eSafety Forum

1st Plenary Meeting, Brussels on 22 April 2003

Report of the Working Group on HMI

Chair: Annie Pauzie (INRETS)

SUMMARY

- HMI is a major topic in the e Safety initiative (recommendations 5, 6 and 20 in the e Safety Working Group Final Report of November 2002)

- HMI is the subject of a European Commission recommendation in 1999 (Commission Recommendation of 21 December 1999 on safe and efficient in-vehicle information and communication systems: A European statement of principles on human machine interface Text with EEA relevance (notified under document number C(1999) 4786) , published in the OJ 25 01 2000 L19)

- The eSafety Forum Working Group on HMI has so far met once, in February 2003. The key results so far:

  - Need to elaborate a further European document on HMI. Format still to be defined (recommendation, code of practice, directive?)

  - Analysis of Member States answers to be done + reminder to the countries who have not yet responded

  - New needs to be taken into account **(nomadic devices, professional vehicles)**

  - Necessity of elaborating precise criteria to evaluate HMI, taking into account industrial constraints (cost, competition between brands, stability of the market, quick evolution of the technology)

The main target of the Working Group is to provide industry with few but strong criteria on HMI , easy to implement in order to avoid HMI misuse, and generally to stabilise the market. The opportunities brought by ADAS to enhances safety are numerous, but the HMI for them has to be developed.

1. Short summary of the past

In December 1999, the EC adopted the European Statement of Principles (SoP) on HMI[1] acknowledging the importance of the Human Machine Interaction (HMI) for in-vehicle telematics. Recommending adherence to the SoP, the EC urged the European motor vehicle manufacturing and supply industries to comply with a number of basic safety requirements concerning the design of, and driver interaction with, in vehicle information, communication and entertainment systems.

The SoP has equally been submitted to the Member States for comments and evaluation. Member States were invited by the EC to take steps to encourage the industry to comply with these Principles, and report back on the impact of the SoP by December 2001. Up to now 4 countries have replied officially: Germany, UK, France, and Denmark.

The SoP set out the key principles to be considered for safe and efficient Human-Machine Interaction. These principles are rather of a general nature, and in-vehicle systems cannot be directly assessed against them. These principles can, however, be considered to form the highest level of hierarchical principles, and the actual assessment against the general principles can be achieved by analysing the compliance with more detailed principles on the lower levels of the hierarchy. The EC has also produced a Working Document "Expansion of the EC Principles" during 2001, but no further actions have been launched until now.

In 2002, the European Commission launched the eSafety initiative. The Final Report of the eSafety Working Group (November 2002) considers HMI as one of the key elements in integrated safety (vehicle-driver-infrastructure) and recommends further actions. These recommendations are the following:

> *(5)Assess the reports by the Member States on the Commission Recommendation "Statement of Principles on safe and efficient in-vehicle information and communications systems", and decide on further actions as necessary taking into account the rapid development in this area.*
> *The use of portable (nomadic) devices requires urgent assessment of risks.*
>
> *(6)Develop workload assessment, testing and certification methodology and procedures for complex in-vehicle working environments involving interfacing with in-vehicle devices for vehicle control, driver assistance, intelligent integrated safety, including Multi-Media systems.*
>
> *(20)Develop a methodology for risk benefit assessment, achieve an industrial and societal consensus on European Code of Practice, and establish guidelines for facilitating the market introduction of Intelligent Integrated Road Safety Systems*

[1] Commission Recommendation of 21 December 1999 on safe and efficient in-vehicle information and communication systems: A European statement of principles on human machine interface Text with EEA relevance (notified under document number C(1999) 4786) , published in the OJ 25 01 2000 L19

2. Information available up to now

From the projects

Currently, apart from the documents produced by the Commission , different projects have written several papers on the subject. Projects (**ADASE, ADASE II, HASTE, RESPONSE II, Hardie, Rosetta…)** funded by the EC have dealt with HMI and have delivered some information that might be useful. Some other projects (Hardy) are dedicated to specific problems related to HMI (Old and disabled persons).

From Member states

Some Member States have also written national information . For example, in the UK it is possible to find a report called "**TRL/DETR HMI Safety Checklist** (Stevens et al, 1999)".

From Commission

Apart from the Sop , an expansion of the Sop has been produced by the Commission . Further investigations can be elaborated from this document

From Countries outside Europe

Outside Europe, several codes of practice have been produced. In the United States, the Alliance of Automobile Manufacturers have issued in April 2002 a guideline named "**Statement of Principles, Criteria and Verification Procedures on Driver Interactions with advanced in vehicle information and communication systems**". The document is organised according to 24 principles, divided into 5 sections.
A phase 2 of these guideline is expected.

