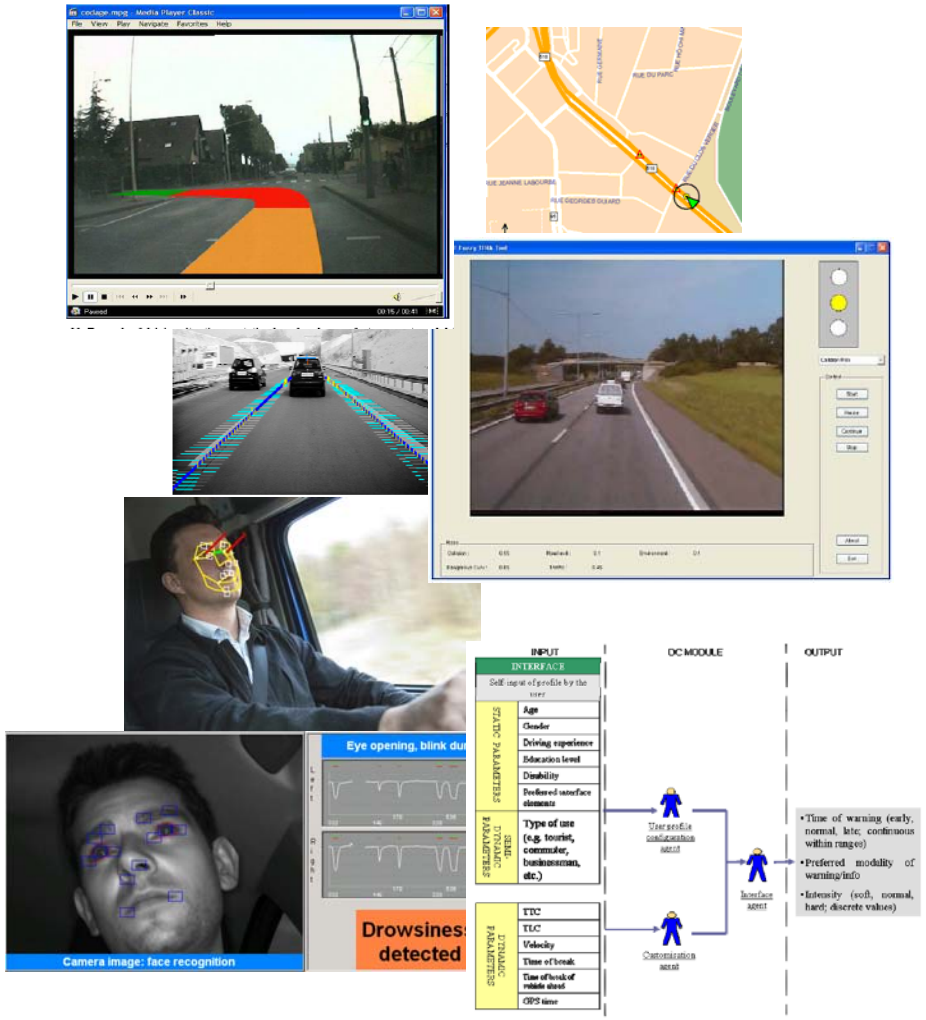
- Driving task demand
- Traffic/environment risk
- Driver distraction
- Driver drowsiness
- Driver characteristics

Use by partners developing modules

- Industry: Reuse of developed algorithms/software in product
- Academia: Further research; spin-off

Use by others

- Uptake of algorithm ideas



# 10. Prototype vehicles and HMI



Four prototype vehicles, verifying and demonstrating AIDE HMI concepts

- Feasibility of AIDE concepts
- Proof of concept for the AIDE architecture

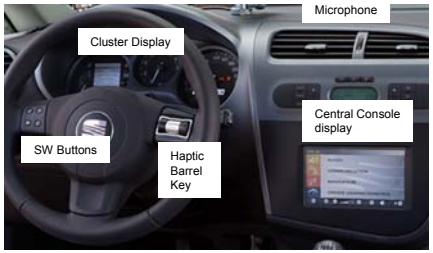
Use during project

- Dissemination
- Evaluation with end users

Use after project, by developing partners and others

- Guide product development decisions

*The city car*
*SEAT Leon*




*The luxury car*
*Fiat Croma*

*The heavy truck*
*Volvo FH12*

*The test car*
*Peugeot 407*

# 11. Prototype evaluation results

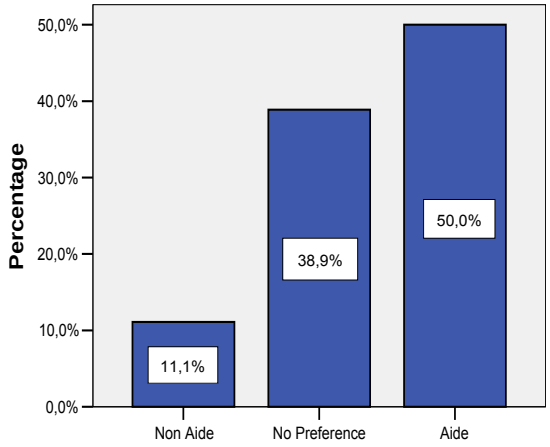


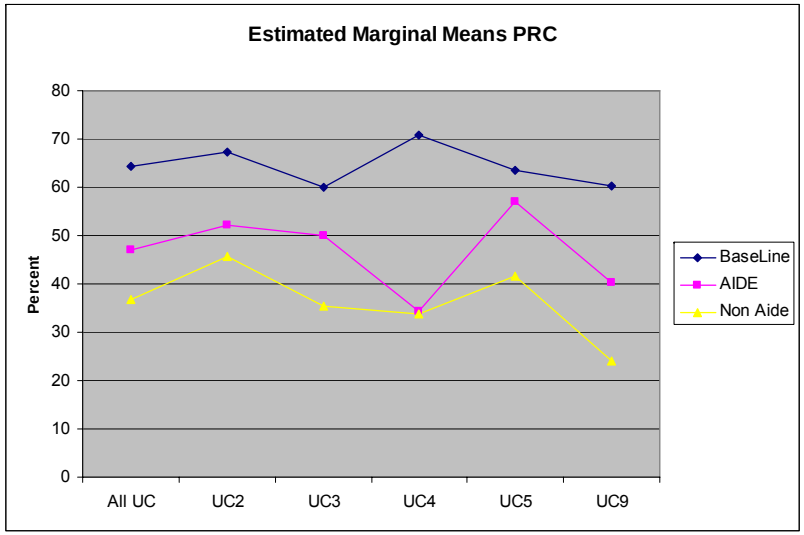
Evaluation results suggest that:

- Driver behaviour can be improved by use of AIDE HMI concepts
- AIDE HMI concepts in general are accepted by drivers
- The AIDE methodology is a useful tool for HMI evaluation

This can guide industry decisions

- Implementation of AIDE HMI concepts in product vehicles



# 12. Input to standards and guidelines

Report providing recommendations for standards and guidelines

- Accidentology (with HUMANIST)
- HMI evaluation methods
- HMI architectures
- Input to future development of European Statement of Principles on HMI

Provides input to standardisation and policy making bodies

- ISO
- European Commission

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aide adaptive integrated driver-vehicle interface

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**Recommendations for HMI Guidelines and Standards**

| | | | |
|---|---|---|---|
| Deliverable No. | | D4.3.2 | |
| SubProject No. | SP4 | SubProject Title | Horizontal activities |
| Workpackage No. | WP4.3 | Workpackage Title | Guidelines and Standards |
| Activity No. | T4.3.2 | Activity Title | Recommendations for HMI guidelines and standards |
| Authors (per company, if more than one company provide it together) | | Christhard Gelau and Roland Schindhelm (BASt); Klaus Bengler (BMW); Andreas Engelsberg (BOSCH); Villy Portouli (CERTH/HIT); Katia Pagle (ICCS); Harald Berninger (OPEL) | |
| Status (D: draft, in progress, S: Submitted to EC, F: Final accepted by EC) | | S | |
| File Name: | | AIDE D4.3.2 v7.doc | |
| Project start date and duration | | 01 March 2004, 48 Months | |

# Impact of AIDE

Effects of AIDE results, all interrelated:

- Functional growth made manageable, by improved in-vehicle HMI
  - Causing less workload and distraction
  - Providing increased comfort and user acceptance
  - With reduced development cost and time
- Raised public awareness of HMI issues and their relation to safety
- Safer driver behaviour
- Increased driver use of integrated safety functions
- Better understanding of HMI issues among policy making / standardisation bodies
- Appropriate policies, guidelines and standards

# Impact of AIDE (cont'd)

… In turn leading to:

- Improved competitiveness of European vehicles
- Improved mobility and productivity
- Improved road traffic safety

# Future work – exploitation



AIDE partner work on **exploitation of AIDE results**, including:

- Continued internal promotion of results within companies
- Product development
- Involvement in standardisation efforts
- For some DVE modules: Adaptation of algorithms to cheaper sensors