From Standardisation bodies

As concerns standardisation, the most relevant HMI in vehicle work is going on within ISO TC 22 SC 13 WG8"TICS on board MMI" (Traffic and information Control Systems Man Machine Interface). CEN TC 204, WG 14 will be also monitored.

From International organisations or dedicated groups

2 groups have been identified :
IHRA (international Harmonised Research activities). It is an international inter-governmental group with 6 working groups set up with the aim to harmonise government research and thus maximise overall benefits.
WERD (Western European Road Departments) . it is gathering State Road Authorities from Member States. A subgroup is dedicated to HMI

EuroNCAP support will be also welcome.

From Industry

The automotive industry is conducting research on HMI. The projects with involvement of automotive industry, funded by EC include RoadSense, ADASE, ADASE II, AWAKE, COMMUNICAR, ADVISORS and IDAS).
Private industry programme like INVENT or ADAM are also of interest.

3/ First inputs from the e Safety working group on HMI

The purpose of the new document to be elaborated by the safety working group on HMI is:
1/ to define what it is allowed during the driving task
2/ and to define the best and economically realistic criteria for HMI

A first reading of the documents provided by the Member States shows different approach to the problem. Further analysis is needed but some missing parts have already been identified. This concerns mainly nomadic devices, professional vehicles and definition of precise criteria. Haptic feedback was also mentioned but the technology and the market are not mature enough for the moment to further investigate a lot.

As for HMI, the problem of the intentional or non-intentional misuse of ADAS is also at stake. Training of the drivers becomes a key point but goes over the scope of the group.

A review of the existing devices on the market is maybe necessary but as the market evolves very quickly, it is urgent to define generic criteria to assess any devices **displaying infotainment information in the vehicle (reference to an existing statement of the SoP** *" 8. System behaviour principles: information not related to driving that is likely to distract the driver significantly (eg: TV; video, automatically scrolling images abnd text) should be disabled or should only be presented in such a way that the driver cannot see it while the vehicle is in motion.")*
->Potential need for a further legislative action, or code of practice, not competing with market forces but preventing obviously dangerous practises.
This point will be further discussed within the group to take into account the constraints of Industry (HMI is a key point in terms of competition between brands) and the needs of the European Citizen. It is urgent to define some limited but mandatory criteria, taking as well into account after sale devices (PDA, after market systems…).

The constraint of cost is also a central one, especially for professional vehicle. Tests to be performed and constraints of HMI integration into the car should take into account the financial dimension in order to be actually implemented.

A review of existing methodologies and running work on the subject will be taken into account by the group. Existing material is already very huge and one of the difficulties is to gather it and to extract the core elements. The experts of the e Safety working group on HMI will work on existing documents **in order to decide on further actions necessary for the rapid improvement of the content of the SoP.**

4/ Contributions from experts of the e Safety working group on HMI

A/ contribution from BAST (Christhard Gelau)

- A satisfying assessment of the reports on the ESoP which draws a representative picture of the situation in Europe requires that indeed all Member States have submitted their reports. As this did not happen up to now, it is recommended that the EC urges those Member States whose reports are still lacking to submit them as soon as possible.
- As a consensus among all stake holders is crucial for the acceptance and success of further activities it is necessary to have a stronger involvement of automotive industry in the eSafety WG HMI. Thus, it is recommended to invite a representative from the members of ACEA to join the WG HMI as a member.
- The importance harmonised European position on the ESoP is acknowledged. However, further actions on the ESoP should also take into account comparable activities in the U.S. and Japan in order to avoid major discrepancies. This means that harmonisation should be achieved between the ESoP, the AAM guidelines and the JAMA guidelines.
- Further elaborating and updating the ESoP cannot be done independently from the development of measurement and assessment tools recommended by the eSafety Working Group on Road Safety. Some relevant sources of information have been gathered in the WG HMI document "state of the art and list of actions". This list has been supplemented during the first meeting of the WG HMI. However, it can reasonably be expected that numerous relevant results will be available from projects within the 6. EU Framework Programme. These should be carefully considered during the process.
- For HMI solutions which have to be considered as critical refer to the paragraph "Conclusions" of the German report. The conclusions from this report can also be seen as a starting point of German contributions to further actions on the ESoP.

B/ contribution from TRL (Alan Stevens)

Strategic perspective

1. Although some detailed criticisms can be made about the eSafety document, we accept the important central point that Driver Information and Assistance Systems have considerable potential for improving road safety and that ***human factors is crucial in design and deployment of such systems***.