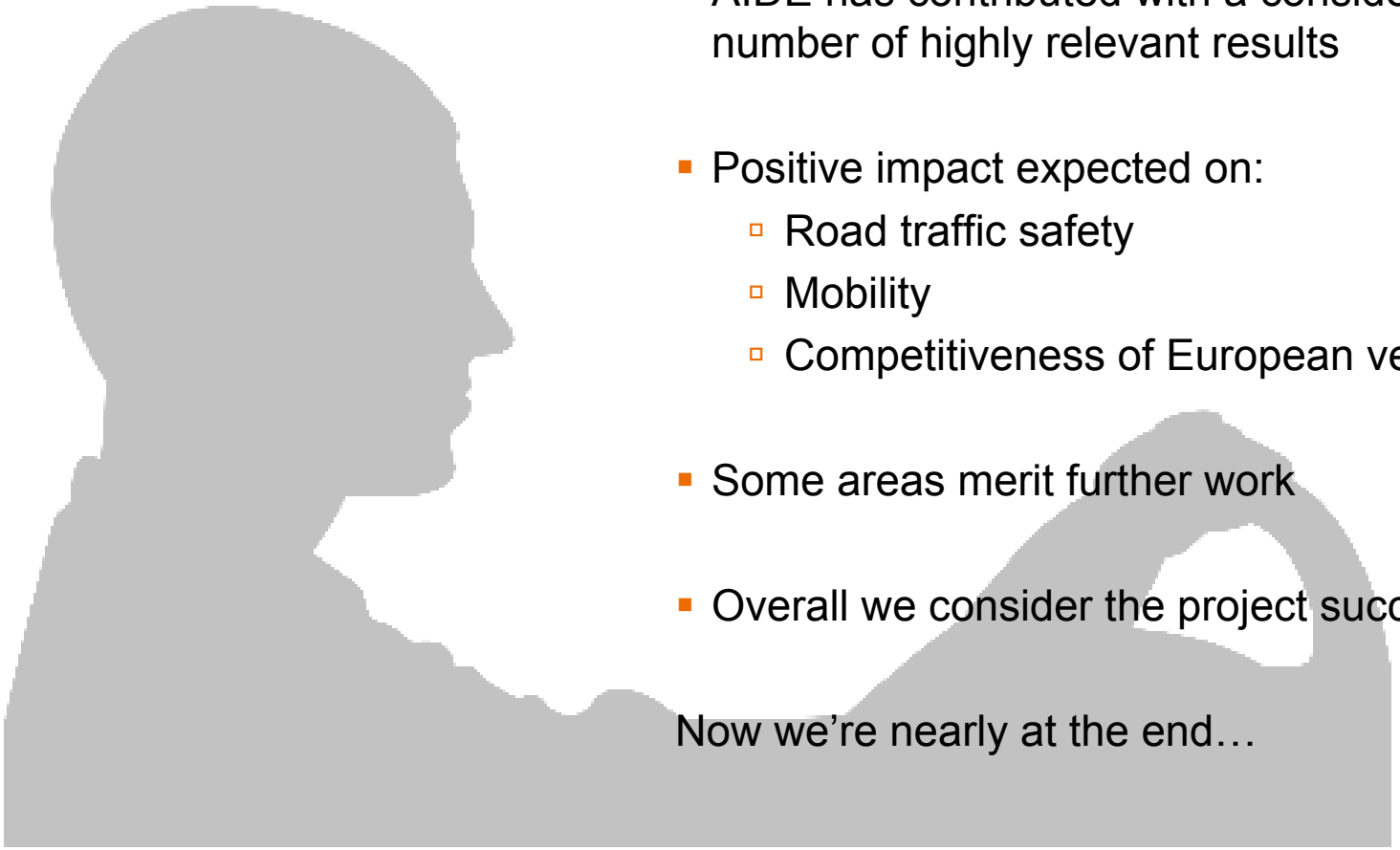
# Future work – research

Continued research on AIDE results, including:

- Further development of DVE model, especially driver model
- Application of DVE models to IVIS/ADAS evaluation
- Some HMI evaluation tools should be developed and validated further
- Possible updates of evaluation tools to account for new IVIS/ADAS
- Further clarification of relation between driver behaviour and risk (FOT?)
- Function/HMI individualisation deserves further focus
- Further development of I/O devices (e.g. natural speech) – intuitiveness
- Next generation seamlessness scenarios – nomadic device integration visions
- Driver instruction/training for maximisation of e.g. safety system benefits

# Final conclusions





- AIDE has contributed with a considerable number of highly relevant results
- Positive impact expected on:
  - Road traffic safety
  - Mobility
  - Competitiveness of European vehicles
- Some areas merit further work
- Overall we consider the project successful

Now we're nearly at the end…

# Thank you



**The AIDE consortium** would like to thank

- The European Commission
- EUCAR
- The EUCAR Integrated Safety Program projects
- HUMANIST NoE
- The Final Workshop and Exhibition attendants

**Volvo Technology** would like to thank

- The AIDE partner companies
- The EC Project Office
- The AIDE Core Group

And…

- **The AIDE co-workers!**

# AIDE Final Workshop and Exhibition

**April 15-16, 2008**