2. Human factors for Driver Information Systems are addressed in the EC "Statements of Principle". Driver Assistance Systems are the main focus of the eSafety document. Because our understanding and the maturity of DAS are less advanced and the human factors issues in the two types of systems are considerably different, Driver Information and Driver Assistance ***should be addressed in parallel but separately.***

Driver Information and the EC SoP

1. We acknowledge that the SoP is lacking in terms of verification procedures and the key task for the Expert Group should be to remedy this shortcoming in a way that is acceptable to all key Stakeholders.

2. The basic working document should be the Expansion of the Principles. This contains useful development and explanatory material surrounding the Principles.

3. The work undertaken by the Member States has identified some additional issues and clarified others. This work should be reviewed to identify implications for the existing Principles.

4. The issue of portable (Nomad) devices may not have been sufficiently addressed by the Principles. This needs to be studied urgently and the Principles extended if necessary.

5. Not all the Statements carry the same weight; some are special cases of others; only some need verification. Consideration should be given to the relationship between the Principles and identification of the key verification issues.

6. We welcome the important contribution to our Principles made by the US AAM group to operationalise some important aspects of verification. We should review and build on this work.

7. Given the global nature of automotive industry activities, we should ensure (at a minimum) that our work is not in conflict with US and Japanese activities.

Driver Assistance Systems

1. eSafety Driver Assistance Systems are less mature in the marketplace than driver information products. Consequently, our understanding of the human factors and safety implications of these devices has a less robust and extensive research base to draw on.

2. Three general approaches to try to assure good human machine interaction and safety can be identified:

- Concentrate on "inputs" to the DAS by developing general principles of HMI design
- Concentrate on the "process" of DAS development, testing and implementation
- Concentrate on the "outputs" through testing and verification procedures

3. The approach of developing general principles is a useful starting point. These have to be at a sufficiently high level not to constrain developments. A first draft set of Principles is proposed at Annex 1.

4. The idea of auditing the process of development, testing and implementation follows closely the principles of "Quality Assurance" with additional specific emphasis on safety. Useful resources include existing standards work (e.g. Suitability standard, and proposed "driver-system integration" work) and the work of the RESPONSE project to develop an implementation process. These approaches should be studied.

5. The approach of verification and testing of ADAS (beyond existing Type Approval) is a complex issue for which there may be an insufficient research and experience base to design a comprehensive programme. Consideration should, however, be given to a few basic or targeted assessment approaches.

Proposed first draft Human Factors Principles for Driver Assistance Systems

1. There is considerable human variability in height, reach and strength. Design such that systems are physically big enough for a large male to use yet are still usable for a small female who may have limited strength and reach.

2. Human performance in sustained attention tasks is poor in comparison with machine sensor systems. ADAS should be designed not to be reliant on the driver maintaining a continuous awareness of the system state or road conditions.

3. People can detect detailed information in a relatively small area in the direction they are looking, the visual area outside of this 'foveal' region is more sensitive to movements and flashing lights and can involuntarily attract the drivers' gaze. Careful consideration should be given to the design of warnings such that they do not distract the driver when control of the vehicle is the primary safety concern.

4. People have limited colour recognition. Avoid using too many colours in ADAS displays to support good discrimination of information. Preferably, three distinct colours should be used and not more than 10. The need for blue-green or white/yellow discrimination should be avoided.

5. The vehicle is a relatively noisy environment, and human hearing decays with increasing age, particularly at high frequency. Caution should be adopted in the pitch, frequency and use of auditory warnings.

6. Humans can react quite slowly so ADAS must provide reasonable time for the human to respond to a signal. Under optimal circumstances, assume one second is required, more realistically provide three seconds or no need to respond in a rapid time frame.

7. The driver's ability to react to and respond appropriately to ADAS operations will be affected by their fundamental level of driving task capability. The ADAS should not compromise driver safety particularly during periods of high task workload.

8. Some individuals adopt a level of risk that is personally acceptable and if the situation is perceived to be safer, it has been suggested that they will undertake riskier activities, e.g., faster driving and shorter headways. Design of ADAS should recognise the variation in personally acceptable levels of risk.

9. Humans have limited short-term memory. Systems should not require the user to remember or recall more than seven items in order to operate an interface or resume operation of the system.

10. Errors will be made by users and should be considered in the system design. ADAS should be designed to be tolerant of human error.

11. Humans have automatic reactions and expectations when interacting with machines and with the environment. ADAS should allow for these such that controls and displays behave in a manner that meets with expectations.

12. Humans and machines both have strengths and weaknesses. Allocate functions between the human and ADAS to exploit the tasks that each can undertake effectively to optimise overall system performance and enjoyment.